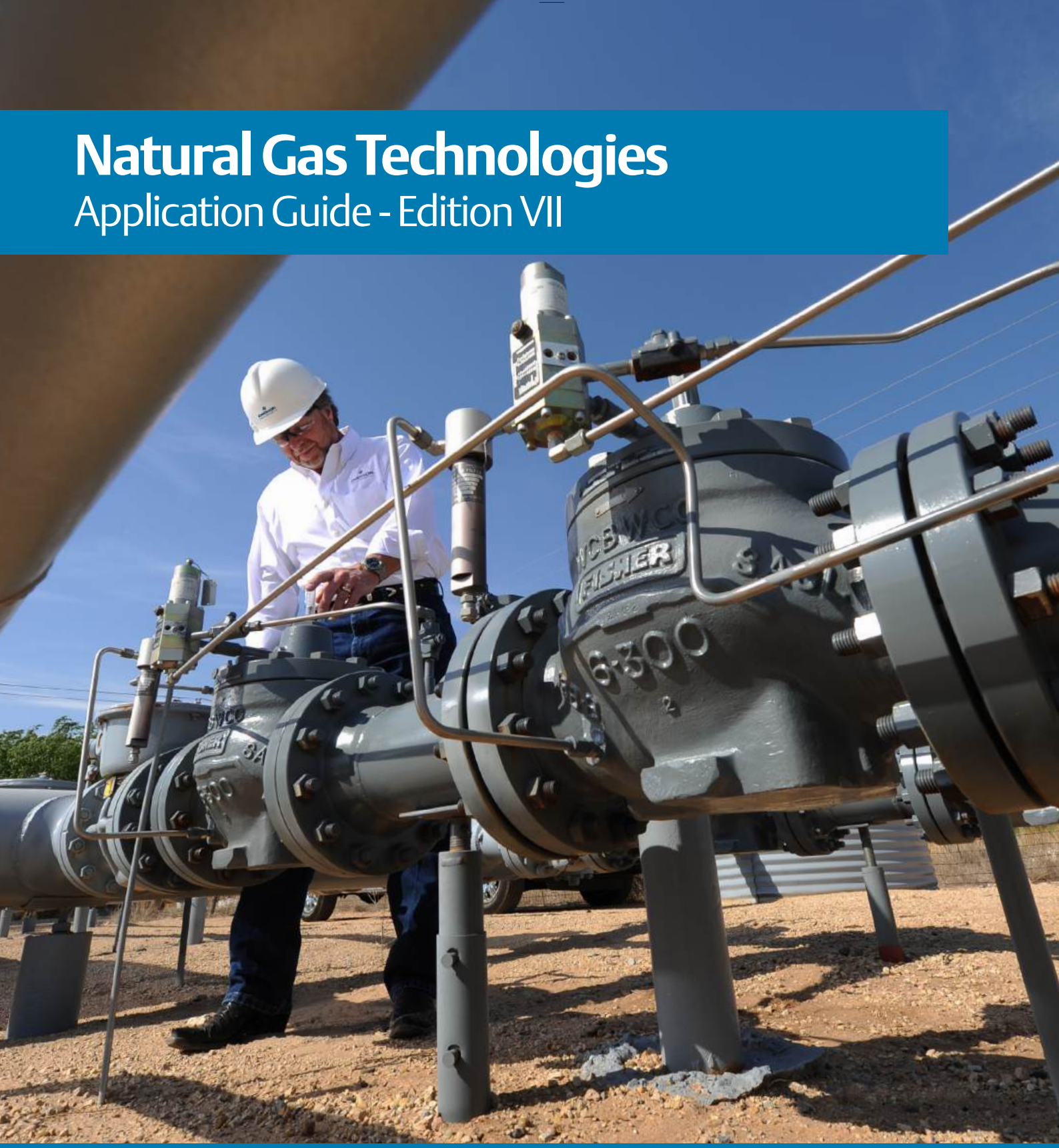
Natural Gas Technologies

Application Guide - Edition VII



Engineered pressure and flow control solutions.

EMERSON™
Process Management

Natural Gas Technologies Application Guide

Welcome

This Application Guide is designed to help you quickly and easily select pressure regulator products for natural gas applications in transmission, distribution and utilization. The principles of pressure regulators and their application within the natural gas industry are also explained. The Technical section is a rich source of general and specific information to aid you in sizing a particular product.

Product Sizing Information

We highly recommend that you keep this book in an easily accessible place for quick reference. If you are an experienced engineer, you will be able to completely size a product from the information presented in this book before calling your local sales representative. For those with a less extensive engineering background, the Quick Selection Guides will be especially useful.

Finding What You Want

A complete Table of Contents and the Index at the back of the book are organized by product type and the common name, which will easily guide you to the appropriate section of the guide to find a product description.

Ordering What You Need

After selecting a product type or sizing that fits your application, contact your local Sales Office to place an order. Your local Sales Office will ensure that you receive the right product in the shortest possible time.

Other Application Guides Available

Should your application or project require industrial regulators or LPG regulation or storage, please request an Industrial Regulators Application Guide or LPG Regulators and Equipment Application Guide. The Industrial Regulators Application Guide features detailed information on products used in Air, Steam, Liquids, Process Gases, Fuel Gases, Tank Blanketing and Vapor Recovery and Sanitary applications. The LPG Application Guide offers pressure regulators and valves and related equipment for regulation, transfer and storage of LPG.



Additional Information Online

You can view and download pressure regulator bulletins, instruction manuals, product schematics and many other helpful documents at emersonprocess.com/regulators. Much of the same information is also available on the Emerson Process Management Regulator Tool Kit. Download the new Regulator Tool Kit:
www.emersonprocess.com/regulatortoolkit



EMERSON.
Process Management

Table of Contents

Welcome / Introduction

Table of Contents i
Emerson Process Management ii
Regulator Technologies iii
Industry Commitment iv
Commercial Service Regulators 1
Fisher History 3

Natural Gas

Application Maps ..... 5 to 12
- Transmission / Oil / Natural Gas 5
- City Gate / Distribution 7
- Commercial / Industrial Service 9
- Residential / Utilization Service 11

Product Availability 13
Quick Selection Guide 15
- Transmission 15
- Farm Tap / Field 16
- City Gate / Distribution 17
- Commercial / Industrial Service 19
- Residential / Utilization Service 23
- Fixed Factor Billing / Pressure Factor Management 24
- Fuel Gas Regulators 25
- Supply Regulators 26
- Stand Alone Shutoff Devices 27
- Relief Valves / Backpressure Regulators 28
- Odorizing System 30
- Electronic Flow and Pressure Measurement 30

Applications 31
Products 34
Training 549

Technical

Table of Contents 551
Reference Data 632
Conversion Tables 639
Glossary of Terms 686

Index

Index vi
Notes x

Worldwide Contact Information

Contents Notice

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Tartarini™
TESCOM™
Topworx™
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Emerson Process Management

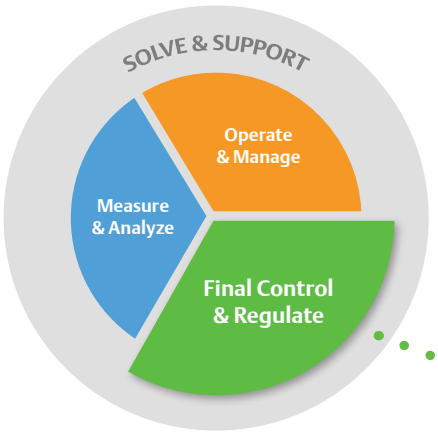
Solving Your Toughest Challenges

Industries are under constant pressure to cut costs, increase output, reduce energy use and improve safety and emissions. That is why companies around the world turn to Emerson Process Management for technologies, services and expertise to solve problems and deliver proven results.

EMERSON™
Process Management

Expertise and Innovation To Deliver Proven Results

Emerson Process Management is the automation innovator with the depth of expertise and breadth of technologies to take on our customers' toughest challenges and bring predictable success anytime, anywhere.





Solve and Support

Expertise and global resources to help you dependably define, execute and support a strategy throughout the lifecycle of your operation.



Measure & Analyze

The broadest range of measurement and analytical technologies for process clarity and insight.



Operate & Manage

The systems and tools that provide the decision integrity to run your operation at its full potential.



Final Control & Regulate

Highly reliable final control technologies to help you regulate and isolate your process with certainty.

Emerson Process Management Regulator Technologies: Control Your System with Certainty

Emerson Process Management Regulator Technologies Inc. (Emerson™) brings together technology and engineering to provide an expanding array of innovative manufacturing and processing solutions for industrial, commercial and consumer markets. We offer the world's largest collection of pressure control, flow control and relief valve solutions for process and specialty gases, liquids, steam, natural gas and liquid propane industries.

Our regulators are renowned for setting industry standards for performance and extended service life, while Emerson product sales, service and technical support teams are unrivaled in their ability to serve you locally from offices located strategically around the globe.

Natural Gas Solutions

Emerson leads the way in providing best in-class natural gas conditioning, metering, pressure regulating products and customized skids to the natural gas industry. From regulators to skids, Emerson products offer design innovation, superior performance and unbeatable reliability and durability under extreme conditions in even the world's most rugged environments. Around the clock, around the world, look to Emerson for natural gas solutions.

LPG Solutions

Throughout the world, Emerson supplies leading liquefied petroleum gas (LPG) suppliers with the broadest available line of Fisher commercial service LPG regulators and bulk storage and transport equipment. Renowned as the propane industry standard for reliable pressure regulation, Fisher LPG valves and regulators provide high value solutions across a range of stationary storage and mobile applications. With more than 2,000 technical experts at over 200 locations worldwide, our service and support remains second to none.

Gas, Liquid and Steam Solutions

Emerson offers a dynamic range of Fisher brand self- and pilot-operated pressure regulators, relief valves and tank management products for industrial gas, liquids and steam applications. Suitable for use in a wide range of environments, from the wellhead to the pharmaceutical plant, their versatility, stability, ease of maintenance and rigorous adherence to ISO-9001 standards for quality and reliability have made them the pressure regulators of choice in tens of thousands of installations worldwide.

Precision Pressure Control Solutions

Emerson designs and manufactures industry-leading standard and custom engineered regulators, valves, and systems for use in precise pressure control solutions for a broad range of sea, land and space-based industries. Our TESCOM brand of products are engineered to exacting standards that continually exceed global certification requirements, allowing us to serve even the most specialized applications. Today, Emerson's TESCOM products and support are hard at work on every industrialized continent.

Regulators and Relief Valves



Natural Gas Solutions
Fisher™
Tartarini™
Francel™



LPG Solutions
Fisher™



Industrial Gas, Liquid & Steam Solutions
Fisher™
Enardo™



Precision Pressure Control Solutions
TESCOM™

www.EmersonProcess.com/regulators

Industry Commitment

Quality

Emerson™ ensures the highest quality and safety standards through our global brands – Fisher™, Francel™, Tartarini™, TESCOM™ and our Asian-specific brand Jeon.

For more than a century we have worked side-by-side with customers to understand their challenges and help implement effective solutions. Our systems, processes and employees are committed to providing defect-free products, information and services that satisfy your expectations on time, every time.

Emerson is dedicated to delivering only the highest product quality and performance utilizing efficient operations. We create value by delivering best-in-class pressure and flow control equipment, systems, services and solutions for an unparalleled range of applications. We execute new product development plans with advanced technologies and solutions that deliver undisputed quality.

To achieve consistent operational and product excellence globally we strive to attract the most talented people and support continuous development of our workforce, products and processes at every level.

Reliability

With more than 125 years of experience, Emerson has built a solid reputation for reliability.

Our regulators, valves and flow control systems are engineered to exacting standards, each carefully designed, thoroughly tested and developed to handle higher pressures while providing increased delivery capacity, reduced noise output and zero emission. We go beyond baseline industry standards to ensure our equipment operates reliably in even the most extreme conditions anywhere in the world.

At Emerson, we are committed to continually raising the bar in our efforts to develop still higher quality, more advanced systems that operate safely and reliably well into the future.

Technology

Innovative technology makes Emerson pressure and flow control solutions more productive, efficient and cost-effective. Our proven results are what make us the leader in the industry.

Spanning the globe, Emerson test and evaluation facilities provide the engineering expertise required to ensure superior quality product design and high performance results wherever our products are deployed. At these facilities, Emerson tests all sizes and types of regulators under real-world plant conditions to ensure production performance, efficiency, environmental compliance and safety before actual installation at your site.

Our test and evaluation facilities are dedicated to tackling the toughest engineering challenges facing today's process manufacturing and energy industries, including helping companies deliver record volumes of natural gas and other forms of energy, consume less energy, reduce costs, operate more quietly and reduce greenhouse emissions.

Service

With over 2,000 local technical experts to serve you from nearly 200 locations around the world, our sales and service network is one of the largest in the industry.

Whether you need an emergency replacement regulator or need expert assistance on a long-range growth and expansion plan, there is a local Sales Office to respond quickly and professionally.

Emerson Process Management Regulator Technologies Facilities



You Demand High Performance. **We Ensure It.**



Real-World Simulation

Flow Testing

- Simulates real-world operating conditions using pipelines up to NPS 32 / DN 800 with compressible and incompressible fluids up to 30,000 psig / 2068 bar
- Ensures product performance, efficiency, environmental compliance, life span and safety

Materials Testing

- Develops and tests materials to improve regulator performance and reliability
- Ensures materials meet customer requirements, national standards, and our own, still higher, brand standards
- Analyzes and troubleshoots field installations for contamination and composition at an elemental level

Environmental Testing

- Simulates real-world operating conditions from the deserts of the Middle East to the Arctic North
- Validates product lifecycles at field conditions to extend service life
- Verifies product corrosion resistance using extended salt-spray exposure to ensure environmental protection of process equipment

You demand products to withstand your toughest conditions, while delivering continued optimal performance, efficiency, reliability and safety.

Emerson™ design, test and evaluation technologies and techniques validate a full range of product offerings in each of these critical areas, providing flow, material and environmental testing under real-world operating conditions before you place them in your application.

Emerson has more than 130 years of application experience in the process industry, with a reputation for solving challenging problems and developing products to specifications exceeding regulatory guidelines. Count on Emerson capabilities worldwide to deliver the highest quality products available to your site.

EMERSON™
Process Management

Next Generation of Pressure Regulator Technology



The Commercial Service Regulator Family of Products from the Technology Leader in Pressure Regulation

Every global customer has a unique gas system based on inlet pressures, delivery pressures, accuracy, flow and overpressure protection requirements. To meet these needs, customers currently utilize several regulator designs and overpressure protection methods from one or more suppliers. This results in nonstandard installations or meter sets, various maintenance requirements and methods, training issues and stocking of a multitude of spare parts.

To meet the current and future needs of worldwide customers, Emerson Process Management has designed the Commercial Service Regulator platform. This platform brings a patentable, modular design that has never been seen in previous regulators, resulting in:

- Easy product sizing and selection
- Broad platform, wide application coverage
- Reduced inventory through shared parts
- Reduced training and maintenance through streamlined design

The Ultimate in Selectivity

With three new actuator designs and modular components, the Commercial Service Regulator family's streamlined platform offers advanced capabilities for natural gas, industrial process and LPG applications. A carefully engineered fit makes it easy to select the exact pressure regulator and overpressure protection required.

Product Advantages:

- **Lower cost of ownership/ reduced time and expense for**
  - Training
  - Installation
  - Maintenance
- **Highly configurable**
  - All actuators and slam-shut are fully rotational for installation in any orientation
  - External, internal or dual-registration for flexible skid and field installation
  - Multiple overpressure protection options
  - Balanced or unbalanced trim
- **Multiple body sizes and configurations to fit new and replacement applications**

The Highest Quality Engineering and Performance Tailored to Fit Your Application

Our Unique Commercial Service Regulator Platform

Trim Style
- Balanced
- Unbalanced

Amplification
- Direct-Operated
- Pressure-Loaded

Internal Relief
- Token
- Standard
- High-Capacity

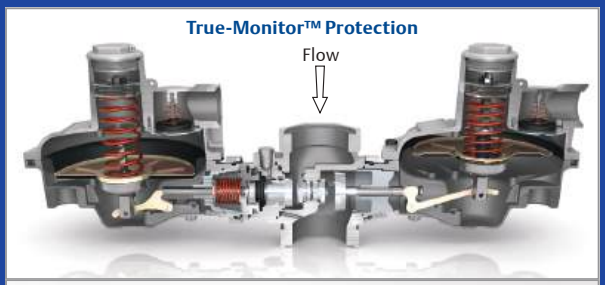
Pressure Registration
- Internal
- External
- Dual

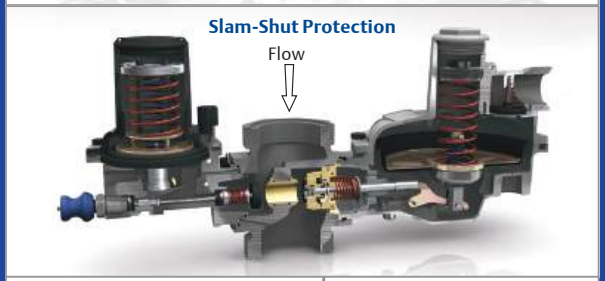
Overpressure Protection
- True-Monitor™ Protection
- Slam-Shut Protection
- High-Capacity Relief
- Secondary Seat™ Protection

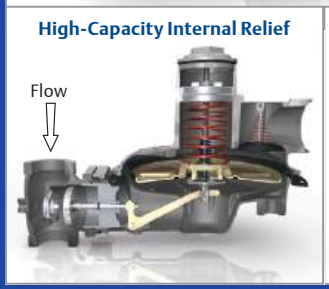


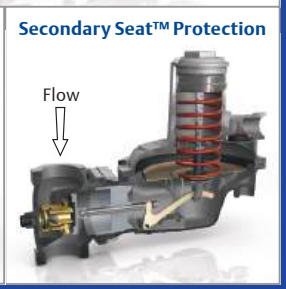
The distinctive swirl pattern cast into every Commercial Service Regulator actuator casing, uniquely identifies the regulator as a genuine Fisher® Commercial Service Regulator Platform product and assures you of the highest quality engineering, performance and support traditionally associated with Fisher™, Francel™ and Tartarini™ regulators.











History:

Our Path to Technology Leadership

In 1880, Fisher Controls was founded in Marshalltown, Iowa, by William Fisher. Fisher Controls grew steadily over the years,evolving into an industry leader offering customers the most complete range of flow control products in the world.

William Fisher came to America from England as a boy of 14. As his family ventured west in the new land, they settled along the Mississippi in Clinton, Iowa. It was there, as a mechanic in a small engine shop for 10 years, that William learned about steam, the major source of power in the late 1800s. Because of his experience in water and steam, William, who was 24 at the time, was invited to Marshalltown to help install the water works.

The idea of a control device was born in the engineer's mind as a fire raged in the city. Working through the night, William Fisher hand-throttled the steam-driven pumps to maintain pressure in the city's mains. During that fire, he saw a need for a device that would both control the steam-driven pumps and maintain them at a constant pressure. Many months and trials later, William Fisher was finally satisfied with one of his designs and began manufacturing what we know today as the Fisher™ Type 1 constant pressure pump governor. He was granted a patent in 1884.

One thing remained the same since William Fisher's first Type 1 pump governor: a pledge to unequalled quality. Today, the brand name Fisher is synonymous with quality throughout the world.



Type 1 Pump Governor 1880

The Fisher Years

1880 Type 1 pump governor is invented by William Fisher.
1888 The Fisher Governor Company is incorporated on Dec. 26.
1906 William Fisher dies. His wife, Martha, becomes president.
1912 Jasper Fisher assumes presidency; first sales offices are established.
1937 Serial number 500,000 assigned to a Type 1 pump governor on Nov. 5.
1938 Jasper Fisher dies.
1940 First Western Union teletype machine is installed to speed communication.
1943 One millionth serial number assigned June 9.
1944 Mrs. J.H. Fisher is elected president.
1946 Sales department holds first school for field representatives.
1950 Two-millionth controller made. Fisher enters licensee agreement with Elliott Automation to manufacture products for England and Europe.
1954 Mrs. J.H. Fisher retires; J.W. (Bill) Fisher is elected president.
1955 New office building opens in Marshalltown.
1960 Ball valves are added to Fisher's product line. Licensing agreement reached to manufacture in Japan.
1965 Gas regulator department moves to McKinney, Texas.
1967 Governor Road facility, the most advanced machine shop of its kind in the world, begins operation in Marshalltown.
1969 Fisher begins manufacturing electronic instrumentation. Bill Fisher remains as Chairman of the Board until 1974.
1970 Our first European facility opens at Cornwall, England, to manufacture electronic instrumentation.
1972 The R.A. Engel Technical Center, Marshalltown, is completed, housing the world's most advanced flow test laboratory.
1975 A new electronics manufacturing facility is opened in Marshalltown.
1976 Production of our new line of rotary valves begins in Sherman, Texas. Fisher Brazil opens its doors.
1979 Fisher Controls Corporation of Delaware forms a stronger manufacturing, sales and service organization.
1980 Fisher celebrates a Century of Control.
1992 ISO 9001 original registration validated, McKinney, Texas

The Emerson Years

1993 Fisher Controls and Rosemount, merge under ownership of Emerson Electric.
1994 Francel, Gallardon, France, acquired, expanding manufacturing and distribution in Europe, Middle East and Africa.
1996 Type 299 pilot-operated regulator introduced to natural gas market.
1997 The 50th anniversary of the Type 99. The FloBoss 503 and Regulator Vault are introduced.
1998 Fisher Regulators FROMEX manufacturing plant opens in Nuevo Laredo, Mexico.
1999 Revolutionary Type EZR pressure regulator introduced.
2001 Tartarini, Bologna, Italy, acquired, extending Fisher's brand and distribution capability in Europe and Asia.
2003 Manufacturing capability expanded with opening of Shanghai Plant.
2003 New, state-of-the-art flow test laboratory opens in McKinney, Texas.
2004 Introduced digitally controlled odorant injection system.
2004 Jeon, Chengdu, China, acquired, expanding Fisher's presence in China's low-pressure regulator market.
2005 Fisher celebrates its 125th anniversary.
2005 EZ Family product lines, EZR, EZH and EZL pressure regulators expanded.
2005 Customer Center opened to display new regulator technology and train customers and sales channel.
2005 Tescom Corporation, Elk River, Minnesota, and Selmsdorf, Germany, manufacturer of high-pressure, high-purity pressure regulators, acquired.
2006 Type SR stainless steel Sanitary Regulator introduced.
2007 Commercial Service Regulators platform introduced featuring True Monitor™ Protection, Slam-Shut and Secondary Seat™ Protection options.
2007 Cluj, Romania, manufacturing location online.
2008 Regulator Division becomes Emerson Process Management Regulator Technologies, Inc.
2013 Enardo, Tulsa, Oklahoma, Acquired, expands Fisher's storage tank solutions for oil and gas, petrochemical and chemical industries.
2014 New Global Regulator Techologies Headquarters opens in McKinney, Texas.
2015 Type CS804 regulator with integral slam-shut is added to CS800 Series.
2015 New product launches for MR95 and MR98 Series
2015 Emerson celebrates its 125th year anniversary

Natural Gas



Natural gas (methane) is a clean-burning fuel gas used for many residential, commercial and industrial applications. This colorless, odorless, naturally occurring gas can be found in many countries around the world.

Natural gas production companies tap gas pools using wells and pipelines. They clean and prepare the gas for sale and transport the gas through pipelines to gas suppliers.

High-pressure transmission pipelines move the gas from the production company's cleaning plants to gas distribution companies for sale to consumers. Regulators and control valves control the high-pressure gas as it moves along the pipeline. At city gate stations and farm taps, regulators reduce the pipeline gas pressure to distribution pressure. Before distribution, an odorant is added to the gas so people can detect the gas in the event of a leak. To provide a constant, measurable gas pressure, service regulators control the gas pressure before it enters the customer's residence or building.

Worldwide, natural gas is used for residential, commercial and industrial applications. Residential applications use natural gas for heating and cooling homes, heating water and fueling gas ranges. Commercial applications, such as grocery stores and office buildings, use natural gas for heating and cooling. For industrial applications, natural gas is used as a feedstock for making chemicals, such as anhydrous ammonia and as a fuel for boilers and furnaces.

Natural Gas Application: Oil & Gas Production / Transmission

Introduction

No other regulator manufacturer offers more products and services tailored to the natural gas industry than Emerson Process Management Regulator Technologies, Inc. Our natural gas regulators and relief valves incorporate only the latest in engineering technology. Many of our regulators, such as Types EZR, FL, 630, 1098-EGR and 99 have become industry standards for performance and extended service life.

Typical Usage Shown

The application maps on the following pages show typical product applications only. These maps and the product information in this Application Guide are presented to familiarize you with the broad range of pressure regulators, relief valves and electronic products available for natural gas applications. Please consult your local Sales Office to obtain a specific solution engineered to meet your system specifications.

Features

- Versatility
- High Speed Response
- Easy Maintenance
- Flexibility
- High Capacity
- Proven Construction Materials
- Safe Operation
- Control Accuracy
- Installation Adaptability

Regulator

SS Slam-Shut Positive Shutoff Technology

EPR Electronic Pressure Recorder

EFM Electronic Flow Estimation and Measurement

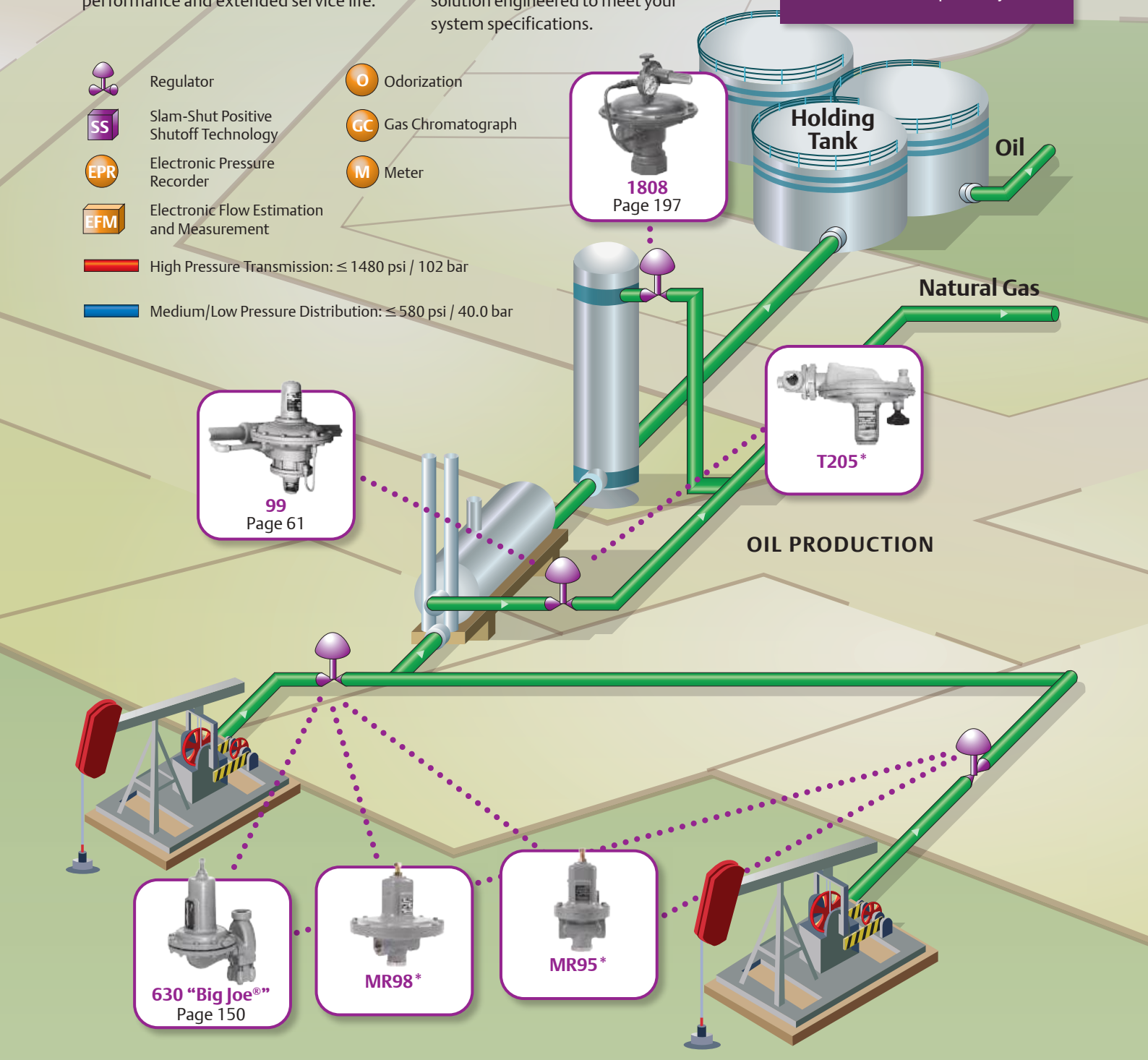
O Odorization

GC Gas Chromatograph

M Meter

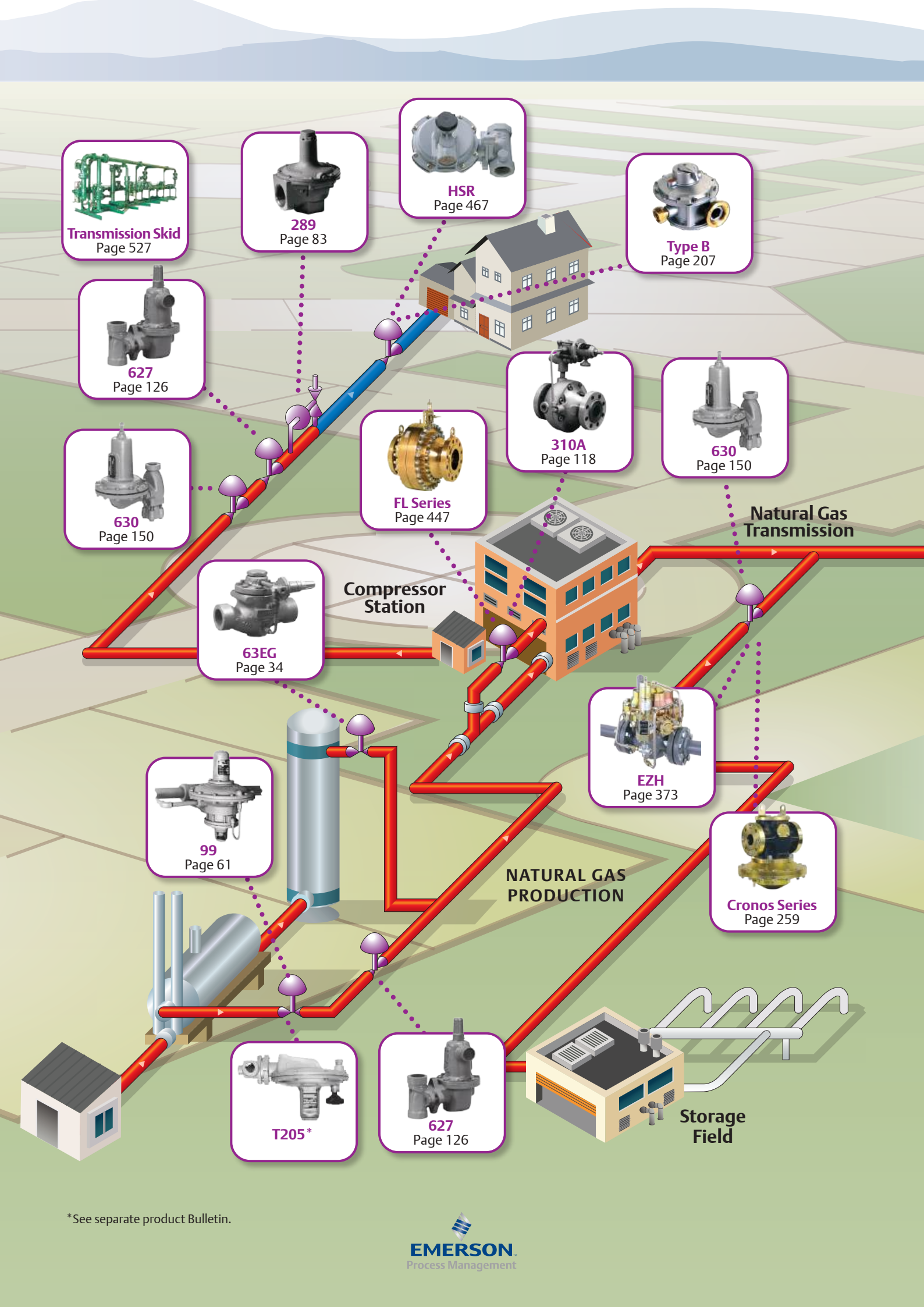
High Pressure Transmission: ≤ 1480 psi / 102 bar

Medium/Low Pressure Distribution: ≤ 580 psi / 40.0 bar



*See separate product Bulletin.

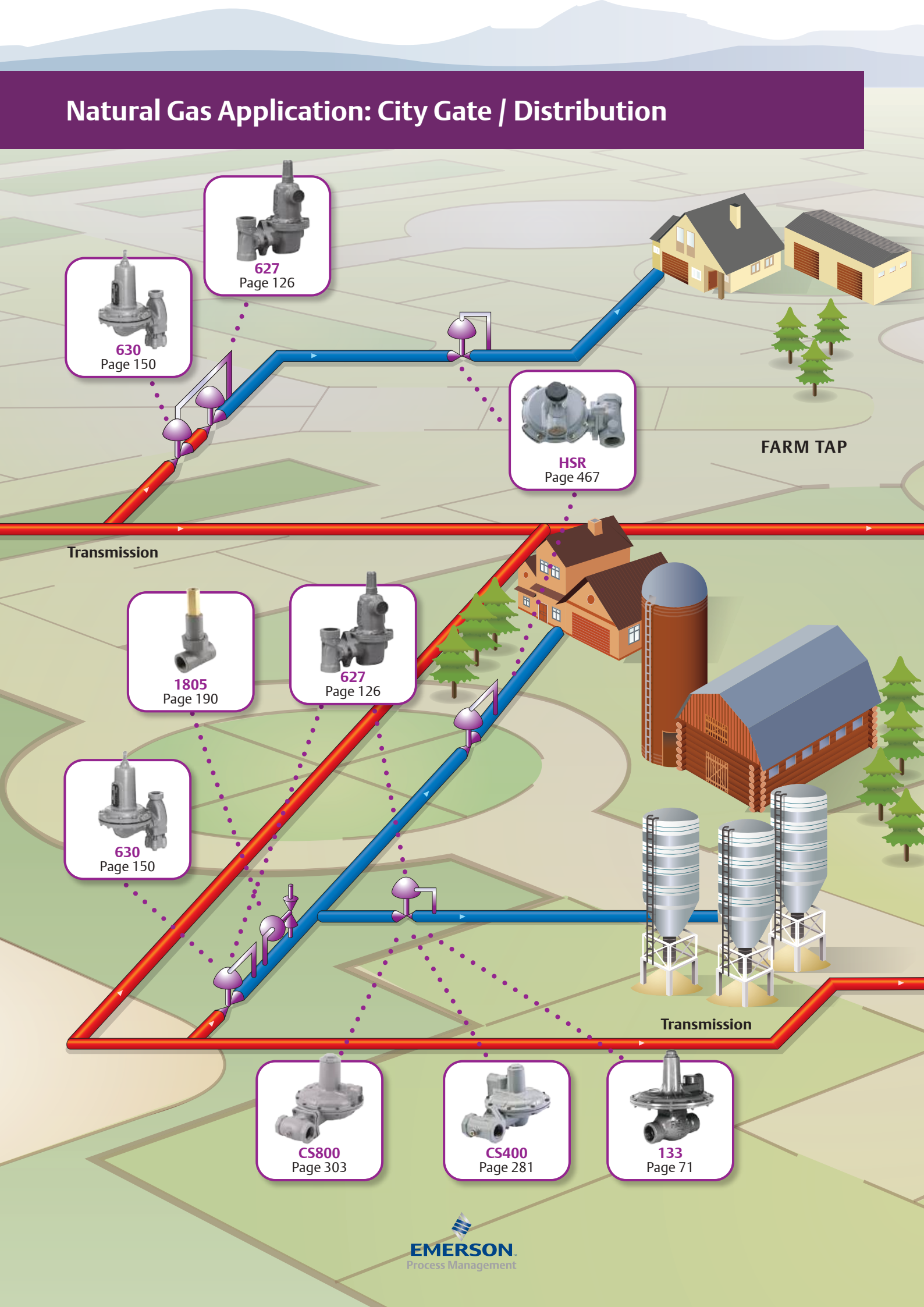
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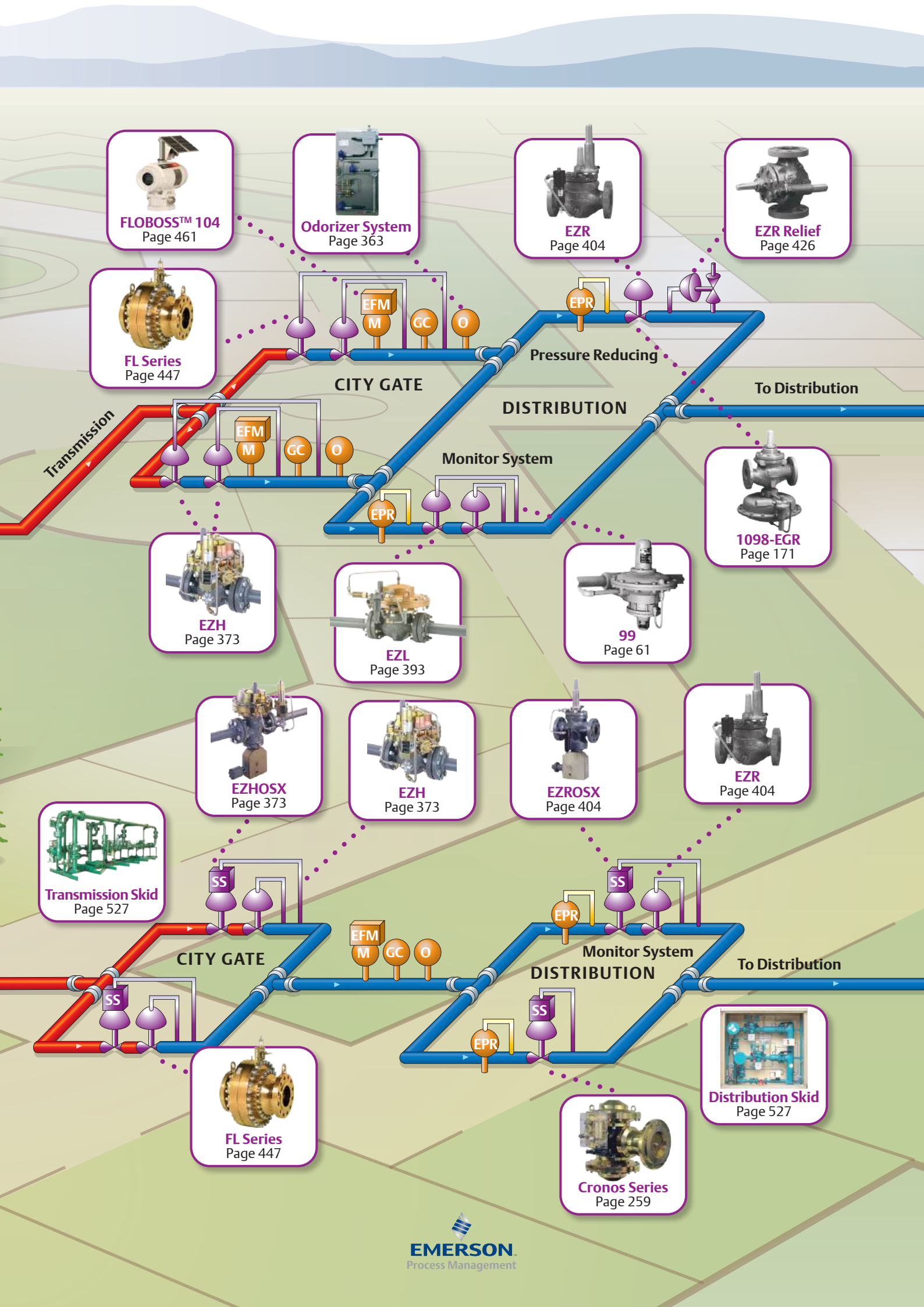
*See separate product Bulletin.

EMERSON
Process Management

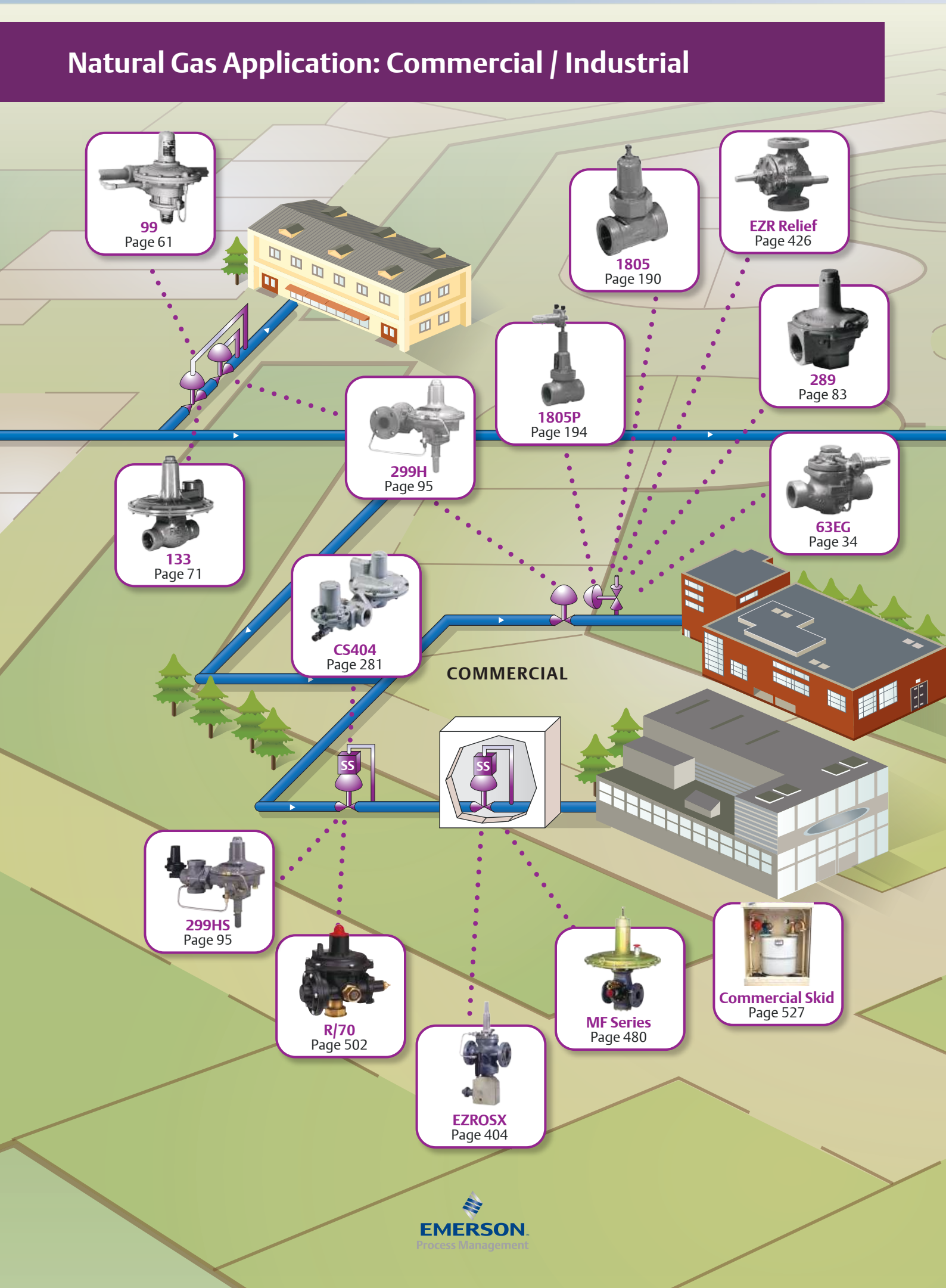
Natural Gas Application: City Gate / Distribution



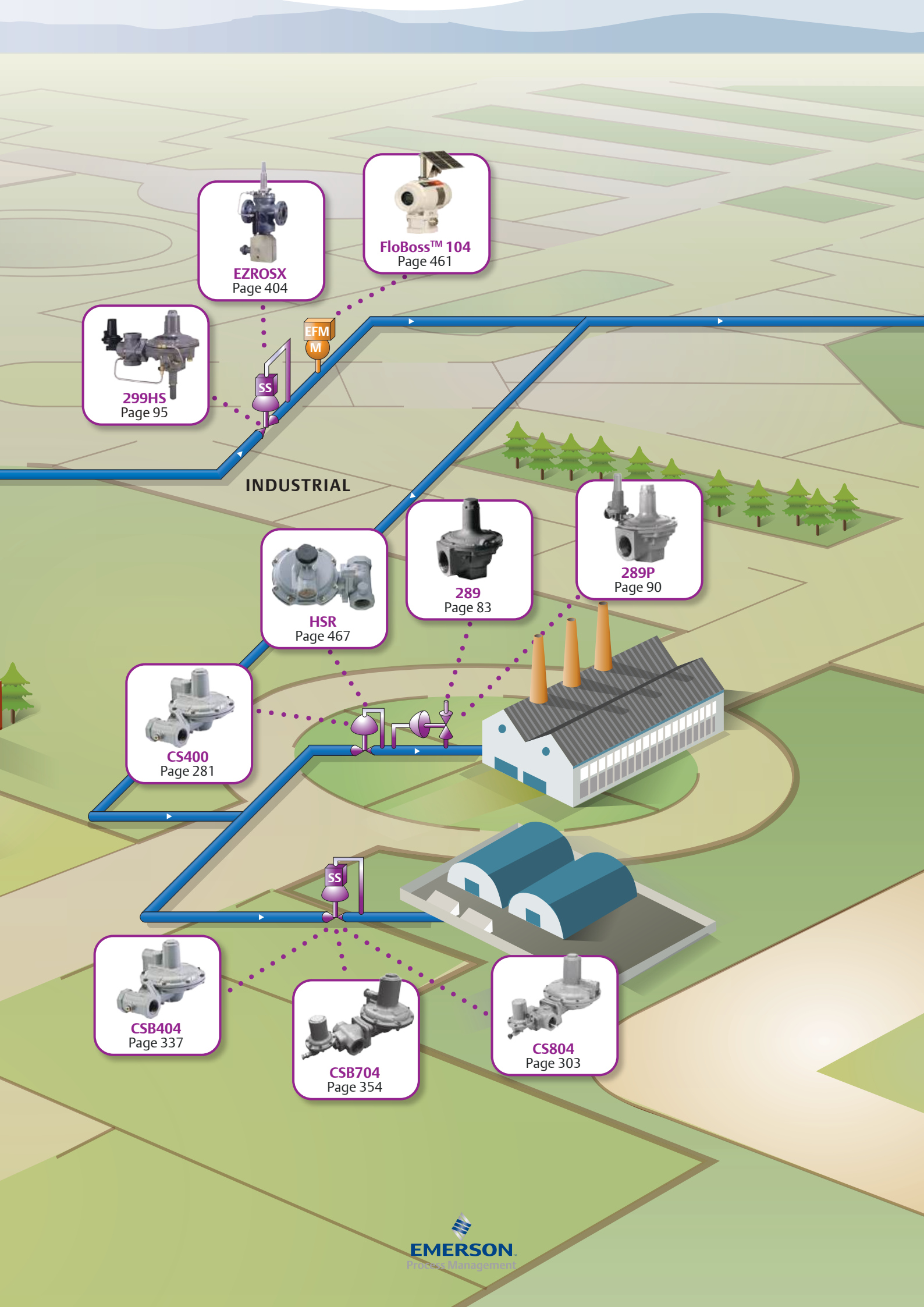
EMERSON
Process Management


FLOBOSS™ 104
Page 461
Odorizer System
Page 363
EZR
Page 404
EZR Relief
Page 426
FL Series
Page 447
EFM
M
GC
O
EPR
Pressure Reducing
CITY GATE
DISTRIBUTION
To Distribution
Transmission
Monitor System
1098-EGR
Page 171
EZH
Page 373
EZL
Page 393
99
Page 61
EZHOSX
Page 373
EZH
Page 373
EZROSX
Page 404
EZR
Page 404
Transmission Skid
Page 527
SS
CITY GATE
Monitor System
DISTRIBUTION
To Distribution
Distribution Skid
Page 527
FL Series
Page 447
Cronos Series
Page 259
EMERSON
Process Management

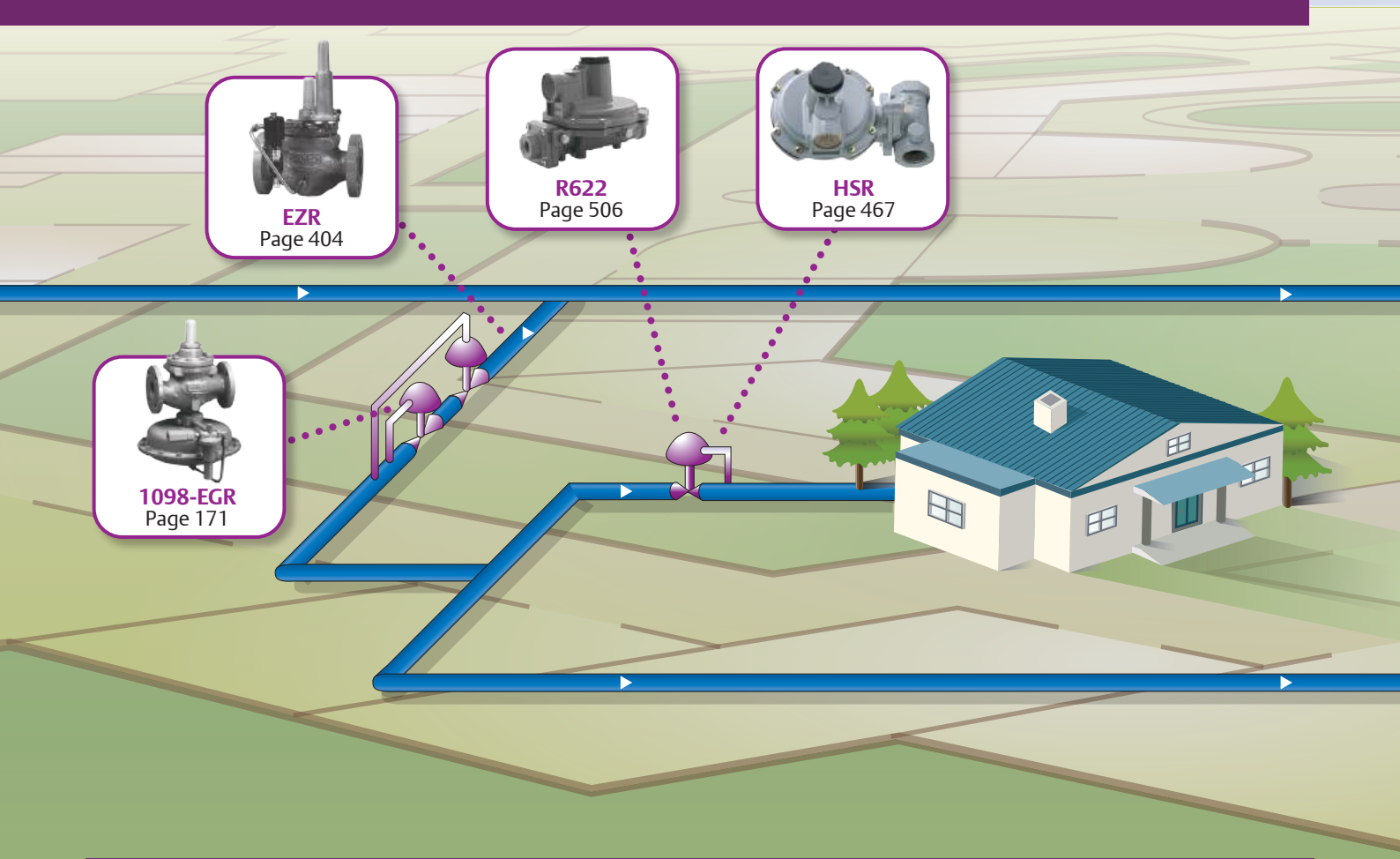
Natural Gas Application: Commercial / Industrial



EMERSON
Process Management


EZROSX
Page 404
FloBoss™ 104
Page 461
299HS
Page 95
EFM
M
SS
INDUSTRIAL
HSR
Page 467
289
Page 83
289P
Page 90
CS400
Page 281
SS
CSB404
Page 337
CSB704
Page 354
CS804
Page 303
EMERSON
Process Management

Natural Gas Application: Residential / Utilization



Products by Application

Application ..... *Page*

Transmission
- Type 310A 118
- Type BLE, BLX 216
- Cronos Series 259
- EZH Series 373
- FL Series 447

Farm Tap/Field
- 627 Series 126
- Type 627F 144
- Type 630 150

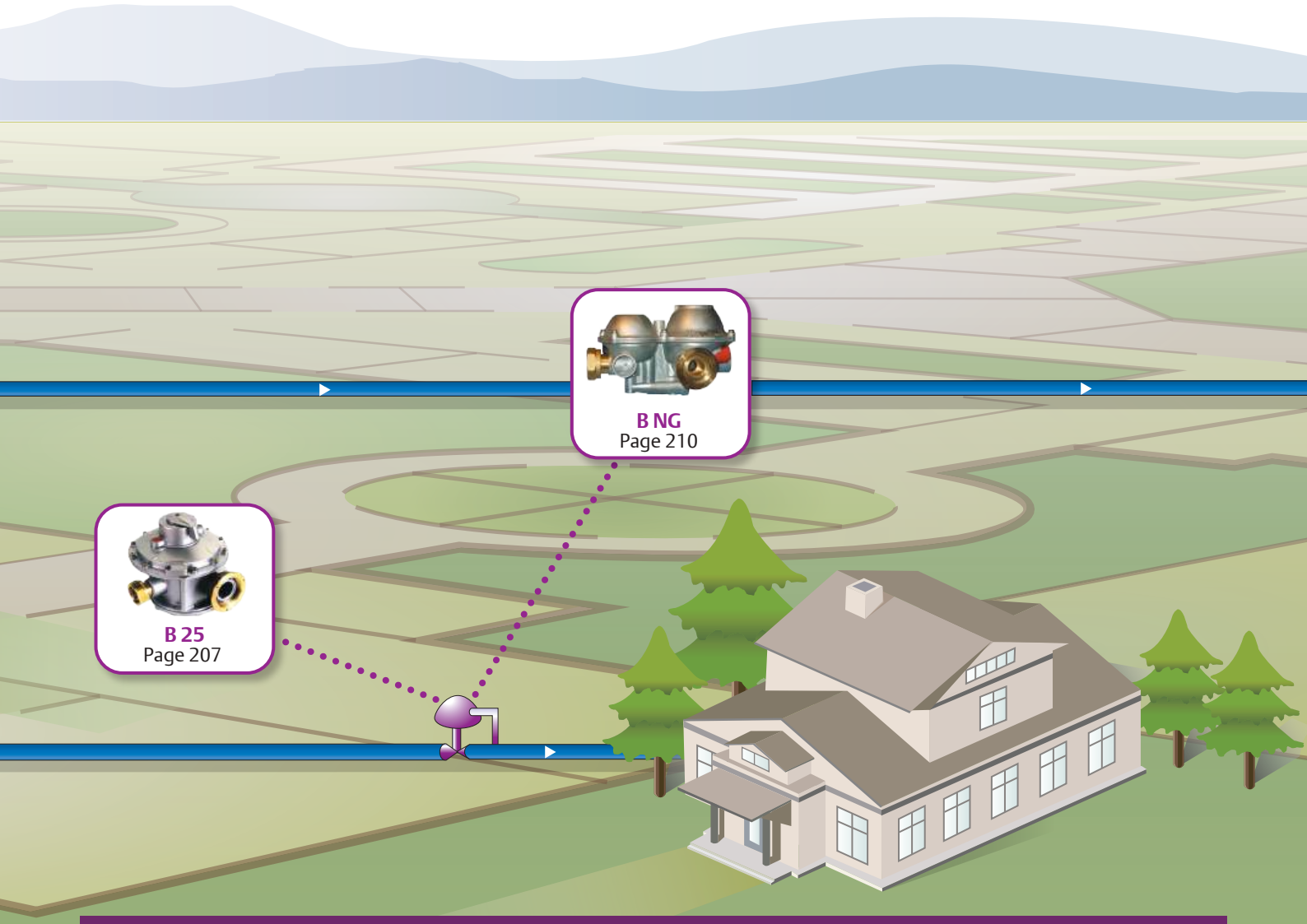
City Gate/District Station
- Type 99 61
- 133 Series 71
- Type 310A 118
- Type 627 126
- Type 971 168
- Type 1098-EGR 171
- Cronos Series 259
- EZH Series 373
- EZL Series 393
- EZR Series 404
- FL Series 447
- M Series 480

Commercial/Industrial Service
- Type 99 61
- 133 Series 71
- 299H Series 95
- 627 Series 126
- Type 627F 144
- Type 912N 165
- Type 1098-EGR 171
- A/100 Series 201
- A/140 Series 204
- B/240 Series 213
- CP200 Series 235
- CP400 Series 242
- Cronos Series 259
- CS200 Series 266
- CS400 Series 281
- CS800 Series 303
- CSB400 Series 337
- CSB600 Series 345
- CSB700 Series 354
- EZL Series 393
- R Series 502

Commercial/Industrial Service
- Regal 3 Series 511
- RP Series 517
- Y600A Series 543

Residential/Utilization Service
- Type 912N 165
- Type B 207
- Type B NG 210
- Type HSR 467
- R Series 502
- Type R622 506

Fixed Factor/Billing
- Type 99 61
- 299H Series 95
- Type 627F 144
- Type 1098-EGR 171
- CP200 Series 235
- CP400 Series 242
- CS200 Series 266
- CS400 Series 281
- CS800 Series 303
- CSB400 Series 337



Products by Application

Application ..... *Page*

Fuel Gas Regulators
66 Series.....48
Type 99.....61
133 Series.....71
299H Series.....95
Type 912N.....165
Type 1098-EGR.....171
CP200 Series.....235
CP400 Series.....242
CS200 Series.....266
CS400 Series.....281
CS800 Series.....303
CSB400 Series.....337
Y600A Series.....543

Supply Regulators
67C Series.....53
1301 Series.....180
1305 Series.....184
Type 1367.....187

Stand Alone Shutoff Devices
634 Series.....162
BM5 Series.....219
Type BM6X.....224
Type BM7.....228
Type OSE.....496

Relief Valve/Backpressure Regulators
Type 63EG.....34
289 Series.....83
Type 289P.....90
Type 1805.....190
Type 1805P.....194
1808 Series.....197
Type EZH Relief.....388
Type EZR Relief.....426
FL Relief Series.....454
Type H120.....463
H200 Series.....465
V Series.....538

Odorizing System
Type Dosaodor-D.....363
OL Series.....495

Electronic Flow and Pressure Measurement
FloBoss™ 103.....459
FloBoss™ 104.....461
ROC800 Series.....515

Accessories
Type 119.....68
Type 252.....81
CNF, CN, CF Series.....231
FA, FAG Series.....436
Type P590.....501
Type RPE.....525
Types SR, SRII, SRS, STP, STL and Whisper Trim™.....529
V Series.....538
VFA Series.....535

Skids.....527

Underground Modules
MIC, MIF, MIR Series.....490

EMERSON
Process Management

Natural Gas Product Availability

PRODUCT TYPE NUMBER	WORLD AVAILABILITY [1]				PED 97/23/CE CATEGORY
	NORTH AMERICA	EUROPE, MIDDLE EAST AND AFRICA	ASIA PACIFIC	LATIN AMERICA	
63EG	●	●	●	●	SEP and II
66	●	●	●	●	SEP
67C	●	●	●	●	SEP
971	●	●	●	●	III
99	●	●	●	●	I [2]
119	●	●	●	●	SEP
133	●	●	●	●	I
252	●	●	●	●	SEP
289	●	●	●	●	I
289P	●	●	●	●	SEP
299H	●	●	●	●	I
310A	●	●	●	●	SEP and III
627	●	●	●	●	SEP and II
627F	●	●	●	●	SEP and II
630	●	●	●	●	SEP
634	●			●	----
912N	●	●	●	●	SEP
1098-EGR	●	●	●	●	SEP and II
1301	●	●	●	●	SEP
1305	●	●	●	●	SEP
1367	●	●	●	●	SEP
1805	●	●	●	●	----
1805P	●	●	●	●	----
1808	●	●	●	●	----
A/100		●	●	●	I
A/140		●	●	●	MAX. IV
B		●	●	●	SEP
B NG		●	●	●	SEP
B/240		●	●	●	MAX. IV
BLE, BLX		●	●	●	IV
BM5		●	●	●	IV
BM6X		●	●	●	IV
BM7		●	●	●	IV
CNF, CN, CF		●	●	●	MAX. IV
CP200	●	●	●	●	----
CP400	●	●	●	●	----
CRONOS		●	●	●	IV
CS200	●	●	●	●	----
CS400	●	●	●	●	I and IV
CS800	●	●	●	●	I and IV

Natural Gas Product Availability

PRODUCT TYPE NUMBER	WORLD AVAILABILITY (1)				PED 97/23/CE CATEGORY
	NORTH AMERICA	EUROPE, MIDDLE EAST AND AFRICA	ASIA PACIFIC	LATIN AMERICA	
CSB400	●	●	●	●	I and IV
CSB600	●	●	●	●	I and IV
CSB700	●	●	●	●	I and IV
DOSAODOR-D / ROC 809	●			●	II(3)
DOSAODOR-D / ELECTRONIC CONTROL UNIT		●	●		II(3)
EZH	●	●	●	●	IV
EZH RELIEF	●	●	●	●	IV
EZL	●	●	●	●	- - - -
EZR	●	●	●	●	III and SEP
EZR RELIEF	●	●	●	●	III
FA AND FAG FILTERS		●	●	●	MAX. IV
FL	●	●	●	●	IV
FL RELIEF (VS-FL)	●	●	●	●	IV
FLOBOSS™ 103	●	●	●	●	- - - -
FLOBOSS™ 104	●	●	●	●	- - - -
H120	●	●	●	●	SEP
H200	●	●	●	●	SEP
HSR	●	●	●	●	SEP
M SERIES		●	●	●	MAX. IV
MIC, MIF, MIR		●	●	●	- - - -
OL ODORIZER		●	●	●	IV
OSE	●	●	●	●	IV
P590	●	●	●	●	SEP
R SERIES		●	●	●	SEP
R622	●	●	●	●	SEP
REGAL 3		●	●	●	I
ROC800	●	●	●	●	- - - -
RP		●	●	●	I and SEP
RPE		●	●	●	- - - -
SR, SRII, SRS, STP, STL AND WHISPER TRIM™	●	●	●	●	- - - -
SV		●	●	●	MAX. IV
V SERIES		●	●	●	MAX. I
VFA		●	●	●	MAX. III
VS100	●	●	●	●	IV
Y600A	●	●	●	●	SEP

NOTES:
1. Product availability and PED status are listed in this table. Some products, systems and/or accessories may not be available in a particular country or PED approved. Please consult your local Sales Office for current product availability or PED status.
2. Inlet pressure limited to 275 psig / 19.0 bar.
3. Only with cylindrical tank with volume > 1 liter.

Natural Gas Quick Selection Guide

Transmission

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
1050 psig / 72.4 bar	6 in. w.c. to 1000 psig / 15 mbar to 68.9 bar	16,124,000 SCFH / 432,000 Nm^3/h		**Type EZROSX** Page 404
1050 psig / 72.4 bar	6 in. w.c. to 1000 psig / 15 mbar to 68.9 bar	26,138,000 SCFH / 700,500 Nm^3/h		**Type EZR** Page 404
1450 psig / 100 bar	4.1 in. w.c. to 1160 psig / 10 mbar to 80.0 bar	9,590,000 SCFH / 257,000 Nm^3/h		**Cronos Series** Page 259
1480 psig / 102 bar	4.1 in. w.c. to 1160 psig / 10 mbar to 80.0 bar	100,535,000 SCFH / 2,694,000 Nm^3/h		**FL Series** Page 447
1500 psig / 103 bar	14.5 to 1160 psig / 1.00 to 80.0 bar	13,685,000 SCFH / 367,000 Nm^3/h		**Type EZHOSX** Page 373
1500 psig / 103 bar	14.5 to 1160 psig / 1.00 to 80.0 bar	13,883,000 SCFH / 372,000 Nm^3/h		**Type EZH** Page 373
1500 psig / 103 bar	10 to 700 psig / 0.69 to 48.3 bar	21,170,000 SCFH / 567,400 Nm^3/h		**Type 310A** Page 118

Farm Tap / Field

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
250 psig / 17.2 bar	5 to 100 psig / 0.34 to 6.9 bar	37,600 SCFH / 1008 Nm^3/h		**Type 627F** Page 144
1500 psig / 103 bar	3 to 500 psig / 0.21 to 34.5 bar	130,000 SCFH / 3480 Nm^3/h		**Type 630** Page 150
2000 psig / 138 bar	5 to 500 psig / 0.34 to 34.5 bar	179,000 SCFH / 4800 Nm^3/h		**627 Series** Page 126

Natural Gas Quick Selection Guide

City Gate / District Station

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
150 psig / 10.3 bar	2 in. w.c. to 60 psig / 5 mbar to 4.1 bar	372,000 SCFH / 9970 Nm^3/h		**133 Series** Page 71
284 psig / 19.6 bar	4 in. w.c. to 43.5 psig / 10 mbar to 3.0 bar	784,000 SCFH / 22,200 Nm^3/h		**M Series** Page 480
290 psig / 20.0 bar	2 to 350 psig / 140 mbar to 24.1 bar	2,427,000 SCFH / 65,000 Nm^3/h		**Type EZLOSX** Page 393
290 psig / 20.0 bar	2 to 350 psig / 140 mbar to 24.1 bar	2,534,000 SCFH / 67,911 Nm^3/h		**Type EZL** Page 393
363 psig / 25.0 bar	4.1 in. w.c. to 44 psig / 10 mbar to 3.0 bar	6,866,000 SCFH / 184,000 Nm^3/h		**Type FL-BP** Page 447
400 psig / 27.6 bar	4 in. w.c. to 300 psig / 10 mbar to 20.7 bar	11,331,000 SCFH / 304,000 Nm^3/h		**Type 1098-EGR** Page 171
1000 psig / 69.0 bar	2 in. w.c. to 100 psig / 5 mbar to 6.9 bar	265,000 SCFH / 7102 Nm^3/h		**Type 99** Page 61

City Gate / District Station (Continued)

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
1050 psig / 72.4 bar	6 in. w.c. to 1000 psig / 15 mbar to 68.9 bar	16,124,000 SCFH / 432,000 Nm^3/h		**Type EZROSX** Page 404
1050 psig / 72.4 bar	6 in. w.c. to 1000 psig / 15 mbar to 68.9 bar	26,138,000 SCFH / 700,500 Nm^3/h		**Type EZR** Page 404
1450 psig / 100 bar	4.1 in. w.c. to 1160 psig / 10 mbar to 80.0 bar	9,590,000 SCFH / 257,000 Nm^3/h		**Cronos Series** Page 259
1480 psig / 102 bar	4.1 in. w.c. to 1160 psig / 10 mbar to 80.0 bar	100,535,000 SCFH / 2,694,000 Nm^3/h		**FL Series** Page 447
1500 psig / 103 bar	14.5 to 1160 psig / 1.00 to 80.0 bar	13,685,000 SCFH / 367,000 Nm^3/h		**Type EZHOSX** Page 373
1500 psig / 103 bar	14.5 to 1160 psig / 1.00 to 80.0 bar	13,883,000 SCFH / 372,000 Nm^3/h		**Type EZH** Page 373
1500 psig / 103 bar	10 to 700 psig / 0.69 to 48.3 bar	21,170,000 SCFH / 567,400 Nm^3/h		**Type 310A** Page 118

Natural Gas Quick Selection Guide

Commercial / Industrial Service

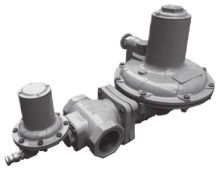
Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
87 psig / 6.0 bar	3.9 in. w.c.to 4.35 psig / 10 mbar to 0.30 bar	31,783 SCFH / 852 Nm^3/h		**A/140 Series** Page 204
87 psig / 6.0 bar	4 in. w.c.to 4.35 psig / 10 mbar to 0.30 bar	10,594 SCFH / 284 Nm^3/h		**B/240 Series** Page 213
116 psig / 8.0 bar	3.9 in. w.c.to 4.35 psig / 10 mbar to 0.30 bar	21,189 SCFH / 568 Nm^3/h		**A/100 Series** Page 201
125 psig / 8.6 bar	3.5 in. w.c.to 2 psig / 9 mbar to 0.14 bar	7600 SCFH / 204 Nm^3/h		**CS200 Series** Page 266
125 psig / 8.6 bar	3.5 in. w.c. to 5.5 psig / 9 mbar to 0.38 bar	12,000 SCFH / 322 Nm^3/h		**CS400 Series** Page 281
125 psig / 8.6 bar	3.5 in. w.c. to 10 psig / 9 mbar to 0.69 bar	36,270 SCFH / 972 Nm^3/h		**CS800 Series** Page 303
125 psig / 8.6 bar	1 to 20 psig / 69 mbar to 1.4 bar	9860 SCFH / 264 Nm^3/h		**CP200 Series** Page 235

Commercial / Industrial Service (Continued)

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
125 psig / 8.6 bar	1 to 20 psig / 69 mbar to 1.4 bar	23,300 SCFH / 624 Nm³/h		**CP400 Series** Page 242
145 psig / 10.0 bar	3.2 in w.c. to 43.5 psig / 8 mbar to 3 bar	126,866 SCFH / 3400 Nm³/h		**Regal 3 Series** Page 511
145 psig / 10.0 bar	6 in. w.c. to 4.35 psig / 15 mbar to 0.30 bar	3531 SCFH / 95 Nm³/h		**R Series** Page 502
150 psig / 10.3 bar	2 in. w.c.to 60 psig / 5 mbar to 4.1 bar	372,000 SCFH / 9970 Nm³/h		**133 Series** Page 71
150 psig / 10.3 bar	4 in. w.c. to 7 psig / 10 mbar to 0.48 bar	6660 SCFH / 178 Nm³/h		**Y600A Series** Page 543
175 psig / 12.1 bar	3.5 in. w.c. to 16 psig / 9 mbar to 1.1 bar	88,170 SCFH / 2363 Nm³/h		**299HS Series** Page 95

Natural Gas Quick Selection Guide

Commercial / Industrial Service (Continued)

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
175 psig / 12.1 bar	3.5 in. w.c. to 60 psig / 9 mbar to 4.1 bar	108,120 SCFH / 2898 Nm^3/h		**299H Series** Page 95
232 psig / 16.0 bar	6.8 in. w.c. to 43.5 psig / 17 mbar to 3 bar	36,197 SCFH / 970 Nm^3/h		**CSB400 Series** Page 337
232 psig / 16 bar	0.11 to 72.5 psig / 7.5 mbar to 5 bar	189,989 SCFH / 5092 Nm^3/h		**CSB600 Series** Page 345
232 psig / 16 bar	0.11 to 72.5 psig / 7.5 mbar to 5 bar	267,186 SCFH / 7161 Nm^3/h		**CSB700 Series** Page 354
250 psig / 17.2 bar	3 in. w.c. to 5 psig / 7 mbar to 0.34 bar	1030 SCFH / 27.6 Nm^3/h		**Type 912N** Page 165
250 psig / 17.2 bar	5 to 100 psig / 0.34 to 6.9 bar	37,600 SCFH / 1008 Nm^3/h		**Type 627F** Page 144
290 psig / 20.0 bar	2 to 350 psig / 140 mbar to 24.1 bar	2,427,000 SCFH / 65,044 Nm^3/h		**Type EZLOSX** Page 393

Commercial / Industrial Service (Continued)

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
290 psig / 20.0 bar	2 to 350 psig / 140 mbar to 24.1 bar	2,534,000 SCFH / 67,911 Nm³/h		**Type EZL** Page 393
290 psig / 20.0 bar	1.45 to 58 psig / 0.1 to 4.0 bar	53,325 SCFH / 1429 Nm³/h		**RP Series** Page 517
363 psig / 25.0 bar	4.1 in. w.c. to 44 psig / 10 mbar to 3.0 bar	6,866,000 SCFH / 184,000 Nm³/h		**Type FL-BP** Page 447
400 psig / 27.6 bar	4 in. w.c. to 300 psig / 10 mbar to 20.7 bar	11,331,000 SCFH / 304,000 Nm³/h		**Type 1098-EGR** Page 171
1000 psig / 69.0 bar	2 in. w.c. to 100 psig / 5 mbar to 6.9 bar	265,000 SCFH / 7102 Nm³/h		**Type 99** Page 61
1450 psig / 100 bar	4 in. w.c. to 1160 psig / 10 mbar to 80.0 bar	9,590,000 SCFH / 257,000 Nm³/h		**Cronos Series** Page 259
2000 psig / 138 bar	5 to 500 psig / 0.34 to 34.5 bar	179,000 SCFH / 4797 Nm³/h		**627 Series** Page 126

Natural Gas Quick Selection Guide

Residential / Utilization Service

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
72.5 psig / 5.0 bar	3.6 to 161 in. w.c. / 9 to 400 mbar	1791 SCFH / 48 Nm^3/h		**Type B** Page 207
72.5 psig / 5.0 bar	3.6 to 20 in. w.c. / 9 to 50 mbar	373 SCFH / 10 Nm^3/h		**Type B NG** Page 210
125 psig / 8.6 bar	1.8 in. w.c. to 2.2 psig / 4 mbar to 0.15 bar	1285 SCFH / 34,4 Nm^3/h		**Type R622** Page 506
125 psig / 8.6 bar	4 in. w.c. to 2.2 psig / 10 mbar to 0.15 bar	4800 SCFH / 129 Nm^3/h		**Type HSR** Page 467
145 psig / 10.0 bar	6.0 in. w.c. to 4.35 psig / 15 mbar to 0.30 bar	3531 SCFH / 95 Nm^3/h		**R Series** Page 502
250 psig / 17.2 bar	3 in. w.c. to 5 psig / 7 mbar to 0.34 bar	1030 SCFH / 27.6 Nm^3/h		**Type 912N** Page 165

Fixed Factor Billing / Pressure Factor Management

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
125 psig / 8.6 bar	3.5 in. w.c. to 10 psig / 9 mbar to 0.69 bar	36,270 SCFH / 972 Nm^3/h		**CS800 Series** Page 303
125 psig / 8.6 bar	3.5 in. w.c. to 5.5 psig / 9 mbar to 0.38 bar	12,000 SCFH / 322 Nm^3/h		**CS400 Series** Page 281
125 psig / 8.6 bar	1 to 20 psig / 69 mbar to 1.4 bar	9860 SCFH / 264 Nm^3/h		**CP200 Series** Page 235
125 psig / 8.6 bar	1 to 20 psig / 69 mbar to 1.4 bar	23,300 SCFH / 624 Nm^3/h		**CP400 Series** Page 242
175 psig / 12.1 bar	3.5 in. w.c. to 60 psig / 9 mbar to 4.1 bar	108,120 SCFH / 2898 Nm^3/h		**299H Series** Page 95
232 psig / 16.0 bar	6.8 in. w.c. to 43.5 psig / 17 mbar to 3 bar	36,197 SCFH / 970 Nm^3/h		**CSB400 Series** Page 337
250 psig / 17.2 bar	5 to 100 psig / 0.34 to 6.9 bar	37,600 SCFH / 1008 Nm^3/h		**Type 627F** Page 144
400 psig / 27.6 bar	4 in. w.c. to 300 psig / 10 mbar to 20.7 bar	11,331,000 SCFH / 304,000 Nm^3h		**Type 1098-EGR** Page 171
1000 psig / 68.9 bar	2 in. w.c. to 100 psig / 5 mbar to 6.9 bar	265,000 SCFH / 7102 Nm^3/h		**Type 99** Page 61

Natural Gas Quick Selection Guide

Fuel Gas Regulators

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
10 psig / 0.69 bar	2 in. w.c. to 5 psig / 5 mbar to 0.34 bar	77,500 SCFH / 2077 Nm^3/h		**66 Series** Page 48
125 psig / 8.6 bar	3.5 in. w.c. to 5.5 psig / 9 mbar to 0.38 bar	12,000 SCFH / 322 Nm^3/h		**CS400 Series** Page 281
125 psig / 8.6 bar	3.5 in. w.c. to 10 psig / 9 mbar to 0.69 bar	36,270 SCFH / 972 Nm^3/h		**CS800 Series** Page 303
150 psig / 10.3 bar	2 in. w.c. to 60 psig / 5 mbar to 4.1 bar	372,000 SCFH / 9970 Nm^3/h		**133 Series** Page 71
150 psig / 10.3 bar	4 in. w.c. to 7 psig / 10 mbar to 0.48 bar	6660 SCFH / 178 Nm^3/h		**Y600A Series** Page 543
175 psig / 12.1 bar	3.5 in. w.c. to 16 psig / 9 mbar to 1.1 bar	88,170 SCFH / 2363 Nm^3/h		**299HS Series** Page 95
175 psig / 12.1 bar	3.5 in. w.c. to 60 psig / 9 mbar to 4.1 bar	108,120 SCFH / 2898 Nm^3/h		**299H Series** Page 95
250 psig / 17.2 bar	3 in. w.c. to 5 psig / 7 mbar to 0.34 bar	1030 SCFH / 27.6 Nm^3/h		**Type 912N** Page 165

Fuel Gas Regulators (Continued)

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
400 psig / 27.6 bar	4 in. w.c. to 300 psig / 10 mbar to 20.7 bar	11,331,000 SCFH / 304,000 Nm^3h		**Type 1098-EGR** Page 171
1000 psig / 68.9 bar	2 in. w.c. to 100 psig / 5 mbar to 6.9 bar	265,000 SCFH / 7102 Nm^3/h		**Type 99** Page 61

Supply Regulators

Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
400 psig / 27.6 bar	0 to 150 psig / 0 to 10.3 bar	4350 SCFH / 117 Nm^3/h		**67C Series** Page 53
2000 psig / 138 bar	5 to 70 psig / 0.34 to 4.8 bar	1100 SCFH / 31 Nm^3/h		**Type 1367** Page 187
4000 psig / 276 bar	0 to 500 psig / 0 to 34.5 bar	5800 SCFH / 155 Nm^3/h		**1305 Series** Page 184
6000 psig / 414 bar	10 to 500 psig / 0.69 to 34.5 bar	5805 SCFH / 156 Nm^3/h		**1301 Series** Page 180

Natural Gas Quick Selection Guide

Stand Alone Shutoff Devices

Maximum Inlet Pressure	Trip Pressure Range	Maximum Capacity	High and Low Pressure Shutoff		Type Number
203 psig / 14 bar	2.8 in. w.c. to 72.5 psig / 7 mbar to 5 bar	36,194 SCFH / 970 Nm^3/h	Yes		**Type BM7** Page 228
232 psig / 16.0 bar	12 in. w.c. to 79.8 psig / 30 mbar to 5.5 bar	C_g: 306 C_l: 52	Yes		**VS100 Series** Page 531
1450 psig / 100 bar	4.2 in. w.c. to 1160 psig / 10 mbar to 80 bar	9,627,000 SCFH / 258,000 Nm^3/h	Yes		**BM5 Series** Page 219
1450 psig / 100 bar	4.2 in. w.c. to 1160 psig / 10 mbar to 80 bar	63,433,000 SCFH / 1,700,000 Nm^3/h	Yes		**Type BM6X** Page 224
1470 psig / 101 bar	4.02 in. w.c. to 1470 psig / 10 mbar to 101 bar	12,916,000 SCFH / 346,000 Nm^3/h	Yes		**Type OSE** Page 496
1500 psig / 103 bar	20 to 88 psig / 1.38 to 6.1 bar	65,000 SCFH / 1742 Nm^3/h	High Pressure Only		**634 Series** Page 162

Relief Valve / Backpressure Regulators

Relief Set Pressure Range	Maximum Capacity		Type Number
5 in. w.c. to 75 psig / 12 mbar to 5.2 bar	100,000 SCFH / 2680 Nm^3/h		**289 Series** Page 83
10 in. w.c. to 580 psig / 25 mbar to 40.0 bar	102,611 SCFH / 2750 Nm^3/h		**V Series** Page 538
14 in. w.c. to 100 psig / 35 mbar to 6.9 bar	111,000 SCFH / 2975 Nm^3/h		**Type 289P** Page 90
3 to 125 psig / 0.21 to 8.6 bar	298,000 SCFH / 7986 Nm^3/h		**1808 Series** Page 197
5 to 125 psig / 0.34 to 8.6 bar	100,000 SCFH / 2680 Nm^3/h		**Type 1805** Page 190
10 to 100 psig / 0.69 to 6.9 bar	136,000 SCFH / 3645 Nm^3/h		**Type 1805P** Page 194

Natural Gas Quick Selection Guide

Relief Valve / Backpressure Regulators (continued)

Relief Set Pressure Range	Maximum Capacity		Type Number
10 to 400 psig / 0.69 to 27.6 bar	8,795,000 SCFH / 235,706 Nm³/h		**Type 63EG** Page 34
29 to 1160 psig / 2.0 to 80.0 bar	10,375,000 SCFH / 278,000 Nm³/h		**Type EZH Relief** Page 388
20 to 1160 psig / 1.4 to 80.0 bar	28,155,000 SCFH / 754,554 Nm³/h		**Type EZR Relief** Page 426
29 to 1160 psig / 2.0 to 80.0 bar	74,442,000 SCFH / 1,995,000 Nm³/h		**Type FL Relief** Page 454
25 to 300 psig / 1.7 to 20.7 bar	195,000 SCFH / 5226 Nm³/h		**H200 Series** Page 465
35 to 350 psig / 2.4 to 24.2 bar	34,560 SCFH / 926 Nm³/h		**Type H120** Page 463

Odorizing System

Odorization Type	Maximum Working Pressure	Maximum Gas Flow Rate		Type Number
Injection	Supply: 1450 psig / 100 bar Injection: 870 psig / 60 bar	49,440,000 SCFH / 1,400,000 Sm^3/h		**Type Dosaodor-D** Pages 363 and 369
Absorption	1305 psig / 90 bar	3,531,000 SCFH / 100,000 Sm^3/h		**OL Series** Page 495

Electronic Flow and Pressure Measurement

Primary Purpose	Meter Runs	Sensor	Maximum I/O Counts	PID Control Loops		Type Number
General Purpose Measurement and Control	12	Remote P and DP sensors	48	16		**ROC800** Page 515
Flow Metering: Single-Run Orifice	1	Integral P and DP sensors	7	1		**FloBoss™ 103** Page 459
Flow Metering: Single-Run Turbine or PD	1	Integral Turbine/ PD interface with dual P sensors	7	1		**FloBoss™ 104** Page 461

Natural Gas Applications

Natural Gas Devices

There are several devices and accessories used in a natural gas system. Your local Sales Office can assist you in selecting the proper regulators and accessories for your system. The purpose of this Application Guide is to familiarize you with some of the products used to control natural gas and briefly explain some of the many natural gas applications.

Applications

Pressure Reducing Regulators

A pressure reducing regulator maintains a desired outlet pressure while providing the required flow to satisfy a variable downstream demand. The level at which the reduced pressure is maintained is the outlet pressure setting of the regulator. Pressure reducing regulators can be direct-operated or pilot-operated.

In a natural gas system, pressure reducing regulators are used both for transmission and distribution which includes farm taps and field regulators; city gates; district stations; residential, commercial, industrial and utilization services; and fixed factor billing or pressure factor measurement (PFM). Pressure reducing regulators control gas pressure inside industrial plants. They are also used as monitors in city gate and district stations.

Transmission

Transmission pipelines move natural gas from one place to another, usually over long distances. Control valves, pilot-operated regulators and relief valves are used to control the pressure and flow of gas through the pipelines. Types EZR, EZH, 310A and FL and Cronos Series are examples of regulators used in transmission pipelines. The Types EZROSX, EZHOSX, FL and Cronos have optional slam-shut devices for overpressure and/or underpressure protection.

Distribution

Farm Tap/Field

Farm taps are points along a transmission pipeline where a distribution tap serves a farm or small community. The major difference between a farm tap and a city or district gate is the volume of gas required to supply the load. Farm taps supply less volume. Types 630, 627 and 627F are examples of regulators used for farm taps. The Type CSB454 has an optional integral slam-shut device for over/underpressure protection.

City Gate Stations

When a natural gas pipeline nears a city, the high-pressure gas needs to be reduced to a distribution level. A city gate is a pressure reducing point. Control valves and pressure reducing regulators are used to reduce the gas pressure. The city gate is usually the point where the local distribution company takes control of the gas. Typically, Types EZR, EZH, 310A, EZL, 133HP, 1098-EGR and Series FL and 971 are used in city gates (Figure 1).

Also, a measurement device such as the FloBoss™ 103 or 104 monitors the gas flow through the city gate for accurate measurement and control.



Figure 1. *Natural Gas Distribution*
A typical dual run city gate station utilizes Type EZR's in a monitor configuration.

District Stations

District stations are located throughout larger towns and cities. They essentially are smaller city gates used to regulate distribution pressure.

Depending upon the size of the district station, any of the following regulators are used: Types 99 and 1098-EGR and Series EZR, EZL, 133, 299H and Cronos.

Services

A service is the point of delivery to the consumer. This point of delivery is where the consumer takes responsibility of the pipeline and devices in the pipeline. Types B, HSR, 912N and R622 regulators are all used for residential and utilization services.

Types 627F, 99, 1098-EGR, REGAL 3 and Series 627, 133, 299H, CSB400, CS800, CS400 and CP400 regulators are used for commercial, industrial and utilization services.

Fixed Factor Billing/Pressure Factor Measurement

Most residential consumers have a meter outside their home that records the exact amount of gas that is being used. This is known as exact consumption billing. Some commercial and small industrial customers need more pressure than the standard 7 in. w.c. / 17 mbar, but they do not use enough gas to install a more expensive pressure-compensated meter. In this case, the gas company can use fixed factor billing.

Fixed factor billing uses an extremely accurate regulator to keep the gas pressure at ±1 percent of P2 absolute. A normal residential meter is used to measure the gas flow. A fixed factor billing is determined between the measured pressure and the actual pressure. This factor is then used to determine the customer's corrected usage.

Types 1098-EGR, 627F, 99 and Series 299H and CP400 are commonly used when accuracy of ± 1 percent is desired.

Fuel Gas Regulators

Fuel gas regulators are used to control the gas pressure to a burner. There are three main characteristics important to the selection of a regulator for a fuel gas burner: accuracy, shutoff and speed of response.

Accurate pressure control is a vital factor that affects the efficiency of the burner. The regulator must maintain the pressure within a specified range regardless of flow to ensure perfect combustion of the fuel. The ideal mix of air and fuel will give the desired energy output from the burner. Tight shutoff and fast speed of response are usually necessary because of the controls that are on the burner. A solenoid valve is often used to turn the burner on and off. This requires the regulator to also react at the same speed. If it does not, it can cause problems with the low-pressure and high-pressure safety cut-outs. If the regulator does not open fast enough it will starve the system of gas and the low-pressure switch will trip. If the regulator does not close fast enough, the high-pressure switch will trip. This high-pressure switch also may be tripped if the regulator does not shut off tight.

For these reasons the regulator chosen must be very accurate, have fast response and have elastomeric seats that shut off tight. Types 1098-EGR, 99 and Series 66 and CS800 are examples of regulators used for fuel gas applications.

Overpressure Protection

To prevent personal injury, equipment damage or leakage due to escaping gas or bursting of pressure-containing parts, it is necessary to install adequate overpressure protection when installing a pressure reducing regulator. Adequate overpressure protection should also be installed to protect all downstream equipment in the event of regulator failure. Some regulators are made with internal overpressure relief, whereas others require the installation of a separate relief valve or an additional regulator to act as a monitor. There are also shutoff devices that are designed specifically to handle overpressure. Pressure relief valves, monitors and automatic shutoffs are used for overpressure protection.

Pressure Relief Valves

A pressure relief valve is used to limit pressure build-up (i.e., prevent overpressure) at its location in a system. The relief valve opens to prevent a rise of internal pressure in excess of a specified value. Pressure relief valves can be direct-operated or pilot-operated. The following are pressure relief valves:

289, 1805 and H200 Series and Types 63EG, EZR, EZH, FL and 1808.

Monitors

Monitor regulators are used in city gate and district stations as overpressure protection. A monitor regulator is installed in series with a regulator that is controlling the flow of gas. The monitor regulator is set to take over if the working regulator fails open. Upstream regulators must always have an external control line. Monitor style constructions are available in the following regulators:

Types 1098-EGR, 99, CS800EN, EZR, EZH, EZL and Series 299H, 133, FL and Cronos.

Natural Gas Applications

Automatic Shutoffs/Slam-Shuts

A pressure shutoff or slam-shut device shuts off the flow whenever the sensed control pressure violates a set limit. Depending on the capability of the device selected, it may be able to shut off in response to a low-pressure condition only, a high-pressure condition only or both. The R and 299HS Series and Types CSB404, CS404 and CS804 are all pressure reducing regulators with integral shutoff devices. Types OSE, BM5, VS100 and 634 Series are stand alone shutoff devices.

Other Applications

Skids

Skids are prefabricated pressure reducing stations. The regulator stations are designed to the customer's specifications, then built to order and include piping, regulators and manual isolation valves (Figure 2).

Skids reduce overall costs and may frequently include components such as gauges, slam-shuts and filters.

ROCs and Flow Computers

The family of Remote Operations Controllers (ROCs) and FloBoss™ Flow Computers are designed to meet the wide-ranging measurement and control needs of the natural gas industry. These products are suited to applications at wellheads, meter runs, custody transfer stations, compressor stations and gate stations. They provide on-site, round-the-clock monitoring, measurement, totalizing, alarming, communications and control. Using microprocessor technology, these products stand alone or network to a data gathering system. Monitored values are processed and stored for easy access by personnel in the field or can be relayed through telephone, radio or satellite transmissions to remote locations.



Figure 2. *Skid*
Fabricated pressure reducing station designed and built to meet specific customer requirements.



Figure 3. *FloBoss™ 104*
The FloBoss™ 104 is a cost effective flow computer for either rotary or turbine metering.

Both ROCs and flow computers use operating systems that support configurable I/O, historical databases, audit trails, user programmability, smart transmitters and self-testing. Plus, standard application programs make AGA calculations, PID control and logic/sequencing control easy to implement.

Odorization

Federal safety regulations require the injection of odorant, usually with mercaptan or Tetrahydrothiophene (THT) into natural gas distribution lines in order to warn or alert public of possible leaks. Natural gas (almost pure methane) is a combustible, odorless gas; odorants are introduced to give it a familiar gas smell. To ensure public safety, odorized gas must be detectable at one-fifth (20%) of the lower flammable or explosive limit. Type Dosaodor-D injection system provides computerized uniform odorant distribution as well as reliable redundancy and backup options for reliable odorization.

Introduction
Types 63EG and 1098-63EGR pilot-operated relief valves or backpressure regulators are suitable for both liquid and gas service and may also be used for throttling backpressure applications, such as on oilfield separators. These relief valves are combined with the 6358 Series pilots.

Body Sizes and End Connection Styles
See Table 1

Flow Capacities
See Tables 8 through 13

Flow Coefficients
See Table 3

IEC Sizing Coefficients
See Table 4

Maximum Relief (Inlet) Pressure
Type 63EG: 400 psig / 27.6 bar including build-up or body rating, whichever is lower
Type 1098-63EGR: 82 psig / 5.6 bar including build-up

Relief Set Pressure Ranges
Type 63EG: 10 to 400 psig / 0.69 to 27.6 bar
Type 1098-63EG: 3 to 65 psig / 0.21 to 4.5 bar

Pressure Registration
External (factory connected to body tap)

Temperature Capabilities
Nitrile (NBR):
-20 to 180°F / -29 to 82°C
Fluorocarbon (FKM):
0 to 300°F / -18 to 149°C,
Water is limited to 0 to 180°F / -18 to 82°C
Ethylenepropylene (EPR):
-20 to 275°F / -29 to 135°C
Perfluoroelastomer (FFKM):
0 to 425°F / -18 to 218°C

Approximate Weights (including pilot)
Type 63EG
NPS 1 / DN 25: 35 lbs / 16 kg
NPS 2 / DN 50: 55 lbs / 25 kg
NPS 3 / DN 80: 95 lbs / 43 kg
NPS 4 / DN 100: 145 lbs / 66 kg
NPS 6 / DN 150: 330 lbs / 150 kg
NPS 8 x 6 / DN 200 x 150: 670 lbs / 304 kg
Type 1098-63EGR
NPS 1 / DN 25: 65 lbs / 29 kg
NPS 2 / DN 50: 85 lbs / 39 kg
NPS 3 / DN 80: 125 lbs / 57 kg

Type 1098-63EGR (continued)
NPS 4 / DN 100: 175 lbs / 79 kg
NPS 6 / DN 150: 360 lbs / 163 kg
NPS 8 x 6 / DN 200 x 150: 700 lbs / 318 kg

Options
- Whisper Trim™ Cage Construction
- NACE Construction
- Aluminum or Stainless steel Type 252 pilot supply filter
- Brass Type P594-1 filter
- Pressure gauges

Additional Technical Data
For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features
- **NACE Construction**
- **Backpressure Regulator**
- **Relief Valve**
- **Oxygen Service**
- **Fast Pilot Reseat**
- **Low Buildup Capability**
- **Versatility**
- **Time Tested**
- **Reliable**
- **Robust**



Figure 1. *Type 63EG Relief Valve or Backpressure Regulator*



Figure 2. *Type 1098-63EGR Relief Valve or Backpressure Regulator*

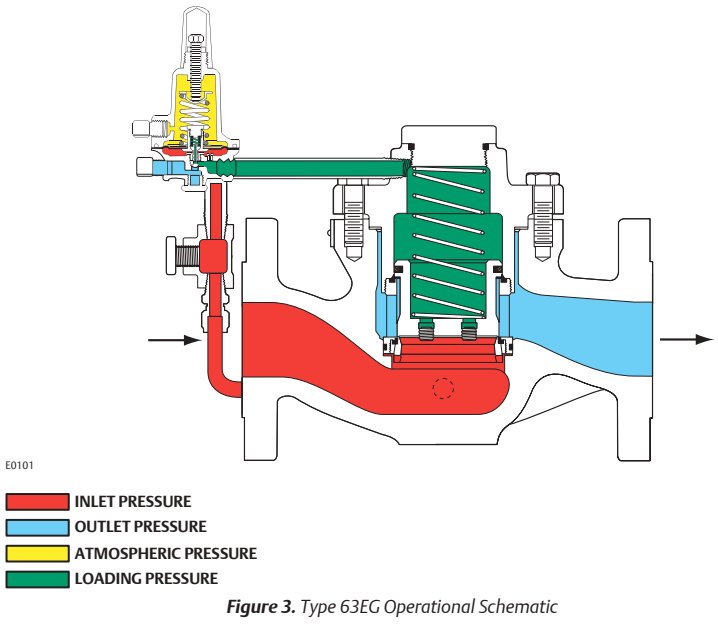


Figure 3. *Type 63EG Operational Schematic*

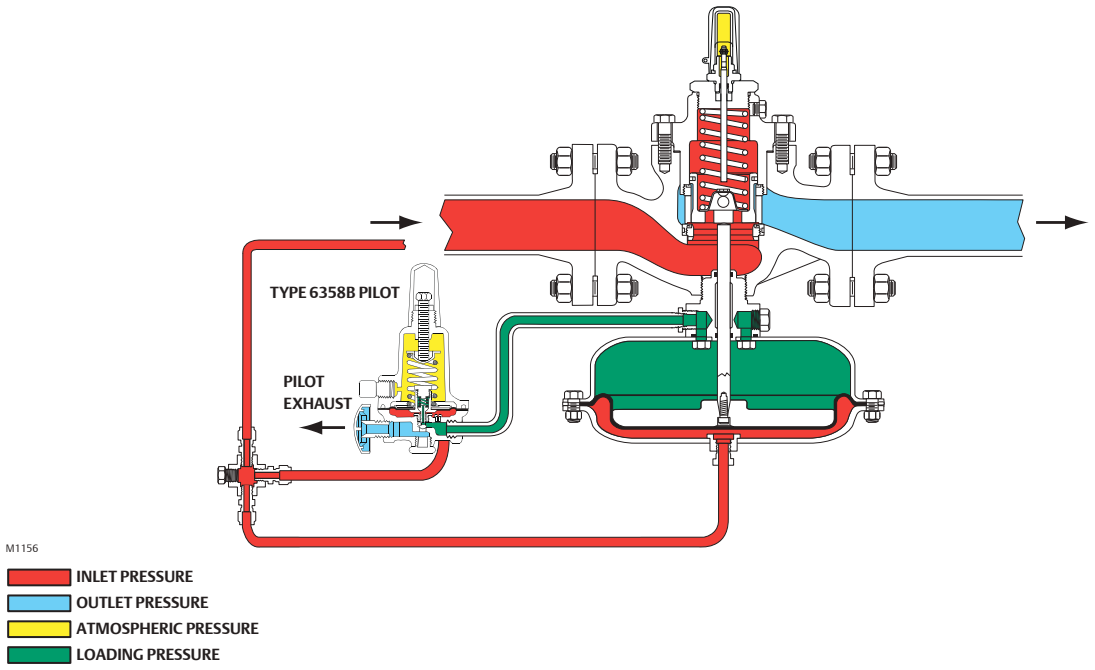


Figure 4. *Type 1098-63EGR Relief Valve Operational Schematic*

Table 1. Body Size and End Connection Style

BODY SIZE		BODY MATERIAL	
NPS	DN	CAST IRON	STEEL OR STAINLESS STEEL
1 or 2	25 or 50	NPT, CL125 FF or CL250 RF flanged	NPT, SWE, BWE, CL150 RF, CL300 RF, CL600 RF or PN 16/25/40 flanged
3, 4, 6 or 8 x 6	80, 100, 150 or 200 x 150	CL125 FF or CL250 RF flanged	BWE, CL150 RF, CL300 RF, CL600 RF or PN 16/25/40 flanged

Table 2. Main Valve Construction Material

BODY AND BODY FLANGE	SEAT RING AND VALVE PLUG	CAGE	SPRING	PISTON RING	O-RING, GASKET AND OTHER ELASTOMER PART
WCC Steel, Cast iron or CF8M Stainless steel	416 Stainless steel **(standard)** and 316 Stainless steel	Stainless steel (standard linear), 416 or 316 Stainless steel (Whisper Trim™ III)	Zinc-plated steel **(standard)** or Inconel® X750 (optional)	Polytetrafuoroethylene (PTFE)	Nitrile (NBR) **(standard)**, Fluorocarbon (FKM) or Ethylenepropylene (EPR)

Table 3. Flow Coefficient

BODY SIZE		PIPING STYLE					
		Line Size Equals Body Size Piping					
		Linear Cage			Whisper Trim III Cage		
		C_g	C_v	C_1	C_g	C_v	C_1
NPS	DN	Regulating	Regulating		Regulating	Regulating	
1	25	600	17.2	37.5	576	17	33.7
2	50	2280	63.3	36.0	1970	54.7	36.0
3	80	4630	132	35.1	3760	107	35.0
4	100	7320	202	36.2	6280	180	34.8
6	150	12,900	397	32.5	9450	295	32.0
8 x 6	200 x 150	17,800	556	32.0	10,500	300	35.0

-continued-

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Table 3. Flow Coefficient (continued)

BODY SIZE		2:1 Line Size to Body Size Piping					
		Linear Cage			Whisper Trim™ III Cage		
		C_g	C_V	C_1	C_g	C_V	C_1
NPS	DN	Regulating	Regulating		Regulating	Regulating	
1	25	568	16.8	33.0	529	15.5	34.0
2	50	2050	59.6	34.4	1830	52.2	35.0
3	80	4410	128	34.4	3630	106	34.2
4	100	6940	198	35.0	6020	171	35.2
6	150	12,100	381	31.7	9240	291	31.7
8 x 6	200 x 150	17,100	534	32.0	10,270	293	35.0

Table 4. IEC Sizing Coefficient

BODY SIZE		X_T	F_D	F_L
NPS	DN			
1	25	0.81	0.43	0.84
2	50	0.82	0.35	
3	80	0.78	0.30	
4	100	0.83	0.28	
6 and 8 x 6	150 and 200 x 150	0.67	0.28	

Table 5. Port Diameter and Valve Plug Travel

BODY SIZE		PORT DIAMETER		VALVE PLUG TRAVEL	
NPS	DN	In.	mm	In.	mm
1 2	25 50	1.31 2.38	33 61	0.75 1.13	19 29
3 4	80 100	3.38 4.38	86 111	1.50 2.00	38 51
6 and 8 x 6	150 and 200 x 150	7.19	183	2.00	51

Table 6. Relief Set Pressure and Backpressure Control Range

TYPE	PILOT TYPE	RELIEF SET PRESSURE RANGE(1)		SPRING PART NUMBER	SPRING COLOR	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
		psig	bar			In.	mm	In.	mm
63EG	6358	10 to 40 35 to 125	0.69 to 2.8 2.4 to 8.6	1E392527022 1K748527202	Yellow Red	0.148 0.187	3.76 4.75	2.00 2.19	50.8 55.6
	6358B	10 to 30 30 to 60 60 to 125	0.69 to 2.1 2.1 to 4.1 4.1 to 8.6	1B788327022 1B788427022 1K748527202	Silver Blue Red	0.142 0.182 0.187	3.61 4.62 4.75	2.13 1.94 2.19	54.1 49.3 55.6
	6358EB	85 to 140 130 to 200 180 to 350	5.9 to 9.6 9.0 to 13.8 12.4 to 24.1	17B1261X012 17B1263X012 17B1264X012	Green Blue Red	0.225 0.262 0.294	5.72 6.65 7.47	3.70 3.85 4.22	94.0 97.8 107
	6358EBH	250 to 400	17.2 to 27.6	17B1263X012	Blue	0.262	6.65	3.85	97.8
1098-63EGR	6358B	3 to 18 15 to 40 35 to 65	0.21 to 1.2 1.0 to 2.8 2.4 to 4.5	1B986027212 1E392527022 1K748527202	Green Yellow Red	0.120 0.148 0.187	3.05 3.76 4.75	2.12 2.00 2.19	53.8 50.8 55.6

1. Set pressure plus buildup should not exceed maximum differential pressure of 400 psig / 27.6 bar.

Table 7. Minimum and Maximum Differential Pressure

BODY SIZE		MAIN VALVE SPRING RANGE		MAIN VALVE SPRING PART NUMBER	MAIN VALVE SPRING COLOR	TYPE 63EG				TYPE 63EG WITH TYPE 1098 SIZE 40 ACTUATOR			
						Minimum Differential Pressure Required for Full Stroke		Maximum Differential Pressure		Minimum Differential Pressure Required for Full Stroke		Maximum Differential Pressure	
NPS	DN	psig	bar			psig	bar	psig	bar	psig	bar	psig	bar
1	25	30 to 125 85 to 400	2.1 to 8.6 5.9 to 27.6	14A9687X012 14A9679X012	Green Red	70 150	4.8 10.3	125 400	8.6 27.6	2.5 ----	0.17 ----	60 ----	4.1 ----
2	50	10 to 40 30 to 125 85 to 400	0.69 to 2.8 2.1 to 8.6 5.9 to 27.6	14A6768X012 14A6626X012 14A6628X012	Yellow Green Red	22 30 90	1.5 2.1 6.2	40 125 400	2.8 8.6 27.6	2 3 ----	0.14 0.21 ----	20 60 ----	1.4 4.1 ----
3	80	10 to 40 30 to 125 85 to 400	0.69 to 2.8 2.1 to 8.6 5.9 to 27.6	14A6771X012 14A6629X012 14A6631X012	Yellow Green Red	19 25 60	1.3 1.7 4.1	40 125 400	2.8 8.6 27.6	2.5 4 ----	0.17 0.28 ----	20 60 ----	1.4 4.1 ----
4	100	10 to 40 30 to 125 85 to 400	0.69 to 2.8 2.1 to 8.6 5.9 to 27.6	14A6770X012 14A6632X012 14A6634X012	Yellow Green Red	16 20 55	1.1 1.4 3.8	40 125 400	2.8 8.6 27.6	3.5 5 ----	0.24 0.34 ----	20 60 ----	1.4 4.1 ----
6 and 8 x 6	150 and 200 x 150	10 to 40 30 to 125 85 to 400	0.69 to 2.8 2.1 to 8.6 5.9 to 27.6	15A2253X012 14A9686X012 15A2615X012	Yellow Green Red	16 20 55	1.1 1.4 3.8	40 125 400	2.8 8.6 27.6	6 9.5 ----	0.41 0.66 ----	20 60 ----	1.4 4.1 ----

Table 8. Type 63EG Relief Capacities for NPS 1 / DN 25 Body with 2:1 Line Size to Body Size Piping

MAIN VALVE SIZE		PILOT TYPE	MAIN VALVE SPRING COLOR	PILOT SPRING RANGE, PART NUMBER AND COLOR, psig / bar	SET PRESSURE[2]		BUILDUP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE[3]		BUILDUP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE[4]		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESET PILOT		CAPACITIES[1] OF 0.6 SPECIFIC GRAVITY NATURAL GAS WITH 2:1 LINE SIZE TO BODY SIZE PIPING	
NPS	DN				psig	bar	psig	bar	psig	bar	psi	bar	SCFH	Nm^3/h
1	25	6358	Green	35 to 125 / 2.4 to 8.6 1K748527202 Red	60 80 100 125	4.1 5.5 6.9 8.6	8.5 3.0 2.5 2.5	0.59 0.21 0.17 0.17	10.0 3.0 3.5 3.5	0.69 0.21 0.24 0.24	5.0	0.34	62,000 72,000 87,000 105,000	1662 1930 2332 2814
		6358B	Green	60 to 125 / 4.1 to 8.6 1K748527202 Red	60 80 100 125	4.1 5.5 6.9 8.6	2.7	0.19	10.0 3.0 3.5 3.5	0.69 0.21 0.24 0.24	1.0	0.07	62,000 72,000 87,000 105,000	1662 1930 2332 2814
		6358EB	Red	85 to 140 / 5.9 to 9.6 17B1261X012 Green	85 100 125 140	5.7 6.9 8.6 9.6	2.5 2.5 3.0 3.0	0.17 0.17 0.21 0.21	72 57 32 17	5.0 3.9 2.2 1.2	2.0	0.14	126,000	3377
				130 to 200 / 9.0 to 13.8 17B1263X012 Blue	140 150 175 200	9.7 10.3 12.1 13.8	5.0 5.0 6.0 6.0	0.34 0.34 0.41 0.41	17.0 14.0 12.0 12.0	1.2 0.97 0.83 0.83	3.0	0.21	126,000 131,000 148,000 166,000	3380 3510 3970 4450
				180 to 350 / 12.4 to 24.1 17B1264X012 Red	200 250 300 350	13.8 17.2 20.7 24.1	6.0	0.41	12.0	0.83	3.0	0.21	166,000 203,000 239,000 276,000	4450 5440 6405 7400
		6358EBH	Red	250 to 400[5] / 17.2 to 27.6 17B1263X012 Blue	300 350 375	20.7 24.1 25.9	7.0 7.0 8.0	13.0 13.0 14.0	13.0 13.0 14.0	0.90 0.90 0.97	6.0	0.41	240,000 277,000 296,000	6432 7423 7932

1. Capacities based on set pressure plus buildup to achieve full opening using a standard linear cage and standard high-gain pilot restriction (or restriction plug on Type 6358).
2. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
3. Crack point of the main valve is the inlet pressure buildup over the set pressure at which the main valve starts audible flow.
4. Inlet pressure buildup over the set pressure for the main valve to achieve wide-open capacity.
5. Set pressure plus buildup should not exceed maximum differential pressure of 400 psi / 27.6 bar.

Table 9. Type 63EG Relief Capacities for NPS 2 / DN 50 Body with 2:1 Line Size to Body Size Piping

MAIN VALVE SIZE		PILOT TYPE	MAIN VALVE SPRING COLOR	PILOT SPRING RANGE, PART NUMBER AND COLOR, psig / bar	SET PRESSURE[2]		BUILDUP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE[3]		BUILDUP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE[4]		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESET PILOT		CAPACITIES[1] OF 0.6 SPECIFIC GRAVITY NATURAL GAS WITH 2:1 LINE SIZE TO BODY SIZE PIPING	
NPS	DN				psig	bar	psig	bar	psig	bar	psig	bar	SCFH	Nm³/h
2	50	6358	Yellow	10 to 40 / 0.69 to 2.8 1E392527022 Yellow	10 15 20 30	0.69 1.0 1.4 2.1	5.5 2.0 1.7 1.7	0.38 0.14 0.12 0.12	12.0 7.0 2.5 2.0	0.83 0.48 0.17 0.14	5.0	0.34	95,000 95,000 96,000 122,000	2546 2546 2573 3270
			Green	35 to 125 / 2.4 to 8.6 1K748527202 Red	40 50 60 80 100 125	2.8 3.4 4.1 5.5 6.9 8.6	2.0 2.0 2.0 2.4 2.4 2.4	0.14 0.14 0.14 0.17 0.17 0.17	2.5 2.5 2.5 3.0 3.0 3.0	0.17 0.17 0.17 0.21 0.21 0.21			151,000 178,000 204,000 258,000 311,000 377,000	4047 4770 5467 6914 8335 10,104
		6358B	Yellow	10 to 30 / 0.69 to 2.1 1B788327022 Silver	10 15 20 30	0.69 1.0 1.4 2.1	5.5 2.0 1.7 1.7	0.38 0.14 0.12 0.12	12.0 7.0 2.5 2.0	0.83 0.48 0.17 0.14	1.0	0.07	95,000 95,000 96,000 122,000	2546 2546 2573 3270
			Green	30 to 60 / 2.1 to 4.1 1B788427022 Blue	30 40 50 60	2.1 2.8 3.4 4.1	1.7	0.12	2.5 2.0 2.0 2.0	0.17 0.14 0.14 0.14			124,000 149,000 176,000 203,000	3323 3993 4717 5440
				60 to 125 / 4.1 to 8.6 1K748527202 Red	60 80 100 125	4.1 5.5 6.9 8.6	2.0 2.4 2.4 2.4	0.14 0.17 0.17 0.17	2.5 3.0 3.0 3.0	0.17 0.21 0.21 0.21			204,000 258,000 311,000 377,000	5467 6914 8335 10,104
		6358EB	Red	85 to 140 / 5.9 to 9.6 17B1261X012 Green	85 100 125 140	5.9 6.9 8.6 9.7	1.7 1.7 2.2 2.2	0.12 0.12 0.15 0.15	10.0 4.0 4.0 4.0	0.69 0.28 0.28 0.28	2.0	0.14	290,000 314,000 380,000 420,000	7772 8415 10,184 11,256
				130 to 200 / 9.0 to 13.8 17B1263X012 Blue	140 150 175 200	9.7 10.3 12.1 13.8	4.0 4.0 5.0 5.0	0.28 0.28 0.34 0.34	7.0 7.0 8.0 8.0	0.48 0.48 0.55 0.55	3.0	0.21	428,000 454,000 523,000 589,000	11,470 12,167 14,016 15,785
				180 to 350 / 12.4 to 24.1 17B1264X012 Red	200 250 300 350	13.8 17.2 20.7 24.1	5.0 5.0 5.5 5.5	0.34 0.34 0.38 0.38	8.0 8.0 8.5 8.5	0.55 0.55 0.59 0.59			589,000 721,000 855,000 987,000	15,785 19,323 22,914 26,452
		6358EBH	Red	250 to 400[5] / 17.2 to 27.6 17B1263X012 Blue	300 350 375	20.7 24.1 25.9	6.0 6.0 7.0	0.41 0.41 0.48	10.0 10.0 11.0	0.69 0.69 0.76	6.0	0.41	859,000 991,000 1,060,000	23,021 26,559 28,408

1. Capacities based on set pressure plus buildup to achieve full opening using a standard linear cage and standard high-gain pilot restriction (or restriction plug on Type 6358).
2. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
3. Crack point of the main valve is the inlet pressure buildup over the set pressure at which the main valve starts audible flow.
4. Inlet pressure buildup over the set pressure for the main valve to achieve wide-open capacity.
5. Set pressure plus buildup should not exceed maximum differential pressure of 400 psi / 27.6 bar.

Table 10. Type 63EG Relief Capacities for NPS 3 / DN 80 Body with 2:1 Line Size to Body Size Piping

MAIN VALVE SIZE		PILOT TYPE	MAIN VALVE SPRING COLOR	PILOT SPRING RANGE, PART NUMBER AND COLOR, psig / bar	SET PRESSURE[2]		BUILDUP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE[3]		BUILDUP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE[4]		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESET PILOT		CAPACITIES[1] OF 0.6 SPECIFIC GRAVITY NATURAL GAS WITH 2:1 LINE SIZE TO BODY SIZE PIPING	
NPS	DN				psig	bar	psig	bar	psig	bar	psi	bar	SCFH	Nm^3/h
3	80	6358	Yellow	10 to 40 / 0.69 to 2.8 1E392527022 Yellow	10 15 20 30	0.69 1.0 1.4 2.1	3.5 1.3 1.2 1.2	0.24 0.09 0.08 0.08	9.0 4.0 2.0 1.5	0.62 0.28 0.14 0.10	5.0	0.34	185,000 185,000 203,000 260,000	4958 4958 5440 6968
			Green	35 to 125 / 2.4 to 8.6 1K748527202 Red	40 50 60 80 100 125	2.8 3.4 4.1 5.5 6.9 8.6	2.0 2.0 2.0 2.0 2.4 2.4	0.14 0.14 0.14 0.14 0.17 0.17	2.5 2.5 2.5 2.5 3.0 3.0	0.17 0.17 0.17 0.17 0.21 0.21			324,000 382,000 439,000 555,000 670,000 812,000	8683 10,238 11,765 14,847 17,956 21,762
		6358B	Yellow	10 to 30 / 0.69 to 2.1 1B788327022 Silver	10 15 20 30	0.69 1.0 1.4 2.1	3.5 1.3 1.2 1.2	0.24 0.09 0.08 0.08	9.0 4.0 2.0 1.5	0.62 0.28 0.14 0.10			185,000 185,000 203,000 260,000	4958 4958 5440 6968
			Green	30 to 60 / 2.1 to 4.1 1B788427022 Blue	30 40 50 60	2.1 2.8 3.4 4.1	1.6	0.11	2.0	0.14	1.0	0.07	263,000 322,000 379,000 436,000	7048 8630 10,157 11,685
				60 to 125 / 4.1 to 8.6 1K748527202 Red	60 80 100 125	4.1 5.5 6.9 8.6	2.0 2.0 2.4 2.4	0.14 0.14 0.17 0.17	2.5 2.5 3.0 3.0	0.17 0.17 0.21 0.21			439,000 553,000 670,000 812,000	11,765 14,820 17,956 21,762
		6358EB	Red	85 to 140 / 5.9 to 9.6 17B1261X012 Green	85 100 125 140	5.9 6.9 8.6 9.7	1.7 1.7 2.2 2.2	0.12 0.12 0.15 0.15	3.0 3.0 3.5 3.5	0.21 0.21 0.24 0.24	2.0	0.14	584,000 670,000 815,000 900,000	15,651 17,956 21,842 24,120
				130 to 200 / 9.0 to 13.8 17B1263X012 Blue	140 150 175 200	9.6 10.3 12.1 13.8	4.0 4.0 5.0 5.0	0.28 0.28 0.34 0.34	6.0 6.0 7.0 7.0	0.41 0.41 0.48 0.48	3.0	0.21	914,000 971,000 1,119,000 1,261,000	24,495 26,023 29,989 33,795
				180 to 350 / 12.4 to 24.1 17B1264X012 Red	200 250 300 350	13.8 17.2 20.7 24.1	5.0 5.0 5.5 5.5	0.34 0.34 0.38 0.38	7.0 7.0 7.5 7.5	0.48 0.48 0.52 0.52			1,261,000 1,546,000 1,833,000 2,117,000	33,795 41,433 49,124 56,736
		6358EBH	Red	250 to 400[5] / 17.2 to 27.6 17B1263X012 Blue	300 350 375	20.7 24.1 25.9	6.0 6.0 7.0	0.41 0.41 0.48	8.5 8.5 9.5	0.59 0.59 0.56	6.0	0.41	1,839,000 2,123,000 2,271,000	49,285 56,896 60,863

1. Capacities based on set pressure plus buildup to achieve full opening using a standard linear cage and standard high-gain pilot restriction (or restriction plug on Type 6358).
2. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
3. Crack point of the main valve is the inlet pressure buildup over the set pressure at which the main valve starts audible flow.
4. Inlet pressure buildup over the set pressure for the main valve to achieve wide-open capacity.
5. Set pressure plus buildup should not exceed maximum differential pressure of 400 psi / 27.6 bar.

Table 11. Type 63EG Relief Capacities for NPS 4 / DN 100 Body with 2:1 Line Size to Body Size Piping

MAIN VALVE SIZE		PILOT TYPE	MAIN VALVE SPRING COLOR	PILOT SPRING RANGE, PART NUMBER AND COLOR, psig / bar	SET PRESSURE[2]		BUILDUP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE[3]		BUILDUP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE[4]		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESET PILOT		CAPACITIES[1] OF 0.6 SPECIFIC GRAVITY NATURAL GAS WITH 2:1 LINE SIZE TO BODY SIZE PIPING	
NPS	DN				psig	bar	psig	bar	psig	bar	psig	bar	SCFH	Nm³/h
4	100	6358	Yellow	10 to 40 / 0.69 to 2.8 1E392527022 Yellow	10 15 20 30	0.69 1.0 1.4 2.1	1.5 1.2 1.2 1.2	0.10 0.08 0.08 0.08	6.0 2.0 1.5 1.5	0.41 0.14 0.10 0.10	5.0	0.34	259,000 269,000 313,000 408,000	6941 7209 8388 10,934
			Green	35 to 125 / 2.4 to 8.6 1K748527202 Red	40 50 60 80 100 125	2.8 3.4 4.1 5.5 6.9 8.6	1.6 1.6 1.6 2.0 2.4 2.4	0.11 0.11 0.11 0.14 0.17 0.17	2.5 2.5 2.5 2.5 3.0 3.0	0.17 0.17 0.17 0.17 0.21 0.21			509,000 600,000 691,000 873,000 1,054,000 1,278,000	13,641 16,080 18,519 23,396 28,247 34,250
		6358B	Yellow	10 to 30 / 0.69 to 2.1 1B788327022 Silver	10 15 20 30	0.69 1.0 1.4 2.1	1.5 1.2 1.2 1.2	0.10 0.08 0.08 0.08	6.0 2.0 1.5 1.5	0.41 0.14 0.10 0.10	1.0	0.07	259,000 269,000 313,000 408,000	6941 7209 8388 10,934
			Green	30 to 60 / 2.1 to 4.1 1B788427022 Blue	30 40 50 60	2.1 2.8 3.4 4.1	1.2	0.08	1.5	0.10			408,000 500,000 591,000 682,000	10,934 13,400 15,839 18,278
				60 to 125 / 4.1 to 8.6 1K748527202 Red	60 80 100 125	4.1 5.5 6.9 8.6	1.6 2.0 2.4 2.4	0.11 0.14 0.17 0.17	2.0 2.5 3.0 3.0	0.14 0.17 0.21 0.21			686,000 870,000 1,054,000 1,278,000	18,385 23,316 28,247 34,250
		6358EB	Red	85 to 140 / 5.9 to 9.7 17B1261X012 Green	85 100 125 140	5.9 6.9 8.6 9.7	1.7 1.7 2.2 2.2	0.12 0.12 0.15 0.15	2.7 2.7 3.2 3.2	0.19 0.19 0.22 0.22	2.0	0.14	917,000 1,051,000 1,279,000 1,414,000	24,576 28,167 34,277 37,895
				130 to 200 / 9.0 to 13.8 17B1263X012 Blue	140 150 175 200	9.7 10.3 12.1 13.8	4.0 4.0 5.0 5.0	0.28 0.28 0.34 0.34	5.5 5.5 6.5 6.5	0.38 0.38 0.45 0.45	3.0	0.21	1,434,000 1,524,000 1,757,000 1,980,000	38,431 40,843 47,088 53,064
				180 to 350 / 12.4 to 24.1 17B1264X012 Red	200 250 300 350	13.8 17.2 20.7 24.1	5.0 5.0 5.5 5.5	0.34 0.34 0.38 0.38	6.5 6.5 7.0 7.0	0.45 0.45 0.48 0.48	3.0	0.21	1,980,000 2,428,000 2,880,000 3,328,000	53,064 65,070 77,184 89,190
		6358EBH	Red	250 to 400[5] / 17.2 to 27.6 17B1263X012 Blue	300 350 375	20.7 24.1 25.9	6.0 6.0 7.0	0.41 0.41 0.48	8.0 8.0 9.0	0.55 0.55 0.62	6.0	0.41	2,889,000 3,337,000 3,569,000	77,425 89,432 95,649

1. Capacities based on set pressure plus buildup to achieve full opening using a standard linear cage and standard high-gain pilot restriction (or restriction plug on Type 6358).
2. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
3. Crack point of the main valve is the inlet pressure buildup over the set pressure at which the main valve starts audible flow.
4. Inlet pressure buildup over the set pressure for the main valve to achieve wide-open capacity.
5. Set pressure plus buildup should not exceed maximum differential pressure of 400 psi / 27.6 bar.

Table 12. Type 63EG Relief Capacities for NPS 6 / DN 150 Body with 2:1 Line Size to Body Size Piping

MAIN VALVE SIZE		PILOT TYPE	MAIN VALVE SPRING COLOR	PILOT SPRING RANGE, PART NUMBER AND COLOR, psig / bar	SET PRESSURE[2]		BUILDUP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE[3]		BUILDUP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE[4]		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESET PILOT		CAPACITIES[1] OF 0.6 SPECIFIC GRAVITY NATURAL GAS WITH 2:1 LINE SIZE TO BODY SIZE PIPING	
NPS	DN				psig	bar	psig	bar	psig	bar	psi	bar	SCFH	Nm^3/h
6	150	6358	Yellow	10 to 40 / 0.69 to 2.8 1E392527022 Yellow	10 15 20 30	0.69 1.0 1.4 2.1	2.5 1.2 1.2 1.2	0.17 0.08 0.08 0.08	6.0 2.0 1.5 1.5	0.41 0.14 0.10 0.10	5.0	0.34	479,000 496,000 573,000 736,000	12,837 13,293 15,356 19,725
			Green	35 to 125 / 2.4 to 8.6 1K748527202 Red	40 50 60 80 100 125	2.8 3.4 4.1 5.5 6.9 8.6	1.6 1.6 1.6 2.0 2.4 2.4	0.11 0.11 0.11 0.14 0.17 0.17	2.5 2.5 2.5 2.5 3.0 3.0	0.17 0.17 0.17 0.17 0.21 0.21			911,000 1,071,000 1,230,000 1,553,000 1,875,000 2,273,000	24,415 28,703 32,964 41,620 50,250 60,916
		6358B	Yellow	10 to 30 / 0.69 to 2.1 1B788327022 Silver	10 15 20 30	0.69 1.0 1.4 2.1	2.5 1.2 1.2 1.2	0.17 0.08 0.08 0.08	6.0 2.0 1.5 1.5	0.41 0.14 0.10 0.10	1.0	0.07	479,000 496,000 573,000 736,000	12,837 13,293 15,356 19,725
			Green	30 to 60 / 2.1 to 4.1 1B788427022 Blue	30 40 50 60	2.1 2.8 3.4 4.1	1.2	0.08	1.5	0.10			736,000 895,000 1,055,000 1,214,000	19,725 23,986 28,274 32,535
				60 to 125 / 4.1 to 8.6 1K748527202 Red	60 80 100 125	4.1 5.5 6.9 8.6	1.6 2.0 2.4 2.4	0.11 0.14 0.17 0.17	2.0 2.5 3.0 3.0	0.14 0.17 0.21 0.21			1,222,000 1,549,000 1,875,000 2,273,000	32,750 41,513 50,250 60,916
		6358EB	Red	85 to 140 / 5.9 to 9.7 17B1261X012 Green	85 100 125 140	5.9 6.9 8.6 9.6	1.7 1.7 2.2 2.2	0.12 0.12 0.15 0.15	2.7 2.7 3.2 3.2	0.19 0.19 0.22 0.22	2.0	0.14	1,598,000 1,832,000 2,231,000 2,465,000	42,826 49,098 59,791 66,062
				130 to 200 / 9.0 to 13.8 17B1263X012 Blue	140 150 175 200	9.6 10.3 12.1 13.8	4.0 4.0 5.0 5.0	0.28 0.28 0.34 0.34	5.5 5.5 6.5 6.5	0.38 0.38 0.45 0.45	3.0	0.21	2,501,000 2,657,000 3,062,000 3,453,000	67,027 71,208 82,062 92,540
				180 to 350 / 12.4 to 24.1 17B1264X012 Red	200 250 300 350	13.8 17.2 20.7 24.1	5.0 5.0 5.5 5.5	0.34 0.34 0.38 0.38	6.5 6.5 7.0 7.0	0.45 0.45 0.48 0.48	3.0	0.21	3,453,000 4,233,000 5,021,000 5,802,000	92,540 113,444 134,563 155,494
		6358EBH	Red	250 to 400[5] / 17.2 to 27.6 17B1263X012 Blue	300 350 375	20.7 24.1 25.9	6.0 6.0 7.0	0.41 0.41 0.48	8.0 8.0 9.0	0.55 0.55 0.62	6.0	0.41	5,037,000 5,817,000 6,223,000	134,992 155,896 166,776

1. Capacities based on set pressure plus buildup to achieve full opening using a standard linear cage and standard high-gain pilot restriction (or restriction plug on Type 6358).
2. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
3. Crack point of the main valve is the inlet pressure buildup over the set pressure at which the main valve starts audible flow.
4. Inlet pressure buildup over the set pressure for the main valve to achieve wide-open capacity.
5. Set pressure plus buildup should not exceed maximum differential pressure of 400 psi / 27.6 bar.

Table 13. Type 63EG Relief Capacities for NPS 8 x 6 / DN 200 x 150 Body with 2:1 Line Size to Body Size Piping

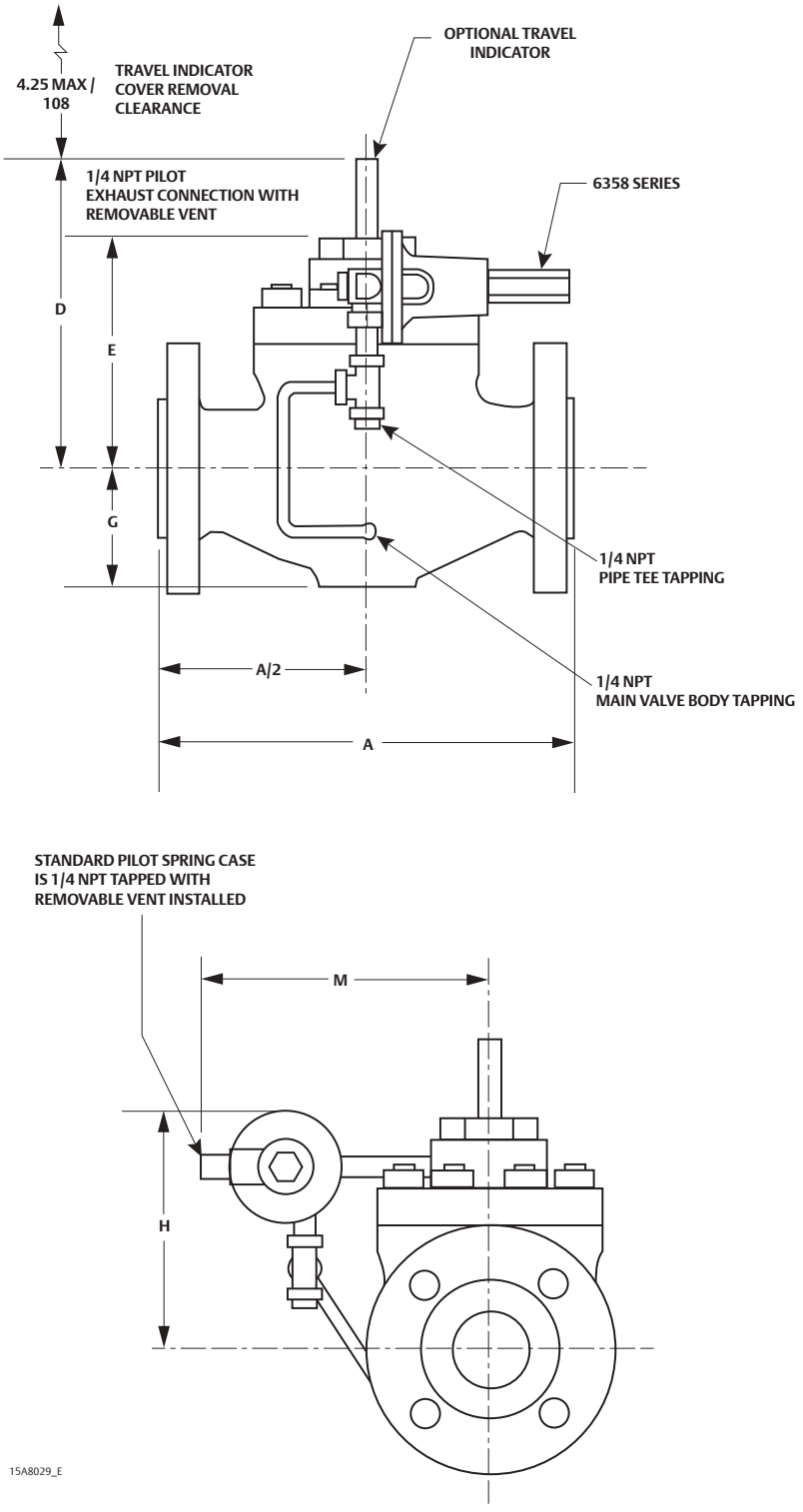
MAIN VALVE SIZE		PILOT TYPE	MAIN VALVE SPRING COLOR	PILOT SPRING RANGE, PART NUMBER AND COLOR, psig / bar	SET PRESSURE[2]		BUILDUP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE[3]		BUILDUP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE[4]		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESET PILOT		CAPACITIES[1] OF 0.6 SPECIFIC GRAVITY NATURAL GAS WITH 2:1 LINE SIZE TO BODY SIZE PIPING	
NPS	DN				psig	bar	psig	bar	psig	bar	psi	bar	SCFH	Nm^3/h
8 x 6	200 x 150	6358	Yellow	10 to 40 / 0.69 to 2.8 1E392527022 Yellow	10 15 20 30	0.69 1.0 1.4 2.1	2.5 1.2 1.2 1.2	0.17 0.08 0.08 0.08	6.0 2.0 1.5 1.5	0.41 0.14 0.10 0.10	5.0	0.34	660,000 684,000 791,000 1,019,000	17,688 18,331 21,199 27,309
			Green	35 to 125 / 2.4 to 8.6 1K748527202 Red	40 50 60 80 100 125	2.8 3.4 4.1 5.5 6.9 8.6	1.6 1.6 1.6 2.0 2.4 2.4	0.11 0.11 0.11 0.14 0.17 0.17	2.5 2.5 2.5 2.5 3.0 3.0	0.17 0.17 0.17 0.17 0.21 0.21	5.0	0.34	1,262,000 1,482,000 1,703,000 2,144,000 2,596,000 3,148,000	33,822 39,718 45,640 57,459 69,573 84,366
		6358B	Yellow	10 to 30 / 0.69 to 2.1 1B788327022 Silver	10 15 20 30	0.69 1.0 1.4 2.1	2.5 1.2 1.2 1.2	0.17 0.08 0.08 0.08	6.0 2.0 1.5 1.5	0.41 0.14 0.10 0.10	1.0	0.07	660,000 684,000 791,000 1,019,000	17,688 18,331 21,199 27,309
			Green	30 to 60 / 2.1 to 4.1 1B788427022 Blue	30 40 50 60	2.1 2.8 3.4 4.1	1.2 1.2 1.2 1.2	0.08 0.08 0.08 0.08	1.5 1.5 1.5 1.5	0.10 0.10 0.10 0.10	1.0	0.07	1,019,000 1,240,000 1,460,000 1,681,000	27,309 33,232 39,128 45,051
				60 to 125 / 4.1 to 8.6 1K748527202 Red	60 80 100 125	4.1 5.5 6.9 8.6	1.6 2.0 2.4 2.4	0.11 0.14 0.17 0.17	2.0 2.5 3.0 3.0	0.14 0.17 0.21 0.21	1.0	0.07	1,692,000 2,144,000 2,596,000 3,148,000	45,346 57,459 69,573 84,366
		6358EB	Red	85 to 140 / 5.9 to 9.6 17B1261X012 Green	85 100 125 140	5.9 6.9 8.6 9.6	1.7 1.7 2.2 2.2	0.12 0.12 0.15 0.15	2.7 2.7 3.2 3.2	0.19 0.19 0.22 0.22	2.0	0.14	2,259,000 2,590,000 3,152,000 3,483,000	60,541 69,412 84,474 93,344
				130 to 200 / 9.0 to 13.8 17B1263X012 Blue	140 150 175 200	9.6 10.3 12.1 13.8	4.0 4.0 5.0 5.0	0.28 0.28 0.34 0.34	5.5 5.5 6.5 6.5	0.38 0.38 0.45 0.45	3.0	0.21	3,534,000 3,754,000 4,328,000 4,879,000	94,711 100,607 115,990 130,757
				180 to 350 / 12.4 to 24.1 17B1264X012 Red	200 250 300 350	13.8 17.2 20.7 24.1	5.0 5.0 5.5 5.5	0.34 0.34 0.38 0.38	6.5 6.5 7.0 7.0	0.45 0.45 0.48 0.48	3.0	0.21	4,879,000 5,982,000 7,096,000 8,199,000	130,757 160,318 190,173 219,733
		6358EBH	Red	250 to 400[5] / 17.2 to 27.6 17B1263X012 Blue	300 350 375	20.7 24.1 25.9	6.0 6.0 7.0	0.41 0.41 0.48	8.0 8.0 9.0	0.55 0.55 0.62	6.0	0.41	7,118,000 8,221,000 8,795,000	190,762 220,323 235,706

1. Capacities based on set pressure plus buildup to achieve full opening using a standard linear cage and standard high-gain pilot restriction (or restriction plug on Type 6358).
2. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
3. Crack point of the main valve is the inlet pressure buildup over the set pressure at which the main valve starts audible flow.
4. Inlet pressure buildup over the set pressure for the main valve to achieve wide-open capacity.
5. Set pressure plus buildup should not exceed maximum differential pressure of 400 psi / 27.6 bar.

Table 14. Type 1098-63EGR Relief Capacities with 1:1 Line Size Body Piping

BODY SIZE		SET PRESSURE RANGE, SPRING PART NUMBER AND COLOR, psig / bar	PILOT SET PRESSURE[2]		BUILDUP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE[3]		BUILDUP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE[4]		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESEAT PILOT		CAPACITIES[1] OF 0.6 SPECIFIC GRAVITY NATURAL GAS WITH 1:1 LINE SIZE TO BODY SIZE PIPING	
NPS	DN		psig	bar	psig	bar	psig	bar	psig	bar	SCFH	Nm^3/h
1	25	3 to 18 / 0.21 to 1.2 1B986027212 Green	3 5 10 15	0.21 0.34 0.69 1.0	0.7	0.048	1.0	0.07	1.0	0.07	10,000 13,000 18,000 22,000	268 348 482 590
		15 to 40 / 1.0 to 2.8 1E392527022 Yellow	15 20 30 40	1.0 1.4 2.1 2.8	0.8	0.055	1.1	0.076			22,000 27,000 35,000 43,000	590 724 938 1152
		35 to 65 / 2.4 to 4.5 1K748527202 Red	40 50 60 65	2.8 3.4 4.1 4.5	1.2	0.08	1.6	0.11			43,000 51,000 59,000 63,000	1152 1367 1581 1688
2	50	3 to 18 / 0.21 to 1.2 1B986027212 Green	3 5 10 15	0.21 0.34 0.69 1.0	0.9 0.7 0.7 0.7	0.062 0.048 0.048 0.048	1.3 1.0 1.0 1.0	0.09 0.07 0.07 0.07			40,000 47,000 67,000 84,000	1072 1260 1796 2251
		15 to 40 / 1.0 to 2.8 1E392527022 Yellow	15 20 30 40	1.0 1.4 2.1 2.8	0.8	0.055	1.1	0.076			84,000 101,000 132,000 162,000	2251 2707 3538 4342
		35 to 65 / 2.4 to 4.5 1K748527202 Red	40 50 60 65	2.8 3.4 4.1 4.5	1.3	0.09	1.7	0.12			164,000 194,000 224,000 239,000	4395 5199 6003 6405
3	80	3 to 18 / 0.21 to 1.2 1B986027212 Green	3 5 10 15	0.21 0.34 0.69 1.0	0.9 0.7 0.7 0.7	0.062 0.048 0.048 0.048	1.5 1.0 1.0 1.0	0.10 0.07 0.07 0.07			84,000 98,000 138,000 173,000	2251 2626 3698 4636
		15 to 40 / 1.0 to 2.8 1E392527022 Yellow	15 20 30 40	1.0 1.4 2.1 2.8	0.8	0.055	1.1	0.076	1.0	0.07	173,000 206,000 270,000 331,000	4636 5521 7236 8871
		35 to 65 / 2.4 to 4.5 1K748527202 Red	40 50 60 65	2.8 3.4 4.1 4.5	1.3	0.09	1.7	0.12			335,000 396,000 456,000 486,000	8978 10,613 12,221 13,025
4	100	3 to 18 / 0.21 to 1.2 1B986027212 Green	3 5 10 15	0.21 0.34 0.69 1.0	1.3 0.8 0.8 0.8	0.09 0.055 0.055 0.055	2.3 1.3 1.1 1.1	0.16 0.09 0.076 0.076			142,000 156,000 215,000 270,000	3806 4181 5762 7236
		15 to 40 / 1.0 to 2.8 1E392527022 Yellow	15 20 30 40	1.0 1.4 2.1 2.8	0.9	0.062	1.2	0.08			271,000 323,000 424,000 521,000	7263 8656 11,363 13,963
		35 to 65 / 2.4 to 4.5 1K748527202 Red	40 50 60 65	2.8 3.4 4.1 4.5	1.4	0.097	1.8	0.12			527,000 624,000 719,000 767,000	14,124 16,723 19,269 20,556
6	150	3 to 18 / 0.21 to 1.2 1B986027212 Green	3 5 10 15	0.21 0.34 0.69 1.0	1.7 0.8 0.8 0.8	0.12 0.055 0.055 0.055	6.4 4.4 1.2 1.1	0.44 0.30 0.08 0.076			365,000 365,000 403,000 497,000	9782 9782 10,800 13,320
		15 to 40 / 1.0 to 2.8 1E392527022 Yellow	15 20 30 40	1.0 1.4 2.1 2.8	0.9	0.062	1.2	0.08			499,000 590,000 763,000 930,000	13,373 15,812 20,448 24,924
		35 to 65 / 2.4 to 4.5 1K748527202 Red	40 50 60 65	2.8 3.4 4.1 4.5	1.5	0.10	1.9	0.13			942,000 1,108,000 1,275,000 1,358,000	25,246 29,694 34,170 36,394

1. Capacities based on set pressure plus buildup to achieve full opening using a size 40 actuator, green main spring, standard linear cage, and standard high-gain pilot restriction.
2. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
3. Crack point of the main valve is the inlet pressure buildup over the set pressure at which the main valve starts audible flow.
4. Inlet pressure buildup over the set pressure for the main valve to achieve wide-open capacity.

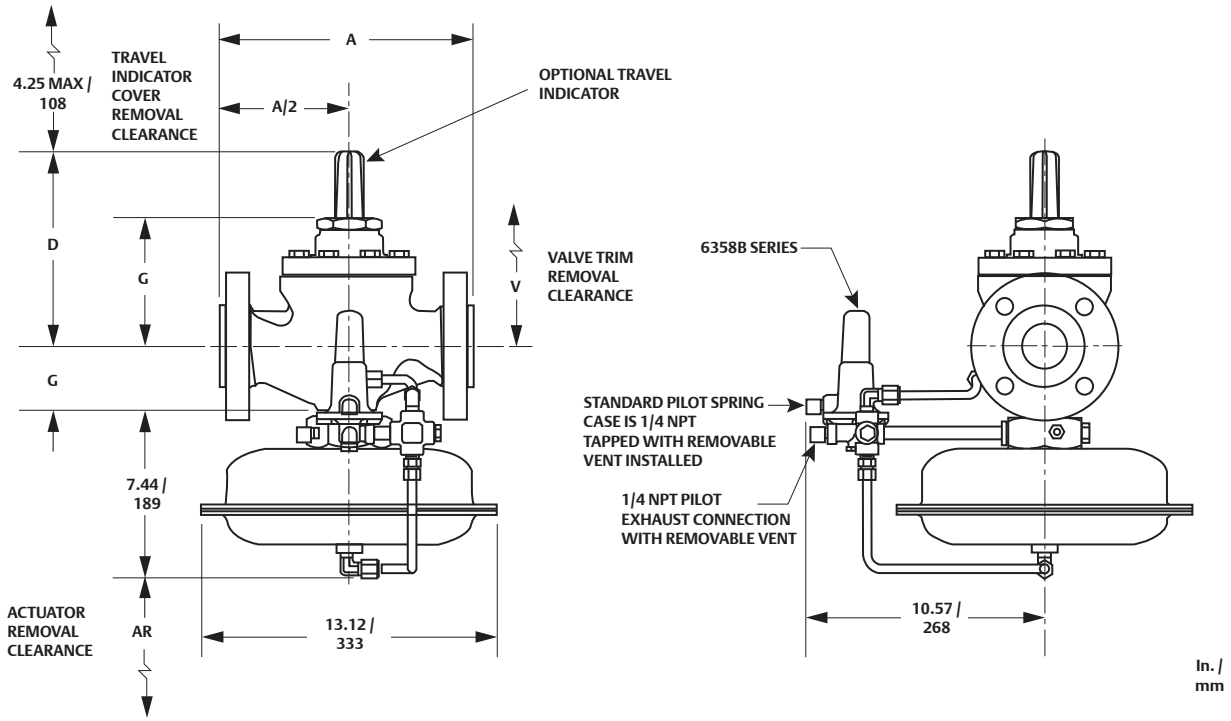


In. / mm

TYPE 63EG WITH 6358 SERIES PILOT

NOTE:
FOR DIMENSIONS OF RELIEF VALVES WITH EN (OR OTHER) END CONNECTIONS, CONSULT THE LOCAL SALES OFFICE.

Figure 5. *Dimensions*



TYPE 1098-63EGR WITH 6358B SERIES PILOT

15A8031_M

NOTE:
FOR DIMENSIONS OF RELIEF VALVES WITH EN (OR OTHER) END CONNECTIONS, CONSULT THE LOCAL SALES OFFICE.

Figure 5. *Dimensions (continued)*

Table 15. Dimension

BODY SIZE		COMMON DIMENSION																		DIMENSION SPECIFIC FOR TYPE 63EG				DIMENSION SPECIFIC FOR TYPE 1098-63EGR	
		A												D (With Travel Indicator)		E (Without Travel Indicator)		G		V		H		M		AR	
		NPT		Cast Iron				Steel/Stainless Steel																			
				CL125 FF		CL250 RF		CL150 RF		CL300 RF		CL600 RF															
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1	25	8.25	209	7.25	184	7.75	197	7.25	184	7.75	197	8.25	209	8.19	208	4.94	125	2.19	55.6	11.38	289	5.44	138	7.25	184	3.00	76.2
2	50	11.25	286	10	254	10.5	267	10	254	10.5	267	11.25	286	8.69	221	5.44	138	2.84	72.1	12.62	320	5.94	151	7.69	195	3.12	79.2
3	80	----		11.75	298	12.5	317	11.75	298	12.5	317	13.25	337	11.25	286	7.00	178	3.5	88.9	16.25	413	7.25	184	8.19	208	3.88	98.6
4	100	----		13.88	353	14.5	368	13.88	353	14.5	368	15.5	394	12.62	321	8.38	213	4.81	122	18.88	479	8.62	219	8.88	226	5.12	130
6	150	----		17.75	451	18.62	473	17.75	451	18.62	473	20	508	13.44	341	9.19	233	5.19	132	20	508	8.81	224	14.56	370	6.38	162
8 x 6	200 x 150	----		----		----		21.38	543	22.38	568	24	610	15.00	381	10.75	273	7.19	183	23.5	597	10.5	267	14.56	370	9.69	246

Ordering Guide

Type (Select One)
- ☐ 63EG***
- ☐ 1098-63EGR**

Body Size (Select One)
- ☐ NPS 1 / DN 25***
- ☐ NPS 2 / DN 50***
- ☐ NPS 3 / DN 80***
- ☐ NPS 4 / DN 100***
- ☐ NPS 6 / DN 150***
- ☐ NPS 8 x 6 / DN 200 x 150***

End Connection Style (Select One)

Cast Iron
- ☐ NPT (available in NPS 1 or 2 / DN 25 or 50 body size only)***
- ☐ CL125 FF***
- ☐ CL250 RF***

Steel, Stainless Steel
- ☐ NPT (available in NPS 1 or 2 / DN 25 or 50 body size only)***
- ☐ SWE (available in NPS 1 or 2 / DN 25 or 50 body size only)**
- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ CL600 RF***
- ☐ BWE**
- ☐ PN 16/25/40 _____ (please specify)*

Body and Flange Material (Select One)
- ☐ Cast iron***
- ☐ Steel***
- ☐ Stainless steel***

Cage Material (Select One)
- ☐ Linear, CF8M Stainless steel***
- ☐ Whisper Trim™ Cage, 416 Stainless steel***
- ☐ Whisper Trim Cage, 316 Stainless steel***

Seat Ring and Valve Plug Material (Select One)
- ☐ 410/416 Stainless steel***
- ☐ 316 Stainless steel*

Gasket and O-ring Material (Select One)
- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)***
- ☐ Ethylenepropylene (EPR)***

Main Valve Spring (Select One)

Type 63EG
- ☐ Yellow (NPS 1 / DN 25 not available)
- ☐ Green
- ☐ Red

Main Valve Spring (Select One) (continued)

Type 1098-63EGR
- ☐ Green
- ☐ Yellow

Set Pressure Range (Select One)

Type 63EG

Type 6358 Backpressure
- ☐ 10 to 40 psig / 0.69 to 2.8 bar, Yellow
- ☐ 35 to 125 psig / 2.4 to 8.6 bar, Red

Type 6358B Relief
- ☐ 10 to 30 psig / 0.69 to 2.1 bar, Silver
- ☐ 30 to 60 psig / 2.1 to 4.1 bar, Blue
- ☐ 60 to 125 psig / 4.1 to 8.6 bar, Red

Type 6358EB Relief
- ☐ 85 to 140 psig / 5.9 to 9.7 bar, Green
- ☐ 130 to 200 psig / 8.9 to 13.8 bar, Blue
- ☐ 180 to 350 psig / 12.4 to 24.1 bar, Red

Type 6358EBH Relief
- ☐ 250 to 400 psig / 17.2 to 27.6 bar, Blue

Type 1098-63EGR

Type 6358B
- ☐ 3 to 18 psig / 0.21 to 1.2 bar, Green
- ☐ 15 to 40 psig / 1.0 to 2.8 bar, Yellow
- ☐ 35 to 65 psig / 2.4 to 4.5 bar, Red

Pilot Body Material (Select One)
- ☐ Aluminum (for Types 6358 and 6358B only)***
- ☐ Stainless steel***

Pilot Diaphragm and O-ring Material (Select One)
- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)**

Travel Indicator (Optional)
- ☐ Pressure gauge for Type 63EG
- ☐ Pressure gauge for Type 1098-63EGR

Tubing and Fittings (Select One)
- ☐ Stainless steel tubing and steel fittings***
- ☐ Stainless steel tubing and Stainless steel fittings***

Pilot Supply Filter (Optional)

Type 252

Aluminum Construction
- ☐ Standard length without drain valve
- ☐ Standard length with drain valve
- ☐ Extended length without drain valve
- ☐ Extended length with drain valve

Stainless Steel Construction
- ☐ Standard length without drain valve
- ☐ Standard length with drain valve
- ☐ Extended length without drain valve
- ☐ Extended length with drain valve

- continued -

Ordering Guide (continued)

P590 Series Pilot Supply Filter (Optional)

☐ Type P594-1 brass filter

Pressure Gauge (Optional)

☐ Pressure gauge for Type 63EG
☐ Pressure gauge for Type 1098-63EGR

Special Cleaning Services (Optional)

☐ Pure Gas
☐ Oxygen

NACE Construction (Optional)

☐ Yes

Quick Change Trim Package (Optional)

☐ Yes, send one trim package to match this order.

Main Valve Parts Kit (Optional)

☐ Yes, send one parts kit to match this order.

Pilot Parts Kit (Optional)

☐ Yes, send one parts kit to match this order.

Wireless Position Monitor Mounting Kit (Optional)

☐ Yes, send one mounting kit for mounting the Topworx™ 4310 or the Fisher™ 4320 wireless position monitor (requires Travel Indicator option).

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.

Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.

Specification Worksheet
Application
☐ Relief Valve ☐ Backpressure Regulator
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Adequate overpressure protection should be installed to protect the regulator from overpressure. Adequate overpressure protection should also be installed to protect all downstream equipment in the event of regulator failure.

Introduction
The 66 Series direct-operated pressure reducing regulators are widely used in burner control and other applications where precise control of low-pressure industrial gases is needed.

Body Sizes and End Connection Styles
See Table 1

Spring Case Vent
3/4 NPT **standard** with removable Type Y602-10 vent assembly

Flow Coefficients
See Table 3

IEC Sizing Coefficients
X_T: 0.775

F_D: *NPS 2 / DN 50:* 0.35
NPS 3 / DN 80: 0.34
NPS 4 / DN 100: 0.30

F_L: 0.89

Maximum Inlet Pressures
Emergency Inlet Pressure:
25 psig / 1.7 bar
Maximum Pressure to Avoid Internal Parts Damage: 10 psig / 0.69 bar

Maximum Outlet (Casing) Pressure
8 psig / 0.55 bar

Outlet Pressure Ranges
2 in. w.c. to 5 psig / 5 mbar to 0.34 bar in 11 ranges
See Table 4

Pressure Registration
Cast Iron Body:
Internal **(standard)** or external
Steel Body:
External **(standard)** or internal

Material Temperature Capabilities
Nitrile (NBR):
-40 to 180°F / -40 to 82°C
Fluorocarbon (FKM):
0 to 350°F / -18 to 177°C
Ethylenepropylene (EPDM):
-40 to 275°F / -40 to 135°C

Additional Technical Data
For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features
- **Sensitive Response to Pressure Changes**
- **Seat Protection Without Sacrifice in Shutoff Capability**
- **Accuracy**
- **Application Flexibility**
- **Severe Service and Sour Gas Capability**



Figure 1. *Type 66 Pressure Reducing Regulator*

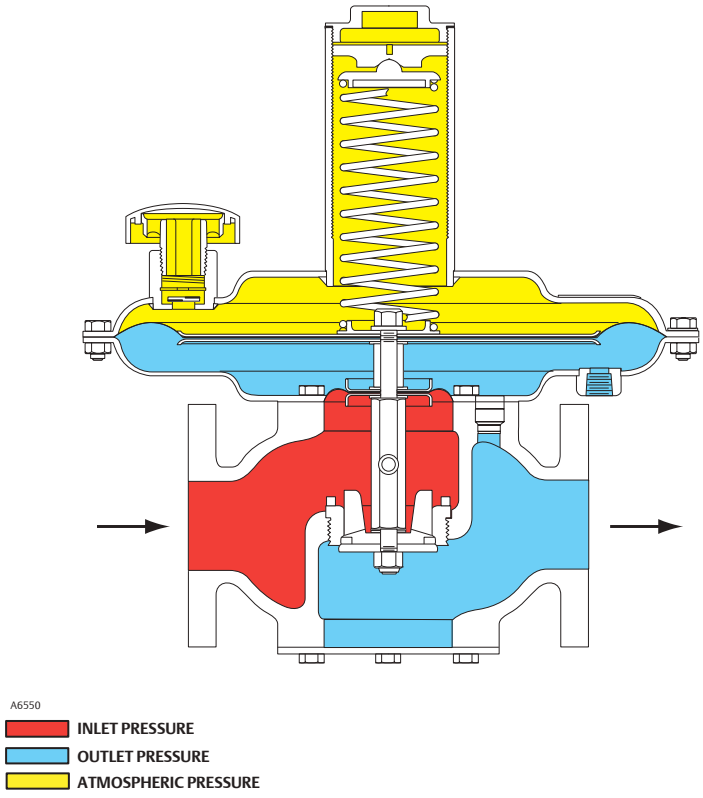


Figure 2. *Type 66 Operational Schematic*

Table 1. Body Size and End Connection Style

BODY SIZE		BODY MATERIAL	
NPS	DN	Cast Iron	Steel
2	50	NPT or CL125 FF	NPT, CL150 FF, CL150 RF or CL300 RF
3 and 4	80 and 100	CL125 FF	CL150 RF

Table 2. Construction Material

BODY	SPRING CASE	DIAPHRAGM PLATE	DIAPHRAGM AND VALVE PLUG O-RING	GASKET	TRIM
Cast iron **(standard)**, Steel, or 316 Stainless steel	Steel or 304 Stainless steel (optional)	Plated steel	Nitrile (NBR) **(standard)**, Fluorocarbon (FKM) (high-temperature), Ethylenepropylene (EPDM), Polytetrafluoroethylene (PTFE)	Composition and Neoprene (CR)	Brass or 316 Stainless steel

Table 3. Flow Coefficient

OUTLET PRESSURE RANGE		DROOP		REGULATING C_g			REGULATING C_v			WIDE-OPEN C_g			WIDE-OPEN C_v			C_1
psig	bar	psig	mbar	NPS 2 / DN 50	NPS 3 / DN 80	NPS 4 / DN 100	NPS 2 / DN 50	NPS 3 / DN 80	NPS 4 / DN 100	NPS 2 / DN 50	NPS 3 / DN 80	NPS 4 / DN 100	NPS 2 / DN 50	NPS 3 / DN 80	NPS 4 / DN 100	
0.75 to 1.5	0.05 to 0.10	0.2 0.3	10 20	765 1150	1865 2800	3330 5000	21.9 32.9	53.3 80	95.1 143	1260	3400	5250	36	97.1	150	35
1 to 2	0.07 to 0.14	0.3 0.4	20 30	825 1100	1650 2200	3150 4200	23.6 31.4	47.1 62.9	90 120							
1.5 to 3	0.10 to 0.21	0.4 0.6	30 40	665 1000	1165 1750	2500 3750	19 28.6	33.3 50	71.4 107							
3 to 5	0.21 to 0.34	0.6 0.8 1.0	40 60 70	540 720 900	725 970 1210	----	15.4 20.6 25.7	20.7 27.7 34.6	----							

Table 4. Outlet Pressure Range

BODY SIZE		OUTLET PRESSURE RANGE		CONTROL SPRING INFORMATION					
				Part Number	Color	Free Length		Wire Diameter	
NPS	DN	In. w.c.	mbar			In.	mm	In.	mm
2	50	4 to 11[1] 8 to 28[1] 2 to 5 4 to 8	10 to 27[1] 20 to 70[1] 5 to 12 10 to 20	0B019727052 1E611427022 1D892527022 1D892627022	Purple Stripe Orange Stripe Brown Stripe Red Stripe	6.00 6.00 6.12 7.53	152 152 155 191	0.148 0.200 0.109 0.112	3.76 5.08 2.77 2.85
		7 to 12 10 to 17 14 to 28	17 to 30 25 to 42 35 to 70	1D892727012 1D892827032 1D892927032	Black Stripe Orange Stripe Purple Stripe	7.88 7.75 7.53	200 197 191	0.130 0.148 0.162	3.30 3.76 4.12
		0.75 to 1.5 psig 1 to 2 psig 1.5 to 3 psig 3 to 5 psig	0.05 to 0.10 bar 0.07 to 0.14 bar 0.10 to 0.21 bar 0.21 to 0.34 bar	1D765727032[2] 1D765827032[2] 1D962627032[2] 1N506427142[3]	Red Stripe Unpainted Unpainted Black Stripe	6.09 6.00 6.25 6.31	155 152 159 160	0.207 0.225 0.262 0.283	5.26 5.72 6.66 7.19
3	80	4 to 11[1] 8 to 28[1] 2 to 5 4 to 8	10 to 27[1] 20 to 70[1] 5 to 12 10 to 20	1D479927032 1D527327022 1D893027022 1D893127012	Yellow Stripe White Stripe Brown Stripe Unpainted	6.00 6.00 6.12 7.12	152 152 155 181	0.162 0.207 0.112 0.125	4.12 5.26 2.85 3.18
		7 to 12 10 to 17 14 to 28	17 to 30 25 to 42 35 to 70	1D892827032 1D893227032 1D893327032	Orange Stripe White Stripe Green Stripe	7.75 7.50 7.25	197 191 184	0.148 0.156 0.182	3.76 3.96 4.62
		0.75 to 1.5 psig 1 to 2 psig 1.5 to 3 psig 3 to 5 psig	0.05 to 0.10 bar 0.07 to 0.14 bar 0.10 to 0.21 bar 0.21 to 0.34 bar	1D765827032[2] 1D962627032[2] 1E204427032[2] 1N506527142[3]	Unpainted Unpainted White and Red Stripe Brown and Purple Stripe	6.00 6.25 6.38 6.38	152 159 162 162	0.225 0.262 0.306 0.362	5.72 6.66 7.77 9.20
4	100	4 to 11[1] 8 to 28[1] 2 to 5 4 to 8	10 to 27[1] 20 to 70[1] 5 to 12 10 to 20	1D527527022 1D527627032 1D892627022 1D893427022	Gray Stripe Gray and White Stripe Red Stripe Green Stripe	7.75 7.75 7.53 7.75	197 197 191 197	0.170 0.225 0.112 0.135	4.32 5.72 2.85 3.43
		7 to 12 10 to 17 14 to 28	17 to 30 25 to 42 35 to 70	1D893227032 1D893527032 1D893627032	White Stripe Yellow Stripe Light Blue Stripe	7.50 7.75 7.81	191 197 198	0.156 0.170 0.207	3.96 4.32 5.26
		0.75 to 1.5 psig 1 to 2 psig 1.5 to 3 psig 3 to 5 psig	0.05 to 0.10 bar 0.07 to 0.14 bar 0.10 to 0.21 bar 0.21 to 0.34 bar	1D771227032[2] 1D771327032[2] 1E204527032[3] ----------	Pink and Blue Stripe Silver Stripe Pink Stripe ----	7.75 7.75 7.53 ----	197 197 191 ----	0.262 0.283 0.331 ----	6.66 7.19 8.41 ----

1. 1 psi / 0.07 bar minimum differential pressure required with this range.
2. Heavy head construction required.
3. Extra heavy head construction required.

Table 5. 66 Series Flow Capacities

BODY SIZE, IN. / DN	OUTLET PRESSURE RANGE AND PART NUMBER, In. w.c. / mbar	OUTLET PRESSURE SETTING, In. w.c. / mbar	ACCURACY RANGE, In. w.c. / mbar	CAPACITIES IN SCFH / Nm³/H OF 0.6 SPECIFIC GRAVITY NATURAL GAS Inlet Pressure Capacities Based on D (Droop) or B (Boost)							
				8.3 in. w.c. / 20 mbar	11.1 in. w.c. / 30 mbar	20.8 in. w.c. / 50 mbar	1.0 psig / 0.07 bar	1.5 psig / 0.10 bar	2.0 psig / 0.14 bar	3.0 psig / 0.21 bar	5 to 10 psig / 0.34 to 0.69 bar
2 / 50	2 to 5 / 5 to 12 1D892527022	2.0 / 5	-1/2 to 3/4 / -1 to 2	4900 / 131 D	6700 / 180 D	8250 / 221 D	10,000 / 268 D	9300 / 249 B	9150 / 245 B	8500 / 228 B	8500 / 228 B
		4.0 / 10		3900 / 105 D	6200 / 166 D	7850 / 210 D	9550 / 256 D	11,750 / 315 B	10,800 / 289 B	10,800 / 289 B	10,300 / 276 B
	4 to 8 / 10 to 20 1D892627022	6.0 / 15	-3/4 to 1-1/8 / -2 to 3	2840 / 76.1 D	5800 / 155 D	7600 / 204 D	9550 / 256 D	12,100 / 324 D	13,500 / 362 B	10,800 / 289 B	10,300 / 276 B
	7 to 12 / 17 to 30 1D892727012	9.0 / 22	-1-1/4 to 1-7/8 / -3 to 5	----	3200 / 85.8 D	6450 / 173 D	8700 / 233 D	11,100 / 297 D	13,400 / 359 B	15,100 / 405 B	13,400 / 359 B
		12 / 30		----	----	4500 / 121 D	6450 / 173 D	10,600 / 284 D	13,300 / 356 D	15,500 / 415 D	13,900 / 373 B
	10 to 17 / 25 to 42 1D892827032	16 / 40		----	----	----	4650 / 125 D	9000 / 241 D	12,900 / 346 D	16,750 / 449 D	16,450 / 441 B
	14 to 28 / 35 to 70 1D892927032	20 / 50	-2 to 3 / -5 to 7	----	----	----	----	8400 / 225 D	12,250 / 328 D	16,100 / 431 D	18,000 / 482 B
		24 / 60		----	----	----	----	7750 / 208 D	11,600 / 311 D	15,500 / 415 D	20,000 / 536 B
		28 / 70		----	----	----	----	----	----	12,900 / 346 D	20,000 / 536 B
3 / 80	2 to 5 / 5 to 12 1D893027022	2.0 / 5	-1/2 to 3/4 / -1 to 2	9000 / 241 D	12,900 / 346 D	15,500 / 415 D	21,300 / 571 D	26,400 / 708 D	29,600 / 793 B	25,100 / 673 B	23,200 / 622 B
		4.0 / 10		8700 / 233 D	12,900 / 346 D	15,500 / 415 D	21,300 / 571 D	26,400 / 708 D	29,600 / 793 B	25,100 / 673 B	23,200 / 622 B
	4 to 8 / 10 to 20 1D893127012	6.0 / 15	-3/4 to 1-1/8 / -2 to 3	6125 / 164 D	12,250 / 328 D	16,750 / 449 D	18,000 / 482 D	23,200 / 622 D	30,000 / 804 B	36,100 / 967 B	31,000 / 831 B
	7 to 12 / 17 to 30 1D892827032	9.0 / 22	-1-1/4 to 1-7/8 / -3 to 5	----	8250 / 221 D	12,900 / 346 D	18,000 / 482 D	23,200 / 622 D	33,500 / 898 D	37,400 / 1002 D	46,400 / 1244 D
		12 / 30		----	----	8400 / 225 D	14,200 / 381 D	20,600 / 552 D	28,400 / 761 D	36,750 / 985 D	46,400 / 1244 D
	10 to 17 / 25 to 42 1D893227032	16 / 40		----	----	----	7750 / 208 D	18,000 / 482 D	23,200 / 622 D	36,100 / 967 D	49,000 / 1313 D
	14 to 28 / 35 to 70 1D893327032	20 / 50	-2 to 3 / -5 to 7	----	----	----	----	12,900 / 346 D	20,600 / 552 D	32,200 / 863 D	46,400 / 1244 D
		24 / 60		----	----	----	----	11,600 / 311 D	19,300 / 517 D	25,800 / 691 D	46,400 / 1244 D
		28 / 70		----	----	----	----	----	----	23,200 / 622 D	46,400 / 1244 D
4 / 100	2 to 5 / 5 to 12 1D892627022	2.0 / 5	-1/2 to 3/4 / -1 to 2	15,500 / 415 D	23,200 / 622 D	28,400 / 761 B	36,100 / 967 B	36,100 / 967 B	36,100 / 967 B	36,100 / 967 B	36,100 / 967 B
		4.0 / 10		15,500 / 415 D	23,200 / 622 D	28,400 / 761 B	36,100 / 967 B	36,100 / 967 B	36,100 / 967 B	36,100 / 967 B	36,100 / 967 B
	4 to 8 / 10 to 20 1D893427022	6.0 / 15	-3/4 to 1-1/8 / -2 to 3	11,600 / 311 D	18,000 / 482 D	24,500 / 657 D	34,800 / 933 D	38,700 / 1037 B	43,800 / 1174 B	43,000 / 1152 B	43,800 / 1174 B
	7 to 12 / 17 to 30 1D893227032	9.0 / 22	-1-1/4 to 1-7/8 / -3 to 5	----	12,900 / 346 D	20,600 / 552 D	33,500 / 898 D	41,300 / 1107 D	51,500 / 1380 B	51,500 / 1380 B	51,500 / 1380 B
		12 / 30		----	----	12,900 / 346 D	22,600 / 606 D	38,700 / 1037 D	51,500 / 1380 D	58,000 / 1554 D	56,700 / 1520 D
	10 to 17 / 25 to 42 1D893527032	16 / 40		----	----	----	20,600 / 552 D	36,100 / 967 D	51,500 / 1380 D	64,500 / 1729 D	61,800 / 1656 D
	14 to 28 / 35 to 70 1D893627032	20 / 50	-2 to 3 / -5 to 7	----	----	----	----	27,000 / 724 D	46,400 / 1244 D	61,800 / 1656 D	71,000 / 1903 D
		24 / 60		----	----	----	----	----	41,300 / 1107 D	61,800 / 1656 D	77,500 / 2077 D
		28 / 70		----	----	----	----	----	----	58,000 / 1554 D	77,500 / 2077 D

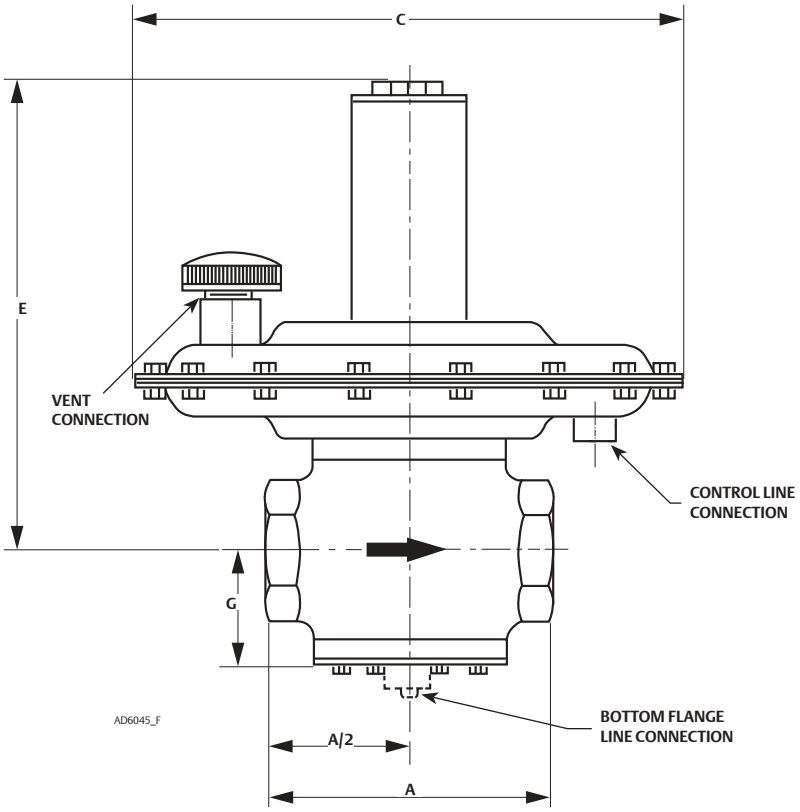


Figure 3. *Dimensions*

Table 6. Dimension

BODY SIZE		A								C		E		G			
		NPT Cast Iron Body		NPT Steel Body		CL125 FF Cast Iron or CL150 RF(1) Steel Body		CL300 RF Steel Body						NPT Steel Body		All Other	
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
2	50	7.25	184	9.25	235	10.00	254	10.50	267	13.88	353	15.00	381	3.31	84	3.25	83
3	80	----	----	----	----	11.75	298	----	----	16.00	406	17.62	448	----	----	4.62	117
4	100	----	----	----	----	13.88	353	----	----	18.00	457	21.25	540	----	----	5.38	137

1. Dimension also is same for NPS 2 / DN 50 CL150 FF steel body.

Table 7. Shipping Weight

BODY SIZE		APPROXIMATE SHIPPING WEIGHT			
		NPT End		Flanged End	
NPS	DN	LB	kg	LB	kg
2	50	50	23	55	25
3	80	----		100	45
4	100	----		155	70

Ordering Guide

Body, Body Size and End Connection Style (Select One)

Cast Iron Body

- ☐ 2 NPT**
- ☐ NPS 2 / DN 50, CL125 FF**
- ☐ NPS 3 / DN 80, CL125 FF**
- ☐ NPS 4 / DN 100, CL125 FF**

Steel Body (External Pressure Registration Only)

- ☐ 2 NPT**
- ☐ NPS 2 / DN 50, CL150 FF**
- ☐ NPS 2 / DN 50, CL150 RF**
- ☐ NPS 2 / DN 50, CL300 RF**
- ☐ NPS 3 / DN 80, CL150 RF**
- ☐ NPS 4 / DN 100, CL150 RF**

Outlet Pressure Range (Select One)

- ☐ 2 to 5 in. w.c. / 5 to 12 mbar**
- ☐ 4 to 8 in. w.c. / 10 to 20 mbar**
- ☐ 4 to 11 in. w.c. / 10 to 27 mbar**
- ☐ 7 to 12 in. w.c. / 17 to 30 mbar**
- ☐ 8 to 28 in. w.c. / 20 to 70 mbar**
- ☐ 10 to 17 in. w.c. / 25 to 42 mbar**
- ☐ 14 to 28 in. w.c. / 35 to 70 mbar**
- ☐ 0.75 to 1.5 psig / 0.05 to 0.10 bar**
- ☐ 1 to 2 psig / 0.07 to 0.14 bar**
- ☐ 1.5 to 3 psig / 0.10 to 0.21 bar**
- ☐ 3 to 5 psig / 0.21 to 0.34 bar** (not available in NPS 4 / DN 100 body)**

Trim Material (Select One)

- ☐ Brass**
- ☐ 316 Stainless steel**

Pressure Registration (Select One)

- ☐ Internal (cast iron) **(standard)****
- ☐ External (required for steel, optional for cast iron)**

Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide

***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.

Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.

Specification Worksheet

Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Does the application require overpressure protection?
☐ Yes, which is preferred? ☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No
Pressure
Maximum Inlet Pressure (P_{1max}):
Minimum Inlet Pressure (P_{1min}):
Downstream Pressure Setting(s) (P_2):
Maximum Flow (Q_{max}):
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

When a regulator appears unable to pass the published flow rate, be sure to check the inlet pressure measured at the regulator body inlet connection. Piping up to and away from regulators can cause significant flowing pressure losses.

67C Series
Instrument Supply Regulators

FISHER

Introduction

The 67C Series regulators are typically used to provide constantly controlled, reduced pressure to pneumatic and electropneumatic controllers and other instruments. These direct-operated regulators are suitable for most air or gas applications. Other applications include providing reduced pressure to air chucks, air jets and spray guns.

Body Size, Inlet and Outlet Connection Style

1/4 NPT

Maximum Inlet Pressure (Body Rating)

Types 67C, 67CR, 67CF, 67CFR, 67CFS and 67CFSR: 250 psig / 17.2 bar

Types 67CS and 67CSR: 400 psig / 27.6 bar

Outlet Pressure Ranges

See Table 1

Maximum Emergency Outlet Pressure

50 psi / 3.4 bar over outlet pressure setting

Wide-Open Flow Coefficients

Main Valve: C_g: 11.7; C_v: 0.36; C_1: 32.2

Internal Relief Valve: C_g: 1.45; C_v: 0.045; C_1: 32.8

IEC Sizing Coefficients

Main Valve: X_T: 0.66; F_D: 0.50; F_L: 0.89

Types 67CR, 67CSR, 67CFR and 67CFSR Internal Relief Performance

Low capacity for minor seat leakage only; other overpressure protection must be provided if inlet pressure can exceed the maximum pressure rating of downstream equipment or exceeds maximum outlet pressure rating of the regulator.

Pressure Registration

Internal

Temperature Capabilities

With Nitrile (NBR)
Standard Bolting:
-20 to 180°F / -29 to 82°C
Stainless Steel Bolting:
-40 to 180°F / -40 to 82°C

With Fluorocarbon (FKM):
Polyethylene Filter[1] ***(Standard):***
0 to 180°F / -18 to 82°C
Polyvinylidene (PVDF), Stainless steel or Glass Filter (Optional):
0 to 300°F / -18 to 149°C

With Silicone (VMQ)[2] **Diaphragm and Low Temperature Bolting:**
-60 to 180°F / -51 to 82°C

With Gauges: -40 to 180°F / -40 to 82°C

Types 67CF, 67CFR, 67CFS and 67CFSR Filter Capabilities

Free Area: 12 times pipe area

Micron Rating:
Polyethylene Filter[1] ***(Standard):*** 5 microns
Glass Fiber Filter (Optional): 5 microns
PVDF Filter (Optional): 40 microns
Stainless Steel Filter (Optional): 40 microns

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Designed for Digital Instrumentation**
- **Optional Smart Bleed™ Construction**
- **Optional Stainless Steel Construction**
- **Compact and Light Weight**
- **No Air Loss**
- **Easy Maintenance**
- **Optional Integral Filter**
- **Optional Internal Relief Valve**
- **Rugged Construction**


W8438

Figure 1. *67C Series Instrument Supply Regulator*


W7412

Figure 2. *67CF Series Filter Regulator shown with Optional Pressure Gauge*

1. Do not use in high aromatic hydrocarbon service.
2. Silicone (VMQ) is not compatible with hydrocarbon gas.

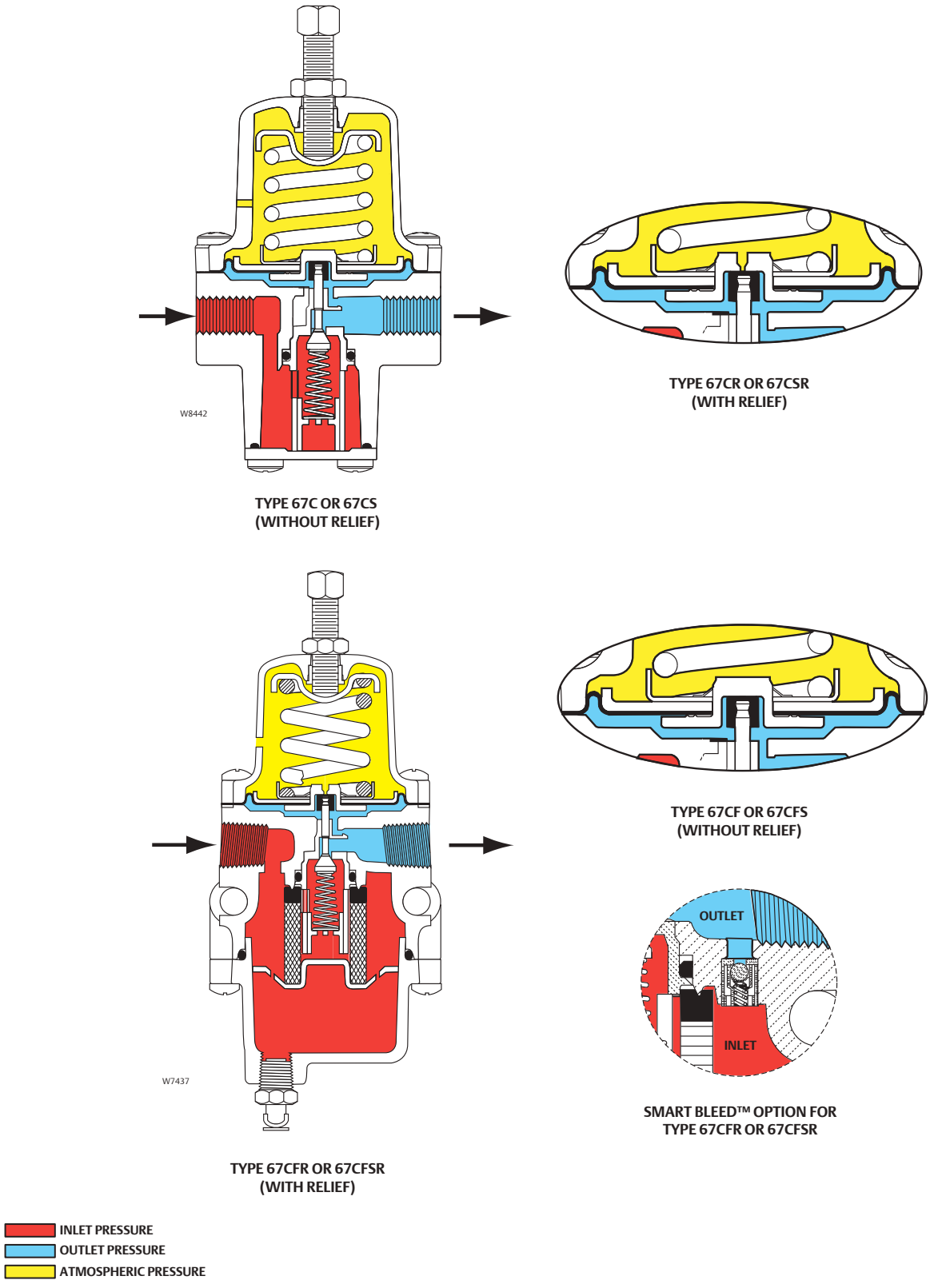


Figure 3. *67C Series Operational Schematics*

Table 1. Outlet Pressure Range and Control Spring Data

TYPE	OUTLET PRESSURE RANGE		CONTROL SPRING DATA						
			Color	Material	Part Number	Wire Diameter		Free Length	
	psig	bar				In.	mm	In.	mm
67C, 67CR, 67CF and 67CFR	0 to 20 0 to 35 0 to 60 0 to 125	0 to 1.4 0 to 2.4 0 to 4.1 0 to 8.6	Green stripe Silver Blue stripe Red stripe	Music Wire	GE07809T012 T14059T0012 T14058T0012 T14060T0012	0.135 0.156 0.170 0.207	3.43 3.96 4.32 5.26	1.425	36.2
	0 to 35 0 to 60 0 to 125	0 to 2.4 0 to 4.1 0 to 8.6	Silver stripe Blue Red	Inconel®	T14113T0012 T14114T0012 T14115T0012	0.156 0.172 0.207	3.96 4.37 5.26	1.425	36.2
67CS, 67CSR, 67CFS and 67CFSR	0 to 20 0 to 35 0 to 60 0 to 125 0 to 150	0 to 1.4 0 to 2.4 0 to 4.1 0 to 8.6 0 to 10.3	Green Silver stripe Blue Red Black	Inconel®	10C1729X012 T14113T0012 T14114T0012 T14115T0012 10C1730X012	0.135 0.156 0.172 0.207 0.250	3.43 3.96 4.37 5.26 6.35	1.500 1.425 1.425 1.425 1.769	38.1 36.2 36.2 36.2 44.9

Table 2. 67C Series Construction Material

PART NAME	TYPE			
	67C and 67CR	67CF and 67CFR	67CS and 67CSR	67CFS and 67CFSR
BODY AND SPRING CASE	Aluminum (ASTM B85/Alloy 380)		CF8M/CF3M Stainless steel	
BOTTOM PLATE	316 Stainless steel	----	316 Stainless steel	----
PUSHER POST AND VALVE CARTRIDGE	Polyester resin			
UPPER SPRING SEAT	Zinc-plated Steel		316 Stainless steel	
LOWER SPRING SEAT, DIAPHRAGM PLATE	Chromate conversion coated aluminum		316 Stainless steel	
CONTROL SPRING	Plated Steel or Inconel® (NACE)		Inconel®	
VALVE PLUG	Brass stem with Nitrile (NBR) plug, Aluminum stem with Nitrile (NBR) or Fluorocarbon (FKM) plug, or Stainless steel stem with Nitrile (NBR) plug		316 Stainless steel stem with Nitrile (NBR) or Fluorocarbon (FKM) plug	
VALVE SPRING	Stainless steel or Inconel® (NACE)		Inconel®	
DIAPHRAGM AND O-RING	Nitrile (NBR), Fluorocarbon (FKM) or Silicone (VMQ)(1)			
SOFT SEAT AND GASKET	Nitrile (NBR) or Fluorocarbon (FKM)			
BOLTING, ADJUSTING SCREW, LOCKNUT	Zinc-plated steel or Stainless steel		Stainless steel	
HANDWHEEL	Zinc-plated steel screw with resin handwheel			
FILTER RETAINER	----	Plated Steel	----	316 Stainless steel
FILTER ELEMENT		Polyethylene, Glass fiber, 316 Stainless steel or PVDF (Plastic)		Polyethylene, Glass fiber, 316 Stainless steel or PVDF (Plastic)
DRAIN VALVE		Brass or Stainless steel		316 Stainless steel or 18-8 Stainless steel
DRIPWELL		Aluminum (ASTM B85/Alloy 380)		CF8M/CF3M Stainless steel

1. Silicone (VMQ) diaphragm is only available with internal relief (Types 67CR, 67CSR, 67CFR and 67CFSR).

Inconel® is a mark owned by Special Metals Corporation.

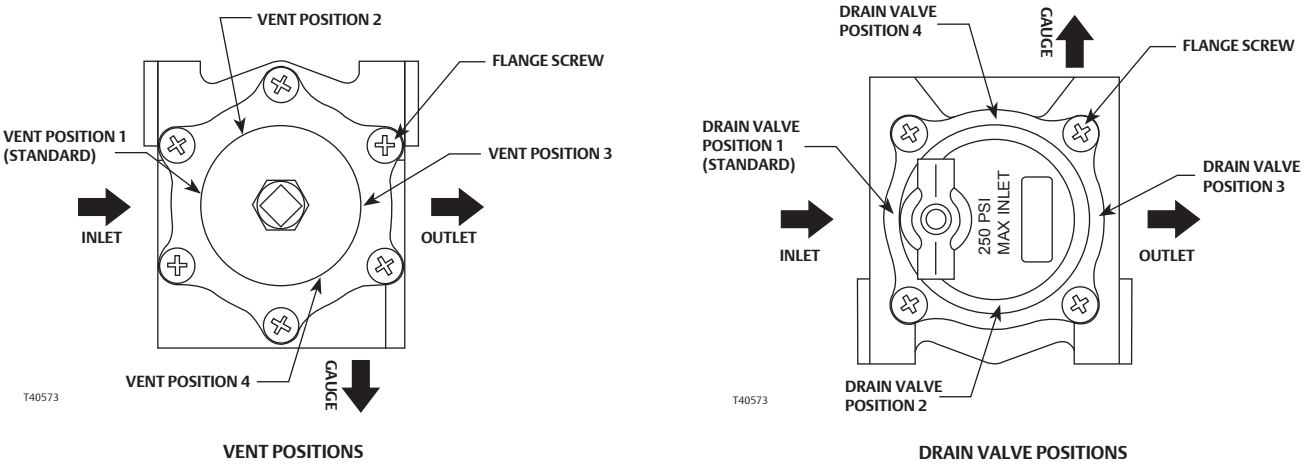


Figure 4. *67C Series Vent and Drain Valve Positions*

Table 3. Capacities

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR, psig / bar	OUTLET PRESSURE		INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
					Types 67C, 67CR, 67CS and 67CSR				Types 67CF, 67CFR, 67CFS and 67CFSR			
					10% Droop		20% Droop		10% Droop		20% Droop	
	psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
0 to 35 / 0 to 2.4 T14059T0012 Silver T14113T0012 Silver stripe	15	1.0	50	3.4	323	8.7	555	14.9	323	8.7	555	14.9
			75	5.2	439	11.8	787	21.1	387	10.4	890	23.9
			100	6.9	555	14.9	1032	27.7	426	11.4	1290	34.6
			150	10.3	877	23.5	1548	41.5	516	13.8	2064	55.3
			250	17.2	1677	44.9	2451	65.7	581	15.6	2322	62.2
			400[2]	27.6[2]	503	13.5	2387	64.0	----	----	----	----
	20	1.4	50	3.4	400	10.7	593	15.9	452	12.1	645	17.3
			75	5.2	542	14.5	903	24.2	684	18.3	1058	28.4
			100	6.9	800	21.4	1213	32.5	968	25.9	1419	38.0
			150	10.3	1238	33.2	1871	50.1	1806	48.4	2064	55.3
			250	17.2	2000	53.6	2774	74.3	3290	88.2	3483	93.3
			400[2]	27.6[2]	1548	41.5	3548	95.1	----	----	----	----
	35	2.4	50	3.4	503	13.5	632	16.9	503	13.5	645	17.3
			75	5.2	761	20.4	1097	29.4	826	22.1	1058	28.4
			100	6.9	993	26.6	1484	39.8	1084	29.1	1419	38.0
			150	10.3	1548	41.5	2258	60.5	1871	50.1	2129	57.1
			250	17.2	2838	76.1	3483	93.3	3161	84.7	3483	93.3
			400[2]	27.6[2]	3677	98.5	4451	119	----	----	----	----
0 to 60 / 0 to 4.1 T14058T0012 Blue stripe T14114T0012 Blue	35	2.4	50	3.4	400	10.7	568	15.2	426	11.4	606	16.2
			75	5.2	568	15.2	864	23.2	645	17.3	942	25.2
			100	6.9	722	19.4	1161	31.1	903	24.2	1290	34.6
			150	10.3	1006	27.0	1742	46.7	1355	36.3	2000	53.6
			250	17.2	1871	50.1	2838	76.1	2580	69.1	3354	89.9
			400[2]	27.6[2]	993	26.6	3225	86.4	----	----	----	----
	60	4.1	75	5.2	671	18.0	929	24.9	671	18.0	929	24.9
			100	6.9	968	25.9	1355	36.3	993	26.6	1290	34.6
			150	10.3	1419	38.0	2193	58.8	1419	38.0	2064	55.3
			250	17.2	2645	70.9	3677	98.5	3161	84.7	3548	95.1
			400[2]	27.6[2]	4128	111	5547	149	----	----	----	----
0 to 125 / 0 to 8.6 T14060T0012 Red stripe T14115T0012 Red	80	5.5	100	6.9	645	17.3	1032	27.7	684	18.3	1006	27.0
			150	10.3	968	25.9	1548	41.5	1006	27.0	1548	41.5
			250	17.2	1548	41.5	2645	70.9	1613	43.2	2838	76.1
			400[2]	27.6[2]	1174	31.5	4773	128	----	----	----	----
	125	8.6	150	10.3	1161	31.1	1613	43.2	1161	31.1	1484	39.8
			250	17.2	2012	53.9	3161	84.7	2129	57.1	3161	84.7
			400[2]	27.6[2]	2838	76.1	5612	150	----	----	----	----
0 to 150 / 0 to 10.3[1] 10C1730X012 Black	80	5.5	250	17.2	710	19.0	1548	41.5	710	19.0	1548	41.5
			400[2]	27.6[2]	516	13.8	1419	38.0	----	----	----	----
	135	9.3	250	17.2	1251	33.5	2322	62.2	1419	38.0	2322	62.2
			400[2]	27.6[2]	1084	29.1	3032	81.3	----	----	----	----
	150	10.3	250	17.2	1419	38.0	2387	64.0	1419	38.0	2387	64.0
			400[2]	27.6[2]	1213	32.5	3225	86.4	----	----	----	----

1. Available for Types 67CS, 67CSR, 67CFS and 67CFSR only.
2. Inlet pressures above 250 psig / 17.2 bar with a maximum of 400 psig / 27.6 bar are only available on Types 67CS and 67CSR.

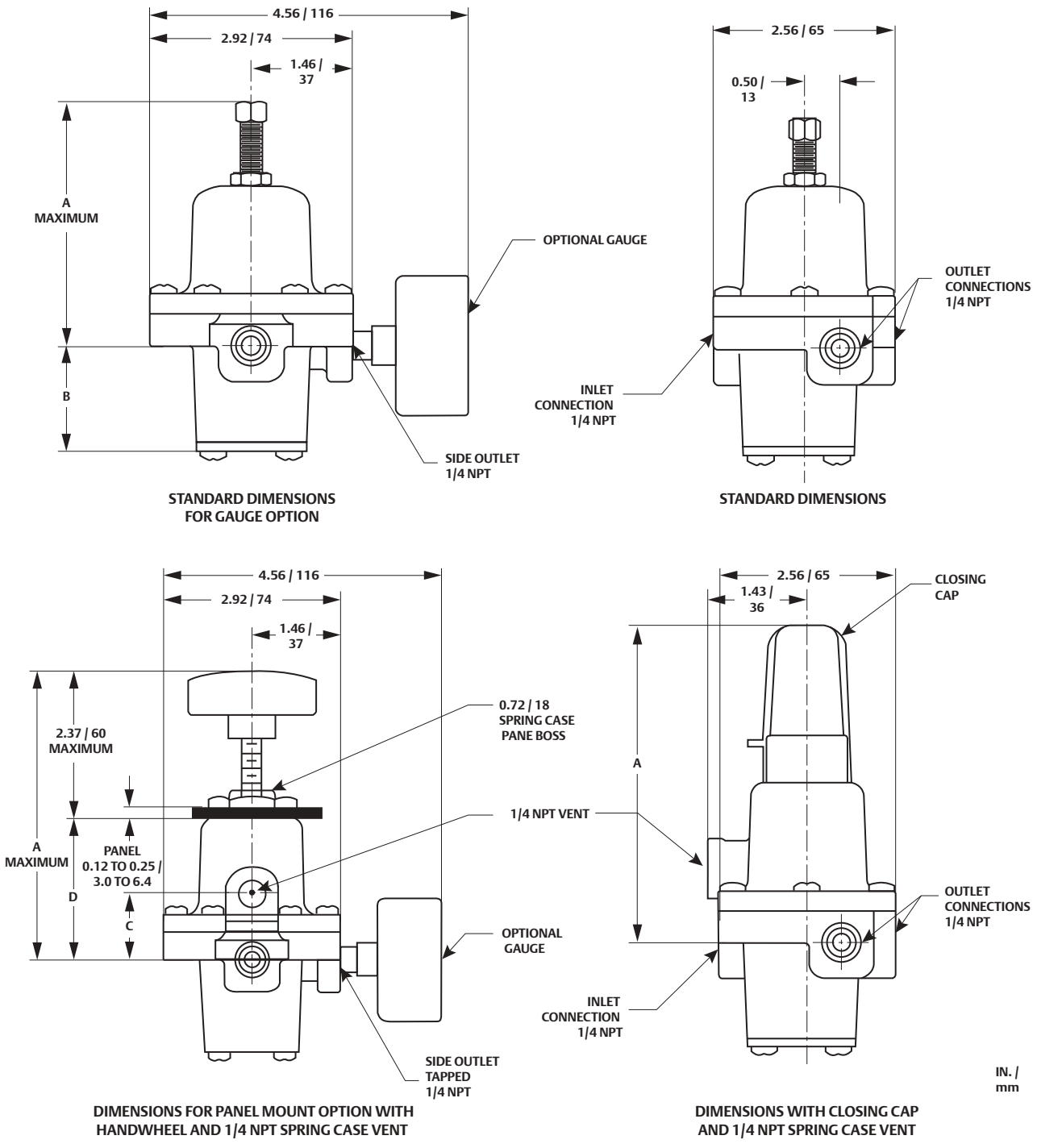
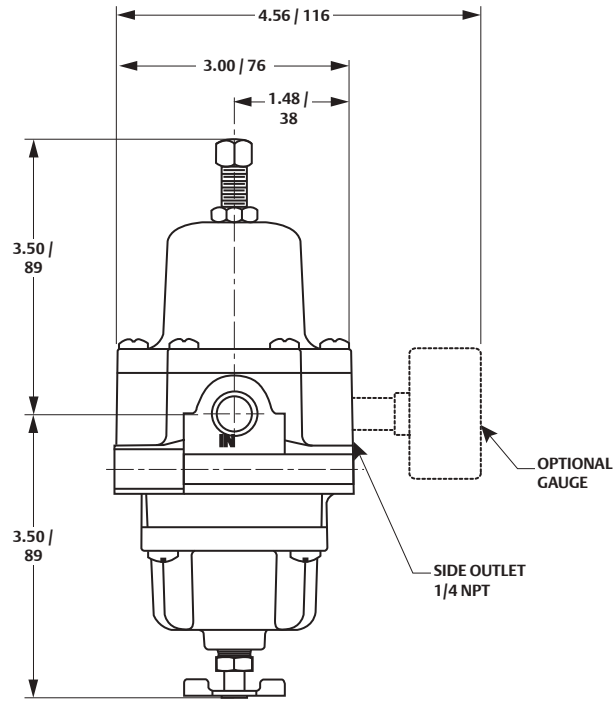


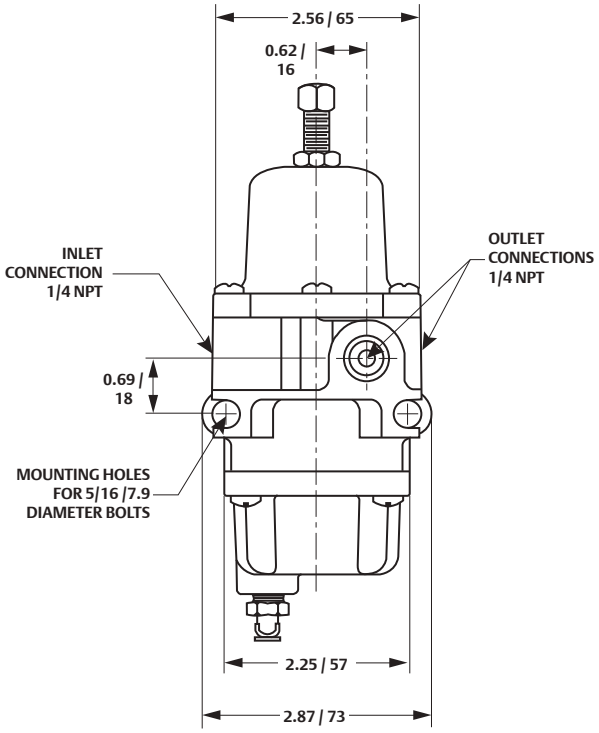
Figure 5. *Types 67C, 67CR, 67CS and 67CSR Dimensions*

Table 4. Types 67C, 67CR, 67CS and 67CSR Dimension

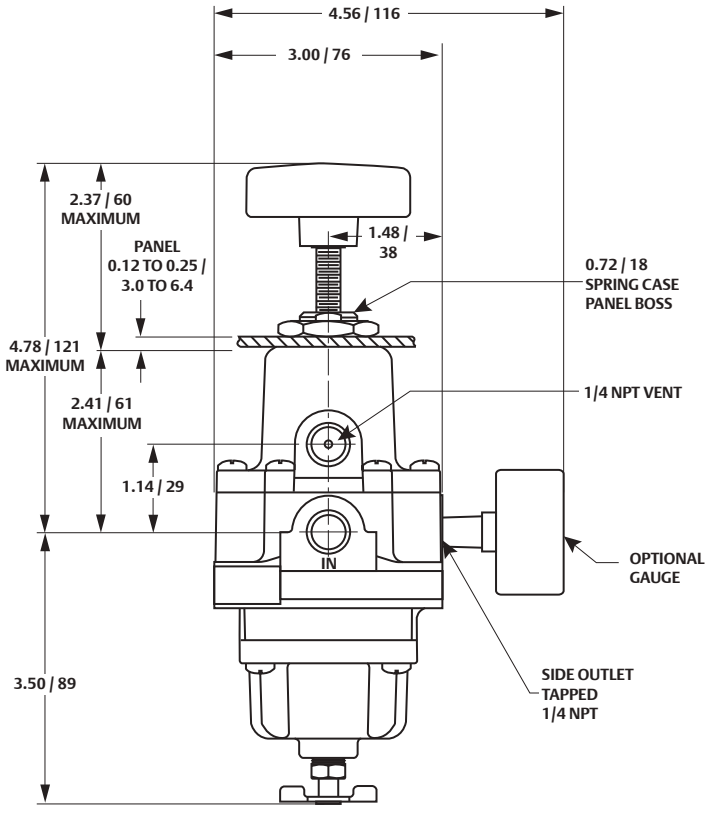
TYPE	STANDARD DIMENSION				DIMENSION WITH CLOSING CAP		PANEL MOUNT OPTION WITH HANDWHEEL DIMENSION					
	A		B		A		A		C		D	
	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
67C and 67CR	3.50	89	1.51	38	4.60	117	4.69	119	1.08	27	2.33	59
67CS and 67CSR	4.13	105	1.62	41	4.93	125	5.00	127	1.14	29	2.65	67



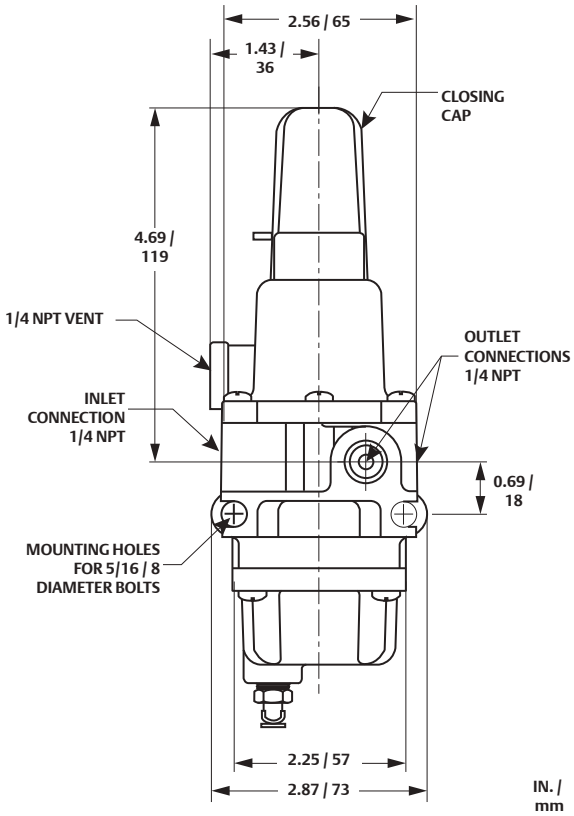
DIMENSIONS FOR GAUGE OPTION



STANDARD DIMENSIONS



DIMENSIONS FOR PANEL MOUNT OPTION
WITH HANDWHEEL AND 1/4 NPT SPRING CASE VENT



DIMENSIONS FOR CLOSING CAP OPTION
WITH 1/4 NPT SPRING CASE VENT

Figure 6. *Types 67CF and 67CFR Dimensions*

Ordering Guide

Type (Select One)

- ☐ 67C (Aluminum without internal relief)***
- ☐ 67CR (Aluminum with internal relief)***
- ☐ 67CS (Stainless steel without internal relief)***
- ☐ 67CSR (Stainless steel with internal relief)***
- ☐ 67CF (Aluminum with filter and without internal relief)***
- ☐ 67CFR (Aluminum with filter and internal relief)***
- ☐ 67CFS (Stainless steel with filter and without internal relief)***
- ☐ 67CFSR (Stainless steel with filter and internal relief)***

Quantity (Specify)

Spring Case Style (Select One)

- ☐ Drilled hole vent (Types 67C, 67CR, 67CF and 67CFR) **(standard)***
- ☐ 1/4 NPT vent (Types 67CS, 67CSR, 67CFS and 67CFSR) **(standard)***
- ☐ Single hole panel mount***
- ☐ 3-hole panel mount (Types 67C, 67CR, 67CF and 67CFR only)***

Adjusting Screw (Select One)

- ☐ Square head (Types 67C, 67CR, 67CF and 67CFR) **(standard)***
- ☐ Square head with closing cap (Types 67CS, 67CSR, 67CFS and 67CFSR) **(standard)***
- ☐ Handwheel***

Outlet Pressure Range (Select One)

- ☐ 0 to 20 psig / 0 to 1.4 bar***
- ☐ 0 to 35 psig / 0 to 2.4 bar***
- ☐ 0 to 60 psig / 0 to 4.1 bar***
- ☐ 0 to 125 psig / 0 to 8.6 bar***
- ☐ 0 to 150 psig / 0 to 10.3 bar (Types 67CS, 67CSR, 67CFS and 67CFSR only)***

Diaphragm, O-rings and Valve Plug (Select One)

- ☐ Nitrile (NBR) **(standard)***
- ☐ Fluorocarbon (FKM)**
- ☐ Silicone (VMQ) diaphragm, O-rings and Nitrile (NBR) valve plug*

Filter Material (Select One)

- ☐ Polyethylene (5 microns) **(standard)***
- ☐ Glass Fiber (5 microns)***
- ☐ PVDF (Plastic) (40 microns)***
- ☐ Stainless steel (40 microns)***

Dripwell (Select One)

- ☐ **Standard**
- ☐ Large capacity with manual drain valve
- ☐ Large capacity with automatic drain valve, Nitrile (NBR)
- ☐ Large capacity with automatic drain valve, Fluorocarbon (FKM)

Drain Valve (For Manual Drain Only) (Select One)

- ☐ Brass (Types 67CF and 67CFR) **(standard)***
- ☐ Stainless steel (Types 67CFS and 67CFSR) **(standard)***

Drain Valve Location (for Standard Dripwell Only) (Select One)

- ☐ Position 1 - Aligned with inlet **(standard)***
- ☐ Position 2
- ☐ Position 3
- ☐ Position 4

Spring Case Vent Location (Select One)

- ☐ Position 1 - Aligned with inlet **(standard)***
- ☐ Position 2
- ☐ Position 3
- ☐ Position 4

Fixed Bleed for Type 67CR, 67CSR, 67CFR or 67CFSR (Optional)

- ☐ Yes**

Smart Bleed™ Internal Check Valve Airset (Optional - Types 67CFR and 67CFSR only)

- ☐ Yes**

- continued -

Ordering Guide (continued)

Second Outlet (Select One)

- ☐ Open (Types 67C, 67CR, 67CF and 67CFR) **(standard)** * * *
- ☐ Plugged with pipe plug (Types 67CS, 67CSR, 67CFS and 67CFSR) **(standard)** * * *
- ☐ Tire Valve * * *
- ☐ Pressure Gauge (see below)

Triple Scale Pressure Gauge (Optional)

- ☐ Brass Gauge or ☐ Stainless steel Gauge
  - ☐ 0 to 30 psig / 0 to 0.2 MPa / 0 to 2.1 bar * * *
  - ☐ 0 to 60 psig / 0 to 0.4 MPa / 0 to 4.1 bar * * *
  - ☐ 0 to 160 psig / 0 to 1.1 MPa / 0 to 11.0 bar * * *

NACE MR0175 Construction (Optional)(1)

- ☐ Yes (not available with gauge) * *

NACE MR0103 Construction (Optional)

- ☐ Yes (not available with gauge) * *

Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

1. Product complies with the material requirements of NACE MR0175. Environmental limits may apply.

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

All regulators should be installed and used in accordance with federal, state and local codes and regulations.

Type 99
Pressure Reducing Regulator

FISHER™

Introduction

Type 99 regulator typically provides fuel gas to boilers, furnaces, ovens, mixers and large commercial or industrial installations. It is available with a Type 61L (low pressure), 61H (high pressure) or 61HP (extra high pressure) pilot integrally mounted to the actuator (see Figure 2).

Body Size and End Connection Styles

See Table 1

Flow Capacities

See Table 8

Flow and Sizing Coefficients

See Table 6

Maximum Inlet Pressures

Type 61LD Pilot: 160 psig / 11.0 bar

Types 61L and 61H Pilots: 400 psig / 27.6 bar

Type 61HP Pilot: 1000 psig / 69.0 bar with Type 1301F pilot supply regulator and Type H110 relief valve (1/2 in. / 13 mm orifice only)

Maximum Actuator Pressures

Operating: 100 psig / 6.9 bar

Emergency: 110 psig / 7.6 bar

Differential Pressures

See Table 6

Outlet (Control) Pressure Ranges

2 in. w.c. to 100 psig / 5 mbar to 6.9 bar
See Table 3

Pressure Registration

External

Temperature Capabilities

With Nitrile (NBR) / Neoprene (CR) / Nylon (PA): -20 to 180°F / -29 to 82°C

With Fluorocarbon (FKM): 0 to 300°F / -18 to 149°C

Approximate Shipping Weight

115 lbs / 52 kg

Options

- Disk or O-ring Seat Design
- 1000 psig / 69.0 bar Inlet Pressure Regulator
- O-ring Stem Seal for Upstream Regulator
- Electronic Remote Control Capability
- Handwheel for Type 61L Pilot
- Travel Indicator

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Wide Variety of Applications**
- **High Accuracy**
- **No Atmospheric Bleed**
- **High Capacity Pressure Control**
- **Excellent Low Flow Control**
- **Easy to Maintain**
- **Easy to Modify for Special Service**

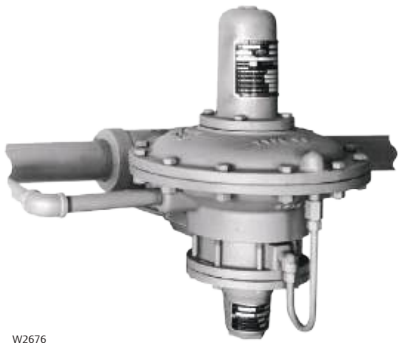


Figure 1. *Type 99 Pressure Reducing Regulator*

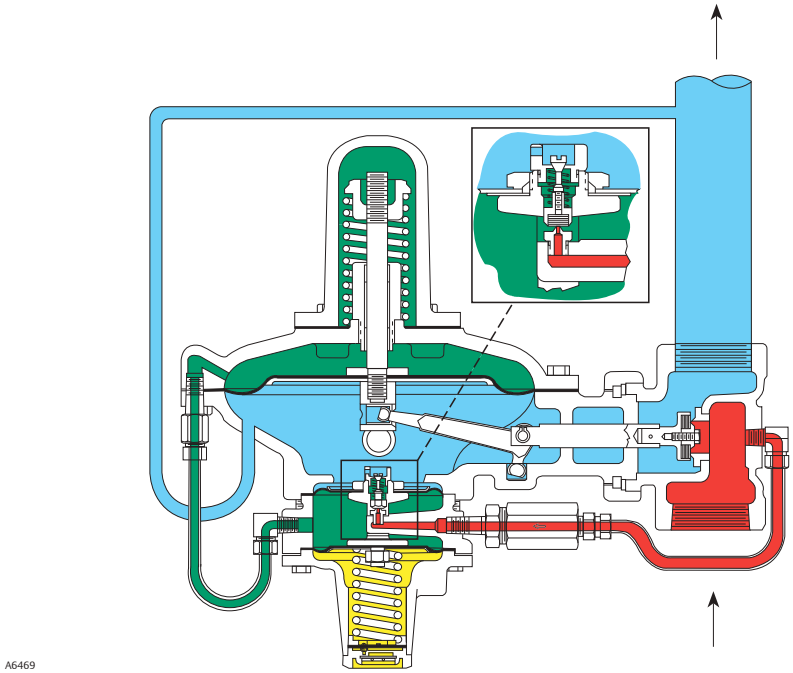


Figure 2. *Type 99 Operational Schematic*

EMERSON. Process Management

Table 1. Body Size and End Connection Style

BODY SIZE		BODY MATERIAL		
NPS	DN	Cast Iron	WCC Steel	Brass
2	50	NPT, CL125 FF or CL250 RF	NPT, CL150 RF, CL300 RF or SWE	NPT

Table 2. Construction Material

BODY	SPRING CASE AND DIAPHRAGM CASE	MAIN VALVE SEAT DISK	DIAPHRAGM	MAIN VALVE TRIM	PILOT TRIM	TUBING	FITTING
Cast iron, WCC Steel or Brass	Cast iron	Neoprene (CR), Nitrile (NBR), Fluorocarbon (FKM), Nylon (PA) or Polytetrafluoroethylene (PTFE)	Nitrile (NBR) or Fluorocarbon (FKM)	Brass or Stainless steel	Steel, Stainless steel, Cast iron, Aluminum, Zinc or Brass	Copper or Stainless steel	Brass, Steel or Stainless steel

Table 3. Outlet (Control) Pressure Range

PILOT TYPE	MAXIMUM PILOT SUPPLY PRESSURE		OUTLET (CONTROL) PRESSURE RANGE		PILOT CONTROL SPRING					
					PART NUMBER	COLOR CODE	WIRE DIAMETER		FREE LENGTH	
	psig	bar	psig	bar			In.	mm	In.	mm
61L	400	27.6	2 to 4 in. w.c.[1] 3 to 12 in. w.c.[1] 0.25 to 2 1 to 5 2 to 10 5 to 15 10 to 20	5 to 10 mbar[1] 7 to 30 mbar[1] 0.02 to 0.14 0.07 to 0.35 0.14 to 0.69 0.35 to 1.0 0.69 to 1.4	1B558527052 1C680627222 1B886327022 1J857827022 1B886427022 1J857927142 1B886527022	Orange Unpainted Red Yellow Blue Brown Green	0.072 0.080 0.109 0.142 0.172 0.187 0.207	1.8 2.0 2.8 3.6 4.4 4.8 5.3	3.78 3.00 2.75 2.75 2.88 3.03 3.12	96 76 69 70 73 77 80
61LD	160	11.0								
61LE	400	27.6								
61H	400	27.6	10 to 65	0.69 to 4.5	0Y066427022	Green stripe	0.363	9.2	6.00	152
61HP	600	41.0	35 to 100	2.4 to 6.9	1D387227022	Blue	0.200	5.1	1.69	43

1. Type 61LD pilot only.

Table 4. Approximate Proportional Band

TYPE	PILOT CONTROL SPRING		APPROXIMATE PROPORTIONAL BAND	
	Part Number	Color Code	In. w.c.	mbar
61LD	1B558527052	Orange	0.1 to 0.5	0.25 to 1
	1C680627222	Unpainted		
61L	1B886327022	Red	1 to 2	2 to 5
61LD			0.25 to 1	0.62 to 2
61LE			5 to 8	12 to 20
61L, 61LD, 61LE	1B886527022	Green	0.1 to 0.3 psi	7 to 21
	1J857927142	Brown		
	1B886427022	Blue		
	1J857827022	Yellow		
61H	0Y066427022	Green stripe	0.1 to 0.3 psi	7 to 21
61HP	1D387227022	Blue	1 to 2 psi	0.07 to 0.14 bar

Table 5. Maximum Inlet Pressure, Allowable Pressure Drop and Minimum Differential Pressure

MAXIMUM ALLOWABLE INLET PRESSURE/ PRESSURE DROP		MAIN VALVE SPRING					MINIMUM DIFFERENTIAL PRESSURE FOR FULL STROKE		DISK MATERIAL	MAXIMUM ORIFICE SIZE[1][5]	
		Part Number	Wire Diameter		Free Length						
psig	bar		In.	mm	In.	mm	psid	bar d		In.	mm
25	1.7	1C277127022	0.148	3.8	6	152	0.75	0.05	Nitrile (NBR) Disk Type Option and Fluorocarbon (FKM)	1-1/8	29
50	3.4	1N801927022	0.156	4.0	7.13	181	1.5	0.10	Neoprene (CR) and Fluorocarbon (FKM)	1-1/8	29
150	10.3	1B883327022	0.187	4.7	6.63	168	3	0.21	Nitrile (NBR) O-ring Type Option, Neoprene (CR) and Fluorocarbon (FKM)	1-1/8	29
175[2]	12.1[2]	1B883327022	0.187	4.7	6.63	168	3	0.21	Nitrile (NBR) O-ring Type Option, Neoprene (CR) and Fluorocarbon (FKM)	7/8	22
250	17.2	1B883327022	0.187	4.7	6.63	168	3	0.21	Neoprene (CR) and Fluorocarbon (FKM)	7/8	22
300	20.7	0W019127022	0.281	7.1	6	152	10	0.69	Nylon (PA)	1-1/8[3]	29[3]
400	27.6	0W019127022	0.281	7.1	6	152	10	0.69	Nylon (PA) and PTFE	7/8	22
1000	69.0	0W019127022	0.281	7.1	6	152	10	0.69	Nylon (PA)	1/2[4]	13[4]

1. Can use all orifice sizes up to maximum size listed. See Table 6.
2. CL125 FF flanged body only.
3. 1-1/8 in. / 29 mm is the only orifice available for 300 psig / 20.7 bar maximum inlet pressure regulator.
4. 1/2 in. / 13 mm is the only orifice available for 1000 psig / 69.0 bar maximum inlet pressure regulator.
5. O-ring seat construction is only available for 7/8 and 1-1/8 in. / 22 and 29 mm orifice sizes.

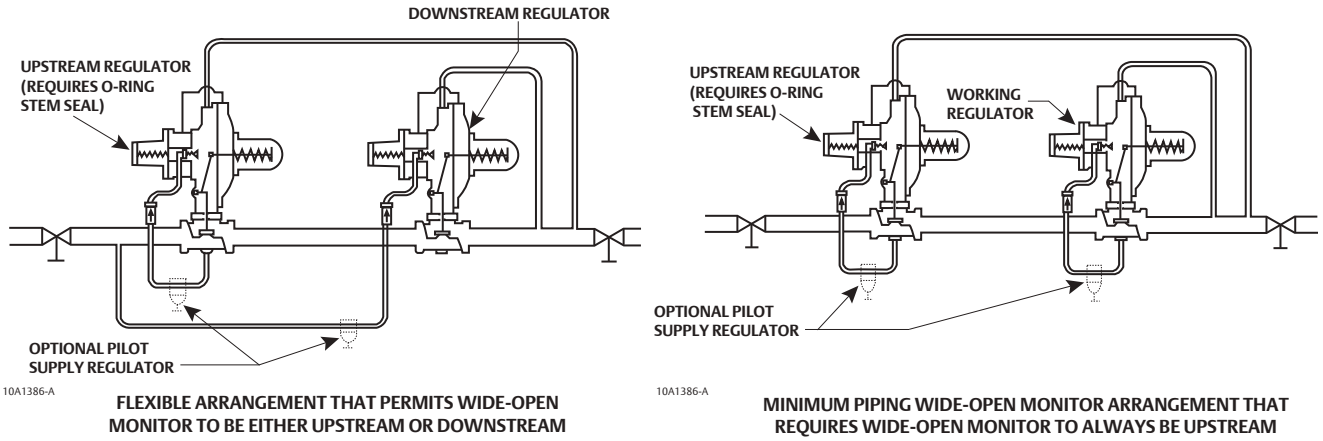


Figure 3. *Typical Wide-Open Monitor Installations*

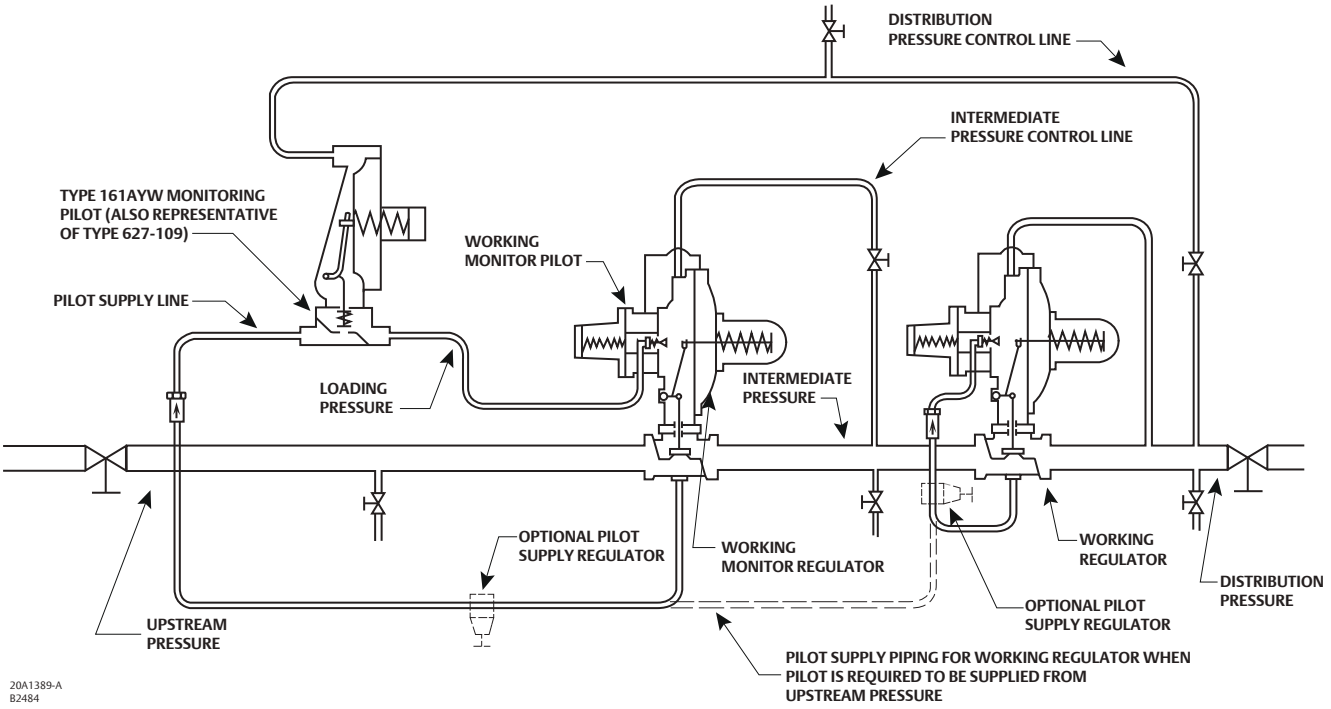


Figure 4. *Working Monitor Installation*

Table 6. Orifice Size and Flow and Sizing Coefficient

TRIM CONSTRUCTION	ORIFICE SIZE		WIDE-OPEN FOR RELIEF SIZING		REGULATING		C_1	IEC SIZING COEFFICIENT		
	In.	mm	C_g	C_v	C_g	C_v		X_T	F_D	F_L
Restricted capacity trim, Straight bore- Elastomer disk seat only	1/2(1)	13(1)	200	5.71	155	4.43	35	0.78	0.50	0.89
	3/4	19	425	12.14	330	9.43				
Restricted capacity trim, Stepped bore- Elastomer disk seat only	7/8 x 3/8	22 x 10	115	3.29	110	3.14				
	7/8 x 1/2	22 x 13	200	5.71	190	5.43				
	7/8 x 5/8	22 x 16	300	8.57	280	8.00				
Full capacity trim, Elastomer disk or O-ring seat	7/8	22	550	15.71	408	11.66				
	1-1/8	29	850	24.29	680	19.43				

1. 1/2-inch / 13 mm is the only orifice size available for 1000 psig / 69.0 bar maximum inlet pressure regulator.

Table 7. Working Monitor Performance

MONITORING PILOT INFORMATION								MINIMUM PRESSURE AT WHICH WORKING MONITOR REGULATOR CAN BE SET
Construction	Spring Range		Pilot Spring					
			Part Number	Wire Diameter		Free Length		
	psig	bar		In.	mm	In.	mm	
Type 161AYW with 1/8 in. / 3.2 mm orifice size and 150 psig / 10.3 bar maximum allowable inlet pressure	3 to 12 in. w.c. 11 to 25 in. w.c.	7 to 30 mbar 27 to 62 mbar	1B653927022 1B537027052	0.105 0.114	2.67 2.90	3.750 4.312	95.2 109	3 in. w.c. / 7 mbar over normal distribution pressure
	0.9 to 2.5 2.5 to 4.5 4.5 to 7	0.06 to 0.17 0.17 to 0.31 0.31 to 0.48	1B537127022 1B537227022 1B537327052	0.156 0.187 0.218	3.96 4.75 5.54	4.060 3.937 3.980	103 100 101	0.5 psi / 0.03 bar over normal distribution pressure
3/4 NPT Type 627-109 with 1/8 in. / 3.2 mm orifice size and 1000 psig / 69.0 bar maximum inlet pressure (body rating) for ductile iron body	5 to 20 15 to 40	0.34 to 1.4 1.0 to 2.8	10B3076X012 10B3077X012	0.170 0.207	4.32 5.26	3.190 3.190	81.0 81.0	3.0 psi / 0.21 bar over normal distribution pressure
	35 to 80 70 to 150	2.1 to 5.5 4.8 to 10.3	10B3078X012 10B3079X012	0.262 0.313	6.65 7.95	3.200 3.070	81.3 78.0	5.0 psi / 0.34 bar over normal distribution pressure

Table 8. Capacities

ORIFICE SIZE	INLET PRESSURE		CAPACITIES[1] IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS[2]																					
			Outlet Pressure, psig / bar																					
			0.25 / 0.02		0.5 / 0.03		2 / 0.14		5 / 0.35		10 / 0.69		15 / 1.0		20 / 1.4		30 / 2.1		40 / 2.8		60 / 4.1		100 / 6.9	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
7/8 in. / 22 mm	5	0.35	7.2	0.2	7.2	0.2	6.6	0.2																
	10	0.69	11.4	0.3	11.4	0.3	10	0.3	8.4	0.2														
	20	1.4	18.6	0.5	18.6	0.5	18.6	0.5	18	0.5	14.4	0.4	10.8	0.3										
	30	2.1	23	0.6	23	0.6	23	0.6	23	0.6	23	0.6	20	0.5	17	0.5								
	40	2.8	28	0.8	28	0.8	28	0.8	28	0.8	28	0.8	28	0.8	26	0.7	19	0.5						
	60	4.1	42	1.1	42	1.1	42	1.1	42	1.1	42	1.1	42	1.1	42	1.1	37	0.9	30	0.8				
	100	6.9	59	1.6	59	1.6	59	1.6	59	1.6	59	1.6	59	1.6	59	1.6	59	1.6	59	1.6	53	1.4		
	150	10.3	86	2.3	86	2.3	86	2.3	86	2.3	86	2.3	86	2.3	86	2.3	86	2.3	86	2.3	86	2.3	72	1.9
	200	13.8	108	2.9	108	2.9	108	2.9	108	2.9	108	2.9	108	2.9	108	2.9	108	2.9	108	2.9	108	2.9	108	2.9
	250	17.2	132	3.5	132	3.5	132	3.5	132	3.5	132	3.5	132	3.5	132	3.5	132	3.5	132	3.5	132	3.5	132	3.5
	300	20.7	162	4.3	162	4.3	162	4.3	162	4.3	162	4.3	162	4.3	162	4.3	162	4.3	162	4.3	162	4.3	162	4.3
	350	24.2	188	5.0	188	5.0	188	5.0	188	5.0	188	5.0	188	5.0	188	5.0	188	5.0	188	5.0	188	5.0	188	5.0
	400	27.6	215	5.8	215	5.8	215	5.8	215	5.8	215	5.8	215	5.8	215	5.8	215	5.8	215	5.8	215	5.8	215	5.8
1-1/8 in. / 29 mm	5	0.35	12	0.3	12	0.3	10	0.3																
	10	0.69	19	0.5	19	0.5	17	0.5	14	0.4														
	20	1.4	31	0.8	31	0.8	31	0.8	30	0.8	24	0.6	18	0.5										
	30	2.1	39	1.1	39	1.1	39	1.1	39	1.1	39	1.1	34	0.9	28	0.8								
	40	2.8	47	1.3	47	1.3	47	1.3	47	1.3	47	1.3	47	1.3	43	1.2	32	0.9						
	60	4.1	65	1.7	65	1.7	65	1.7	65	1.7	65	1.7	65	1.7	65	1.7	62	1.7	50	1.3				
	100	6.9	99	2.7	99	2.7	99	2.7	99	2.7	99	2.7	99	2.7	99	2.7	99	2.7	99	2.7	99	2.7		
	150	10.3	143	3.8	143	3.8	143	3.8	143	3.8	143	3.8	143	3.8	143	3.8	143	3.8	143	3.8	143	3.8	120	3.2
	200	13.8	180	4.8	180	4.8	180	4.8	180	4.8	180	4.8	180	4.8	180	4.8	180	4.8	180	4.8	180	4.8	180	4.8
	250	17.2	220	5.9	220	5.9	220	5.9	220	5.9	220	5.9	220	5.9	220	5.9	220	5.9	220	5.9	220	5.9	220	5.9
	300	20.7	265	7.1	265	7.1	265	7.1	265	7.1	265	7.1	265	7.1	265	7.1	265	7.1	265	7.1	265	7.1	265	7.1

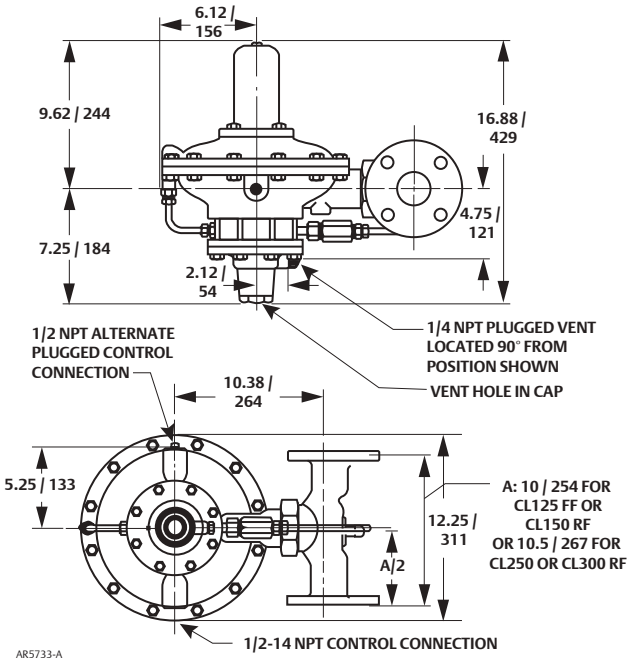
TYPE 61L PILOT

TYPE 61H PILOT

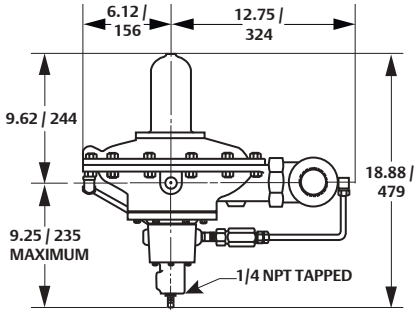
TYPE 61HP PILOT

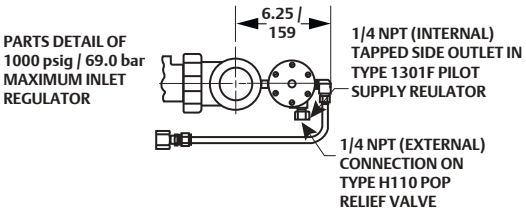
▭ - Blank areas show no capacity due to differential pressure requirement.

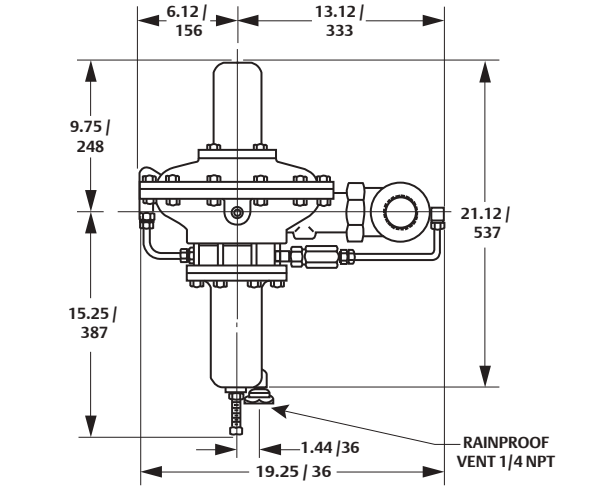
1. When sizing a regulator, always use the lowest inlet pressure, the highest outlet pressure and the maximum capacity desired.
2. Requires 0.75 psig / 0.05 bar minimum differential pressure construction.

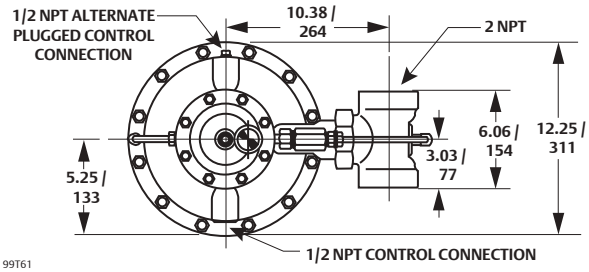


FLANGED TYPE 99 WITH TYPE 61L PILOT

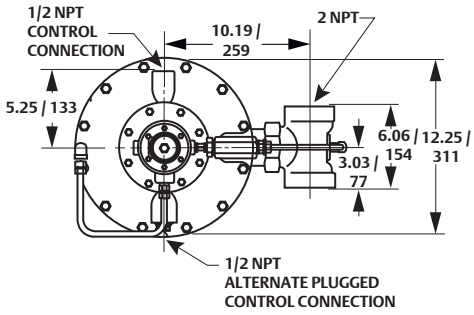








NPT TYPE 99 WITH TYPE 61H PILOT



IN. / mm

NPT TYPE 99 WITH TYPE 61HP PILOT

Figure 5. *Dimensions*

Ordering Guide

Body Material and End Connection Style (Select One)

NPS2 / DN 50 Cast Iron Body
- ☐ NPT***
- ☐ CL125 FF***
- ☐ CL250 RF***

NPS 2 / DN 50 WCC Steel Body
- ☐ NPT***
- ☐ CL150 RF**
- ☐ CL300 RF**
- ☐ SWE*

2 NPT Brass Body
- ☐ NPT*

Orifice Size (Select One)
- ☐ 1/2 in. / 13 mm***
- ☐ 3/4 in. / 19 mm***
- ☐ 7/8 in. / 22 mm***
- ☐ 1-1/8 in. / 29 mm***
- ☐ 7/8 x 3/8 in. / 22 x 9.5 mm*
- ☐ 7/8 x 1/2 in. / 22 x 13 mm**
- ☐ 7/8 x 5/8 in. / 22 x 16 mm**

Main Valve Spring (See Table 6) (Select One)

Maximum Allowable Differential Pressure and Spring Part Number
- ☐ 25 psi / 1.7 bar, 1C277127022***
- ☐ 50 psi / 3.4 bar, 1N801927022***
- ☐ 100 psig / 6.9 bar,1B883327022***
- ☐ 150 psig / 10.3 bar, 1B883327022***
- ☐ 175 psig / 12.1 bar, 1B883327022***
- ☐ 250 psi / 17.2 bar, 1B883327022***
- ☐ 300 psig / 20.7 bar, 0W019127022**
- ☐ 400 psig / 27.6 bar, 0W019127022**
- ☐ 1000 psi / 69.0 bar, 0W019127022***

Trim Material Main Valve and Pilot (Select One)
- ☐ Brass with disk seat **(standard)***
- ☐ Stainless steel with disk seat**
- ☐ Brass with O-ring seat (7/8 or 1-1/8 in. / 22 or 29 mm orifice)***
- ☐ Stainless steel with O-ring seat (7/8 or 1-1/8 in. / 22 or 29 mm orifice)**

Seat Material (Select One)
- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)**
- ☐ Neoprene (CR)**
- ☐ Nylon (PA)**
- ☐ PTFE**

Tubing and Fittings (Select One)
- ☐ Copper tubing and brass fittings **(standard)***
- ☐ Stainless steel tubing and stainless steel fittings**
- ☐ Stainless steel tubing and steel fittings**

Outlet Pressure Range (See Table 3) (Select One)
- ☐ 2 to 4 in. w.c. / 5 to 10 mbar, Orange*
- ☐ 3 to 12 in. w.c. / 7 to 30 mbar, Unpainted***
- ☐ 0.25 to 2 psig / 0.02 to 0.14 bar, Red***
- ☐ 1 to 5 psig / 0.07 to 0.35 bar, Yellow***
- ☐ 2 to 10 psig / 0.14 to 0.69 bar, Blue**
- ☐ 5 to 15 psig / 0.35 to 1.0 bar, Brown***
- ☐ 10 to 20 psig / 0.69 to 1.4 bar, Green**
- ☐ 10 to 65 psig / 0.69 to 4.5 bar, Green Stripe***
- ☐ 35 to 100 psig / 2.4 to 6.9 bar, Blue***

Upstream Regulator O-ring Stem Seal (Optional)
- ☐ Yes

Travel Indicator (Optional)
- ☐ Yes

Electronic Remote Control Capability (Optional)
- ☐ Yes

Handwheel for Type 61L Pilot (Optional)
- ☐ Yes

Main Valve Parts Kit (Optional)
- ☐ Yes, please send me one parts kit to match this order.

Pilot Parts Kit (Optional)
- ☐ Yes, please send me one parts kit to match this order.

Ordering Guide (continued)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

If two or more available springs have published pressure ranges that include the desired pressure setting, use the spring with the lower range for better accuracy.

Introduction

Type 119 control valve is used for on-off or throttling control of non-corrosive or mildly corrosive liquids and gases, such as fuel valves for heaters and treaters. It is designed to meet low-pressure liquid and gas application requirements in many varied industries.

If the control valve requires maintenance, the trim can be exposed by removing two bolts and lifting the actuator assembly off the valve body without disassembling the actuator.

Body Size and End Connection Style

3/4, 1 or 1-1/4 NPT

Flow Coefficients

See Table 3

Maximum Inlet Pressure

150 psig / 10.3 bar

Outlet Pressure Ranges

3 to 60 psig / 0.21 to 4.1 bar in four ranges
See Table 1

Material Temperature Capabilities

Nitrile (NBR):
-20 to 180°F / -29 to 82°C
Fluorocarbon (FKM):
0 to 250°F / -18 to 121°C

Approximate Shipping Weight

6 lbs / 2.7 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Easy Installation**
- **Easy Leak Detection**
- **Easy In-Line Maintenance**
- **Easily Adjusted Spring**
- **Sour Gas Service Capability**



Figure 1. *Type 119 Control Valve*

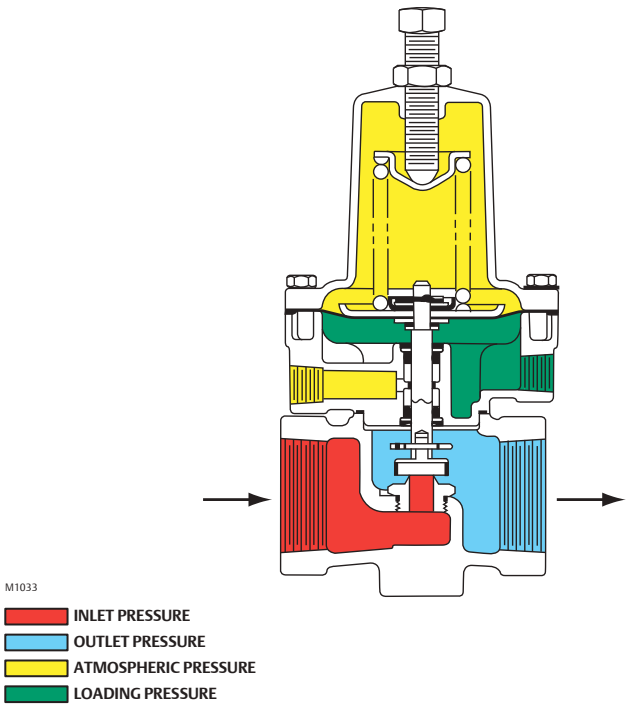


Figure 2. *Operational Schematic*

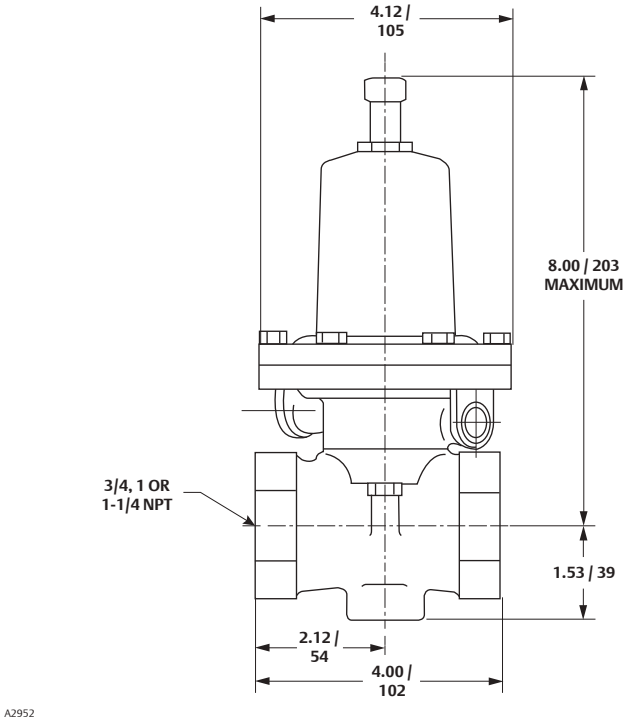


Figure 3. *Dimensions*

Table 1. Outlet Pressure Range

OUTLET PRESSURE RANGE		SPRING PART NUMBER	SPRING COLOR
psig	bar		
3 to 15	0.21 to 1.0	1D892327022	Red
5 to 20	0.34 to 1.4	1D751527022	Unpainted
5 to 35	0.34 to 2.4	1D665927022	Blue
30 to 60	2.1 to 4.1	1D7455T0012	Green

Table 2. Construction Material

VALVE BODY	SPRING CASE	BONNET	DISK HOLDER ASSEMBLY	ORIFICE	DIAPHRAGM	O-RING	STEM WIPER	ADJUSTING SCREW	SPRING
Cast iron	Aluminum	Aluminum	Aluminum and Nitrile (NBR) **(standard)**, Stainless steel and Nitrile (NBR) or Stainless steel and Fluorocarbon (FKM)	Aluminum **(standard)** or Stainless steel	Nitrile (NBR) or Fluorocarbon (FKM)	Nitrile (NBR) **(standard)** or Fluorocarbon (FKM)	Polytetrafluoroethylene (PTFE)	Steel	Steel

Table 3. Flow Coefficient

VALVE TRAVEL		ORIFICE SIZE		3/4 IN. BODY			1 IN. BODY			1-1/4 IN. BODY		
In.	mm	In.	mm	C_V	C_g	C_1	C_V	C_g	C_1	C_V	C_g	C_1
3/16	4.8	1/8	3.2	0.43	12.5	29.1	0.43	12.5	29.1	0.43	12.5	29.1
		3/16	4.8	0.95	27.8	29.3	0.95	27.8	29.3	0.95	27.8	29.3
		1/4	6.4	1.70	48.3	28.4	1.70	48.3	28.4	1.70	48.3	28.4
		5/16	7.9	2.64	76.5	29.0	2.64	76.5	29.0	2.64	76.5	29.0
		3/8	9.5	3.22	104	32.3	3.3	105	31.8	3.57	106	29.7
		1/2	13	4.7	176	37.4	5.0	178	35.6	5.75	183	31.8
		9/16	14	5.6	213	38.0	5.9	218	36.9	7.2	230	31.9

Ordering Guide

Body Size and End Connection Style (Select One)

- ☐ 3/4 NPT***
- ☐ 1 NPT***
- ☐ 1-1/4 NPT***

Disk Holder Assembly Material (Select One)

- ☐ Aluminum and Nitrile (NBR) **(standard)*****
- ☐ Stainless steel and Nitrile (NBR)**
- ☐ Stainless steel and Fluorocarbon (FKM)*

Orifice Material (Select One)

- ☐ Aluminum **(standard)*****
- ☐ Stainless steel**

Diaphragm Material (Select One)

- ☐ Nitrile (NBR) **(standard)*****
- ☐ Fluorocarbon (FKM)**

O-ring Material (Select One)

- ☐ Nitrile (NBR) **(standard)*****
- ☐ Fluorocarbon (FKM)**

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Outlet Pressure Range (Select One)

- ☐ 3 to 15 psig / 0.21 to 1.0 bar, Red***
- ☐ 5 to 20 psig / 0.34 to 1.4 bar, Unpainted***
- ☐ 5 to 35 psig / 0.34 to 2.4 bar, Blue***
- ☐ 30 to 60 psig / 2.1 to 4.1 bar, Green***

Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

The full advertised range of a spring can be utilized without sacrificing performance or spring life.

133 Series
Pressure Reducing Regulator

FISHER

Introduction
The 133 Series direct-operated gas regulators are primarily designed for industrial and commercial applications supplying gas to furnaces, burners and other appliances. The 133 Series balancing system enables the regulator to provide accurate control of gas pressure for maximum combustion efficiency despite varying inlet pressure conditions. The single port construction provides bubble-tight shutoff. An external downstream control line is required for the operation of the regulator. 133 Series regulators are available in a 2 in. / DN 50 body size with either NPT or flanged end connections.

An optional restriction collar can be installed if wide-open capacity is too high for applications using a relief valve as overpressure protection. The collar reduces wide-open capacity to 25%, 40% or 60% of standard wide-open capacity.

Body Size and End Connection Styles
Cast Iron Body: NPS 2 / DN 50 NPT or CL125 FF flanged
WCC Steel Body: NPS 2 / DN 50 NPT or CL150 RF flanged

Pressure Registration
External; downstream control line is required

Flow and Sizing Coefficients
See Table 2

Maximum Inlet Pressures
See Table 2

Maximum Emergency Outlet (Casing) Pressure
See Table 2

Outlet Pressure Ranges
See Table 3

Temperature Capabilities
-20 to 150°F / -29 to 66°C

Construction Materials
Body: Cast iron or WCC Steel
Orifice and Cage: Aluminum
Valve Disk: Aluminum/Neoprene (CR) or Aluminum/Fluorocarbon (FKM)(1)
O-rings: Nitrile (NBR) or Fluorocarbon (FKM)(1)

1. Available for Types 133L and 133H only.

Diaphragms: Nitrile (NBR) / Nylon (PA) (Neoprene (CR) in actuator) or Fluorocarbon (FKM)(1) / Polymer Thermoplastic
Guide Bushing: Nylon (PA)
Stem and Stem Sleeve: Stainless steel
Diaphragm Plate: Steel
Balancing Diaphragm Plate: Plated steel
Spring Case and Closing Cap:
Type 133HP: Cast Iron
Types 133H, 133L and 133Z: Aluminum
Lower Casing:
Types 133H, 133L and 133Z: Aluminum
Type 133HP: Steel
Adjusting Screw:
Types 133H and 133Z: Brass
Type 133L: Aluminum
Type 133HP: Steel
Optional Restriction Collar: Aluminum

Approximate Weights
Types 133H, 133L, and 133Z NPT End Connections: 35 pounds / 16 kg
Types 133H, 133L, and 133Z Flanged End Connections: 40 pounds / 18 kg
Type 133HP NPT End Connections: 56.5 pounds / 26 kg
Type 133HP Flanged End Connections: 62.5 pounds / 28 kg

Options
Restriction collar to reduce wide-open capacity to approximately 25, 40 or 60% of standard wide-open capacity

Additional Technical Data
For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features
- **Wide Pressure Range Capability with Single Regulator**
- **Types 133L, 133H and 133HP Suitable for Monitoring Applications**
- **Excellent Shock Characteristics and Fast Speed of Response**
- **Bubble-Tight Shutoff**
- **Easy Access to Trim Parts**


W1327

Figure 1. *Types 133H, 133L and 133Z Regulators*


W5803

Figure 2. *Type 133HP Pressure Reducing Regulator*

EMERSON
Process Management

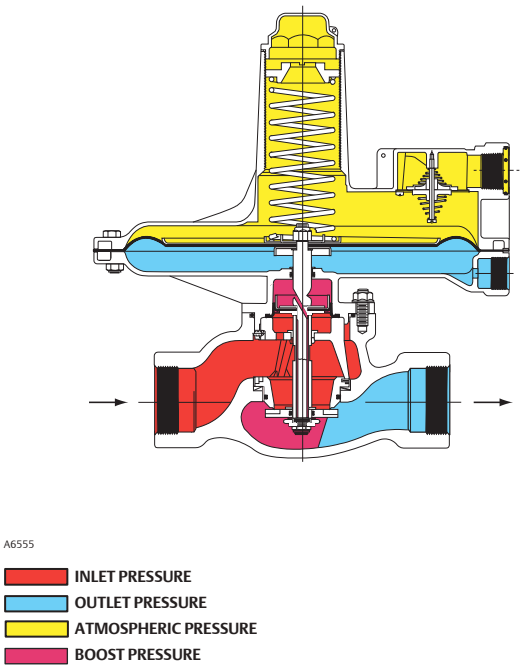


Figure 3. *Type 133L Operational Schematic (Also Typical of Type 133H)*

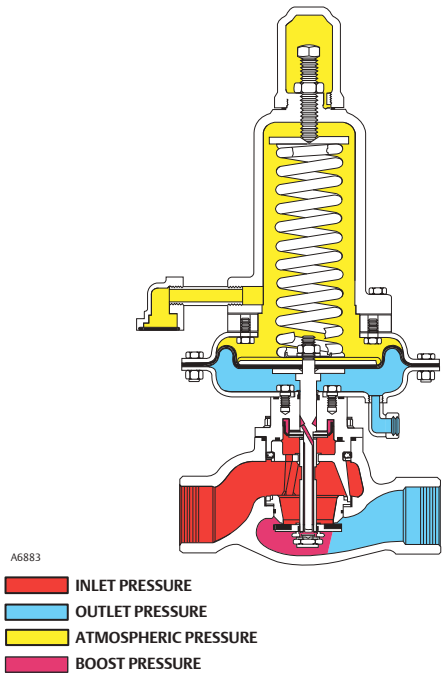


Figure 4. *Type 133HP Operational Schematic*

Table 1. Flow and Sizing Coefficient

PERCENT CAPACITY	WIDE-OPEN C_g	WIDE-OPEN C_v	C_1	IEC SIZING COEFFICIENT		
				X_T	F_D	F_L
25%(1)	490	17.4	28.2	0.78	0.72	0.89
40%(1)	760	26.1	29.1			
60%(1)	1150	36.2	31.8			
100%	1800	51.4	35.0			

1. Optional restriction collar used.

Table 2. Outlet Pressure Range

TYPE	OUTLET PRESSURE RANGE		SPRING PART NUMBER	SPRING COLOR CODE	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
	psig	bar			In.	mm	In.	mm
133H(1)	1.5 to 3	0.10 to 0.21	1H975927032	Orange	0.250	6.35	6.91	176
	2 to 5	0.14 to 0.34	10A9440X012	Yellow	0.283	7.19	6.47	164
	5 to 10	0.34 to 0.69	1J146927142	Blue	0.375	9.53	6.19	157
133HP(2)	2 to 5	0.14 to 0.34	17B8632X012	Yellow	0.282	7.16	8.5	216
	4.5 to 10	0.31 to 0.69	17B8633X012	Orange	0.343	8.71	8.5	216
	6 to 20	0.41 to 1.4	10C1238X012	Silver	0.375	9.52	8.25	210
	16 to 30	1.1 to 2.1	10C1240X012	Red	0.438	11.1	8.25	210
	26 to 40	1.8 to 2.8	10C1241X012	Blue	0.500	12.7	8.25	210
	36 to 50	2.5 to 3.4	10C1242X012	Green	0.500	12.7	8.25	210
	45 to 60	3.1 to 4.1	10C1243X012	White	0.531	13.5	8.25	210
133L(1) and 133H(2)	2 to 4 in. w.c.	5 to 10 mbar	1D892527022	Brown	0.109	2.77	6.12	156
	3.5 to 6 in. w.c.	9 to 15 mbar	1D892627022	Red	0.112	2.84	7.53	191
	5 to 9 in. w.c.	12 to 22 mbar	1D892727012	Black	0.130	3.30	7.88	200
	8.5 to 18 in. w.c.	21 to 45 mbar	1D893227032	White	0.156	3.96	7.50	190
	14 to 28 in. w.c.	35 to 70 mbar	1D893327032	Green	0.182	4.62	7.25	184
	0.75 to 2	0.05 to 0.14	1H975827032	Blue	0.225	5.72	7.09	180
133Z(1)	-1 to 1 inch w.c.	-3 to 3 mbar	1K633427012 (Extension Spring)	Unpainted	0.075	1.91	2	50.8
	0 to 4 inches w.c.	0 to 10 mbar	1K633427012 (Extension Spring)	Unpainted	0.075	1.91	2	50.8
			and					
			1D892527022 (Compression Spring)	Brown	0.109	2.77	6.13	156

1. Pressure ranges shown are correct if the regulator is installed with the actuator portion above the body portion. If the regulator is installed with the actuator portion below the body, the pressure ranges will be lowered by approximately 2 in. w.c. / 5 mbar for the Type 133L and by approximately 3 in. w.c. / 7 mbar for Type 133H.
2. The 2 in. w.c. to 2 psig / 5 mbar to 0.14 bar springs shown for the Type 133L may also be used in the Type 133H. However, the outlet pressure ranges will increase by approximately 1 in. w.c. / 2 mbar due to the weight of the Type 133H parts (assuming that the actuator portion is installed above the body portion).

Table 3. Maximum Inlet and Outlet Pressure

PRESSURE	TYPE							
	133H		133HP		133L		133Z	
	psig	bar	psig	bar	psig	bar	psig	bar
Maximum Operating Inlet Pressure	60	4.1	150	10.3	60	4.1	20	1.4
Maximum Emergency Inlet Pressure	125	8.6			125	8.6	125	8.6
Maximum Operating Outlet Pressure(1)	10	0.69	Setpoint plus 40	Setpoint plus 2.8	2	0.14	4 in. w.c.	10 mbar
Maximum Outlet Pressure Over Outlet Pressure Setting	3	0.21			3	0.21	3	0.21
Maximum Emergency Outlet (Casing) Pressure	15	1.0	150	10.3	15	1.0	15	1.0

1. With highest spring range available only.

Table 4. Full-Capacity Type 133H Regulated Flow

INLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 psia / 1 bar AND 60°F / 15°C									
		Outlet Pressure Setting(1), Spring Part Number and Outlet Pressure Range									
		3 psig / 0.21 bar 1H975927032 1.5 to 3 psig / 0.10 to 0.21 bar		2 psig / 0.14 bar 10A9440X012 2 to 5 psig / 0.14 to 0.34 bar		5 psig / 0.34 bar 10A9440X012 2 to 5 psig / 0.14 to 0.34 bar		5 psig / 0.34 bar 1J146927142 5 to 10 psig / 0.34 to 0.69 bar		10 psig / 0.69 bar 1J146927142 5 to 10 psig / 0.34 to 0.69 bar	
psig	bar	10% droop	20% droop	10% droop	20% droop	10% droop	20% droop	10% droop	20% droop	10% droop	20% droop
3	0.21	----	----	6.5 / 0.17	11.5 / 0.31	----	----	----	----	----	----
5	0.34	14 / 0.38	22 / 0.59	11 / 0.30	18 / 0.48	----	----	----	----	----	----
7	0.48	21.5 / 0.58	31 / 0.83	13 / 0.35	22 / 0.59	15.5 / 0.42	24 / 0.64	9 / 0.24	15 / 0.40	----	----
10	0.69	28 / 0.75	42 / 1.13	15 / 0.40	27 / 0.72	24 / 0.64	35 / 0.94	14 / 0.38	22 / 0.59	----	----
15	1.03	40 / 1.07	57 / 1.53	25.5 / 0.68	39 / 1.04	35 / 0.94	51 / 1.37	19 / 0.51	31.5 / 0.84	21 / 0.56	35 / 0.94
20	1.38	52 / 1.39	72 / 1.93	35 / 0.94	52 / 1.39	46 / 1.23	67 / 1.80	24 / 0.64	41 / 1.10	31 / 0.83	51 / 1.37
30	2.07	76 / 2.04	96 / 2.57	49 / 1.31	73 / 1.96	68 / 1.82	95 / 2.55	35 / 0.94	58 / 1.55	44 / 1.18	74 / 1.98
40	2.76	98 / 2.63	119 / 3.19	66 / 1.77	97 / 2.60	88 / 2.36	117 / 3.14	44 / 1.18	73 / 1.96	56 / 1.50	97 / 2.60
50	3.44	118 / 3.16	141 / 3.78	84 / 2.25	112 / 3.00	103 / 2.76	138 / 3.70	57 / 1.53	89 / 2.38	74 / 1.98	117 / 3.14
60	4.14	136 / 3.64	165 / 4.42	104 / 2.79	132 / 3.54	122 / 3.27	156 / 4.18	65 / 1.74	106 / 2.84	91 / 2.44	136 / 3.64

1. Outlet pressure setting was made at approximately 10% of the maximum capacity for the listed conditions.

Table 5. Restricted-Capacity Type 133H Regulated Flow

INLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 psia / 1 bar AND 60°F / 15°C																							
		Outlet Pressure Setting(1), Spring Part Number and Outlet Pressure Range																							
		25% Capacity								40% Capacity								60% Capacity							
		5 psig / 0.34 bar 10A9440X012 2 to 5 psig / 0.14 to 0.34 bar				10 psig / 0.69 bar 1J146927142 5 to 10 psig / 0.34 to 0.69 bar				5 psig / 0.34 bar 10A9440X012 2 to 5 psig / 0.14 to 0.34 bar				10 psig / 0.69 bar 1J146927142 5 to 10 psig / 0.34 to 0.69 bar				5 psig / 0.34 bar 10A9440X012 2 to 5 psig / 0.14 to 0.34 bar				10 psig / 0.69 bar 1J146927142 5 to 10 psig / 0.34 to 0.69 bar			
psig	bar	10% Droop		20% Droop		10% Droop		20% Droop		10% Droop		20% Droop		10% Droop		20% Droop		10% Droop		20% Droop		10% Droop		20% Droop	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
7	0.48	8.0	0.21	9.0	0.24	----	----	----	----	11.0	0.30	15.0	0.40	----	----	----	----	13.0	0.35	17.0	0.46	----	----	----	----
10	0.69	12.3	0.33	13.0	0.35	----	----	----	----	16.5	0.44	20.0	0.54	----	----	----	----	20.0	0.54	25.0	0.67	----	----	----	----
15	1.0	----	----	----	----	13.0	0.35	15.5	0.42	----	----	----	----	16.5	0.44	23.5	0.63	----	----	----	----	20.0	0.54	29.5	0.79
20	1.4	20.8	0.56	21.2	0.57	17.5	0.47	20.0	0.54	31.5	0.84	33.5	0.90	23.5	0.63	30.5	0.82	36.0	0.96	46.5	1.25	29.0	0.78	39.5	1.06
40	2.8	33.5	0.90	33.5	0.90	33.0	0.88	33.5	0.90	52.0	1.39	53.2	1.43	46.0	1.23	53.2	1.43	70.0	1.88	77.5	2.08	57.0	1.53	74.5	2.00
60	4.1	45.5	1.22	45.5	1.22	45.5	1.22	45.5	1.22	72.7	1.95	72.7	1.95	67.0	1.80	72.7	1.95	105	2.81	107	2.87	87.0	2.33	107	2.87

1. Outlet pressure setting was made at approximately 10% of the maximum capacity for the listed conditions.

Table 6. Full-Capacity Type 133L Regulated Flow

INLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 psia / 1 bar AND 60°F / 15°C									
		Outlet Pressure Setting(1), Spring Part Number and Outlet Pressure Range									
		4 in. w.c. / 10 mbar 1D892527022 2 to 4 in. w.c. / 5 to 10 mbar	6 in. w.c. / 15 mbar 1D892627022 3.5 to 6 in. w.c. / 9 to 15 mbar	7 in. w.c. / 17 mbar 1D892727012 5 to 9 in. w.c. / 12 to 22 mbar	14 in. w.c. / 35 mbar 1D893227032 8.5 to 18 in. w.c. / 21 to 45 mbar		14 in. w.c. / 35 mbar 1D893327032 14 to 28 in. w.c. / 35 to 70 mbar		1 psig / 69 mbar 1D893327032 14 to 28 in. w.c. / 35 to 70 mbar		2 psig / 0.14 bar 1H975827032 0.75 to 2 psig / 52 mbar to 0.14 bar	
psig	bar	1 in. w.c. / 2.5 mbar droop	1 in. w.c. / 2.5 mbar droop	1 in. w.c. / 2.5 mbar droop	1 in. w.c. / 2.5 mbar droop	2 in. w.c. / 5 mbar droop	1 in. w.c. / 2.5 mbar droop	2 in. w.c. / 5 mbar droop	10% droop	20% droop	10% droop	20% droop
1	0.07	14 / 0.38	13 / 0.35	12 / 0.32	5 / 0.134	8.40 / 0.22	----	----	----	----	----	----
2	0.14	20.8 / 0.56	20 / 0.54	17 / 0.46	8.20 / 0.22	15.20 / 0.41	----	----	11.5 / 0.31	16 / 0.43	----	----
3	0.21	26 / 0.70	24.5 / 0.66	21 / 0.56	12 / 0.32	19.50 / 0.52	----	----	15.5 / 0.42	21.5 / 0.58	12.5 / 0.34	18.5 / 0.50
5	0.34	35 / 0.94	33 / 0.88	32 / 0.86	16 / 0.43	28 / 0.75	14 / 0.38	23 / 0.62	24 / 0.64	31.5 / 0.84	20.5 / 0.55	28 / 0.75
10	0.69	52 / 1.39	52 / 1.39	48 / 1.29	34 / 0.91	45 / 1.21	26 / 0.70	38 / 1.02	37.5 / 1.00	44 / 1.18	38 / 1.02	46 / 1.23
20	1.38	78 / 2.09	77 / 2.06	79 / 2.12	69 / 1.85	76 / 2.04	60 / 1.61	69 / 1.85	70 / 1.88	77 / 2.06	62 / 1.66	76 / 2.04
30	2.07	101 / 2.71	100 / 2.68	100 / 2.68	91 / 2.44	97 / 2.60	87 / 2.33	93 / 2.49	90 / 2.41	101 / 2.71	87 / 2.33	101 / 2.71
40	2.76	124 / 3.32	122 / 3.27	124 / 3.32	109 / 2.92	116 / 3.11	107 / 2.87	115 / 3.08	110 / 2.95	122 / 3.27	105 / 2.81	121 / 3.24
50	3.45	146 / 3.91	144 / 3.86	145 / 3.89	130 / 3.48	136 / 3.64	132 / 3.54	137 / 3.67	127 / 3.40	145 / 3.89	124 / 3.32	145 / 3.89
60	4.14	170 / 4.56	168 / 4.50	166 / 4.45	155 / 4.15	161 / 4.32	152 / 4.07	158 / 4.23	149 / 3.99	167 / 4.48	145 / 3.89	170 / 4.56

1. Outlet pressure setting was made at approximately 10% of the maximum capacity for the listed conditions.

Table 7. Full-Capacity Type 133Z Regulated Flow

INLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 psia / 1 bar AND 60°F / 15°C			
		1 in. w.c. / 3 mbar Outlet Pressure Setting[1] (Either Spring Range)			
		0.5 in. w.c. / 1 mbar droop		1 in. w.c. / 3 mbar droop	
psig	bar	SCFH	Nm³/h	SCFH	Nm³/h
8 in. w.c. 14 in. w.c. 1 2	20 mbar 35 mbar 0.07 0.14	2.4 4.1 6.5 11.5	0.06 0.11 0.17 0.31	5.1 7.4 12 18	0.14 0.20 0.32 0.48
5 10 20	0.34 0.69 1.4	22 44 76	0.59 1.18 2.04	32 50 78	0.86 1.34 2.09

1. Outlet pressure setting was made at approximately 10% of the maximum capacity for the listed conditions.

Table 8. Type 133HP Regulator 100% Capacities

OUTLET PRESSURE RANGES, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING[1]		INLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 psia / 1 bar AND 60°F / 15°C					
					Droop from Setpoint					
					10%		20%		30%	
	psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
2 to 5 psig / 0.14 to 0.34 bar 17B8632X012 Yellow	2	0.14	10 20 60 100 150	0.69 1.4 4.1 6.9 10.3	10.4 16.4 37.1 57.1 82.0	0.28 0.44 0.99 1.53 2.20	18.9 29.8 67.5 103.9 149.1	0.51 0.80 1.81 2.78 4.00	27.5 43.3 97.9 150.6 216.3	0.74 1.16 2.62 4.04 5.80
	5	0.34	10 40 60 80 150	0.69 2.8 4.1 5.5 10.3	20.2 59.6 82.4 104.9 182.7	0.54 1.60 2.21 2.81 4.90	41.5 121.3 167.9 213.6 371.8	1.11 3.25 4.50 5.72 9.96	42.8 121.5 168.0 213.6 371.8	1.15 3.26 4.50 5.72 9.96
4.5 to 10 psig / 0.31 to 0.69 bar 17B8633X012 Orange	5	0.34	10 20 60 100 150	0.69 1.4 4.1 6.9 10.3	11.4 19.6 45.7 70.5 101.2	0.31 0.52 1.22 1.89 2.71	21.4 36.4 84.7 130.6 187.5	0.57 0.98 2.27 3.50 5.02	32.0 53.4 123.7 190.7 273.8	0.86 1.43 3.32 5.11 7.34
	10	0.69	25 40 60 80 150	1.7 2.8 4.1 5.5 10.3	40.3 59.9 84.0 107.4 187.5	1.08 1.60 2.25 2.88 5.02	80.5 119.1 166.8 213.0 371.8	2.16 3.19 4.47 5.71 9.96	81.7 119.7 167.1 213.2 371.8	2.19 3.21 4.48 5.71 9.96
6 to 20 psig / 0.41 to 1.4 bar 10C1238X012 Silver	10	0.69	15 40 80 100 150	1 2.8 5.5 6.9 10.3	16.4 39.9 71.4 86.8 125.0	0.44 1.07 1.91 2.33 3.35	32.0 75.4 134.0 163.0 235.0	0.86 2.02 3.59 4.37 6.30	51.9 111.0 198.0 240.0 344.0	1.39 2.98 5.31 6.43 9.22
	20	1.4	25 60 80 150	1.7 4.1 5.5 10.3	38.8 102.0 133.0 234.0	1.39 4.15 5.31 9.22	65.0 163.0 211.0 372.0	1.74 4.37 5.66 9.97	70.0 164.0 211.0 372.0	1.88 4.40 5.66 9.97
16 to 30 psig / 1.1 to 2.1 bar 10C1240X012 Red	20	1.4	25 60 80 150	1.7 4.1 5.5 10.3	24.8 63.8 83.0 146.0	0.66 1.71 2.22 3.91	50.4 122.0 158.0 277.0	1.35 3.27 4.23 7.42	70.0 164.0 211.0 372.0	1.88 4.40 5.66 9.97
	30	2.1	35 80 125 150	2.4 5.5 8.6 10.3	43.0 117.0 178.0 211.0	1.15 3.14 4.77 5.66	80.6 207.0 313.0 371.0	2.16 5.55 8.39 9.94	88.2 208.0 314.0 371.0	2.36 5.57 8.42 9.94
26 to 40 psig / 1.8 to 2.8 bar 10C1241X012 Blue	30	2.1	35 80 125 150	2.4 5.5 8.6 10.3	28.9 76.4 116.0 137.0	0.78 2.05 3.11 3.67	59.6 146.0 220.0 260.0	1.60 3.91 5.90 6.97	88.2 208.0 314.0 371.0	2.36 5.57 8.42 9.94
	40	2.8	45 80 100 150	3.1 5.5 6.9 10.3	43.5 95.4 120.0 177.0	1.17 2.56 3.22 4.74	96.2 186.0 232.0 341.0	2.58 4.98 6.22 9.14	106.0 204.0 253.0 370.0	2.84 5.47 6.78 9.92
36 to 50 psig / 2.5 to 3.4 bar 10C1242X012 Green	40	2.8	45 80 100 150	3.1 5.5 6.9 10.3	36.2 78.1 97.9 145.0	0.97 2.09 2.62 3.89	76.1 150.0 187.0 276.0	2.04 4.02 5.01 7.40	106.0 204.0 253.0 370.0	2.84 5.47 6.78 9.92
	50	3.4	55 100 150	3.8 6.9 10.3	50.4 116.0 176.0	1.35 3.11 4.72	112.0 227.0 338.0	3.00 6.08 9.06	124.0 248.0 368.0	3.32 6.65 9.86
45 to 60 psig / 3.1 to 4.1 bar 10C1243X012 White	50	3.4	55 100 150	3.8 6.9 10.3	43.5 99.0 149.0	1.17 2.65 3.99	92.7 191.0 285.0	2.48 5.12 7.64	124.0 248.0 368.0	3.32 6.65 9.86
	60	4.1	65 100 150	4.5 6.9 10.3	57.5 112.0 174.0	1.54 3.00 4.66	127.0 236.0 336.0	3.40 6.32 9.00	143.0 242.0 365.0	3.83 6.49 9.78

▭ - Shaded area is equal to maximum flow capacity.
1. Outlet pressure setting was made at approximately 10% of the maximum capacity for the listed conditions.

Table 9. Type 133HP Regulator 25% Capacities

OUTLET PRESSURE RANGES, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING[1]		INLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY GAS AT 14.7 PSIA AND 60°F					
					Droop from Setpoint					
					10%		20%		30%	
	psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
2 to 5 psig / 0.14 to 0.34 bar 17B8632X012 Yellow	2	0.14	10	0.69	4.0	0.11	7.8	0.21	13.4	0.36
			40	2.8	10.5	0.28	20.6	0.55	34.9	0.94
			80	5.5	18.4	0.49	36.0	0.97	61.1	1.64
			100	6.9	22.3	0.60	43.7	1.17	74.0	1.98
			150	10.3	32.0	0.86	62.7	1.68	106.2	2.85
	5	0.34	10	0.69	8.3	0.22	11.5	0.31	11.9	0.32
			40	2.8	25.4	0.68	34.6	0.93	34.7	0.93
			60	4.1	35.2	0.94	47.9	1.28	48.0	1.29
			80	5.5	44.8	1.20	61.0	1.64	61.0	1.64
			150	10.3	78.1	2.09	106.2	2.85	106.2	2.85
4.5 to 10 psig / 0.31 to 0.69 bar 17B8633X012 Orange	5	0.34	10	0.69	4.4	0.12	8.7	0.23	11.9	0.32
			40	2.8	13.3	0.36	26.1	0.70	34.7	0.93
			80	5.5	23.4	0.63	46.1	1.24	61.0	1.64
			100	6.9	28.4	0.76	55.9	1.50	74.0	1.98
			150	10.3	40.8	1.09	80.2	2.15	106.2	2.85
	10	0.69	25	1.7	17.0	0.46	22.6	0.61	23.0	0.62
			40	2.8	25.5	0.68	33.8	0.91	34.0	0.91
			60	4.1	35.9	0.96	47.5	1.27	47.6	1.28
			80	5.5	45.9	1.23	60.8	1.63	60.9	1.63
			150	10.3	80.2	2.15	106.2	2.85	106.2	2.85
6 to 20 psig / 0.41 to 1.4 bar 10C1238X012 Silver	10	0.69	15	1	6.3	0.17	13.3	0.36	14.1	0.38
			20	1.4	8.8	0.24	18.3	0.49	18.9	0.51
			40	2.8	16.4	0.44	33.8	0.91	34.0	0.91
			100	6.9	35.8	0.96	73.9	1.98	73.9	1.98
			150	10.3	51.5	1.38	106.2	2.85	106.2	2.85
	20	1.4	25	1.7	15.7	0.42	16.8	0.45	18.6	0.50
			60	4.1	45.9	1.23	46.1	1.24	46.5	1.25
			80	5.5	59.8	1.60	60.0	1.61	60.2	1.61
			125	8.6	89.8	2.41	89.8	2.41	89.9	2.41
			150	10.3	106.1	2.84	106.1	2.84	106.2	2.85
16 to 30 psig / 1.1 to 2.1 bar 10C1240X012 Red	20	1.4	25	1.7	9.2	0.25	16.8	0.45	18.6	0.50
			60	4.1	26.6	0.71	46.1	1.24	46.5	1.25
			80	5.5	34.6	0.93	60.0	1.61	60.2	1.61
			150	10.3	61.3	1.64	106.1	2.84	106.2	2.85
	30	2.1	35	2.4	18.5	0.50	20.2	0.54	23.0	0.62
			60	4.1	37.1	0.99	43.6	1.17	44.6	1.20
			100	6.9	62.1	1.66	72.3	1.94	72.7	1.95
			125	8.6	76.6	2.05	89.2	2.39	89.4	2.40
			150	10.3	90.9	2.44	105.7	2.83	105.9	2.84
26 to 40 psig / 1.8 to 2.8 bar 10C1241X012 Blue	30	2.1	35	2.4	10.3	0.28	20.2	0.54	23.0	0.62
			60	4.1	23.4	0.63	43.6	1.17	44.6	1.20
			80	5.5	31.6	0.85	58.4	1.56	59.0	1.58
			100	6.9	39.1	1.05	72.3	1.94	72.7	1.95
			150	10.3	57.3	1.54	105.7	2.83	105.9	2.84
	40	2.8	45	3.1	15.5	0.42	23.7	0.64	27.5	0.74
			80	5.5	39.9	1.07	56.0	1.50	57.2	1.53
			100	6.9	50.6	1.36	70.7	1.90	71.5	1.92
			125	8.6	63.2	1.69	88.1	2.36	88.6	2.37
			150	10.3	75.4	2.02	105.0	2.81	105.4	2.82
36 to 50 psig / 2.5 to 3.4 bar 10C1242X012 Green	40	2.8	45	3.1	12.5	0.34	23.7	0.64	27.5	0.74
			80	5.5	32.1	0.86	56.0	1.50	57.2	1.53
			100	6.9	40.7	1.09	70.7	1.90	71.5	1.92
			125	8.6	50.8	1.36	88.1	2.36	88.6	2.37
			150	10.3	60.6	1.62	105.0	2.81	105.4	2.82
	50	3.4	55	3.8	17.5	0.47	27.0	0.72	31.9	0.86
			80	5.5	37.1	0.99	52.5	1.41	54.6	1.46
			100	6.9	48.7	1.30	68.4	1.83	69.8	1.87
			125	8.6	61.9	1.66	86.6	2.32	87.5	2.34
			150	10.3	74.5	2.00	103.9	2.78	104.5	2.80
45 to 60 psig / 3.1 to 4.1 bar 10C1243X012 White	50	3.4	55	3.8	14.8	0.40	27.0	0.72	31.9	0.86
			80	5.5	31.1	0.83	52.5	1.41	54.6	1.46
			100	6.9	40.9	1.10	68.4	1.83	69.8	1.87
			125	8.6	52.0	1.39	86.6	2.32	87.5	2.34
			150	10.3	62.5	1.68	103.9	2.78	104.5	2.80
	60	4.1	65	4.5	19.5	0.52	30.4	0.82	36.4	0.98
			100	6.9	46.3	1.24	65.2	1.75	67.4	1.81
			125	8.6	60.4	1.62	84.5	2.26	85.9	2.30
			150	10.3	73.5	1.97	102.4	2.74	103.4	2.77

▭ - Shaded area is equal to maximum flow capacity.

1. Outlet pressure setting was made at approximately 10% of the maximum capacity for the listed conditions.

Table 10. Type 133HP Regulator 40% Capacities

OUTLET PRESSURE RANGES, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING(1)		INLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY GAS AT 14.7 PSIA AND 60°F					
					Droop from Setpoint					
					10%		20%		30%	
	psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
2 to 5 psig / 0.14 to 0.34 bar 17B8632X012 Yellow	20	1.4	10	0.69	6.9	0.18	13.2	0.35	19.7	0.53
			40	2.8	16.6	0.44	31.9	0.86	47.2	1.26
			100	6.9	34.8	0.93	66.9	1.79	99.0	2.65
			150	10.3	50.0	1.34	96.0	2.57	142.1	3.81
	5	0.34	10	0.69	14.5	0.39	19.8	0.53	20.4	0.55
			20	1.4	24.4	0.65	32.8	0.88	32.9	0.88
			40	2.8	39.5	1.06	52.9	1.42	52.9	1.42
			100	6.9	82.9	2.22	111.0	2.98	111.0	2.98
			150	10.3	119.1	3.19	159.3	4.27	159.3	4.27
4.5 to 10 psig / 0.31 to 0.69 bar 17B8633X012 Orange	5	0.34	10	0.69	3.8	0.10	7.1	0.19	10.4	0.28
			20	1.4	5.8	0.16	10.7	0.29	15.7	0.42
			40	2.8	9.2	0.25	17.0	0.46	24.9	0.67
			100	6.9	19.3	0.52	35.7	0.96	52.2	1.40
			150	10.3	27.7	0.74	51.3	1.38	75.0	2.01
	10	0.69	25	1.7	28.2	0.76	37.0	0.99	37.4	1.00
			30	2.1	32.5	0.87	42.6	1.14	42.8	1.15
			40	2.8	40.5	1.08	52.9	1.42	52.9	1.42
			100	6.9	85.2	2.28	111.0	2.98	111.0	2.98
			150	10.3	122.4	3.28	159.3	4.27	159.3	4.27
6 to 20 psig / 0.41 to 1.4 bar 10C1238X012 Silver	10	0.69	15	1.03	11.3	0.30	23.6	0.63	24.7	0.66
			20	1.4	15.1	0.40	30.9	0.83	31.5	0.84
			40	2.8	26.3	0.70	52.9	1.42	52.9	1.42
			100	6.9	55.2	1.48	111.0	2.98	111.0	2.98
			150	10.3	79.3	2.12	159.3	4.27	159.3	4.27
	20	1.4	25	1.7	28.5	0.76	31.2	0.84	33.2	0.89
			40	2.8	50.4	1.35	51.2	1.37	51.9	1.39
			60	4.1	72.0	1.93	72.2	1.94	72.3	1.94
			100	6.9	111.0	2.98	111.0	2.98	111.0	2.98
			150	10.3	159.3	4.27	159.3	4.27	159.3	4.27
16 to 30 psig / 1.1 to 2.1 bar 10C1240X012 Red	20	1.4	25	1.7	17.2	0.46	31.2	0.84	33.2	0.89
			40	2.8	29.8	0.80	51.2	1.37	51.9	1.39
			60	4.1	42.5	1.14	72.2	1.94	72.3	1.94
			100	6.9	65.5	1.76	111.0	2.98	111.0	2.98
			150	10.3	94.0	2.52	159.3	4.27	159.3	4.27
	30	2.1	35	2.4	34.4	0.92	38.7	1.04	41.8	1.12
			60	4.1	61.2	1.64	71.0	1.90	71.6	1.92
			80	5.5	79.7	2.14	91.5	2.45	91.6	2.46
			100	6.9	96.9	2.60	111.0	2.98	111.0	2.98
			150	10.3	139.1	3.73	159.3	4.27	159.3	4.27
26 to 40 psig / 1.8 to 2.8 bar 10C1241X012 Blue	30	2.1	35	2.4	19.7	0.53	38.7	1.04	41.8	1.12
			60	4.1	39.0	1.04	71.0	1.90	71.6	1.92
			80	5.5	50.7	1.36	91.5	2.45	91.6	2.46
			100	6.9	61.6	1.65	111.0	2.98	111.0	2.98
			150	10.3	88.4	2.37	159.3	4.27	159.3	4.27
	40	2.8	45	3.1	30.3	0.81	46.2	1.24	50.4	1.35
			60	4.1	48.0	1.29	67.8	1.82	69.7	1.87
			80	5.5	65.6	1.76	90.5	2.42	91.2	2.44
			100	6.9	80.9	2.17	110.9	2.97	111.0	2.98
			150	10.3	116.6	3.12	159.3	4.27	159.3	4.27
36 to 50 psig / 2.5 to 3.4 bar 10C1242X012 Green	40	2.8	45	3.1	24.6	0.66	46.2	1.24	50.4	1.35
			60	4.1	38.8	1.04	67.8	1.82	69.7	1.87
			80	5.5	52.9	1.42	90.5	2.42	91.2	2.44
			100	6.9	65.3	1.75	110.9	2.97	111.0	2.98
			150	10.3	94.0	2.52	159.3	4.27	159.3	4.27
	50	3.4	55	3.8	34.8	0.93	53.7	1.44	59.0	1.58
			80	5.5	62.9	1.69	88.1	2.36	89.8	2.41
			100	6.9	79.7	2.14	110.0	2.95	110.7	2.97
			125	8.6	98.7	2.64	135.2	3.62	135.2	3.62
			150	10.3	116.6	3.12	159.3	4.27	159.3	4.27
45 to 60 psig / 3.1 to 4.1 bar 10C1243X012 White	50	3.4	55	3.8	29.5	0.79	53.7	1.44	59.0	1.58
			80	5.5	53.0	1.42	88.1	2.36	89.8	2.41
			100	6.9	67.2	1.80	110.0	2.95	110.7	2.97
			125	8.6	83.1	2.23	135.2	3.62	135.2	3.62
			150	10.3	98.1	2.63	159.3	4.27	159.3	4.27
	60	4.1	65	4.5	39.5	1.06	61.3	1.64	67.6	1.81
			100	6.9	77.8	2.08	108.0	2.89	109.6	2.94
			125	8.6	98.1	2.63	134.6	3.61	135.1	3.62
			150	10.3	116.8	3.13	159.3	4.27	159.3	4.27

▭ - Shaded area is equal to maximum flow capacity.

1. Outlet pressure setting was made at approximately 10% of the maximum capacity for the listed conditions.

Table 10. Type 133HP Regulator 60% Capacities

OUTLET PRESSURE RANGES, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING(1)		INLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY GAS AT 14.7 PSIA AND 60°F					
					Droop from Setpoint					
					10%		20%		30%	
	psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
2 to 5 psig / 0.14 to 0.34 bar 17B8632X012 Yellow	2	0.14	10	0.69	9.1	0.24	17.7	0.47	26.4	0.71
			40	2.8	24.2	0.65	47.1	1.26	70.0	1.88
			60	4.1	33.5	0.90	65.2	1.75	96.9	2.60
			150	10.3	74.5	2.00	145.0	3.89	215.6	5.78
	5	0.34	10	0.69	18.8	0.50	26.1	0.70	27.0	0.72
			40	2.8	57.8	1.55	78.4	2.10	78.5	2.10
			60	4.1	80.5	2.16	109.1	2.92	109.2	2.93
			80	5.5	102.9	2.76	139.4	3.74	139.4	3.74
			150	10.3	180.2	4.83	244.0	6.54	244.0	6.54
4.5 to 10 psig / 0.31 to 0.69 bar 17B8633X012 Orange	5	0.34	10	0.69	10.0	0.27	20.0	0.54	27.0	0.72
			40	2.8	30.4	0.82	59.5	1.60	78.5	2.10
			60	4.1	42.3	1.13	82.9	2.22	109.2	2.93
			100	6.9	65.7	1.76	128.6	3.45	169.4	4.54
			150	10.3	94.6	2.54	185.2	4.96	244.0	6.54
	10	0.69	25	1.7	38.3	1.03	51.2	1.40	52.1	1.40
			40	2.8	57.8	1.55	76.6	2.07	77.1	2.07
			60	4.1	81.8	2.19	108.0	2.90	108.3	2.90
			80	5.5	105.1	2.82	138.6	3.72	138.8	3.72
			150	10.3	184.9	4.96	243.7	6.53	243.8	6.53
6 to 20 psig / 0.41 to 1.4 bar 10C1238X012 Silver	10	0.69	15	1	14.6	0.39	31.1	0.83	32.7	0.88
			40	2.8	37.3	1.00	76.6	2.05	77.1	2.07
			60	4.1	52.7	1.41	108.0	2.89	108.3	2.90
			100	6.9	82.5	2.21	168.8	4.52	168.9	4.53
			150	10.3	119.1	3.19	243.7	6.53	243.8	6.53
	20	1.4	25	1.7	36.9	0.99	40.9	1.10	44.2	1.18
			60	4.1	103.6	2.78	104.7	2.81	105.7	2.83
			80	5.5	135.5	3.63	136.3	3.65	136.9	3.67
			100	6.9	166.5	4.46	167.0	4.48	167.6	4.49
			150	10.3	242.3	6.49	242.7	6.50	243.0	6.51
16 to 30 psig / 1.1 to 2.1 bar 10C1240X012 Red	20	1.4	25	1.7	22.0	0.59	40.9	1.10	44.2	1.18
			40	2.8	40.5	1.08	71.1	1.90	72.7	1.95
			100	6.9	96.9	2.60	167.0	4.48	167.6	4.49
			150	10.3	141.0	3.78	242.7	6.50	243.0	6.51
	30	2.1	35	2.4	39.1	1.05	50.7	1.36	55.7	1.49
			60	4.1	84.3	2.26	99.7	2.67	101.8	2.73
			100	6.9	141.2	3.78	164.5	4.41	165.6	4.44
			150	10.3	207.9	5.57	241.2	6.46	241.8	6.48
26 to 40 psig / 1.8 to 2.8 bar 10C1241X012 Blue	30	2.1	35	2.4	25.0	0.67	50.7	1.36	55.7	1.49
			60	4.1	53.4	1.43	99.7	2.67	101.8	2.73
			100	6.9	89.3	2.39	164.5	4.41	165.6	4.44
			150	10.3	131.4	3.52	241.2	6.46	241.8	6.48
	40	2.8	45	3.1	38.5	1.03	60.5	1.62	67.1	1.80
			100	6.9	115.0	3.08	161.0	4.32	162.9	4.37
			125	8.6	144.0	3.86	200.5	5.37	201.9	5.41
			150	10.3	172.1	4.61	239.1	6.41	240.2	6.44
36 to 50 psig / 2.5 to 3.4 bar 10C1242X012 Green	40	2.8	45	3.1	31.2	0.84	60.5	1.62	67.1	1.80
			80	5.5	73.1	1.96	128.1	3.43	130.7	3.50
			100	6.9	92.6	2.48	161.0	4.32	162.9	4.37
			150	10.3	138.5	3.71	239.1	6.41	240.2	6.44
	50	3.4	55	3.8	44.2	1.18	70.3	1.88	78.6	2.11
			80	5.5	84.8	2.27	121.7	3.26	125.9	3.37
			100	6.9	110.9	2.97	156.4	4.19	159.4	4.27
			150	10.3	169.7	4.55	236.5	6.34	238.2	6.38
45 to 60 psig / 3.1 to 4.1 bar 10C1243X012 White	50	3.4	55	3.8	37.3	1.00	70.3	1.88	78.6	2.11
			80	5.5	71.4	1.91	121.7	3.26	125.9	3.37
			100	6.9	93.2	2.50	156.4	4.19	159.4	4.27
			125	8.6	118.4	3.17	197.1	5.28	199.3	5.34
	60	4.1	65	4.5	50.0	1.34	80.1	2.15	90.1	2.42
			80	5.5	77.0	2.06	113.2	3.03	119.8	3.21
			100	6.9	105.8	2.84	150.5	4.03	155.0	4.15
			150	10.3	167.4	4.49	233.2	6.25	235.8	6.32

▭ - Shaded area is equal to maximum flow capacity.
1. Outlet pressure setting was made at approximately 10% of the maximum capacity for the listed conditions.

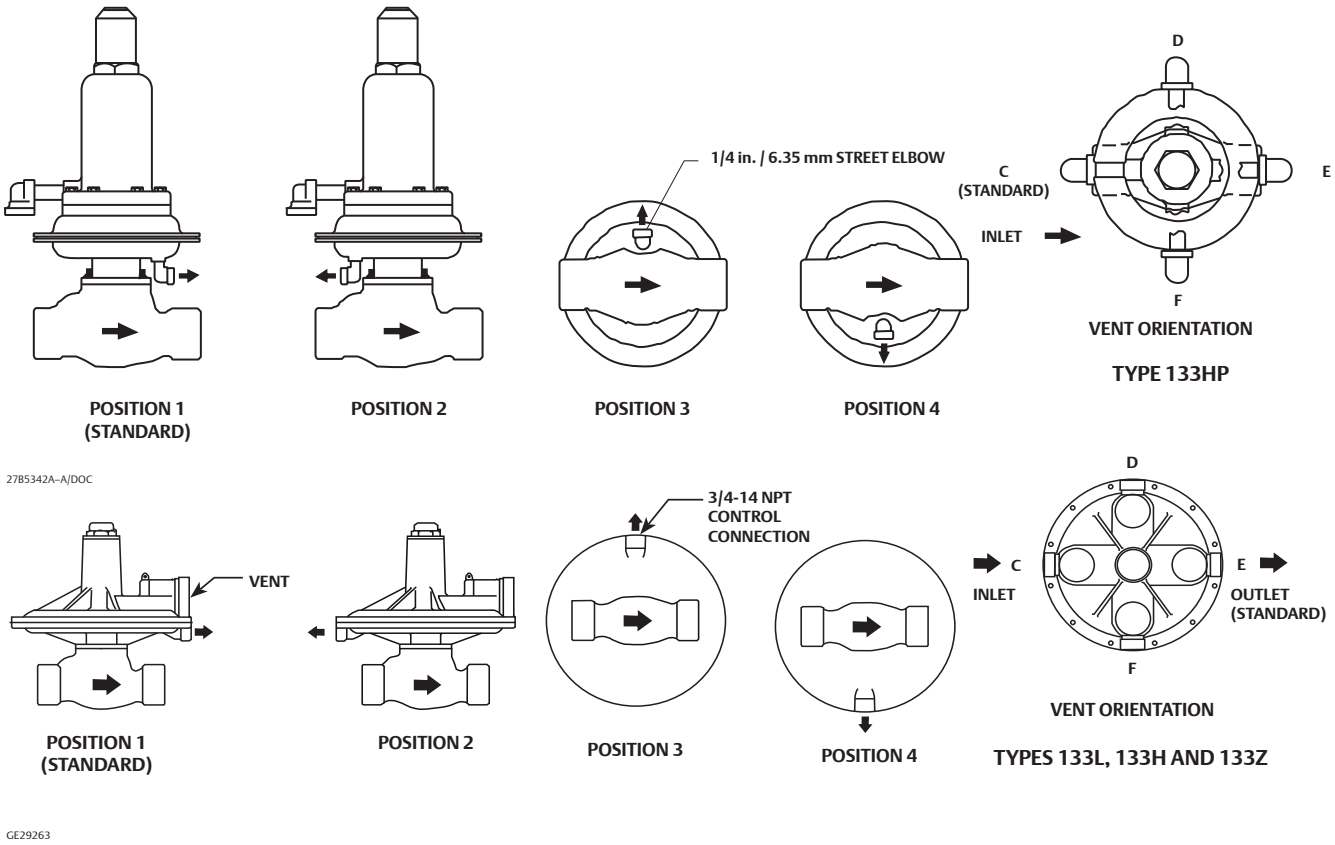


Figure 5. *133 Series Assembly Positions for Body/Spring Case Orientation*

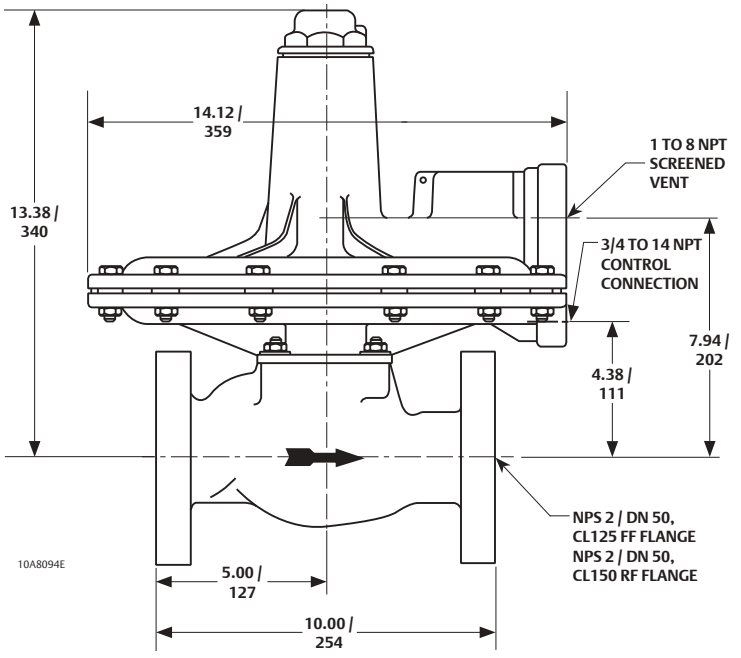


Figure 6. *Dimensions*

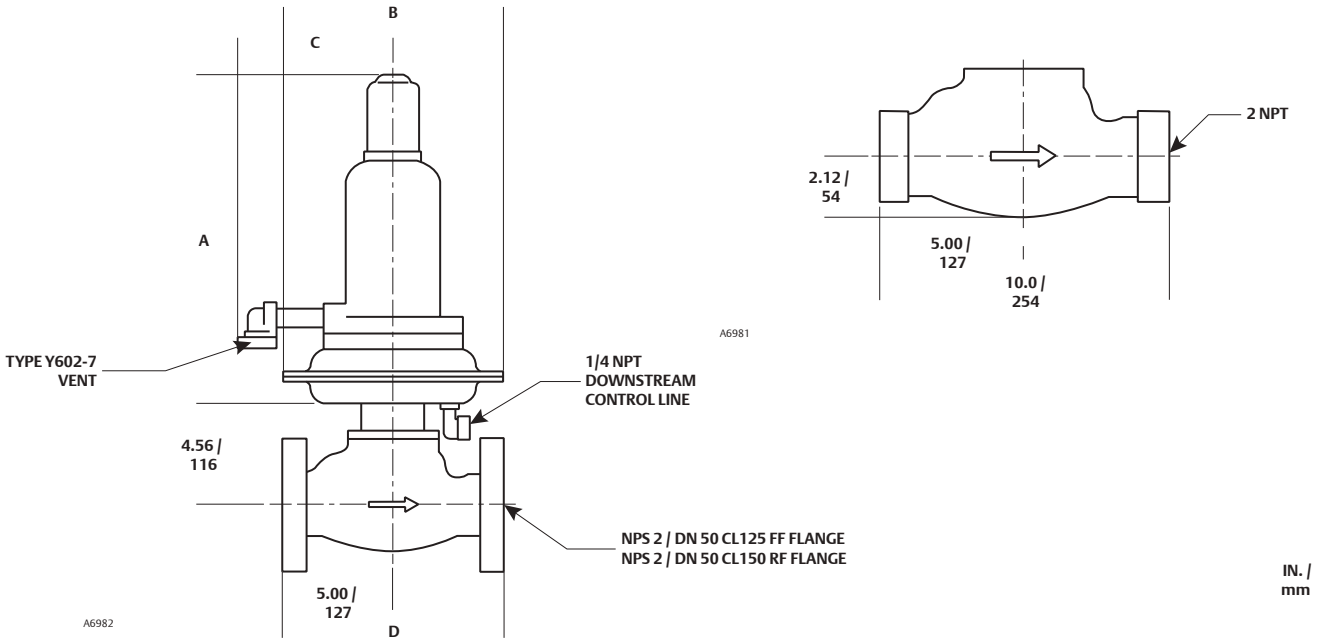


Figure 6. *Dimensions (continued)*

Ordering Guide

Type (Select One)

- ☐ 133L
- ☐ 133H
- ☐ 133Z
- ☐ 133HP

Body Material and End Connection Style (Select One)

Cast Iron
- ☐ NPT
- ☐ CL125 FF

Steel
- ☐ NPT
- ☐ CL150 RF

Outlet Pressure Range (Select One)

Types 133L and 133H
- ☐ 2 to 4 in. w.c. / 5 to 10 mbar, Brown
- ☐ 3.5 to 6 in. w.c. / 9 to 15 mbar, Red
- ☐ 5 to 9 in. w.c. / 12 to 22 mbar, Black
- ☐ 8.5 to 18 in. w.c. / 21 to 45 mbar, White
- ☐ 14 to 28 in. w.c. / 35 to 70 mbar, Green
- ☐ 21 in. w.c. to 2 psig / 52 mbar to 0.14 bar, Blue

Type 133H
- ☐ 1.5 to 3 psig / 0.10 to 0.21 bar, Orange
- ☐ 2 to 5 psig / 0.14 to 0.34 bar, Yellow
- ☐ 5 to 10 psig / 0.34 to 0.69 bar, Blue

Type 133Z
- ☐ -1 to 1 in. w.c. / -2 to 2 mbar, Unpainted
- ☐ 0 to 4 in. w.c. / 0 to 10 mbar, Brown
- ☐ 5 to 10 psig / 0.34 to 0.69 bar, Blue

Type 133HP
- ☐ 2 to 5 psig / 0.14 to 0.34 bar, Yellow
- ☐ 4.5 to 10 psig / 0.31 to 0.69 bar, Orange
- ☐ 6 to 20 psig / 0.41 to 1.4 bar, Silver
- ☐ 16 to 30 psig / 1.1 to 2.1 bar, Red
- ☐ 26 to 40 psig / 1.8 to 2.8 bar, Blue
- ☐ 36 to 50 psig / 2.5 to 3.4 bar, Green
- ☐ 45 to 60 psig / 3.1 to 4.1 bar, White

Ordering Guide (continued)

Trim, Percent of Full Capacity (Select One)

- ☐ 100 percent **(standard)**
- ☐ 60 percent
- ☐ 40 percent
- ☐ 25 percent

Elastomers (Select One)

- ☐ Nitrile (NBR) **(standard)**
- ☐ Fluorocarbon (FKM)
  (Available for Types 133L and 133H only)

Body Position (refer to Figure 8) (Select One)

- ☐ Position 1 **(standard)**
- ☐ Position 2
- ☐ Position 3
- ☐ Position 4

Vent Position (refer to Figure 8) (Select One)

- ☐ Position C (**standard** for Type 133HP)
- ☐ Position D
- ☐ Position E (**standard** for Types 133L, 133H and 133Z)
- ☐ Position F

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired?	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Droop is the reduction of outlet pressure experienced by pressure-reducing regulators as the flow rate increases. It is stated as a percent, in inches of water column (mbar) or in pounds per square inch (bar) and indicates the difference between the outlet pressure setting made at low flow rates and the actual outlet pressure at the published maximum flow rate. Droop is also called offset or proportional band.

Type 252
Filters

FISHER

Introduction

The Type 252 filter is designed to clean supply gas or air before it enters the pilot on a pilot-operated regulator, pneumatic instrument or other device that requires clean gas to operate properly. The extended length filter has a larger drip chamber to hold more moisture and debris. Filter materials comply with the recommendations of NACE International MR-0175.

End Connection Size

1/4 NPT

Maximum Working Pressure

Aluminum: 2150 psig / 148 bar
Stainless Steel: 2750 psig / 190 bar

Maximum Differential

100 psig / 6.9 bar

Flow and Sizing Coefficients

C_g: 20
C_v: 0.57
C_1: 35

Filter Rating

20 microns

Temperature Capability

-40 to 180°F / -40 to 82°C

Approximate Shipping Weights

Standard Body:
Aluminum: 0.8 lb / 0.4 kg
Stainless Steel: 2.2 lbs / 1 kg
Extended Body:
Aluminum: 1 lb / 0.5 kg
Stainless Steel: 2.2 lbs / 1 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Excellent Filtration**
- **Clean Pilot Supply Drainage**
- **NACE Construction**
- **High Flow Rate**



Figure 1. *Type 252 Filters*

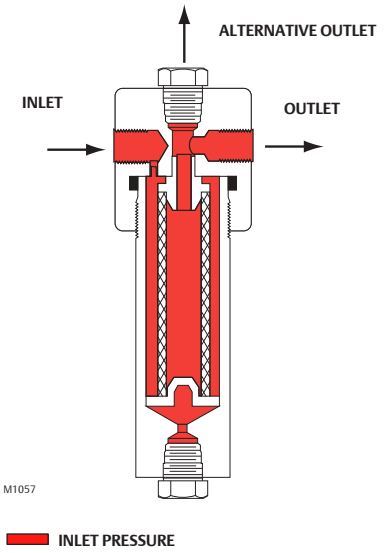


Figure 2. *Type 252 Operational Schematic*

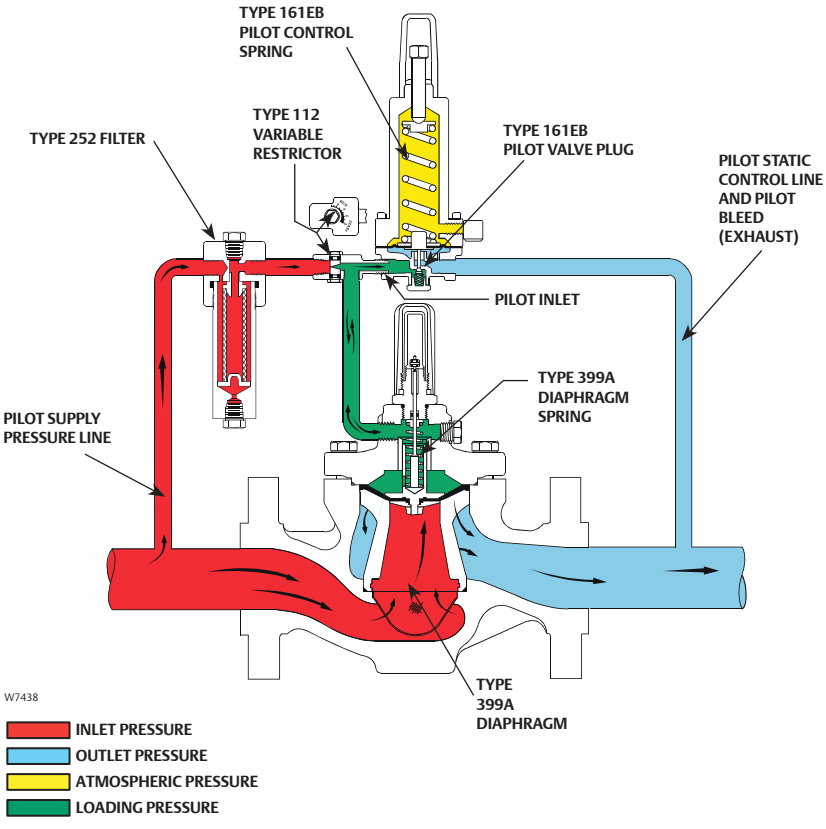


Figure 2. *Type 252 Operational Schematic (continued)*

EMERSON Process Management

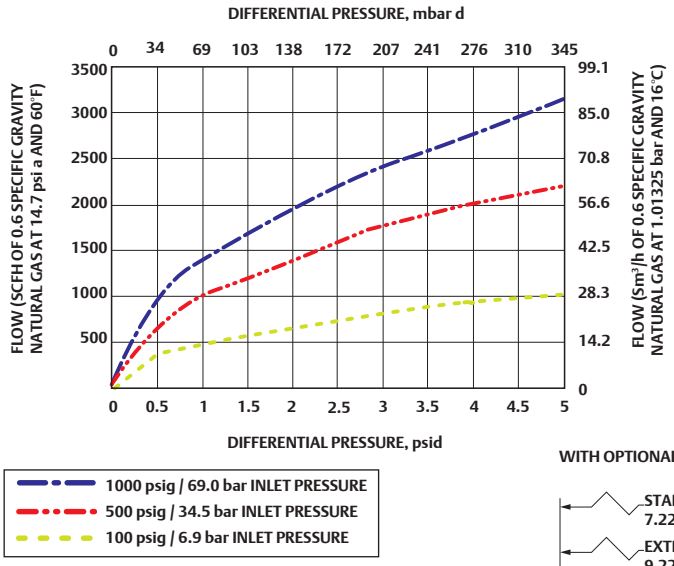


Figure 3. *Typical Flow Capabilities*

Table 1. Construction Material

BODY	O-RING	UPPER AND LOWER SEAT	FILTER CARTRIDGE	DRAIN VALVE (OPTIONAL)
316 Stainless steel or Aluminum	Nitrile (NBR)	Acetal	Polyethylene	316 Stainless steel

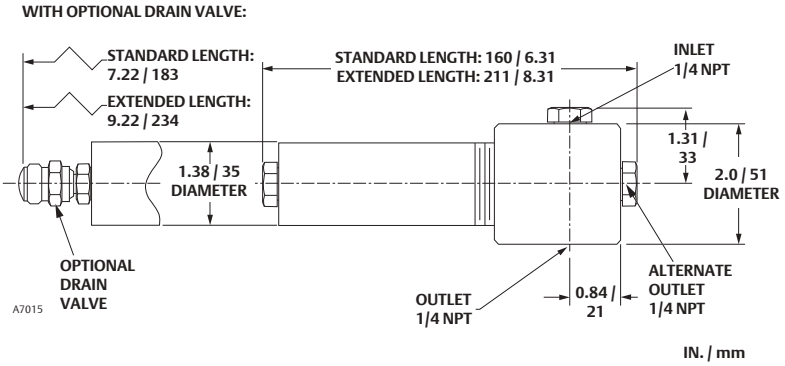


Figure 4. *Dimensions*

Ordering Guide

Construction Materials

☐ Stainless steel
☐ Aluminum

Length

☐ Standard
☐ Extended

Drain Valve

☐ With Stainless steel drain valve
☐ Without Stainless steel drain valve

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

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www.emersonprocess.com/regulators

Regulators Quick Order Guide

* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.

Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.

Regulator Tip:

When you know the application and Type or Series of the product you need, you can use the Quick Product Index in the Table of Contents, the Section Outline in the Application Map of each section, or the Product Index at the back of this Application Guide to direct you to the page on which the product is described.

289 Series
Relief Valve

FISHER

Introduction

The 289 Series relief valve is a throttling relief valve used downstream of pressure regulators to protect the downstream system from overpressure. A smooth throttling action minimizes pressure surges in the system during emergency operation. The 289 Series relief valves are ideal for low-pressure settings due to the increased sensitivity provided by a large diaphragm area.

Body Sizes and End Connection Styles

Inlet Connections
Type 289L: 3/4 or 1 NPT
Types 289A and 289U: 1/4 NPT
Type 289H: 1 or 2 NPT
Type 289HH: 1 NPT

Outlet (Vent) Connections
Same size as inlet connection

IEC Sizing Coefficients

See Table 3

Maximum Allowable Relief (Inlet) Pressures

100 psig / 6.9 bar
See Table 2

Relief Set Pressure Range

5 in. w.c. to 75 psig / 12 mbar to 5.2 bar
See Table 2

Pressure Registration

Internal

Temperature Capabilities

With Nitrile (NBR) and Neoprene (CR) Elastomers: -20 to 150°F / -29 to 66°C

With Fluorocarbon (FKM):
20 to 300°F / -7 to 149°C
Available with Types 289H and 289HH only

Options

- Polytetrafluoroethylene (PTFE) diaphragm protector (Types 289A and 289U only)
- Wire-seal on closing cap (1 NPT Type 289L only)

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Throttling Type Relief**
- **High Flow Rates**
- **Small Size**
- **Reliability Due to Simplicity**

Table 1. Construction Material

TYPE	VALVE BODY AND SPRING CASE	DIAPHRAGM	GASKET	SPRING
289A	Zinc	Neoprene (CR)	Composition	Zinc-Plated Steel
289H - 1 NPT	Aluminum	Nitrile (NBR) or Fluorocarbon (FKM)		
289H - 2 NPT	Cast Iron Body with Aluminum Spring Case			
289HH	Aluminum			
289L	Aluminum	Nitrile (NBR)	Neoprene (CR)	
289U	Zinc		Composition	

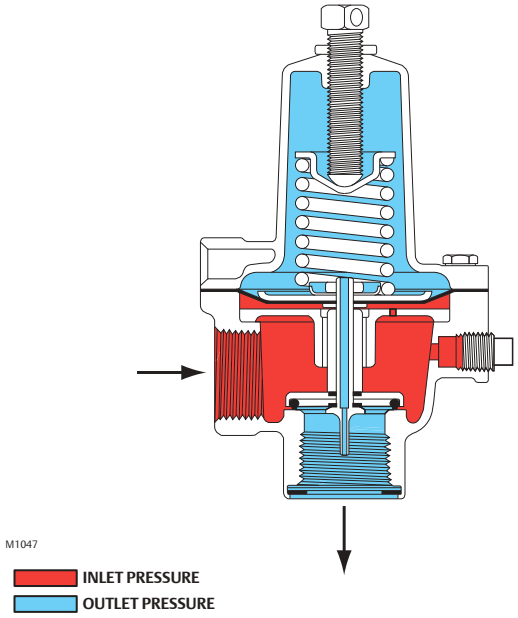

W18701
Figure 1. *1 NPT Types 289H and 289HH*


18702IN
Figure 2. *2 NPT Type 289H*

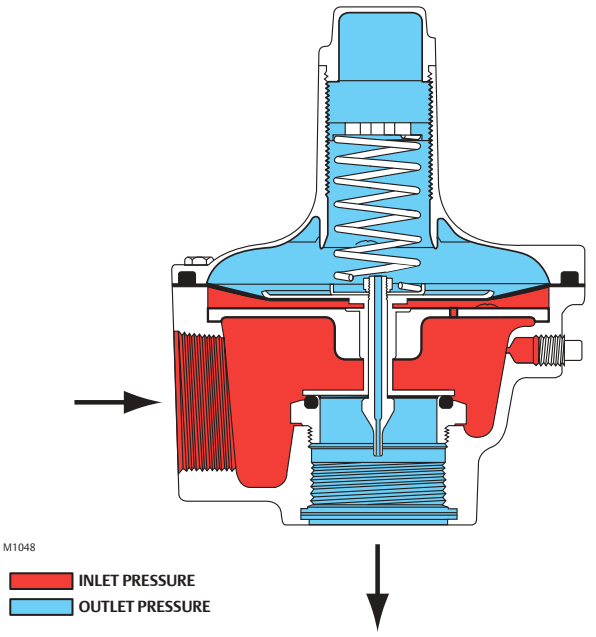

W1870_1
Figure 3. *Type 289L*


W1870_2
Figure 4. *Types 289A and 289U*

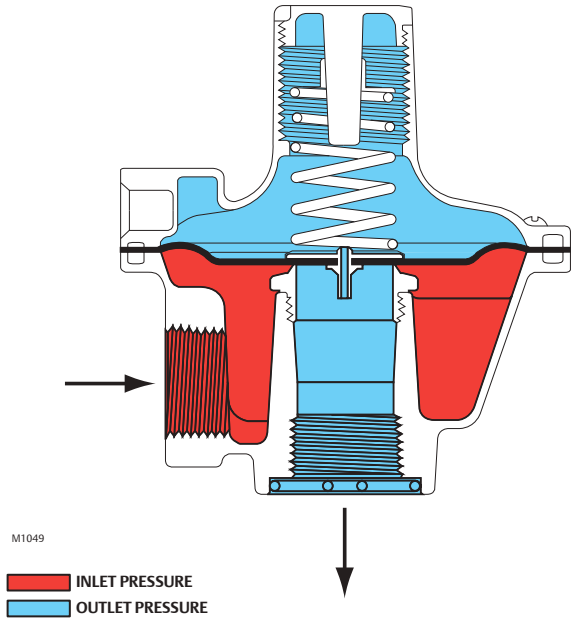
EMERSON
Process Management



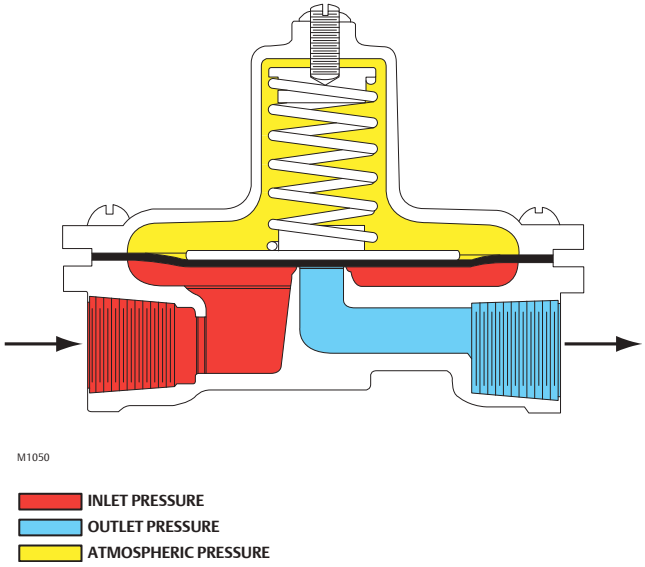
1 NPT TYPES 289H AND 289HH



2 NPT TYPE 289H



TYPE 289L



TYPE 289A OR 289U

Figure 5. *289 Series Operational Schematics*

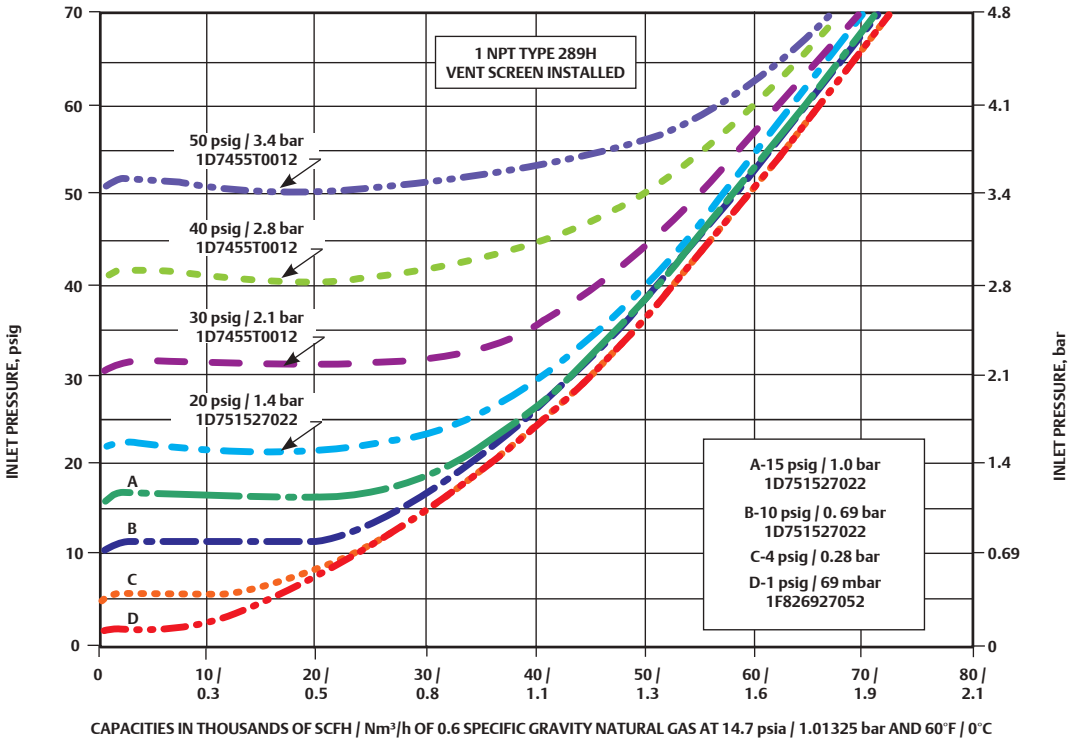
Table 2. Spring Range and Maximum Allowable Relief (Inlet) Pressure

TYPE	BODY SIZE, NPT	SPRING PART NUMBER	COLOR CODE	SPRING RANGE (RELIEF PRESSURE SETTING)		MAXIMUM ALLOWABLE RELIEF (INLET) PRESSURE(1)	
				psig	bar	psig	bar
289A	1/4	0Z056327022 1B268227022	Silver Silver	3 to 13 11 to 22	0.21 to 0.90 0.76 to 1.5	45	3.1
289H	1	1F826927052 1D892327022 1D751527022 1D7455T0012	Pink Red Silver Green	1 to 4.5 4 to 15 10 to 20 15 to 50	0.07 to 0.31 0.28 to 1.0 0.69 to 1.4 1.0 to 3.4	100	6.9
	2	1B536527052 1B536627052 1B536827062 1B536927052	Dark Blue Gray Dark Green Red Stripe	7 to 18 in. w.c. 0.5 to 2.25 1.75 to 7 4 to 10	17 to 45 mbar 0.03 to 0.16 0.12 to 0.48 0.28 to 0.69	25	1.7
289HH	1	1D7455T0012	Green	45 to 75	3.1 to 5.2	100	6.9
289L	3/4 or 1	13A7917X012 13A7916X012	Silver Red Stripe	10 to 18 in. w.c. 12 to 40 in. w.c.	25 to 45 mbar 30 to 99 mbar	7	0.48
289U	1/4	0V060227022 0F058227022	Silver Silver	5 to 25 in. w.c. 20 in. w.c. to 3 psig	12 to 62 mbar 50 to 207 mbar	10	0.69

1. This value indicates the relief pressure setting plus pressure build-up.

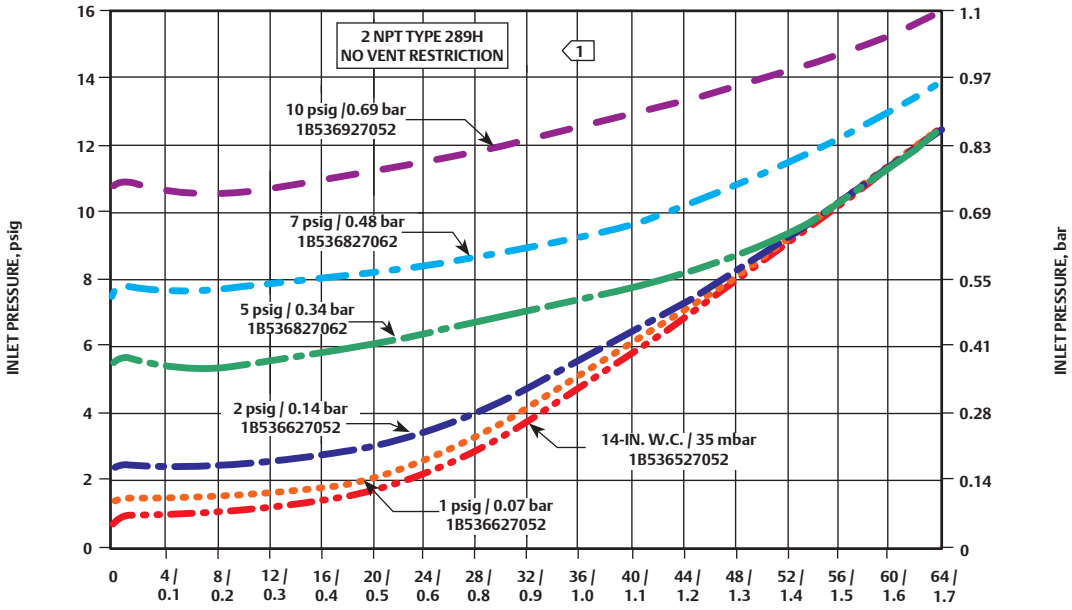
Table 3. IEC Sizing Coefficient

BODY SIZE, NPS	X_T	F_D	F_L
1/4	0.775	0.50	0.89
3/4	0.775		
1	0.648		
2	0.616		



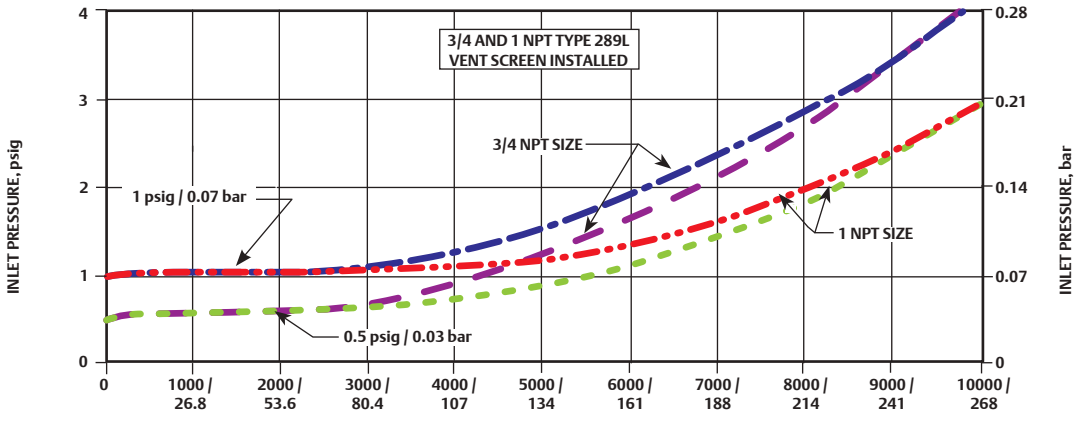
NOTE:
1. LESS THAN A 5% CAPACITY LOSS CAN BE EXPECTED WITH THE VENT SCREEN INSTALLED ON THE 2 NPT TYPE 289H AT MAXIMUM FLOW.
2. WHEN SELECTING ANY RELIEF VALVE FOR INSTALLATION DOWNSTREAM OF THE REGULATOR, THE CAPACITY OF THE RELIEF VALVE SHOULD BE COMPARED WITH THE WIDE-OPEN CAPACITY OF THE REGULATOR.
3. BUBBLE POINT RELIEF SETTING AND SPRING PART NUMBER ARE NOTED ON EACH CURVE.
4. TO CONVERT TO EQUIVALENT CAPACITIES OF OTHER GASES, MULTIPLY VALUES OBTAINED FROM CURVE BY THE FOLLOWING FACTORS: AIR = 0.78, PROPANE = 0.628, BUTANE = 0.548, NITROGEN = 0.789.

Figure 6. *Type 289H Capacities*



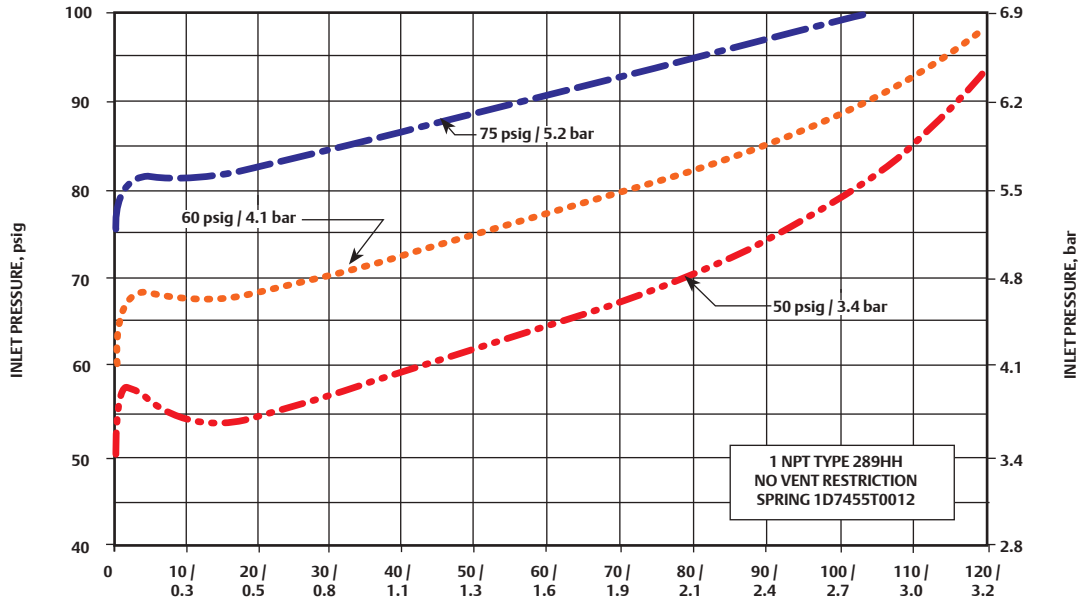
NOTE:
1. LESS THAN A 5% CAPACITY LOSS CAN BE EXPECTED WITH THE VENT SCREEN INSTALLED ON THE 2 NPT TYPE 289H AT MAXIMUM FLOW.
2. WHEN SELECTING ANY RELIEF VALVE FOR INSTALLATION DOWNSTREAM OF THE REGULATOR, THE CAPACITY OF THE RELIEF VALVE SHOULD BE COMPARED WITH THE WIDE-OPEN CAPACITY OF THE REGULATOR.
3. BUBBLE POINT RELIEF SETTING AND SPRING PART NUMBER ARE NOTED ON EACH CURVE.
4. TO CONVERT TO EQUIVALENT CAPACITIES OF OTHER GASES, MULTIPLY VALUES OBTAINED FROM CURVE BY THE FOLLOWING FACTORS: AIR = 0.78, PROPANE = 0.628, BUTANE = 0.548, NITROGEN = 0.789.

Figure 6. *Type 289H Capacities (continued)*



NOTE:
1. WHEN SELECTING ANY RELIEF VALVE FOR INSTALLATION DOWNSTREAM OF THE REGULATOR, THE CAPACITY OF THE RELIEF VALVE SHOULD BE COMPARED WITH THE WIDE-OPEN CAPACITY OF THE REGULATOR.
2. BUBBLE POINT RELIEF SETTING IS NOTED ON EACH CURVE.
3. TO CONVERT TO EQUIVALENT CAPACITIES OF OTHER GASES, MULTIPLY VALUES OBTAINED FROM CURVE BY THE FOLLOWING FACTORS: AIR = 0.78, PROPANE = 0.628, BUTANE = 0.548, NITROGEN = 0.789.

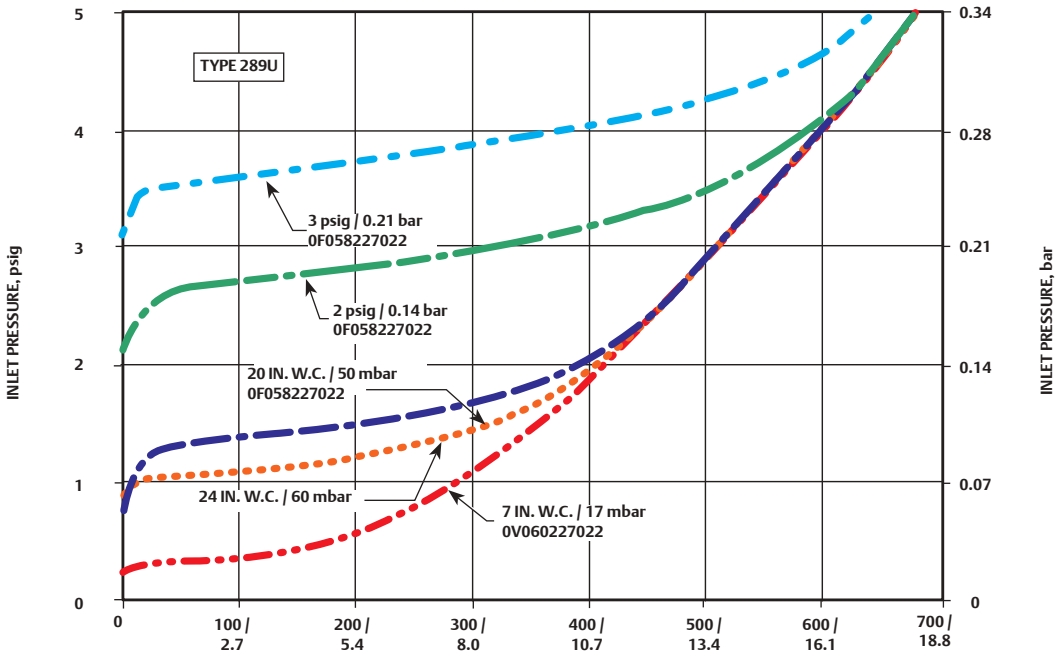
Figure 7. *Type 289L Capacities*



CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 psia / 1.01325 bar AND 60°F / 0°C

NOTE:
1. WHEN SELECTING ANY RELIEF VALVE FOR INSTALLATION DOWNSTREAM OF THE REGULATOR, THE CAPACITY OF THE RELIEF VALVE SHOULD BE COMPARED WITH THE WIDE-OPEN CAPACITY OF THE REGULATOR.
2. BUBBLE POINT RELIEF SETTING AND SPRING PART NUMBER ARE NOTED ON EACH CURVE.
3. TO CONVERT TO EQUIVALENT CAPACITIES OF OTHER GASES, MULTIPLY VALUES OBTAINED FROM CURVE BY THE FOLLOWING FACTORS: AIR = 0.78, PROPANE = 0.628, BUTANE = 0.548, NITROGEN = 0.789.

Figure 8. *Type 289HH Capacities*



CAPACITIES IN THOUSANDS OF CUBIC FEET PER HOUR / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS AT 14.7 psia / 1.01325 bar AND 60°F / 0°C

NOTE:
1. WHEN SELECTING ANY RELIEF VALVE FOR INSTALLATION DOWNSTREAM OF THE REGULATOR, THE CAPACITY OF THE RELIEF VALVE SHOULD BE COMPARED WITH THE WIDE-OPEN CAPACITY OF THE REGULATOR.
2. BUBBLE POINT RELIEF SETTING AND SPRING PART NUMBER ARE NOTED ON EACH CURVE.
3. TO CONVERT TO EQUIVALENT CAPACITIES OF OTHER GASES, MULTIPLY VALUES OBTAINED FROM CURVE BY THE FOLLOWING FACTORS: AIR = 0.78, PROPANE = 0.628, BUTANE = 0.548, NITROGEN = 0.789.

Figure 9. *Type 289U Capacities*

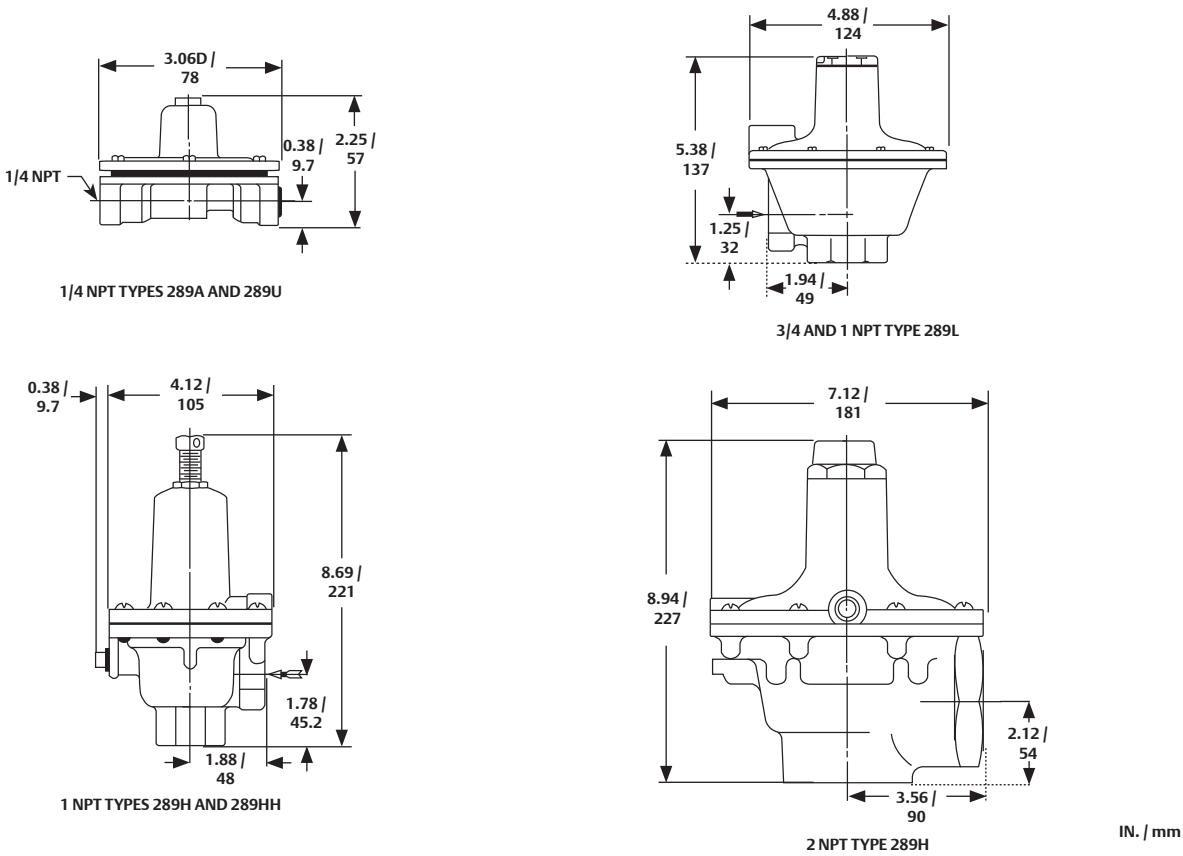


Figure 10. *Dimensions*

Table 4. Shipping Weight

TYPE	BODY SIZE, NPS	APPROXIMATE SHIPPING WEIGHT	
		lb	kg
289A and 289U	1/4	0.75	0.3
289H	1	4	2
	2	15	7
289HH	1	4	2
289L	3/4 or 1	15	7

Ordering Guide

Type, Body Size and Material (Select One)

Type 289A
- ☐ 1/4 NPT, Zinc***

Type 289H
- ☐ 1 NPT Aluminum***
- ☐ 2 NPT Cast iron with aluminum spring case***

Type 289HH
- ☐ 1 NPT Aluminum***

Type 289L
- ☐ 3/4 NPT Aluminum***
- ☐ 1 NPT Aluminum***

Type 289U
- ☐ 1/4 NPT, Zinc***

Relief Set Pressure Range (Select One)

Type 289A
- ☐ 3 to 13 psig / 0.21 to 0.90 bar***
- ☐ 11 to 22 psig / 0.76 to 1.5 bar***

Type 289H, 1 NPT
- ☐ 1 to 4.5 psig / 0.07 to 0.31 bar***
- ☐ 4 to 15 psig / 0.28 to 1.0 bar***
- ☐ 10 to 20 psig / 0.69 to 1.4 bar***
- ☐ 15 to 50 psig / 1.0 to 3.4 bar***

- continued -

Ordering Guide (continued)

Relief Set Pressure Range (Select One) (continued)
Type 289H, 2 NPT
☐ 7 to 18 in. w.c. / 17 to 45 mbar***
☐ 0.5 to 2.25 psig / 0.03 to 0.16 bar***
☐ 1.75 to 7 psig / 0.12 to 0.48 bar***
☐ 4 to 10 psig / 0.28 to 0.69 bar***
Type 289HH
☐ 45 to 75 psig / 3.1 to 5.2 bar***
Type 289L
☐ 10 to 18 in. w.c. / 25 to 45 mbar***
☐ 12 to 40 in. w.c. / 30 to 99 mbar***
Type 289U
☐ 5 to 25 in. w.c. / 12 to 62 mbar***
☐ 20 in. w.c. to 3 psig / 50 to 207 mbar***

Replacement Parts Kit (Optional)
☐ Yes, send one replacement parts kit to match this order

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
☐ Relief Valve ☐ Backpressure Regulator
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

When using relief valves, be sure to remember that the reseat point is lower than the start-to-bubble point. To avoid seepage, keep the relief valve setpoint far enough above the regulator setpoint.

Introduction

Type 289P is an accurate, low-cost, pilot-operated relief valve. This relief valve is suitable for service on natural gas, air, propane and other operating media compatible with the internal parts. The external control line provides quick, accurate pressure registration. Pilot operation requires very little buildup over set pressure to completely open the main valve for maximum relief capacity.

Body Sizes and End Connection Style

1 or 2 NPT

Flow and Sizing Coefficients

See Table 7

Maximum Relief (Inlet) Pressures

1 NPT: 50 psig / 3.4 bar over relief pressure setting or 110 psig / 7.6 bar, whichever is lower

2 NPT: 15 psig / 1.0 bar

Set Pressure Range

1 NPT: 10 to 100 psig / 0.69 to 6.9 bar

2 NPT: 14 in. w.c. to 10 psig / 35 mbar to 0.69 bar

See Table 4

Pressure Registration

External

Temperature Capabilities

With Nitrile (NBR):
-20 to 180°F / -29 to 82°C

With Fluorocarbon (FKM):
0 to 300°F / -18 to 149°C

Approximate Weights

1 NPT: 5 lbs / 2.3 kg

2 NPT: 15 lbs / 6.8 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Fast Reseat After Operation**
- **Economical**
- **High Relief Capacity With Low Buildup**
- **Accurate**
- **Fast Reseat After Operation**
- **Ease of Maintenance**
- **Rugged Construction**
- **Power Paint Coating**
- **Corrosion Resistant Fasteners**
- **Full Usable Capacity**



W6834

Figure 1. *1 NPT Type 289P Pilot-Operated Relief Valve*



W3167_3

Figure 2. *2 NPT Type 289P Pilot-Operated Relief Valve*

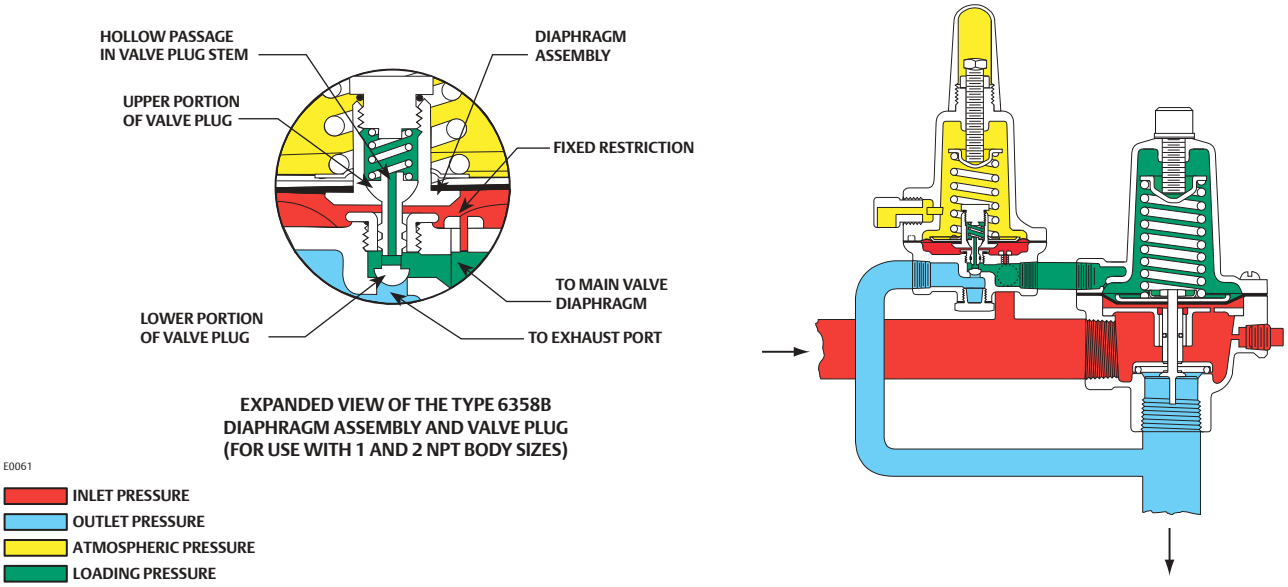


Figure 3. *1 NPT Body Type 289P with Type 6358B Pilot Operational Schematic*

Type 289P
Relief Valve/Backpressure Regulator

FISHER

Table 1. Main Valve Construction Material

BODY SIZE	BODY	SPRING CASE	DIAPHRAGM AND O-RING	PITOT TUBE OR STEM	STEM GUIDE
1 NPT	Aluminum	Aluminum	Nitrile (NBR) or Fluorocarbon (FKM)	Aluminum	Brass and Stainless steel, Zinc and brass
2 NPT	Cast iron	Aluminum	Nitrile (NBR)	Brass	Cast iron and Brass

Table 2. Type 6358B Pilot Construction Material

BODY AND SPRING CASE	VALVE PLUG AND STEM	DIAPHRAGM	PILOT SPRING
Aluminum	Nitrile (NBR) or Fluorocarbon (FKM) and Stainless steel	Nitrile (NBR) or Fluorocarbon (FKM)	Steel

Table 3. Type 6365 Pilot Construction Material

BODY AND SPRING CASE	DIAPHRAGM	STEM GUIDE	SPRING
Aluminum	Nitrile (NBR)	416 Stainless steel	Steel

Table 4. Relief Set Pressure and Pilot Control Spring Information

MAIN VALVE BODY SIZE	PILOT TYPE	RELIEF SET PRESSURE RANGE		PILOT CONTROL SPRING INFORMATION					
		psig	bar	Part Number	Color	Wire Diameter		Free Length	
						In.	mm	In.	mm
1 NPT	6358B	10 to 18 18 to 30 30 to 100	0.69 to 1.2 1.2 to 2.1 2.1 to 6.9	1B986027212 1B788327022 1K748527202	Green Unpainted Red	0.120 0.142 0.187	3.05 3.61 4.75	2.13	54.1
2 NPT	6365	14 in. w.c. to 2 psig	35 mbar to 0.14 bar	14A9672X012	Yellow	0.070	1.78		
	6358B	2 to 10	0.14 to 0.69	14A9673X012	Black	0.102	2.59		

Table 5. Capacities for 1 NPT Main Valve Body and Type 6358B Pilot Information

MAIN VALVE SPRING, PART NUMBER AND COLOR	SET PRESSURE RANGE		SET PRESSURE[1]		BUILDUP OVER SET PRESSURE TO BEGIN OPENING MAIN VALVE[2]		BUILDUP OVER SET PRESSURE TO FULLY OPEN MAIN VALVE[3]		PRESSURE DROP BELOW SET PRESSURE TO RESEAT PILOT		CAPACITIES OF 0.6 SPECIFIC GRAVITY NATURAL GAS[4]	
	psig	bar	psig	bar	psig	bar	psig	bar	psi	bar	SCFH	Nm^3/h
For set pressures up to 30 psig / 2.1 bar 1F826927052 Pink	10 to 18	0.69 to 1.2	10 15 18	0.69 1.0 1.2	0.8	0.05	1.0	0.07	1.0	0.07	23,000 29,000 32,000	616 777 858
	18 to 30	1.2 to 2.1	18 25 30	1.2 1.7 2.1	0.9	0.06	1.2	0.08	1.0	0.07	32,000 39,000 44,000	858 1045 1179
For set pressures over 30 psig / 2.1 bar 1D892327022 Red	30 to 100	2.1 to 6.9	30 40 50 60	2.1 2.8 3.4 4.1	1.4	0.10	1.9	0.13	1.0	0.07	44,000 54,000 64,000 73,000	1179 1447 1715 1956
			70 80 90 100	4.8 5.5 6.2 6.9	1.6	0.11	2.1	0.15	1.0	0.07	83,000 92,000 102,000 111,000	2224 2466 2734 2975

1. Set pressure is defined as the pressure at which the pilot exhaust starts-to-bubble (discharge).
2. Crack pressure is the inlet pressure at which the main valve starts audible flow.
3. Inlet pressure buildup over the set pressure to achieve wide-open capacity.
4. Capacities with inlet piping equal to body size and without outlet piping.

Table 6. Capacities for 2 NPT Main Valve Body and Types 6365 and 6358B Pilot Information

PILOT TYPE	RELIEF SET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	SET PRESSURE[1]		BUILDUP OVER SET PRESSURE TO FULLY OPEN MAIN VALVE[2]		PRESSURE DROP BELOW SET PRESSURE TO RESEAT PILOT		CAPACITIES OF 0.6 SPECIFIC GRAVITY NATURAL GAS[3]	
		psig	bar	psig	mbar	psi	mbar	SCFH	Nm^3/h
6365	14 in. w.c. to 2 psig / 35 mbar to 0.14 bar 14A9672X012 Yellow	0.5 1.0 1.5 2.0	0.03 0.07 0.10 0.14	0.25	17	0.25	17	18,700 24,000 28,400 32,100	501 643 761 860
6358B	2 to 10 psig / 0.14 to 0.69 bar 14A9673X012 Black	2.0 4.0 6.0 8.0 10.0	0.14 0.28 0.41 0.55 0.69	0.30	21	0.30	21	32,500 44,300 53,700 62,000 69,500	871 1187 1439 1662 1863

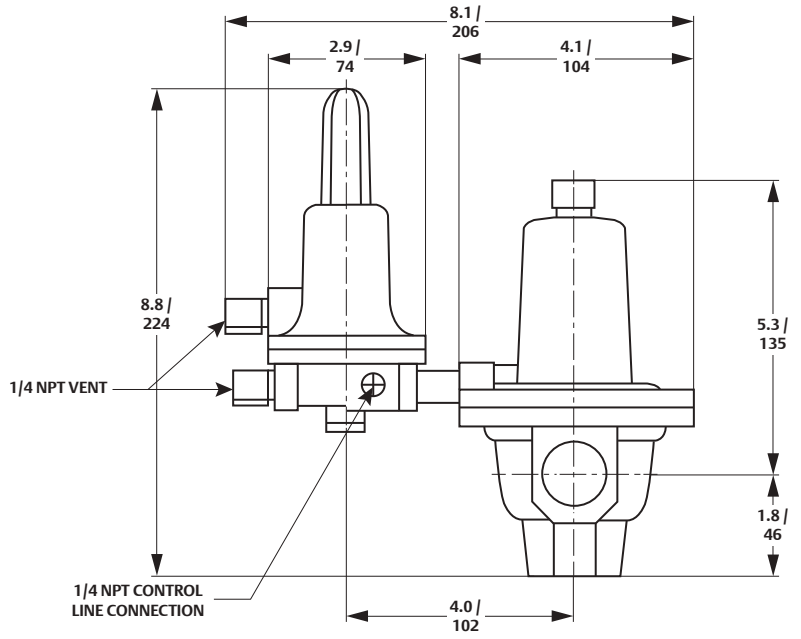
1. Set pressure is defined as the pressure at which the pilot exhaust starts-to-bubble (discharge).
2. Inlet pressure buildup over the set pressure to achieve wide-open capacity.
3. Capacities with inlet piping equal to body size and without outlet piping.

Table 7. Flow and Sizing Coefficient

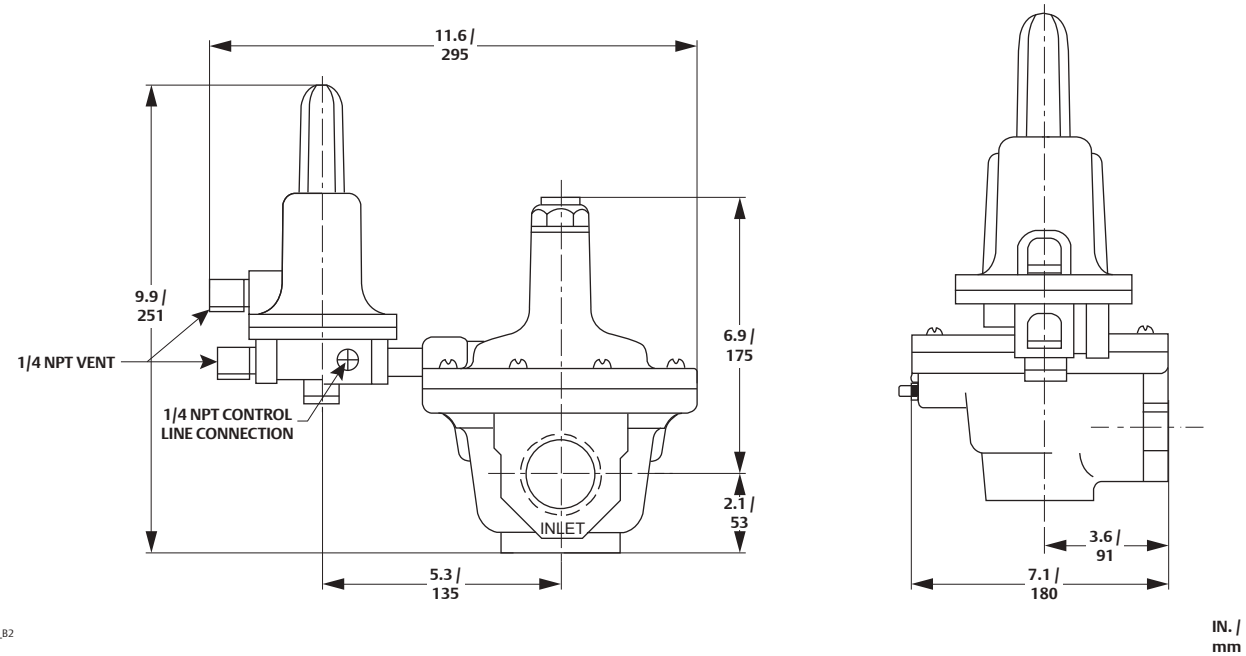
MAIN VALVE BODY SIZE	LINE SIZE EQUALS BODY SIZE		2:1 LINE SIZE TO BODY SIZE PIPING		C_1	IEC SIZING COEFFICIENT		
	C_g	C_v	C_g	C_v		X_T	F_D	F_L
1 NPT	740	23.1	2290	73.4	32	0.648	0.50	0.89
2 NPT	560	17.5	2050	65.7	31.2	0.616		

Note: Wide-open flow coefficients without outlet piping and outlet screen.

EMERSON
Process Management



1 NPT BODY SIZE



2 NPT BODY SIZE

Figure 4. *Type 289P-6365 Dimensions*

Ordering Guide

1 NPT Type 289P

Main Valve Diaphragm (Select One)
- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Main Valve O-rings (Select One)
- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Main Valve Stem Guide Assembly (Select One)
- ☐ Brass with Stainless steel bushing **(standard)** * * *
- ☐ Zinc with brass bushing * *

Relief Set Pressure Range (Select One)
- ☐ 10 to 18 psig / 0.69 to 1.2 bar, Green * * *
- ☐ 18 to 30 psig / 1.2 to 2.1 bar, Unpainted * * *
- ☐ 30 to 100 psig / 2.1 to 6.9 bar, Red * * *

Pilot Valve Plug and Stem (Select One)
- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Pilot Diaphragm (Select One)
- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Pilot O-rings and Gaskets (Select One)
- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Main Valve Replacement Parts Kit (Optional)
- ☐ Yes, send one replacement parts kit to match this order.

Pilot Replacement Parts Kit (Optional)
- ☐ Yes, send one replacement parts kit to match this order.

2 NPT Type 289P

Relief Set Pressure Range (Select One)

Type 6365 Pilot
- ☐ 14 in. w.c. to 2 psig / 35 mbar to 0.14 bar, Yellow * * *

Type 6358B Pilot
- ☐ 2 to 10 psig / 0.14 to 0.69 bar, Black * * *

Type 6358B Pilot Valve Plug and Stem (Select One)
- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Type 6358B Pilot Diaphragm (Select One)
- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Type 6358B Pilot O-rings and Gaskets (Select One)
- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Main Valve Replacement Parts Kit (Optional)
- ☐ Yes, send one replacement parts kit to match this order.

Pilot Replacement Parts Kit (Optional)
- ☐ Yes, send one replacement parts kit to match this order.

Ordering Guide (continued)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
☐ Relief Valve ☐ Backpressure Regulator
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Diaphragms leak a small amount due to migration of gas through the diaphragm material. To allow escape of this gas, be sure casing vents (where provided) remain open.

299H Series

Pressure Reducing Regulators

FISHER

Introduction

The 299H Series pressure reducing regulators provide a broad capacity of controlled pressure ranges and capacities in a wide variety of distribution, industrial and commercial applications. A 299H Series regulator has a pilot integrally mounted to the actuator casing. The 299H Series regulators can handle inlet pressures up to 175 psig / 12.1 bar depending on orifice size.

The integral token relief on the Types 299HR and 299HSR regulators is located in the pilot and alerts you to an increase in downstream pressure beyond the regulator setpoint.

The Type 299HS provides overpressure or overpressure and underpressure protection by completely shutting off the flow of gas to the downstream system. It comes with a Type VSX-2 slam-shut device which can be configured for Ovepressure Shutoff (OPSO) or Overpressure and Underpressure Shutoff (OPSO/UPSO). The slam-shut device's actions are independent of the main valve and of variations to the inlet pressure. The Type VSX-2 slam-shut device has internal or external registration. External registration requires a downstream sensing line.

Body Size and End Connection Styles

See Table 1

Maximum Operating Inlet Pressure by Orifice Size

175 psig / 12.1 bar
See Table 3

Maximum Casing and Emergency Outlet Pressure

66 psig / 4.5 bar

Outlet (Control) Pressure Ranges[1]

See Table 2

Maximum Set Pressure for Type 299HS

16 psig / 1.1 bar

Maximum Set Pressure for Slam-Shut Device

23 psig / 1.6 bar

Minimum and Maximum Trip Pressure Ranges

See Table 6

Flow Coefficients

See Table 5

Flow Capacities

See Tables 7 through 12

Minimum Differential Pressure For Full stroke

1.5 psid / 0.10 bar d

Temperature Capabilities

-20 to 150°F / -29 to 66°C

Approximate Weight

21 lbs / 10 kg

Pressure Registration

Internal, External or Dual Registration
See Figures 3 and 4

Fixed Restriction Sizes

0.044 In. / 1.1 mm, Red (standard gain)
0.071 In. / 1.8 mm, Green (low gain)
0.082 In. / 2.1 mm, Blue (lower gain)

Options

- Filter[2]: A P590 Series filter installed in the pilot supply tubing between main body and pilot
- Filtered pilot supply regulator(2)(3): A Type 67CF supply regulator with integral 5 micron Polyethylene filter

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com



W7513

Figure 1. *299H Series Pressure Reducing Regulators*



W7728

Figure 2. *Type 299HS Pressure Reducing Regulator with Type VSX-2 Slam-Shut Device*

Features

- **Compact size**
- **Unique no Bleed Monitor system**
- **±1% accuracy for Fixed Factor Billing (PFM)**
- **Wide Variety of applications**
- **Economical, labor-saving Installation**
- **High-Capacity pressure Control**
- **Easy registration conversion**

1. For optimum performance, a pilot supply regulator may be installed in the pilot supply tubing between the main valve and pilot.
2. A pilot supply regulator or a P590 Series filter (only one may be used, not both) may be ordered with the Type 299H, but not both.
3. For In. w.c., use a pilot supply regulator if actual inlet pressure varies more than ±20 psi / ±1.4 bar and published accuracy is required.

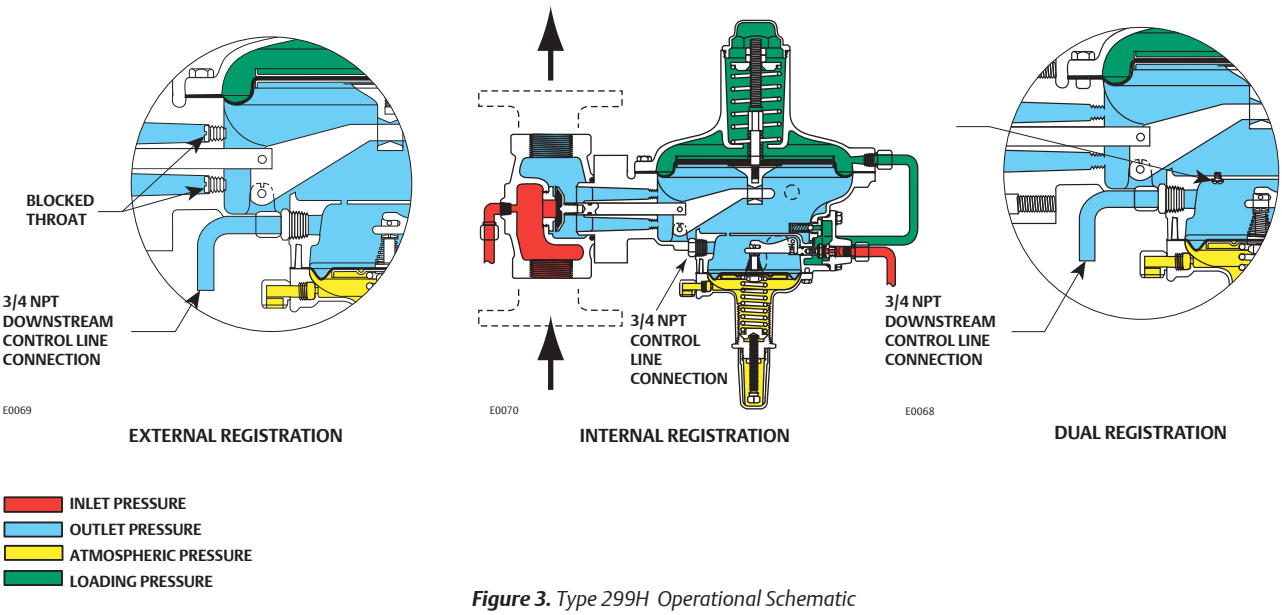


Figure 3. *Type 299H Operational Schematic*

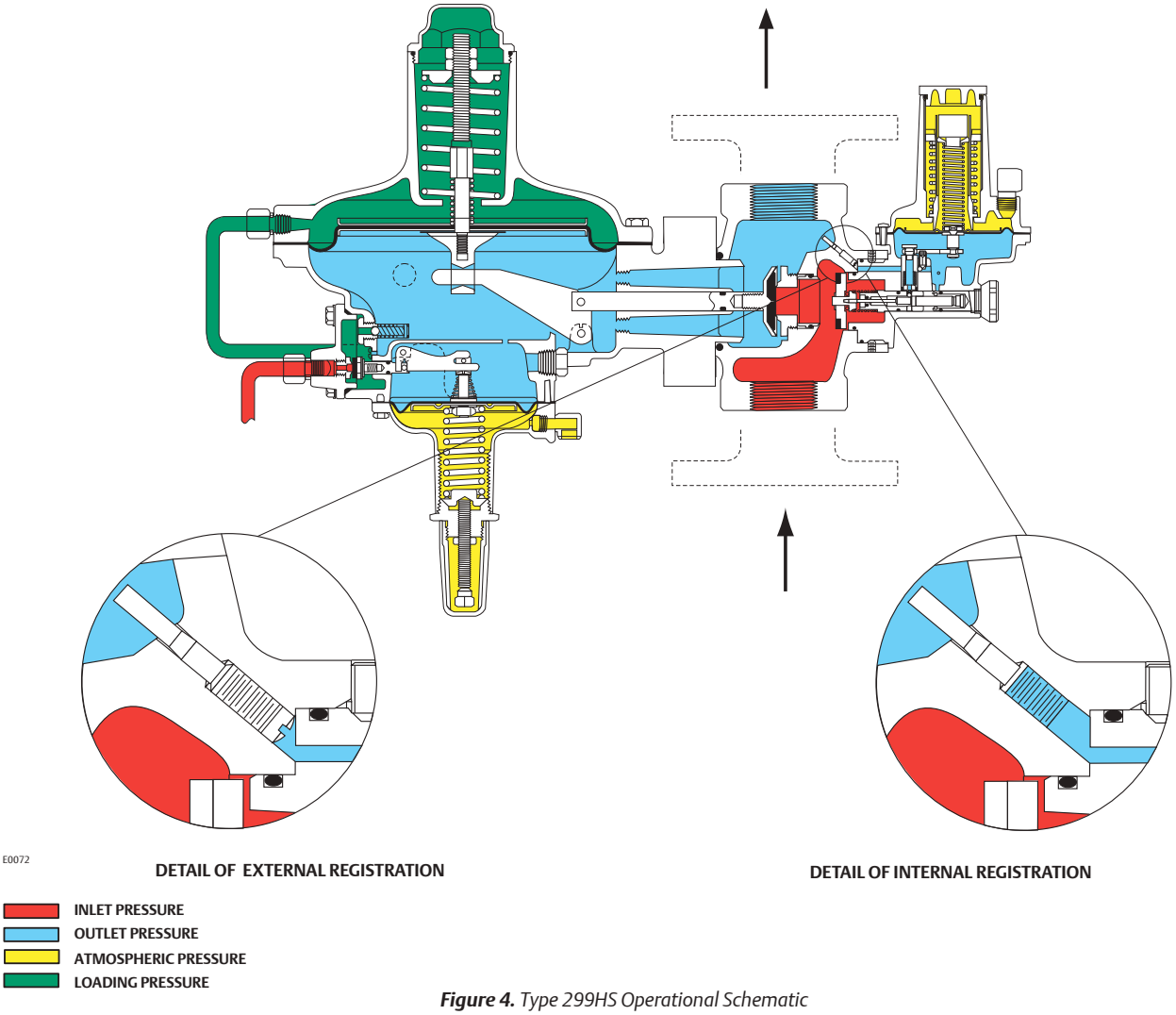


Figure 4. *Type 299HS Operational Schematic*

Table 1. Body Size and End Connection Style

BODY SIZE, NPS / DN	BODY MATERIAL AND END CONNECTION STYLE		
	Cast Iron (For Types 299H and 299HR only)	Ductile Iron	Steel (For Types 299H and 299HR only)
1-1/4	NPT	----	----
1-1/2	NPT	NPT	NPT
2 / 50	NPT, CL125 FF Flanged(1)	NPT, CL125 FF and CL250 RF Flanged, PN 10/16 Flanged	NPT, CL150 RF Flanged

1. This flange is available with a face-to-face dimension of 7.5 or 10 In. / 191 or 254 mm.

Table 2. Main Valve Construction Material

VALVE BODY	ACTUATOR CASING AND PILOT SPRING CASE	DIAPHRAGM, DISK AND O-RING	ORIFICE, VALVE STEM AND DISK HOLDER	TUBING AND FITTING
Cast iron, Ductile iron or Steel	Aluminum	Nitrile (NBR)	Aluminum	Stainless steel tubing with steel fittings (**Standard**) or Stainless steel tubing and fittings

Table 3. Maximum Operating Inlet Pressure(1)

ORIFICE SIZE		MAXIMUM OPERATING INLET PRESSURE	
In.	mm	psig	bar
1/4 x 3/8	6.4 x 9.5	175	12.1
3/8	9.5	175	12.1
1/2	13	175	12.1
3/4	19	150	10.3

1. The pressure/temperature limits in this document and any applicable standard or code limitation should not be exceeded.

Table 4. Outlet Pressure Range

OUTLET (CONTROL) PRESSURE RANGE		TYPE		PILOT CONTROL SPRING					
						Free Length		Wire Diameter	
In. w.c.	mbar	299H	299HR, 299HS and 299HSR	Part Number	Color	In.	mm	In.	mm
3.5 to 6(1)	9 to 15(1)	X	X	T13707T0012	Black	1.86	47.2	0.055	1.40
5 to 9(1)	12 to 22(1)	X	X	T13589T0012	Yellow	2.05	52.1	0.051	1.30
7 to 20(1)	17 to 50(1)	X	X	1N3112X0012	Unpainted	2.18	55.4	0.075	1.90
16 to 40(1)	40 to 99(1)	X	X	1B413727222	Purple	2.12	53.8	0.092	2.34
1 to 3.25 psig	69 mbar to 0.22 bar	X	X	T13593T0012	Light blue	2.12	53.8	0.105	2.67
2.75 to 6 psig	0.19 to 0.41 bar	X	X	T13671T0012	Orange	2.40	61.0	0.120	3.05
5 to 16 psig	0.34 to 1.1 bar	X	X	T13600T0012	Red	2.10	53.3	0.142	3.61
14 to 35 psig	0.97 to 2.4 bar	X	----	19B0432X012	Zinc	2.15	54.6	0.207	5.26
30 to 60 psig	2.1 to 4.1 bar	X	----	19B0432X022	Green	2.75	69.8	0.225	5.71

1. Use a pilot supply regulator if actual inlet pressure varies more than ±20 psi / ±1.4 bar and the published accuracy is required.

Table 5. Flow Coefficient

TYPE	ORIFICE DIAMETER		WIDE-OPEN		REGULATING(1)		C_1 WHEN $\Delta P < 10$ psi / 0.69 bar	C_1 WHEN $\Delta P > 10$ psi / 0.69 bar
	In.	mm	C_g	C_v	C_g	C_v		
299H / 299HR	1/4 x 3/8	6.4 x 9.5	53	2.0	50	1.9	26	26
	3/8	9.5	117	4.2	115	4.0	30	28
	1/2	13	203	7.0	200	6.9	30	28
	3/4	19	437	14.1	430	13.9	32	30
	7/8	22	544	16.5	534	16.2	34	32
	1	25	725	20.7	710	20.3	36	34
	1-3/16	30	910	25.3	885	24.6	37	35
299HS / 299HSR	1/4 x 3/8	6.4 x 9.5	53	2.0	50	1.9	26	26
	3/8	9.5	117	4.1	115	4.0	30	28
	1/2	13	184	5.0	180	4.9	38	36
	3/4	19	421	11.9	415	11.7	36	35

1. For external/dual registration only.

Table 6. Type VSX-2 High and Low Trip Pressure Range

RANGE	SLAM-SHUT REGISTRATION	FOR USE WITH MAIN VALVE SPRING RANGE		MINIMUM TO MAXIMUM TRIP PRESSURE		SPRING FREE LENGTH		SPRING WIRE DIAMETER	
		In. w.c.	mbar	In. w.c.	mbar	In.	mm	In.	mm
High Pressure Trip	Internal or External	3.5 to 6	9 to 15	12 to 25	30 to 62	3.15	80.0	0.07	1.70
		5 to 9	12 to 22						
		3.5 to 6	9 to 15	20 to 52	50 to 129	3.15	80.0	0.08	2.03
		5 to 9	12 to 22						
		7 to 20	17 to 50						
		7 to 20	17 to 50	1.4 to 3.9 psig	97 to 269	3.15	80.0	0.09	2.31
		16 to 40	40 to 99						
		16 to 40	40 to 99	3.8 to 8.7 psig	262 to 600	3.15	80.0	0.12	3.05
		1 to 3.25 psig	69 mbar to 0.22 bar						
		2.75 to 6 psig	0.19 to 0.41 bar						
		2.75 to 6 psig	0.19 to 0.41 bar	5.8 to 16 psig	400 to 1103	3.15	80.0	0.14	3.51
		5 to 16 psig	0.34 to 1.1 bar						
		5 to 16 psig	0.34 to 1.1 bar	11.6 to 23 psig	800 to 1586	3.15	80.0	0.17	4.32
Low Pressure Trip	External	5 to 9	12 to 22	2 to 12	5 to 30	3.15	80.0	0.04	1.09
		7 to 20	17 to 50						
		7 to 20	17 to 50	4 to 30	10 to 75	3.15	80.0	0.06	1.40
		16 to 40	40 to 99						
		1 to 3.25 psig	69 mbar to 0.22 bar	0.36 to 2.3 psig	25 to 159	3.15	80.0	0.07	1.70
		2.75 to 6 psig	0.19 to 0.41 bar						
		2.75 to 6 psig	0.19 to 0.41 bar	1.5 to 10.8 psig	103 to 745	3.15	80.0	0.13	3.17
		5 to 16 psig	0.34 to 1.1 bar						
Low Pressure Trip	Internal	5 to 9[1]	12 to 22[1]	----	----	----	----	----	----
		7 to 20[1]	17 to 50[1]						
		7 to 20[1]	17 to 50[1]						
		16 to 40[1]	40 to 99[1]						
		1 to 3.25 psig[2]	69 mbar to 0.22 bar[2]	70% of regulator setpoint to 2.3 psig	70% of regulator setpoint to 159 mbar	3.15	80.0	0.07	1.70
		2.75 to 6 psig[2]	0.19 to 0.41 bar[2]						
		2.75 to 6 psig[2]	0.19 to 0.4 1 bar[2]	70% of regulator setpoint to 10.8 psig	70% of regulator setpoint to 745 mbar	3.15	80.0	0.13	3.17
		5 to 16 psig[3]	0.34 to 1.1 bar[3]	75% of regulator setpoint to 10.8 psig	75% of regulator setpoint to 745 mbar	3.15	80.0	0.13	3.17

1. Low Pressure Trip cannot be used with this main valve spring range for an internally registered Type VSX-2 to provide underpressure shutoff under flowing conditions. If protection against loss of inlet pressure is the only required function for the Type VSX-2 then an internally registered Type VSX-2 may be used with the same minimum trip pressures as an externally registered Type VSX-2.
2. 70% of regulator setpoint is the minimum allowable Low Pressure Trip setting for an internally registered Type VSX-2 used with this main valve spring range. If protection against loss of inlet pressure is the only required function for the Type VSX-2 then an internally registered Type VSX-2 may be used with the same minimum trip pressures as an externally registered Type VSX-2.
3. 75% of regulator setpoint is the minimum allowable Low Pressure Trip setting for an internally registered VSX-2 used with this main valve spring range. If protection against loss of inlet pressure is the only required function for the Type VSX-2 then an internally registered Type VSX-2 may be used with the same minimum trip pressures as an externally registered Type VSX-2.

Note: Other spring combinations are available. Please contact your local Sales Office for additional information.

Table 7. Types 299H and 299HR Flow Capacities(1) for 1-1/2 NPT and NPS 2 / DN 50 External/Dual Registration

OUTLET PRESSURE RANGE, SETTING, ACCURACY, SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
			Orifice Size, In. / mm													
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19		7/8 / 22		1 / 25		1-3/16 / 30	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
3.5 to 6 In. w.c. / 9 to 15 mbar 3.5 In. w.c. / 9 mbar -1 to 2 In. w.c. / -2 to 5 mbar T13707T0012 Black	2	0.14	760	20.4	1560	41.8	2700	72.4	5490	147	6460	173	8170	219	9940	266
	5	0.34	1160	31.1	2460	65.9	4270	114	8790	236	10,350	277	13,310	357	16,250	436
	10	0.69	1590	42.6	3580	95.9	6230	167	13,060	350	15,270	409	20,300	544	24,900	667
	15	1.0	1920	51.4	4410	118	7670	206	16,480	442	19,450	521	25,780	691	31,730	850
	20	1.4	2240	60.0	5150	138	8960	240	19,250	516	24,110	646	31,790	852	39,620	1062
	25	1.7	2570	68.9	5890	158	10,250	275	22,030	590	27,110	727	36,370	975	45,330	1215
	30	2.1	2890	77.4	6640	178	11,540	309	24,800	665	31,110	834	40,950	1097	51,040	1368
	40	2.8	3530	94.6	8120	218	14,120	378	30,350	813	38,100	1021	50,100	1343	62,450	1674
	50	3.4	4180	112	9600	257	16,700	448	35,890	962	44,100	1182	59,260	1588	73,870	1980
	60	4.1	4820	129	11,090	297	19,280	517	41,440	1111	51,090	1369	68,420	1834	85,290	2286
	80	5.5	6110	164	14,050	377	24,440	655	52,540	1408	65,080	1744	86,740	2325	108,120	2898
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816		
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574				
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448						
	175	12.1	12,240	328	28,150	754	48,950	1312								
5 to 9 In. w.c. / 12 to 22 mbar 7 In. w.c. / 17 mbar -1 to 2 In. w.c. / -2 to 5 mbar T13589T0012 Yellow	2	0.14	750	20.1	1520	40.7	2650	71.0	5380	144	6270	168	8000	214	9730	261
	5	0.34	1160	31.1	2440	65.4	4240	114	8730	234	10,250	275	13,220	354	16,130	432
	10	0.69	1590	42.6	3580	95.9	6220	167	13,040	349	15,220	408	20,250	543	24,830	665
	15	1.0	1920	51.4	4410	118	7670	206	16,480	442	19,420	520	25,750	690	31,690	849
	20	1.4	2240	60.0	5150	138	8960	240	19,250	516	24,110	646	31,790	852	39,620	1062
	25	1.7	2570	68.9	5890	158	10,250	275	22,030	590	27,110	727	36,370	975	45,330	1215
	30	2.1	2890	77.4	6640	178	11,540	309	24,800	665	31,110	834	40,950	1097	51,040	1368
	40	2.8	3530	94.6	8120	218	14,120	378	30,350	813	38,100	1021	50,100	1343	62,450	1674
	50	3.4	4180	112	9600	257	16,700	448	35,890	962	44,100	1182	59,260	1588	73,870	1980
	60	4.1	4820	129	11,090	297	19,280	517	41,440	1111	51,090	1369	68,420	1834	85,290	2286
	80	5.5	6110	164	14,050	377	24,440	655	52,540	1408	65,080	1744	86,740	2325	108,120	2898
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816		
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574				
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448						
	175	12.1	12,240	328	28,150	754	48,950	1312								
7 to 20 In. w.c. / 17 to 50 mbar 14 In. w.c. / 35 mbar ±2 In. w.c./ ±5 mbar 1N3112X0012 Unpainted	2	0.14	700	18.8	1430	38.3	2480	66.5	5040	135	5850	157	7480	200	9090	244
	5	0.34	1140	30.5	2400	64.3	4170	112	8570	230	10,040	269	12,950	347	15,800	423
	10	0.69	1580	42.3	3560	95.4	6190	166	12,970	348	15,110	405	20,110	539	24,640	660
	15	1.0	1920	51.4	4410	118	7670	206	16,480	442	19,350	519	25,660	688	31,560	846
	20	1.4	2240	60.0	5150	138	8960	240	19,250	516	24,110	646	31,790	852	39,620	1062
	25	1.7	2570	68.9	5890	158	10,250	275	22,030	590	27,110	727	36,370	975	45,330	1215
	30	2.1	2890	77.4	6640	178	11,540	309	24,800	665	31,110	834	40,950	1097	51,040	1368
	40	2.8	3530	94.6	8120	218	14,120	378	30,350	813	38,100	1021	50,100	1343	62,450	1674
	50	3.4	4180	112	9600	257	16,700	448	35,890	962	44,100	1182	59,260	1588	73,870	1980
	60	4.1	4820	129	11,090	297	19,280	517	41,440	1111	51,090	1369	68,420	1834	85,290	2286
	80	5.5	6110	164	14,050	377	24,440	655	52,540	1408	65,080	1744	86,740	2325	108,120	2898
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816		
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574				
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448						
	175	12.1	12,240	328	28,150	754	48,950	1312								
16 to 40 In. w.c. / 40 to 99 mbar 28 In. w.c. / 70 mbar ±4 In. w.c. / ±10 mbar 1B413727222 Purple	5	0.34	1110	29.7	2320	62.2	4020	108	8250	221	9580	257	12,430	333	15,150	406
	10	0.69	1570	42.1	3530	94.6	6140	165	12,830	344	14,870	399	19,830	531	24,290	651
	15	1.0	1920	51.4	4410	118	7670	206	16,170	433	19,220	515	25,480	683	31,320	839
	20	1.4	2240	60.0	5150	138	8960	240	19,250	516	24,110	646	30,670	822	37,820	1014
	25	1.7	2570	68.9	5890	158	10,250	275	22,030	590	27,110	727	36,370	975	45,330	1215
	30	2.1	2890	77.4	6640	178	11,540	309	24,800	665	31,110	834	40,950	1097	51,040	1368
	40	2.8	3530	94.6	8120	218	14,120	378	30,350	813	38,100	1021	50,100	1343	62,450	1674
	50	3.4	4180	112	9600	257	16,700	448	35,890	962	44,100	1182	59,260	1588	73,870	1980
	60	4.1	4820	129	11,090	297	19,280	517	41,440	1111	51,090	1369	68,420	1834	85,290	2286
	80	5.5	6110	164	14,050	377	24,440	655	52,540	1408	65,080	1744	86,740	2325	108,120	2898
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816		
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574				
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448						
	175	12.1	12,240	328	28,150	754	48,950	1312								

1. Downstream piping may affect actual capacity. It may be necessary to use enlarged downstream piping to obtain published capacities.
□ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

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Table 7. Types 299H and 299HR Flow Capacities[1] for 1-1/2 NPT and NPS 2 / DN 50 External/Dual Registration (continued)

OUTLET PRESSURE RANGE, SETTING, ACCURACY, SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS												
			Orifice Size, In. / mm												
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19		7/8 / 22		1 / 25		1-3/16 / 30
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH
1 to 3.25 psig / 69 mbar to 0.22 bar 2 psig / 0.14 bar ±1% psia / bar T13593T0012 Light Blue	5	0.34	1020	27.3	2100	56.4	3640	97.5	7440	199	8650	232	11,140	299	13,560
	10	0.69	1550	41.5	3340	89.5	5810	156	12,040	323	14,410	386	18,460	495	22,570
	15	1.0	1920	51.4	4360	117	7580	203	15,990	429	18,950	508	25,050	671	30,760
	20	1.4	2240	60.0	5150	138	8960	240	19,250	516	24,110	646	30,380	814	37,410
	25	1.7	2570	68.9	5890	158	10,250	275	22,030	590	27,110	727	36,370	975	45,330
	30	2.1	2890	77.4	6640	178	11,540	309	24,800	665	31,110	834	40,950	1097	51,040
	40	2.8	3530	94.6	8120	218	14,120	378	30,350	813	38,100	1021	50,100	1343	62,450
	50	3.4	4180	112	9600	257	16,700	448	35,890	962	44,100	1182	59,260	1588	73,870
	60	4.1	4820	129	11,090	297	19,280	517	41,440	1111	51,090	1369	68,420	1834	85,290
	80	5.5	6110	164	14,050	377	24,440	655	52,540	1408	65,080	1744	86,740	2325	108,120
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816	
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574			
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448					
	175	12.1	12,240	328	28,150	754	48,950	1312							
2.75 to 6 psig / 0.19 to 0.41 bar 5 psig / 0.34 bar ±1% psia / bar T13671T0012 Orange	10	0.69	1390	37.2	2910	78.0	5050	135	10,350	277	12,700	340	15,600	418	19,030
	15	1.0	1870	50.1	4190	112	7280	195	15,150	406	17,950	481	23,310	625	28,530
	20	1.4	2240	60.0	5090	136	8850	237	18,640	500	22,970	616	29,180	782	35,820
	25	1.7	2570	68.9	5890	158	10,250	275	22,030	590	27,110	727	34,550	926	42,530
	30	2.1	2890	77.4	6640	178	11,540	309	24,800	665	31,110	834	40,950	1097	51,040
	40	2.8	3530	94.6	8120	218	14,120	378	30,350	813	38,100	1021	50,100	1343	62,450
	50	3.4	4180	112	9600	257	16,700	448	35,890	962	44,100	1182	59,260	1588	73,870
	60	4.1	4820	129	11,090	297	19,280	517	41,440	1111	51,090	1369	68,420	1834	85,290
	80	5.5	6110	164	14,050	377	24,440	655	52,540	1408	65,080	1744	86,740	2325	108,120
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816	
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574			
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448					
	175	12.1	12,240	328	28,150	754	48,950	1312							
5 to 16 psig / 0.34 to 1.1 bar 10 psig / 0.69 bar ±1% psia / bar T13600T0012 Red	15	1.0	1580	42.3	3280	87.9	5690	152	11,640	312	12,640	339	17,470	468	21,280
	20	1.4	2130	57.1	4720	126	8210	220	17,000	456	20,380	546	25,940	695	31,690
	25	1.7	2540	68.1	5710	153	9930	266	20,790	557	24,570	658	32,220	863	39,480
	30	2.1	2890	77.4	6640	178	11,540	309	24,150	647	29,540	792	37,900	1016	46,550
	40	2.8	3530	94.6	8120	218	14,120	378	30,350	813	38,100	1021	50,100	1343	62,450
	50	3.4	4180	112	9600	257	16,700	448	35,890	962	44,100	1182	59,260	1588	73,870
	60	4.1	4820	129	11,090	297	19,280	517	41,440	1111	51,090	1369	68,420	1834	85,290
	80	5.5	6110	164	14,050	377	24,440	655	52,540	1408	65,080	1744	86,740	2325	108,120
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816	
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574			
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448					
	175	12.1	12,240	328	28,150	754	48,950	1312							
5 to 16 psig / 0.34 to 1.1 bar 15 psig / 1.0 bar ±1% psia / bar T13600T0012 Red	20	1.4	1750	46.9	3620	97.0	6290	169	12,830	344	15,830	424	19,190	514	23,360
	25	1.7	2360	63.2	5220	140	9070	243	18,700	501	22,040	591	28,360	760	34,610
	30	2.1	2820	75.6	6290	169	10,940	293	22,790	611	27,870	747	35,050	939	42,890
	40	2.8	3530	94.6	8120	218	14,120	378	29,650	795	36,530	979	46,610	1249	57,270
	50	3.4	4180	112	9600	257	16,700	448	35,890	962	44,100	1182	57,080	1530	70,350
	60	4.1	4820	129	11,090	297	19,280	517	41,440	1111	51,090	1369	68,420	1834	85,290
	80	5.5	6110	164	14,050	377	24,440	655	52,540	1408	65,080	1744	86,740	2325	108,120
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816	
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574			
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448					
	175	12.1	12,240	328	28,150	754	48,950	1312							
14 to 35 psig / 0.97 to 2.4 bar 20 psig / 1.4 bar ±1% psia / bar 19B0432X012 Zinc	25	1.7	1920	51.4	3930	105	6840	183	13,930	373	14,960	401	20,800	557	25,310
	30	2.1	2580	69.1	5680	152	9870	265	20,280	544	24,090	646	30,630	821	37,340
	40	2.8	3480	93.3	7830	210	13,610	365	28,440	762	34,480	924	43,980	1179	53,880
	50	3.4	4180	112	9600	257	16,700	448	35,140	942	41,940	1124	55,310	1482	67,980
	60	4.1	4820	129	11,090	297	19,280	517	41,440	1111	51,090	1369	65,780	1763	81,060
	80	5.5	6110	164	14,050	377	24,440	655	52,540	1408	65,080	1744	86,740	2325	108,120
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816	
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574			
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448					
	175	12.1	12,240	328	28,150	754	48,950	1312							

1. Downstream piping may affect actual capacity. It may be necessary to use enlarged downstream piping to obtain published capacities.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

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Table 7. Types 299H and 299HR Flow Capacities(1) for 1-1/2 NPT and NPS 2 / DN 50 External/Dual Registration (continued)

OUTLET PRESSURE RANGE, SETTING, ACCURACY, SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
			Orifice Size, In. / mm													
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19		7/8 / 22		1 / 25		1-3/16 / 30	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
14 to 35 psig / 0.97 to 2.4 bar 25 psig / 1.7 bar ±1% psia / bar 19B0432X012 Zinc	30	2.1	2070	55.5	4230	113	7360	197	14,980	401	18,330	491	22,310	598	27,140	727
	40	2.8	3320	89.0	7350	197	12,780	343	26,420	708	32,120	861	40,220	1078	49,120	1316
	50	3.4	4140	111	9340	250	16,250	436	34,040	912	40,400	1083	52,830	1416	64,770	1736
	60	4.1	4820	129	11,090	297	19,280	517	40,630	1089	48,920	1311	64,010	1715	78,690	2109
	80	5.5	6110	164	14,050	377	24,440	655	52,540	1408	65,080	1744	86,740	2325	108,120	2898
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816		
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574				
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448						
	175	12.1	12,240	328	28,150	754	48,950	1312								
14 to 35 psig / 0.97 to 2.4 bar 30 psig / 2.1 bar ±1% psia / bar 19B0432X012 Zinc	40	2.8	2980	79.9	6520	175	11,330	304	23,190	621	27,330	732	34,790	932	42,370	1136
	50	3.4	4020	108	8950	240	15,560	417	32,300	866	37,410	1003	49,460	1326	60,480	1621
	60	4.1	4800	129	10,850	291	18,870	506	39,600	1061	46,980	1259	61,630	1652	75,590	2026
	80	5.5	6110	164	14,050	377	24,440	655	52,540	1408	65,080	1744	83,170	2229	102,470	2746
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816		
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574				
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448						
	175	12.1	12,240	328	28,150	754	48,950	1312								
14 to 35 psig / 0.97 to 2.4 bar 35 psig / 2.4 bar ±1% psia / bar 19B0432X012 Zinc	40	2.8	2350	63.0	4790	128	8330	223	16,920	453	20,530	550	25,150	674	30,580	820
	50	3.4	3770	101	8300	222	14,430	387	29,690	796	34,220	917	44,890	1203	54,750	1467
	60	4.1	4700	126	10,510	282	18,270	490	38,050	1020	44,960	1205	58,520	1568	71,620	1919
	80	5.5	6110	164	14,050	377	24,440	655	51,600	1383	62,470	1674	81,400	2182	100,090	2682
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	79,060	2119	105,060	2816		
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	96,050	2574				
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448						
	175	12.1	12,240	328	28,150	754	48,950	1312								
30 to 60 psig / 2.1 to 4.1 bar 40 psig / 2.8 bar ±1% psia / bar 19B0432X022 Green	50	3.4	3340	89.5	7290	195	12,670	340	25,840	693	30,500	817	38,590	1034	46,950	1258
	60	4.1	4500	121	9970	267	17,340	465	35,820	960	42,700	1144	54,480	1460	66,530	1783
	80	5.5	6100	163	13,840	371	24,070	645	50,670	1358	61,300	1643	79,160	2121	97,160	2604
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	77,250	2070	100,560	2695		
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	95,700	2565				
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448						
	175	12.1	12,240	328	28,150	754	48,950	1312								
30 to 60 psig / 2.1 to 4.1 bar 50 psig / 3.4 bar ±1% psia / bar 19B0432X022 Green	60	4.1	3680	98.6	7990	214	13,900	373	28,290	758	33,300	892	42,110	1129	51,210	1372
	80	5.5	5900	158	13,170	353	22,900	614	47,570	1275	57,000	1528	72,950	1955	89,220	2391
	100	6.9	7400	198	16,830	451	29,260	784	61,700	1654	74,800	2005	96,630	2590		
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077	94,400	2530				
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448						
	175	12.1	12,240	328	28,150	754	48,950	1312								
30 to 60 psig / 2.1 to 4.1 bar 60 psig / 4.1 bar ±1% psia / bar 19B0432X022 Green	80	5.5	5380	144	11,810	317	20,540	550	42,160	1130	50,000	1340	63,540	1703	77,440	2075
	100	6.9	7260	195	16,270	436	28,290	758	59,000	1581	70,900	1900	90,970	2438		
	125	8.6	9020	242	20,730	556	35,860	961	75,900	2034	92,300	2474				
	150	10.3	10,630	285	24,440	655	42,500	1139	91,360	2448						
	175	12.1	12,240	328	28,150	754	48,950	1312								

1. Downstream piping may affect actual capacity. It may be necessary to use enlarged downstream piping to obtain published capacities.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

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Table 8. Types 299H and 299HR Flow Capacities(1) for 1-1/2 NPT Internal Registration

OUTLET PRESSURE RANGE, SETTING, ACCURACY, SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
			Orifice Size, In. / mm											
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19		1 / 25		1-3/16 / 30	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
3.5 to 6 In. w.c. / 9 to 15 mbar 3.5 In. w.c. / 9 mbar -1 to 2 In. w.c. / -2 to 5 mbar T13707T0012 Black	2	0.14	760	20.4	1560	41.8	2700	72.4	4050	109	4340	116	4540	122
	5	0.34	1200	32.2	2600	69.7	4500	121	8490	228	10,690	286	7290	195
	10	0.69	1700	45.6	3800	102	6500	174	7140	191	8570	230	10,570	283
	15	1.0	2000	53.6	4600	123	8000	214	7120	191	10,860	291	9020	242
	20	1.4	2350	63.0	5300	142	9250	248	7060	189	11,250	302	9810	263
	25	1.7	2700	72.4	6000	161	10,010	268	7100	190	11,170	299	9760	262
	30	2.1	3040	81.5	6740	181	10,330	277	8030	215	11,660	312	9700	260
	40	2.8	3700	99.2	8200	220	11,640	312	9610	258	10,790	289	11,150	299
	50	3.4	4400	118	9700	260	11,650	312	10,530	282	9460	254	10,100	271
	60	4.1	5100	137	11,200	300	11,380	305	11,590	311	9010	241	10,200	273
	80	5.5	4700	126	4680	125	4510	121	15,210	408	6250	168	8900	239
	100	6.9	4300	115	3040	81.5	3990	107	14,510	389	7700	206		
	125	8.6	4300	115	3200	85.8	4390	118	8640	232				
	150	10.3	4320	116	3200	85.8	4810	129	2650	71.0				
	175	12.1	5600	150	5050	135	7300	196						
5 to 9 In. w.c. / 12 to 22 mbar 7 In. w.c. / 17 mbar -1 to 2 In. w.c. / -2 to 5mbar T13589T0012 Yellow	2	0.14	750	20.1	1520	40.7	2650	71.0	5380	144	5610	150	5790	155
	5	0.34	1300	34.8	2600	69.7	4250	114	7110	191	7600	204	6620	177
	10	0.69	1600	42.9	3800	102	6500	174	8150	218	8210	220	10,320	277
	15	1.0	2000	53.6	4400	118	8000	214	6180	166	10,770	289	9040	242
	20	1.4	2300	61.6	5100	137	9500	255	6520	175	11,510	308	9510	255
	25	1.7	2600	69.7	5800	155	10,660	286	6190	166	10,920	293	9850	264
	30	2.1	2970	79.6	6600	177	10,410	279	7420	199	10,850	291	10,080	270
	40	2.8	3700	99.2	8200	220	10,170	273	12,030	322	10,310	276	10,170	273
	50	3.4	4400	118	9700	260	11,170	299	12,160	326	10,430	280	10,000	268
	60	4.1	5100	137	11,200	300	11,710	314	10,620	285	8230	221	10,200	273
	80	5.5	4850	130	4700	126	4570	122	3610	96.7	8000	214	8500	228
	100	6.9	4600	123	2800	75.0	3790	102	3380	90.6	6400	172		
	125	8.6	4600	123	3200	85.8	4190	112	3440	92.2				
	150	10.3	4600	123	3640	97.5	4590	123	2400	64.3				
	175	12.1	5400	145	5050	135	7300	196						
7 to 20 In. w.c. / 17 to 50 mbar 14 In. w.c. / 35 mbar ±2 In. w.c. / ±5 mbar 1N3112X0012 Unpainted	2	0.14	700	18.8	1430	38.3	2480	66.5	5040	135	6900	185	7050	189
	5	0.34	1100	29.5	2200	59.0	4000	107	7180	192	7280	195	8860	237
	10	0.69	1700	45.6	3600	96.5	6500	174	8310	223	9330	250	10,320	277
	15	1.0	1900	50.9	4600	123	8000	214	7000	188	11,940	320	9530	255
	20	1.4	2150	57.6	5300	142	8500	228	7410	199	11,850	318	11,060	296
	25	1.7	2400	64.3	6000	161	9000	241	6900	185	11,330	304	11,080	297
	30	2.1	2740	73.4	6740	181	10,000	268	6500	174	11,270	302	10,780	289
	40	2.8	3400	91.1	8200	220	10,900	292	9220	247	10,820	290	11,220	301
	50	3.4	4250	114	9700	260	10,210	274	12,580	337	10,820	290	10,450	280
	60	4.1	5100	137	11,000	295	9650	259	11,750	315	8840	237	11,100	297
	80	5.5	5250	141	5210	140	4060	109	4970	133	8550	229	9400	252
	100	6.9	5400	145	4580	123	4410	118	4970	133	6780	182		
	125	8.6	5400	145	4400	118	5290	142	4330	116				
	150	10.3	5900	158	5020	135	6170	165	3130	83.9				
	175	12.1	555	149	5200	139	6500	174						
16 to 40 In. w.c. / 40 to 99 mbar 28 In. w.c. / 70 mbar ±4 In. w.c. / ±10 mbar 1B413727222 Purple	5	0.34	1200	32.2	2400	64.3	4000	107	6010	161	9210	247	9070	243
	10	0.69	1600	42.9	3700	99.2	6500	174	8130	218	10,300	276	10,650	285
	15	1.0	2000	53.6	4400	118	8000	214	10,340	277	13,020	349	12,890	345
	20	1.4	2300	61.6	5100	137	9250	248	11,980	321	14,790	396	13,170	353
	25	1.7	2600	69.7	5800	155	10,500	281	12,390	332	14,570	390	14,180	380
	30	2.1	2800	75.0	6600	177	11,840	317	12,500	335	14,050	377	13,770	369
	40	2.8	3200	85.8	8200	220	14,060	377	13,350	358	13,290	356	14,110	378
	50	3.4	4100	110	9750	261	14,010	375	14,530	389	12,860	345	12,050	323
	60	4.1	5000	134	11,100	297	14,040	376	13,440	360	13,020	349	10,950	293
	80	5.5	6300	169	5910	158	6140	165	9950	267	8500	228	10,200	273
	100	6.9	7600	204	5220	140	5420	145	7780	209	6500	174		
	125	8.6	9200	247	5690	152	6010	161	8220	220				
	150	10.3	10,700	287	7380	198	5970	160	4900	131				
	175	12.1	5510	148	5100	137	7250	194						

1. Downstream piping may affect actual capacity. It may be necessary to use enlarged downstream piping to obtain published capacities.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

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Table 8. Types 299H and 299HR Flow Capacities(1) for 1-1/2 NPT Internal Registration (continued)

OUTLET PRESSURE RANGE, SETTING, ACCURACY, SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
			Orifice Size, In. / mm											
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19		1 / 25		1-3/16 / 30	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
1 to 3.25 psig / 69 mbar to 0.22 bar 2 psig / 0.14 bar ±1% psia / bar T13593T0012 Light Blue	5	0.34	1020	27.3	2100	56.4	3640	97.5	7020	188	10,790	289	10,820	290
	10	0.69	1550	41.5	3340	89.5	5840	157	8990	241	12,180	326	11,180	300
	15	1.0	1920	51.4	4360	117	7580	203	11,260	302	13,580	364	11,960	321
	20	1.4	2240	60.0	5150	138	8960	240	12,950	347	13,630	365	12,750	342
	25	1.7	2570	68.9	5890	158	10,250	275	13,090	351	13,890	372	13,370	358
	30	2.1	2890	77.4	6640	178	11,540	309	14,830	397	13,740	368	14,000	375
	40	2.8	3530	94.6	8120	218	14,120	378	13,500	362	13,470	361	15,250	409
	50	3.4	4180	112	9600	257	15,010	402	13,780	369	13,970	374	12,500	335
	60	4.1	4820	129	10,890	292	15,740	422	14,050	377	14,080	377	12,300	330
	80	5.5	6110	164	9000	241	12,230	328	11,100	297	12,750	342	10,500	281
	100	6.9	7400	198	5200	139	5200	139	5200	139	6400	172		
	125	8.6	8170	219	5040	135	5200	139	5200	139				
	150	10.3	8450	226	5870	157	5200	139	5600	150				
	175	12.1	7750	208	5250	141	5730	154						
2.75 to 6 psig / 0.19 to 0.41 bar 5 psig / 0.34 bar ±1% psia / bar T13671T0012 Orange	10	0.69	1390	37.2	2910	78.0	5050	135	8470	227	12,010	322	12,190	327
	15	1.0	1870	50.1	4190	112	7280	195	11,290	303	14,300	383	12,400	332
	20	1.4	2240	60.0	5090	136	8850	237	12,590	337	13,820	370	13,260	355
	25	1.7	2570	68.9	5890	158	10,250	275	13,210	354	14,500	389	14,310	384
	30	2.1	2890	77.4	6640	178	11,540	309	13,820	370	15,290	410	15,370	412
	40	2.8	3530	94.6	8120	218	14,120	378	15,060	404	15,650	419	16,630	446
	50	3.4	4180	112	9600	257	16,700	448	15,400	413	16,010	429	14,000	375
	60	4.1	4820	129	11,090	297	16,290	437	15,750	422	16,370	439	13,250	355
	80	5.5	6110	164	14,050	377	14,000	375	13,620	365	14,000	375	14,000	375
	100	6.9	7400	198	17,020	456	9020	242	9610	258	14,000	375		
	125	8.6	9020	242	7690	206	7690	206	7890	211				
	150	10.3	10,630	285	6330	170	6360	170	5500	147				
	175	12.1	6800	182	6050	162	8200	220						
5 to 16 psig / 0.34 to 1.1 bar 10 psig / 0.69 bar ±1% psia / bar T13600T0012 Red	15	1.0	1580	42.3	3280	87.9	5690	152	9930	266	13,230	355	13,570	364
	20	1.4	2130	57.1	4720	126	8210	220	11,990	321	14,130	379	14,100	378
	25	1.7	2540	68.1	5740	154	9940	266	13,400	359	15,990	429	15,870	425
	30	2.1	2890	77.4	6580	176	11,440	307	14,810	397	17,850	478	17,640	473
	40	2.8	3530	94.6	8120	218	14,120	378	17,640	473	18,630	499	18,920	507
	50	3.4	4180	112	9600	257	16,700	448	18,110	485	19,400	520	16,400	440
	60	4.1	4820	129	11,090	297	17,200	461	18,580	498	20,170	541	16,600	445
	80	5.5	6110	164	14,050	377	16,950	454	17,810	477	15,750	422	17,600	472
	100	6.9	7400	198	17,020	456	15,350	411	15,900	426	15,950	427		
	125	8.6	9020	242	20,730	556	16,740	449	16,270	436				
	150	10.3	6790	182	6790	182	6830	183	5800	155				
	175	12.1	6200	166	5600	150	5700	153						
5 to 16 psig / 0.34 to 1.1 bar 15 psig / 1.0 bar ±1% psia / bar T13600T0012 Red	20	1.4	1750	46.9	3620	97.0	6290	169	11,380	305	114,450	3067	14,980	401
	25	1.7	2360	63.2	5220	140	9070	243	13,590	364	17,440	467	17,430	467
	30	2.1	2820	75.6	6290	169	10,940	293	15,810	424	20,430	548	19,910	534
	40	2.8	3540	94.9	8070	216	14,020	376	20,230	542	21,610	579	21,220	569
	50	3.4	4180	112	9600	257	16,700	448	20,820	558	22,800	611	20,500	549
	60	4.1	4820	129	11,090	297	18,110	485	21,410	574	23,890	640	21,600	579
	80	5.5	6110	164	14,050	377	19,910	534	22,000	590	19,500	523	19,900	533
	100	6.9	7400	198	17,020	456	21,710	582	22,600	606	22,200	595		
	125	8.6	9020	242	20,730	556	23,960	642	23,190	621				
	150	10.3	10,630	285	24,440	655	26,210	702	21,200	568				
	175	12.1	7400	198	6750	181	7100	190						
14 to 35 psig / 0.97 to 2.4 bar 20 psig / 1.4 bar ±1% psia / bar 19B0432X012 Zinc	25	1.7	1920	51.4	3930	105	6840	183	12,840	344	15,670	420	16,320	437
	30	2.1	2580	69.1	5690	152	9870	265	15,200	407	20,740	556	20,760	556
	40	2.8	3480	93.3	7830	210	13,610	365	22,820	612	24,600	659	23,510	630
	50	3.4	4180	112	9550	256	16,610	445	20,950	561	23,620	633	22,200	595
	60	4.1	4820	129	11,090	297	18,080	485	23,330	625	26,120	700	25,000	670
	80	5.5	6110	164	14,050	377	20,980	562	25,120	673	24,500	657	24,900	667
	100	6.9	7400	198	17,020	456	23,680	635	26,930	722	26,200	702		
	125	8.6	9020	242	20,730	556	26,980	723	28,020	751				
	150	10.3	10,630	285	24,440	655	30,280	812	21,600	579				
	175	12.1	7500	201	8200	220	8600	230						

1. Downstream piping may affect actual capacity. It may be necessary to use enlarged downstream piping to obtain published capacities.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

- continued -

Table 8. Types 299H and 299HR Flow Capacities(1) for 1-1/2 NPT Internal Registration (continued)

OUTLET PRESSURE RANGE, SETTING, ACCURACY, SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
			Orifice Size, In. / mm											
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19		1 / 25		1-3/16 / 30	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
14 to 35 psig / 0.97 to 2.4 bar 25 psig / 1.7 bar ±1% psia / bar 19B0432X012 Zinc	30	2.1	2070	55.5	4230	113	7360	197	14,300	383	16,880	452	17,700	474
	40	2.8	3320	89.0	7350	197	12,780	343	16,810	451	24,040	644	24,090	646
	50	3.4	4140	111	9340	250	16,250	436	21,090	565	24,430	655	23,500	630
	60	4.1	4830	129	11,030	296	18,050	484	25,240	676	28,260	757	27,400	734
	80	5.5	6110	164	14,050	377	22,050	591	28,250	757	30,200	809	28,500	764
	100	6.9	7400	198	17,020	456	25,650	687	31,260	838	27,000	724		
	125	8.6	9020	242	20,730	556	30,000	804	32,840	880				
	150	10.3	10,630	285	24,440	655	34,360	921	27,000	724				
	175	12.1	10,200	273	25,200	675	7900	212						
14 to 35 psig / 0.97 to 2.4 bar 30 psig / 2.1 bar ±1% psia / bar 19B0432X012 Zinc	40	2.8	2980	79.9	6520	175	11,330	304	15,750	422	18,100	485	19,080	511
	50	3.4	4020	108	8950	240	15,560	417	21,220	569	25,240	676	22,500	603
	60	4.1	4800	129	10,850	291	18,020	483	27,150	728	30,390	814	28,000	750
	80	5.5	6110	164	14,050	377	23,130	620	31,370	841	30,500	817	32,300	866
	100	6.9	7400	198	17,020	456	27,630	740	35,690	956	32,500	871		
	125	8.6	9020	242	20,730	556	33,030	885	37,670	1010				
	150	10.3	10,630	285	24,440	655	38,430	1030	32,000	858				
	175	12.1	10,600	284	24,500	657	31,500	844						
14 to 35 psig / 0.97 to 2.4 bar 35 psig / 2.4 bar ±1% psia / bar 19B0432X012 Zinc	40	2.8	2350	63.0	4790	128	8330	223	13,640	366	19,570	524	20,850	559
	50	3.4	3770	101	8300	222	14,430	387	21,350	572	26,060	698	22,000	590
	60	4.1	4700	126	10,510	282	18,270	490	29,060	779	32,530	872	29,000	777
	80	5.5	6120	164	14,000	375	24,350	653	34,490	924	34,500	925	33,600	900
	100	6.9	7400	198	17,020	456	29,600	793	39,920	1070	38,200	1024		
	125	8.6	9020	242	20,730	556	36,050	966	42,500	1139				
	150	10.3	10,630	285	24,440	655	42,500	1139	32,100	860				
	175	12.1	10,900	292	24,800	665	37,000	992						
30 to 60 psig / 2.1 to 4.1 bar 40 psig / 2.8 bar ±1% psia / bar 19B0432X022 Green	50	3.4	2400	64.3	6000	161	10,000	268	14,000	375	20,000	536	20,000	536
	60	4.1	3470	93.0	8000	214	13,670	366	22,000	590	26,000	697	22,667	607
	80	5.5	5600	150	12,000	322	21,000	563	38,000	1018	30,000	804	28,000	750
	100	6.9	6400	172	14,500	389	27,000	724	38,000	1018	34,000	911		
	125	8.6	7600	204	19,500	523	33,000	884	38,000	1018				
	150	10.3	9500	255	22,750	610	37,000	992	42,000	1126				
	175	12.1	11,400	306	26,000	697	41,000	1099						
30 to 60 psig / 2.1 to 4.1 bar 50 psig / 3.4 bar ±1% psia / bar 19B0432X022 Green	60	4.1	3000	80.4	6500	174	9500	255	16,250	436	22,500	603	25,000	670
	80	5.5	5250	141	10,750	288	17,750	476	28,750	771	31,250	838	32,500	871
	100	6.9	6750	181	15,000	402	26,000	697	41,250	1106	40,000	1072		
	125	8.6	8250	221	17,500	469	32,500	871	43,750	1173				
	150	10.3	9500	255	21,750	583	37,750	1012	46,250	1240				
	175	12.1	10,750	288	26,000	697	43,000	1152						
30 to 60 psig / 2.1 to 4.1 bar 60 psig / 4.1 bar ±1% psia / bar 19B0432X022 Green	80	5.5	2750	73.7	7200	193	13,000	348	18,750	503	27,500	737	32,500	871
	100	6.9	2750	73.7	10,600	284	15,500	415	25,000	670	40,000	1072		
	125	8.6	3250	87.1	3000	80.4	22,000	590	46,250	1240				
	150	10.3	3130	83.9	2900	77.7	18,000	482	11,250	302				
	175	12.1	3000	80.4	2800	75.0	14,000	375						

1. Downstream piping may affect actual capacity. It may be necessary to use enlarged downstream piping to obtain published capacities.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

Table 9. Types 299H and 299HR Flow Capacities(1) for NPS 2 / DN 50 Internal Registration

OUTLET PRESSURE RANGE, SETTING, ACCURACY, SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
			Orifice Size, In. / mm											
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19		1 / 25		1-3/16 / 30	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
3.5 to 6-In. w.c. / 9 to 15 mbar 3.5-In. w.c. / 9 mbar -1 to 2-In. w.c. / -2 to 5 mbar T13707T0012 Black	2	0.14	760	20.4	1560	41.8	2700	72.4	4050	109	5740	154	6350	170
	5	0.34	1200	32.2	2600	69.7	4500	121	8600	230	11,500	308	12,000	322
	10	0.69	1700	45.6	3800	102	6500	174	9500	255	14,750	395	17,000	456
	15	1.0	2000	53.6	4600	123	8000	214	10,600	284	18,000	482	15,500	415
	20	1.4	2350	63.0	5300	142	9250	248	11,400	306	19,700	528	16,000	429
	25	1.7	2700	72.4	6000	161	10,500	281	12,200	327	20,400	547	17,300	464
	30	2.1	3030	81.2	6730	180	11,500	308	14,630	392	21,100	565	18,600	498
	40	2.8	3700	99.2	8200	220	13,500	362	19,500	523	20,400	547	21,800	584
	50	3.4	4400	118	9700	260	17,000	456	20,000	536	19,700	528	25,000	670
	60	4.1	5100	137	11,200	300	20,500	549	20,500	549	14,833	398	12,500	335
	80	5.5	4700	126	7500	201	12,750	342	19,600	525	5100	137	12,000	322
	100	6.9	4300	115	3800	102	5000	134	18,700	501	3500	93.8		
	125	8.6	4300	115	4000	107	5500	147	11,150	299				
	150	10.3	4300	115	4000	107	6000	161	3600	96.5				
	175	12.1	4300	115	4000	107	6500	174						
5 to 9-In. w.c. / 12 to 22 mbar 7-In. w.c. / 17 mbar -1 to 2-In. w.c. / -2 to 5 mbar T13589T0012 Yellow	2	0.14	750	20.1	1520	40.7	2650	71.0	5380	144	6260	168	6680	179
	5	0.34	1300	34.8	2600	69.7	4250	114	8500	228	10,500	281	10,000	268
	10	0.69	1600	42.9	3800	102	6500	174	12,500	335	14,350	385	17,000	456
	15	1.0	2000	53.6	4400	118	8000	214	10,500	281	18,200	488	16,000	429
	20	1.4	2300	61.6	5100	137	9500	255	11,500	308	20,600	552	16,000	429
	25	1.7	2600	69.7	5800	155	11,000	295	12,500	335	20,500	549	17,750	476
	30	2.1	2970	79.6	6600	177	11,170	299	16,830	451	20,400	547	19,500	523
	40	2.8	3700	99.2	8200	220	11,500	308	25,500	683	20,200	541	20,200	541
	50	3.4	4400	118	9700	260	15,750	422	22,500	603	20,000	536	20,900	560
	60	4.1	5100	137	11,200	300	20,000	536	19,500	523	14,800	397	12,500	335
	80	5.5	4850	130	7350	197	12,380	332	4500	121	4400	118	12,500	335
	100	6.9	4600	123	3500	93.8	4750	127	4500	121	2800	75.0		
	125	8.6	4600	123	4000	107	5250	141	4500	121				
	150	10.3	4600	123	4560	122	5750	154	4500	121				
	175	12.1	4600	123	5120	137	6500	174						
7 to 20-In. w.c. / 17 to 50 mbar 14-In. w.c. / 35 mbar ±2-In. w.c. / ±5 mbar 1N3112X0012 Unpainted	2	0.14	700	18.8	1430	38.3	2480	66.5	5040	135	7440	199	8460	227
	5	0.34	1100	29.5	2200	59.0	4000	107	8500	228	11,800	316	12,400	332
	10	0.69	1700	45.6	3600	96.5	6500	174	12,500	335	15,850	425	17,000	456
	15	1.0	1900	50.9	4600	123	8000	214	11,500	308	19,900	533	17,000	456
	20	1.4	2150	57.6	5300	142	8500	228	12,500	335	21,000	563	19,100	512
	25	1.7	2400	64.3	6000	161	9000	241	13,250	355	21,150	567	19,750	529
	30	2.1	2740	73.4	6740	181	10,000	268	14,000	375	21,300	571	20,400	547
	40	2.8	3400	91.1	8200	220	12,000	322	19,500	523	21,150	567	21,650	580
	50	3.4	4250	114	9700	260	13,500	362	25,000	670	21,000	563	22,900	614
	60	4.1	5100	137	11,200	300	15,000	402	22,050	591	16,330	438	14,100	378
	80	5.5	5250	141	8200	220	10,000	268	5620	151	7000	188	12,400	332
	100	6.9	5400	145	5200	139	5000	134	6000	161	8300	222		
	125	8.6	5400	145	5000	134	6000	161	6000	161				
	150	10.3	5900	158	5700	153	7000	188	6000	161				
	175	12.1	6400	172	6400	172	7000	188						
16 to 40-In. w.c. / 40 to 99 mbar 28-In. w.c. / 70 mbar ±4-In. w.c. / ±10 mbar 1B413727222 Purple	5	0.34	1200	32.2	2400	64.3	4000	107	7500	201	9500	255	11,400	306
	10	0.69	1600	42.9	3700	99.2	6500	174	11,750	315	14,850	398	16,850	452
	15	1.0	2000	53.6	4400	118	8000	214	16,000	429	20,200	541	22,300	598
	20	1.4	2300	61.6	5100	137	9250	248	19,000	509	24,500	657	21,800	584
	25	1.7	2600	69.7	5800	155	10,500	281	21,750	583	25,600	686	23,900	641
	30	2.1	2800	75.0	6600	177	11,830	317	24,500	657	25,230	676	24,130	647
	40	2.8	3200	85.8	8200	220	14,500	389	26,750	717	24,500	657	24,600	659
	50	3.4	4100	110	9750	261	16,500	442	29,000	777	24,000	643	26,000	697
	60	4.1	5000	134	11,300	303	18,500	496	24,170	648	23,500	630	27,200	729
	80	5.5	6300	169	9150	245	12,880	345	14,500	389	24,500	657	30,000	804
	100	6.9	7600	204	7000	188	7250	194	14,500	389	22,400	600		
	125	8.6	9200	247	7000	188	7380	198	14,500	389				
	150	10.3	10,700	287	9300	249	7500	201	15,500	415				
	175	12.1	12,200	327	11,600	311	15,250	409						

1. Downstream piping may affect actual capacity. It may be necessary to use enlarged downstream piping to obtain published capacities.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

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Table 9. Types 299H and 299HR Flow Capacities(1) for NPS 2 / DN 50 Internal Registration (continued)

OUTLET PRESSURE RANGE, SETTING, ACCURACY, SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
			Orifice Size In. / mm											
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 95		1/2 / 13		3/4 / 19		1 / 25		1-3 / 16/30	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
1 to 3.25 psig / 69 bar to 0.22 bar 2 psig / 0.14 bar ± 1% psia / bar T13593T0012 Light Blue	5	0.34	1020	27.3	2100	56.4	3640	97.5	7440	199	10,980	294	13,800	370
	10	0.69	1550	41.5	3340	89.5	5840	157	12,040	323	15,460	414	17,710	475
	15	1.0	1920	51.4	4360	117	7580	203	15,990	429	20,900	560	20,670	554
	20	1.4	2240	60.0	5150	138	8960	240	19,250	516	22,470	602	21,620	579
	25	1.7	2670	71.5	5890	158	10,250	275	22,030	590	24,000	643	22,410	601
	30	2.1	2890	77.4	6640	178	11,540	309	27,800	745	24,860	666	24,170	648
	40	2.8	3530	94.6	8120	218	14,120	378	27,070	725	25,640	687	26,160	701
	50	3.4	4180	112	9600	257	16,700	448	28,970	776	26,390	707	26,900	721
	60	4.1	4820	129	11,090	297	19,280	517	25,770	691	26,000	697	29,000	777
	80	5.5	6110	164	14,050	377	24,440	655	25,500	683	12,800	343	30,000	804
	100	6.9	7400	198	17,020	456	29,840	800	14,260	382	28,300	758		
	125	8.6	8170	219	12,360	331	17,520	470	13,260	355				
	150	10.3	8450	226	13,750	369	18,580	498	17,000	456				
	175	12.1	12,400	332	7100	190	20,000	536						
2.75 to 6 psig / 0.19 to 0.41 bar 5 psig / 0.34 bar ±1 % psig / bar T13671T0012 Orange	10	0.69	1390	37.2	2910	78.0	5050	135	10,350	277	13,200	354	16,070	431
	15	1.0	1870	50.1	4190	112	7280	195	15,150	406	21,850	586	21,370	573
	20	1.4	2240	60.0	5090	136	8850	237	18,640	500	21,350	572	21,390	573
	25	1.7	2570	68.9	5890	158	10,250	275	21,260	570	24,540	658	22,740	609
	30	2.1	2890	77.4	6640	178	11,540	309	24,340	652	26,500	710	25,870	693
	40	2.8	3530	94.6	8120	218	14,120	378	27,670	742	28,300	758	28,930	775
	50	3.4	4180	112	9600	257	16,700	448	30,570	819	29870	801	30,000	804
	60	4.1	4820	129	11,090	297	19,280	517	29,390	788	30,390	814	31,000	831
	80	5.5	6110	164	14,050	377	24,440	655	31,410	842	28,000	750	34,000	911
	100	6.9	7400	198	17,020	456	29,600	793	22,150	594	32,000	858		
	125	8.6	9020	242	20,730	556	36,050	966	21,590	579				
	150	10.3	10,630	285	17,170	460	26,560	712	17,000	456				
	175	12.1	11,800	316	15,400	413	21,500	576						
5 to 16 psig / 0.34 to 1.1 bar 10 psig / 0.69 bar ± 1% psia / bar T13600T0012 Red	15	1.0	1580	42.3	3280	87.9	5690	152	11,640	312	15,420	413	18,340	492
	20	1.4	2130	57.1	4720	126	8210	220	17,000	456	19,500	523	21,000	563
	25	1.7	2540	68.1	5740	154	9940	266	20,790	557	25,440	682	23,290	624
	30	2.1	2890	77.4	6580	176	11,440	307	24,150	647	29,250	784	28,700	769
	40	2.8	3530	94.6	8120	218	14,120	378	28,660	768	32,780	879	33,540	899
	50	3.4	4180	112	9600	257	16,700	448	33,230	891	35,680	956	33,100	887
	60	4.1	4820	129	11,090	297	19,280	517	35,410	949	37,700	1010	33,100	887
	80	5.5	6110	164	14,050	377	24,440	655	41,270	1106	38,000	1018	37,000	992
	100	6.9	7400	198	17,020	456	29,600	793	35,310	946	35,000	938		
	125	8.6	9020	242	20,730	556	36,050	966	35,740	958				
	150	10.3	10,630	285	20,590	552	34,530	925	22,000	590				
	175	12.1	11,200	300	18,100	485	25,000	670						
5 to 16 psig / 0.34 to 1.1 bar 15 psig / 10 bar ± 1% psia / bar T13600T0012 Red	20	1.4	1750	46.9	3620	97.0	6290	169	12,830	344	17,640	473	20,640	553
	25	1.7	2360	63.2	5220	140	9070	243	18,700	501	26,350	706	23,850	639
	30	2.1	2820	75.6	6290	169	10,940	293	22,790	611	31,990	857	31,540	845
	40	2.8	3540	94.9	8070	216	14,020	376	29,650	795	37,270	999	38,150	1022
	50	3.4	4180	112	9600	257	16,700	448	35,890	962	41,490	1112	43,000	1152
	60	4.1	4820	129	11,090	297	19,280	517	41,440	1111	45,020	1207	39,000	1045
	80	5.5	6110	164	14,050	377	24,440	655	51,120	1370	49,000	1313	43,000	1152
	100	6.9	7400	198	17,020	456	29,600	793	48,470	1299	46,000	1233		
	125	8.6	9020	242	20,730	556	36,050	966	49,780	1334				
	150	10.3	10,630	285	24,440	655	42,500	1139	60,000	1608				
	175	12.1	11,800	316	27,400	734	48,000	1286						
14 to 35 psig / 0.97 to 2.4 bar 20 psig / 14 bar ± 1% psia / bar 19B0432X012 Zinc	25	1.7	1920	51.4	3930	105	6840	183	13,930	373	20,800	557	21,940	588
	30	2.1	2580	69.1	5680	152	9870	265	20,280	544	30,630	821	32,630	874
	40	2.8	3480	93.3	7830	210	13,610	365	28,440	762	33,040	885	35,700	957
	50	3.4	4180	112	9550	256	16,610	445	35,140	942	41,800	1120	40,520	1086
	60	4.1	4820	129	11,090	297	19,280	517	41,440	1111	47,530	1274	40,520	1086
	80	5.5	6110	164	14,050	377	24,440	655	51,240	1373	41,800	1120	41,000	1099
	100	6.9	7400	198	17,020	456	29,600	793	52,260	1401	41,800	1120		
	125	8.6	9020	242	20,730	556	36,050	966	56,710	1520				
	150	10.3	10,630	285	24,440	655	42,500	1139	65,000	1742				
	175	12.1	11,600	311	26,300	705	47,000	1260						

1. Downstream piping may affect actual capacity. It may be necessary to use enlarged downstream piping to obtain published capacities.
▭ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

- continued -

Table 9. Types 299H and 299HR Flow Capacities(1) for NPS 2 / DN 50 Internal Registration (continued)

OUTLET PRESSURE RANGE, SETTING, ACCURACY, SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
			Orifice Size, In. / mm											
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19		1 / 25		1-3/16 / 30	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
14 to 35 psig / 0.97 to 2.4 bar 25 psig / 1.7 bar ±1% psia / bar 19B0432X012 Zinc	30	2.1	2070	55.5	4230	113	7360	197	14,980	401	22,310	598	23,270	624
	40	2.8	3320	89.0	7350	197	12,780	343	23,420	628	40,220	1078	33,260	891
	50	3.4	4140	111	9340	250	16,250	436	34,040	912	42,110	1129	50,000	1340
	60	4.1	4830	129	11,030	296	19,190	514	40,630	1089	50,050	1341	54,000	1447
	80	5.5	6110	164	14,050	377	24,440	655	51,360	1376	62,000	1662	60,000	1608
	100	6.9	7400	198	17,020	456	29,600	793	56,050	1502	60,000	1608		
	125	8.6	9020	242	20,730	556	36,050	966	63,640	1706				
	150	10.3	10,630	285	24,440	655	42,500	1139	77,000	2064				
	175	12.1	11,000	295	26,500	710	46,000	1233						
14 to 35 psig / 0.97 to 2.4 bar 30 psig / 2.1 bar ±1% psia / bar 19B0432X012 Zinc	40	2.8	2980	79.9	6520	175	11,330	304	23,190	621	24,580	659	30,810	826
	50	3.4	4020	108	8950	240	15,560	417	32,300	866	42,430	1137	50,000	1340
	60	4.1	4800	129	10,850	291	18,870	506	39,600	1061	52,560	1409	54,000	1447
	80	5.5	6110	164	14,050	377	24,440	655	51,480	1380	72,000	1930	72,000	1930
	100	6.9	7400	198	17,020	456	29,600	793	59,840	1604	76,000	2037		
	125	8.6	9020	242	20,730	556	36,050	966	70,570	1891				
	150	10.3	10,630	285	24,440	655	42,500	1139	84,000	2251				
	175	12.1	10,200	273	25,000	670	48,000	1286						
14 to 35 psig / 0.97 to 2.4 bar 35 psig / 2.4 bar ±1% psia / bar 19B0432X012 Zinc	40	2.8	2350	63.0	4790	128	8330	223	16,920	453	20,350	545	28,360	760
	50	3.4	3770	101	8300	222	14,430	387	29,690	796	42,740	1145	48,000	1286
	60	4.1	4700	126	10,510	282	18,270	490	38,050	1020	55,080	1476	60,000	1608
	80	5.5	6120	164	14,000	375	24,350	653	51,600	1383	70,000	1876	74,000	1983
	100	6.9	7400	198	17,020	456	29,600	793	63,630	1705	76,000	2037		
	125	8.6	9020	242	20,730	556	36,050	966	77,500	2077				
	150	10.3	10,630	285	24,440	655	42,500	1139	87,000	2332				
	175	12.1	11,200	300	25,500	683	49,000	1313						
30 to 60 psig / 2.1 to 4.1 bar 40 psig / 2.8 bar ±1% psia / bar 19B0432X022 Green	50	3.4	1600	42.9	6500	174	9000	241	20,000	536	28,000	750	34,000	911
	60	4.1	2800	75.0	8170	219	17,000	456	33,000	884	48,000	1286	52,000	1394
	80	5.5	5200	139	11,500	308	23,000	616	48,000	1286	66,000	1769	68,000	1822
	100	6.9	7600	204	13,500	362	29,000	777	31,000	831	76,000	2037		
	125	8.6	8200	220	19,000	509	35,000	938	76,000	2037				
	150	10.3	9800	263	22,750	610	42,000	1126	91,000	2439				
	175	12.1	11,400	306	26,500	710	47,000	1260						
30 to 60 psig / 2.1 to 4.1 bar 50 psig / 3.4 bar ±1% psia / bar 19B0432X022 Green	60	4.1	3400	91.1	7000	188	10,000	268	21,000	563	32,000	858	45,000	1206
	80	5.5	5800	155	11,000	295	21,000	563	45,000	1206	69,000	1849	74,000	1983
	100	6.9	6200	166	15,000	402	26,000	697	59,000	1581	88,000	2358		
	125	8.6	8400	225	19,500	523	35,000	938	77,000	2064				
	150	10.3	9600	257	23,000	616	42,000	1126	89,000	2385				
	175	12.1	10,800	289	26,500	710	49,000	1313						
30 to 60 psig / 2.1 to 4.1 bar 60 psig / 4.1 bar ±1% psia / bar 19B0432X022 Green	80	5.5	2800	75.0	3500	93.8	17,000	456	36,000	965	52,000	1394	53,000	1420
	100	6.9	3600	96.5	9500	255	23,000	616	50,000	1340	64,000	1715		
	125	8.6	2800	75.0	15,000	402	22,000	590	69,000	1849	90,000	2412		
	150	10.3	4600	123	11,000	295	18,000	482	89,000	2385				
	175	12.1	6400	172	7000	188	18,000	482						

1. Downstream piping may affect actual capacity. It may be necessary to use enlarged downstream piping to obtain published capacities.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

Table 10. Types 299HS and 299HSR Flow Capacities[1][2] for 1-1/2 NPT and NPS 2 / DN 50 External/Dual Registration

OUTLET PRESSURE RANGE AND SETTING, CONTROL SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH/ Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
			Orifice Size, In. / mm							
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
3.5 to 6 In. w.c. / 9 to 15 mbar	2	0.14	750	20.1	1540	41.3	1960	52.5	4750	127
	5	0.34	1150	30.8	2440	65.4	3230	86.6	7760	208
	10	0.69	1580	42.3	3570	95.7	4970	133	11,660	312
	15	1.0	1910	51.2	4400	118	6890	185	15,890	426
	20	1.4	2230	59.8	5140	138	8050	216	18,570	498
	25	1.7	2560	68.6	5880	158	9210	247	21,250	570
3.5 In. w.c. / 9 mbar -1 to 2 In. w.c. / -2 to 5 mbar T13707T0012 Black	30	2.1	2880	77.2	6630	178	10,370	278	23,930	641
	40	2.8	3520	94.3	8110	217	12,700	340	29,280	785
	50	3.4	4170	112	9590	257	15,020	403	34,630	928
	60	4.1	4810	129	11,080	297	17,340	465	39,990	1072
	80	5.5	6100	163	14,040	376	21,980	589	50,690	1358
	100	6.9	7390	198	17,010	456	26,630	714	61,400	1646
	125	8.6	9010	241	20,720	555	32,430	869	74,780	2004
	150	10.3	10,620	285	24,430	655	38,240	1025	88,170	2363
	175	12.1	12,230	328	28,140	754	44,040	1180		
5 to 9 In. w.c. / 12 to 22 mbar	2	0.14	730	19.6	1490	39.9	1900	50.9	4610	124
	5	0.34	1150	30.8	2420	64.9	3190	85.5	7690	206
	10	0.69	1580	42.3	3570	95.7	4950	133	11,620	311
	15	1.0	1910	51.2	4400	118	6890	185	15,890	426
	20	1.4	2230	59.8	5140	138	8050	216	18,570	498
	25	1.7	2560	68.6	5880	158	9210	247	21,250	570
7 In. w.c. / 17 mbar -1 to 2 In. w.c. / -2 to 5 mbar T13589T0012 Yellow	30	2.1	2880	77.2	6630	178	10,370	278	23,930	641
	40	2.8	3520	94.3	8110	217	12,700	340	29,280	785
	50	3.4	4170	112	9590	257	15,020	403	34,630	928
	60	4.1	4810	129	11,080	297	17,340	465	39,990	1072
	80	5.5	6100	163	14,040	376	21,980	589	50,690	1358
	100	6.9	7390	198	17,010	456	26,630	714	61,400	1646
	125	8.6	9010	241	20,720	555	32,430	869	74,780	2004
	150	10.3	10,620	285	24,430	655	38,240	1025	88,170	2363
	175	12.1	12,230	328	28,140	754	44,040	1180		
7 to 20 In. w.c. / 17 to 50 mbar	2	0.14	690	18.5	1410	37.8	1790	48.0	4340	116
	5	0.34	1130	30.3	2390	64.1	3130	83.9	7550	202
	10	0.69	1570	42.1	3550	95.1	4920	132	11,540	309
	15	1.0	1910	51.2	4400	118	6890	185	15,890	426
	20	1.4	2230	59.8	5140	138	8050	216	18,570	498
	25	1.7	2560	68.6	5880	158	9210	244	21,250	570
14 In. w.c. / 35 mbar ±2 In. w.c. / ±5 mbar 1N3112X0012 Unpainted	30	2.1	2880	77.2	6630	178	10,370	278	23,930	641
	40	2.8	3520	94.3	8110	217	12,700	340	29,280	785
	50	3.4	4170	112	9590	257	15,020	403	34,630	928
	60	4.1	4810	129	11,080	297	17,340	465	39,990	1072
	80	5.5	6100	163	14,040	376	21,980	589	50,690	1358
	100	6.9	7390	198	17,010	456	26,630	714	61,400	1646
	125	8.6	9010	241	20,720	555	32,430	869	74,780	2004
	150	10.3	10,620	285	24,430	655	38,240	1025	88,170	2363
	175	12.1	12,230	328	28,140	754	44,040	1180		
16 to 40 In. w.c. / 40 to 99 mbar	5	0.34	1100	29.5	2310	61.9	3010	80.7	7260	195
	10	0.69	1560	41.8	3420	91.7	4680	125	11,180	300
	15	1.0	1910	51.2	4400	118	6890	185	14,680	393
	20	1.4	2230	59.8	5140	138	8050	216	18,570	498
	25	1.7	2560	68.6	5880	158	9210	247	21,250	570
28 In. w.c. / 70 mbar ±4 In. w.c. / ±10 mbar 1B413727222 Purple	30	2.1	2880	77.2	6630	178	10,370	278	23,930	641
	40	2.8	3520	94.3	8110	217	12,700	340	29,280	785
	50	3.4	4170	112	9590	257	15,020	403	34,630	928
	60	4.1	4810	129	11,080	297	17,340	465	39,990	1072
	80	5.5	6100	163	14,040	376	21,980	589	50,690	1358
	100	6.9	7390	198	17,010	456	26,630	714	61,400	1646
	125	8.6	9010	241	20,720	555	32,430	869	74,780	2004
	150	10.3	10,620	285	24,430	655	38,240	1025	88,170	2363
	175	12.1	12,230	328	28,140	754	44,040	1180		

1. Capacities are limited to 15,000 SCFH / 402 Nm³/h when the Type VSX-2 is used without a control line.
2. Due to slam-shut properties, capacities cannot be calculated with critical flow equation.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

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Table 10. Types 299HS and 299HSR Flow Capacities[1][2] for 1-1/2 NPT and NPS 2 / DN 50 External/Dual Registration (continued)

OUTLET PRESSURE RANGE AND SETTING, CONTROL SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
			Orifice Size, In. / mm							
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
1 to 3.25 psig / 69 mbar to 0.22 bar 2 psig / 0.14 bar ±1% psia / bar T13593T0012 Light blue	5	0.34	1010	27.1	2090	56.0	2690	72.1	6500	174
	10	0.69	1540	41.3	3330	89.2	4500	121	10,780	289
	15	1.0	1910	51.2	4350	117	6160	165	14,420	386
	20	1.4	2230	59.8	5140	138	8050	216	18,570	498
	25	1.7	2560	68.6	5880	158	9210	247	21,250	570
	30	2.1	2880	77.2	6630	178	10,370	278	23,930	641
	40	2.8	3520	94.3	8110	217	12,700	340	29,280	785
	50	3.4	4170	112	9590	257	15,020	403	34,630	928
	60	4.1	4810	129	11,080	297	17,340	465	39,990	1072
	80	5.5	6100	163	14,040	376	21,980	589	50,690	1358
	100	6.9	7390	198	17,010	456	26,630	714	61,400	1646
	125	8.6	9010	241	20,720	555	32,430	869	74,780	2004
	150	10.3	10,620	285	24,430	655	38,240	1024	88,170	2363
	175	12.1	12,230	328	28,140	754	44,040	1180		
2.75 to 6 psig / 0.19 to 0.41 bar 5 psig / 0.34 bar ±1% psia / bar T13671T0012 Orange	10	0.69	1380	37.0	2890	77.5	3780	101	9110	244
	15	1.0	1860	49.8	4180	112	5690	152	13,370	358
	20	1.4	2230	59.8	5080	136	7170	192	16,790	450
	25	1.7	2560	68.6	5880	158	9210	247	21,250	570
	30	2.1	2880	77.2	6630	178	10,370	278	23,930	641
	40	2.8	3520	94.3	8110	217	12,700	340	29,280	785
	50	3.4	4170	112	9590	257	15,020	403	34,630	928
	60	4.1	4810	129	11,080	297	17,340	465	39,990	1072
	80	5.5	6100	163	14,040	376	21,980	589	50,690	1358
	100	6.9	7390	198	17,010	456	26,630	714	61,400	1646
	125	8.6	9010	241	20,720	555	32,430	869	74,780	2004
	150	10.3	10,620	285	24,430	655	38,240	1024	88,170	2363
	175	12.1	12,230	328	28,140	754	44,040	1180		
5 to 16 psig / 0.34 to 1.1 bar 10 psig / 0.69 bar ±1% psia / bar T13600T0012 Red	15	1.0	1570	42.1	3270	87.6	4220	113	10,200	273
	20	1.4	2120	56.8	4710	126	6310	169	14,850	398
	25	1.7	2530	67.8	5700	153	7890	211	18,510	496
	30	2.1	2880	77.2	6630	178	10,370	278	21,820	585
	40	2.8	3520	94.3	8110	217	12,700	340	29,280	785
	50	3.4	4170	112	9590	257	15,020	403	34,630	928
	60	4.1	4810	129	11,080	297	17,340	465	39,990	1072
	80	5.5	6100	163	14,040	376	21,980	589	50,690	1358
	100	6.9	7390	198	17,010	456	26,630	714	61,400	1646
	125	8.6	9010	241	20,720	555	32,430	869	74,780	2004
	150	10.3	10,620	285	24,430	655	38,240	1025	88,170	2363
	175	12.1	12,230	328	28,140	754	44,040	1180		
5 to 16 psig / 0.34 to 1.1 bar 15 psig / 1.0 bar ±1% psia / bar T13600T0012 Red	20	1.4	1740	46.6	3610	96.7	4640	124	11,210	300
	25	1.7	2350	63.0	5210	139	6890	185	16,220	435
	30	2.1	2810	75.3	6280	168	8560	229	20,110	539
	40	2.8	3520	94.3	8110	217	12,700	340	26,850	720
	50	3.4	4170	112	9590	257	15,020	403	34,630	928
	60	4.1	4810	129	11,080	297	17,340	464	39,990	1072
	80	5.5	6100	163	14,040	376	21,980	589	50,690	1358
	100	6.9	7390	198	17,010	456	26,630	714	61,400	1646
	125	8.6	9010	241	20,720	555	32,430	869	74,780	2004
	150	10.3	10,620	285	24,430	655	38,240	1025	88,170	2363
	175	12.1	12,230	328	28,140	754	44,040	1180		

1. Capacities are limited to 15,000 SCFH / 402 Nm³/h when the Type VSX-2 is used without a control line.
2. Due to slam-shut properties, capacities cannot be calculated with critical flow equation.
▭ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

Table 11. Types 299HS and 299HSR Flow Capacities[1][2] for 1-1/2 NPT and NPS 2 / DN 50 Internal Registration

OUTLET PRESSURE RANGE AND SETTING, CONTROL SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
			Orifice Size, In. / mm							
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
3.5 to 6 In. w.c. / 9 to 15 mbar	2	0.14	760	20.4	1780	47.7	2800	75.0	6460	173
	5	0.34	1160	31.1	2450	65.7	4000	107	7140	191
	10	0.69	1590	42.6	3560	95.4	6000	161	7140	191
	15	1.0	1920	51.5	4400	118	7500	201	8320	223
	20	1.4	2240	60.0	5100	137	9000	241	10,830	290
	25	1.7	2570	68.9	5450	146	7620	204	9870	265
3.5 In. w.c. / 9 mbar -1 to 2 In. w.c. / -2 to 5 mbar T13707T0012 Black	30	2.1	2890	77.5	5800	155	9880	265	9870	265
	40	2.8	3530	94.6	7550	202	12,070	323	6400	172
	50	3.4	3880	104	9300	249	11,300	303	6840	183
	60	4.1	4090	110	7700	206	6660	178	7010	188
	80	5.5	3110	83.3	2800	75.0	1230	33.0	9000	241
	100	6.9	4790	128	3600	96.5	2990	80.1	4650	125
	125	8.6	5210	140	3600	96.5	4090	110	3230	86.6
	150	10.3	5640	151	3600	96.5	5210	140	3230	86.6
	175	12.1	7310	196	5680	152	7300	196		
5 to 9 In. w.c. / 12 to 22 mbar	2	0.14	750	20.1	1890	50.7	2800	75.0	5520	148
	5	0.34	1120	30.0	2460	65.9	4000	107	6020	161
	10	0.69	1590	42.6	3400	91.1	6000	161	6520	175
	15	1.0	1920	51.5	4320	116	7000	188	8000	214
	20	1.4	2240	60.0	5060	136	9000	241	7930	213
	25	1.7	2570	68.9	5800	155	9690	260	7420	199
7 In. w.c. / 17 mbar -1 to 2 In. w.c. / -2 to 5 mbar T13589T0012 Yellow	30	2.1	2890	77.5	6500	174	10,480	281	7050	189
	40	2.8	3530	94.6	7900	212	11,490	308	4900	131
	50	3.4	4180	112	7800	209	10,280	276	5940	159
	60	4.1	4820	129	6560	176	7170	192	6310	169
	80	5.5	4020	108	2620	70.2	1200	32.2	8340	224
	100	6.9	4670	125	3420	91.7	2990	80.1	3900	105
	125	8.6	5070	136	3600	96.5	5180	139	3360	90.0
	150	10.3	5480	147	3870	104	5180	139	2340	62.7
	175	12.1	6430	172	5120	137	7300	196		
7 to 20 In. w.c. / 17 to 50 mbar	2	0.14	700	18.8	1420	38.1	3440	92.2	4790	128
	5	0.34	1110	29.7	2200	59.0	4000	107	6080	163
	10	0.69	1580	42.3	3500	93.8	6000	161	7440	199
	15	1.0	1920	51.5	4300	115	7600	204	9250	248
	20	1.4	2240	60.0	5000	134	9000	241	10,670	286
	25	1.7	2570	68.9	5700	153	10,000	268	8950	240
14 In. w.c. / 35 mbar ±2 In. w.c. / ±5 mbar 1N3112X0012 Unpainted	30	2.1	2890	77.5	6500	174	11,200	300	8450	226
	40	2.8	3530	94.6	7900	212	11,620	311	6800	182
	50	3.4	4180	112	9300	249	12,400	332	7240	194
	60	4.1	4820	129	7490	201	12,090	324	7400	198
	80	5.5	4600	123	2730	73.2	2030	54.4	7420	199
	100	6.9	4970	133	3900	105	4410	118	4970	133
	125	8.6	5200	139	3900	105	5990	161	4330	116
	150	10.3	5430	146	3900	105	5990	161	3120	83.6
	175	12.1	4700	126	3900	105	6310	169		
16 to 40 In. w.c. / 40 to 99 mbar	5	0.34	1110	29.7	2600	69.7	3600	96.5	5200	139
	10	0.69	1570	42.1	3500	93.8	6000	161	6910	185
	15	1.0	1920	51.5	4400	118	7200	193	9370	251
	20	1.4	2240	60.0	5100	137	8800	236	11,030	296
	25	1.7	2570	68.9	5800	155	10,000	268	11,390	305
28 In. w.c. / 70 mbar ±4 In. w.c. / ±10 mbar 1B413727222 Purple	30	2.1	2890	77.5	6500	174	11,600	311	11,980	321
	40	2.8	3530	94.6	7900	212	13,570	364	11,220	301
	50	3.4	4180	112	9300	249	13,920	373	10,020	269
	60	4.1	4820	129	8250	221	14,410	386	9170	246
	80	5.5	6110	164	4260	114	3090	82.8	11,320	303
	100	6.9	6360	170	5150	138	4850	130	3750	101
	125	8.6	6450	173	5930	159	5290	142	3960	106
	150	10.3	6540	175	6110	164	5570	149	2520	67.5
	175	12.1	2950	79.1	3560	95.4	3320	89.0		

1. Capacities are limited to 15,000 SCFH / 402 Nm³/h when the Type VSX-2 is used without a control line.
2. Due to slam-shut properties, capacities cannot be calculated with critical flow equation.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

- continued -

Table 11. Types 299HS and 299HSR Flow Capacities[1][2] for 1-1/2 NPT and NPS 2 / DN 50 Internal Registration (continued)

OUTLET PRESSURE RANGE AND SETTING, CONTROL SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
			Orifice Size, In. / mm							
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
1 to 3.25 psig / 69 mbar to 0.22 bar 2 psig / 0.14 bar ±1% psia / bar T13593T0012 Light blue	5	0.34	1020	27.3	2900	77.7	4000	107	5660	152
	10	0.69	1550	41.5	3600	96.5	5500	147	7840	210
	15	1.0	1920	51.5	4300	115	7500	201	10,210	273
	20	1.4	2240	60.0	5000	134	8500	228	12,100	324
	25	1.7	2570	68.9	5550	149	10,000	268	11,880	318
	30	2.1	2890	77.5	6100	163	11,000	295	12,800	343
	40	2.8	3530	94.6	7750	208	14,000	375	13,960	374
	50	3.4	4180	112	9400	252	14,380	385	10,940	293
	60	4.1	4820	129	10,530	282	15,510	416	9810	263
	80	5.5	6110	164	8580	230	12,000	322	3700	99.2
	100	6.9	6850	184	3290	88.2	1130	30.3	2910	78.0
	125	8.6	7070	189	3050	81.7	2220	59.5	2910	78.0
	150	10.3	7300	196	3200	85.8	2090	56.0	2910	78.0
	175	12.1	4560	122	5540	148	2090	56.0		
2.75 to 6 psig / 0.19 to 0.41 bar 5 psig / 0.34 bar ±1% psia / bar T13671T0012 Orange	10	0.69	1390	37.3	2800	75.0	5000	134	6540	175
	15	1.0	1870	50.1	3750	101	7000	188	9680	259
	20	1.4	2240	60.0	4700	126	8500	228	11,480	308
	25	1.7	2570	68.9	5700	153	9500	255	12,420	333
	30	2.1	2890	77.5	6430	172	11,000	295	13,050	350
	40	2.8	3530	94.6	7900	212	13,000	348	15,780	423
	50	3.4	4180	112	9300	249	16,000	429	15,110	405
	60	4.1	4790	128	10,700	287	15,200	407	10,710	287
	80	5.5	5740	154	13,350	358	13,170	353	8670	232
	100	6.9	6680	179	16,000	429	2430	65.1	8670	232
	125	8.6	7170	192	4740	127	1700	45.6	7300	196
	150	10.3	7650	205	3530	94.6	1910	51.2	6470	173
	175	12.1	4400	118	3530	94.6	3050	81.7		
5 to 16 psig / 0.34 to 1.1 bar 10 psig / 0.69 bar ±1% psia / bar T13600T0012 Red	15	1.0	1800	48.2	3200	85.8	4000	107	7250	194
	20	1.4	2200	59.0	4300	115	12,000	322	9870	265
	25	1.7	2600	69.7	5400	145	9000	241	12,240	328
	30	2.1	3000	80.4	6600	177	10,000	268	13,490	362
	40	2.8	3650	97.8	7800	209	13,000	348	17,230	462
	50	3.4	4300	115	9000	241	16,000	429	18,520	496
	60	4.1	4950	133	10,460	280	16,050	430	20,460	548
	80	5.5	6250	168	13,400	359	15,950	427	10,780	289
	100	6.9	7600	204	16,110	432	15,030	403	11,250	302
	125	8.6	9300	249	19,500	553	16,250	436	11,250	302
	150	10.3	6320	169	4960	133	1970	52.8	6590	177
	175	12.1	5810	156	3270	87.6	1970	52.8		
5 to 16 psig / 0.34 to 1.1 bar 15 psig / 1.0 bar ±1% psia / bar T13600T0012 Red	20	1.4	1900	50.9	3400	91.1	6000	161	8860	237
	25	1.7	2450	65.7	4550	122	8000	214	10,900	292
	30	2.1	3000	80.4	5700	153	10,000	268	13,870	372
	40	2.8	3700	99.2	7600	204	13,000	348	19,100	512
	50	3.4	4320	116	8900	239	15,000	402	20,300	544
	60	4.1	4950	133	10,330	277	16,900	453	20,660	554
	80	5.5	6200	166	13,200	354	18,730	502	21,940	588
	100	6.9	7350	197	16,000	429	21,260	570	16,310	437
	125	8.6	8800	236	19,500	523	23,920	641	13,970	374
	150	10.3	10,220	274	22,950	615	25,900	694	10,600	284
	175	12.1	7300	196	6500	174	5910	158		

1. Capacities are limited to 15,000 SCFH / 402 Nm³/h when the Type VSX-2 is used without a control line.
2. Due to slam-shut properties, capacities cannot be calculated with critical flow equation.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

- continued -

Table 12. Types 299HS and 299HSR Flow Capacities[1][2] for 2 NPT Internal Registration

OUTLET PRESSURE RANGE AND SETTING, CONTROL SPRING PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
			Orifice Size, In. / mm							
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
3.5 to 6 In. w.c. / 9 to 15 mbar 3.5 In. w.c. / 9 mbar -1 to 2 In. w.c. / -2 to 5 mbar T13707T0012 Black	2	0.14	760	20.4	1780	47.7	2800	75.0	6460	173
	5	0.34	1160	31.1	2450	65.7	4000	107	7600	204
	10	0.69	1590	42.6	3560	95.4	6000	161	9500	255
	15	1.0	1920	51.5	4400	118	7500	201	12,400	332
	20	1.4	2240	60.0	5100	137	9000	241	17,500	469
	25	1.7	2570	68.9	5450	146	8000	214	17,000	456
	30	2.1	2890	77.5	5800	155	11,000	295	17,000	456
	40	2.8	3530	94.6	7550	202	14,000	375	13,000	348
	50	3.4	3880	104	9300	249	16,500	442	13,000	348
	60	4.1	4090	110	7700	206	12,000	322	12,400	332
	80	5.5	3110	83.3	4500	121	3500	93.8	11,600	311
	100	6.9	4790	128	4500	121	3750	101	6000	161
	125	8.6	5210	140	4500	121	5120	137	4400	118
	150	10.3	5620	151	4500	121	6500	174	4400	118
	175	12.1	5620	151	4500	121	6500	174		
5 to 9 In. w.c. / 12 to 22 mbar 7 In. w.c. / 17 mbar -1 to 2 In. w.c. / -2 to 5 mbar T13589T0012 Yellow	2	0.14	750	20.1	1890	50.7	2800	75.0	5520	148
	5	0.34	1120	30.0	2460	65.9	4000	107	7200	193
	10	0.69	1590	42.6	3400	91.1	6000	161	10,000	268
	15	1.0	1920	51.5	4320	116	7000	188	13,600	364
	20	1.4	2240	60.0	5060	136	9000	241	14,000	375
	25	1.7	2570	68.9	5800	155	10,000	268	15,000	402
	30	2.1	2890	77.5	6500	174	11,250	302	16,000	429
	40	2.8	3530	94.6	7900	212	13,000	348	10,400	279
	50	3.4	4180	112	7800	209	14,500	389	10,400	279
	60	4.1	4180	112	6560	176	12,250	328	10,400	279
	80	5.5	4020	108	4100	110	3250	87.1	10,400	279
	100	6.9	4670	125	4270	114	3750	101	5200	139
	125	8.6	5070	136	4500	121	6500	174	4400	118
	150	10.3	5480	147	4850	130	6500	174	4400	118
	175	12.1	5480	147	5200	139	6500	174		
7 to 20 In. w.c. / 17 to 50 mbar 14 In. w.c. / 35 mbar ±2 In. w.c. / ±5 mbar 1N3112X0012 Unpainted	2	0.14	700	18.8	1420	38.1	3440	92.2	4800	129
	5	0.34	1110	29.7	2200	59.0	4000	107	7200	193
	10	0.69	1580	42.3	3500	93.8	6000	161	11,200	300
	15	1.0	1920	51.5	4300	115	7600	204	15,200	407
	20	1.4	2240	60.0	5000	134	9000	241	18,000	482
	25	1.7	2570	68.9	5700	153	10,000	268	17,200	461
	30	2.1	2890	77.5	6500	174	11,200	300	18,200	488
	40	2.8	3530	94.6	7900	212	12,800	343	14,400	386
	50	3.4	4180	112	9300	249	16,400	440	14,400	386
	60	4.1	4820	129	7630	204	18,800	504	14,000	375
	80	5.5	4600	123	4300	115	5000	134	8400	225
	100	6.9	4970	133	4430	119	5000	134	6000	161
	125	8.6	5200	139	4600	123	6800	182	6000	161
	150	10.3	5430	146	4850	130	6800	182	6000	161
	175	12.1	5430	146	5100	137	6800	182		
16 to 4 In. w.c. / 40 to 99 mbar 28 In. w.c. / 70 mbar ±4 In. w.c. / ±10 mbar 1B413727222 Purple	5	0.34	1110	29.7	2600	69.7	3600	96.5	6500	174
	10	0.69	1570	42.1	3500	93.8	6000	161	10,000	268
	15	1.0	1920	51.5	4400	118	7200	193	14,500	389
	20	1.4	2240	60.0	5100	137	8800	236	17,500	469
	25	1.7	2570	68.9	5800	155	10,000	268	20,000	536
	30	2.1	2890	77.5	6500	174	11,600	311	23,500	630
	40	2.8	3530	94.6	7900	212	14,000	375	22,500	603
	50	3.4	4180	112	9300	249	16,400	440	20,000	536
	60	4.1	4820	129	8400	225	19,000	509	16,500	442
	80	5.5	6110	164	6600	177	6500	174	16,500	442
	100	6.9	6360	170	6910	185	6500	174	7000	188
	125	8.6	6450	173	7300	196	6500	174	7000	188
	150	10.3	6540	175	7700	206	7000	188	7000	188
	175	12.1	6540	175	8100	217	7000	188		

1. Capacities are limited to 15,000 SCFH / 402 Nm³/h when the Type VSX-2 is used without a control line.
2. Due to slam-shut properties, capacities cannot be calculated with critical flow equation.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

- continued -

Table 12. Types 299HS and 299HSR Flow Capacities[1][2] for 2 NPT Internal Registration (continued)

OUTLET PRESSURE RANGE AND SETTING, CONTROL SPRING, PART NUMBER AND COLOR	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
			Orifice Size, In. / mm							
			1/4 x 3/8 / 6.4 x 9.5		3/8 / 9.5		1/2 / 13		3/4 / 19	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
1 to 3.25 psig / 69 mbar to 0.22 bar 2 psig / 0.14 bar ±1% psia / bar T13593T0012 Light blue	5	0.34	1020	27.3	2900	77.7	4000	107	6000	161
	10	0.69	1550	41.5	3600	96.5	5500	147	10,500	281
	15	1.0	1920	51.5	4300	115	7500	201	14,500	389
	20	1.4	2240	60.0	5000	134	8500	228	18,000	482
	25	1.7	2670	71.6	5550	149	10,000	268	20,000	536
	30	2.1	2890	77.5	6100	163	11,000	295	24,000	643
	40	2.8	3530	94.6	7750	208	14,000	375	28,000	750
	50	3.4	4180	112	9400	252	16,000	429	23,000	616
	60	4.1	4820	129	10,730	288	19,000	509	18,000	482
	80	5.5	6110	164	13,400	359	24,000	643	8000	214
	100	6.9	6850	184	10,770	289	6500	174	8000	214
	125	8.6	7070	189	7500	201	7500	201	8000	214
	150	10.3	7300	196	7500	201	7500	201	9500	255
	175	12.1	7300	196	7500	201	7500	201		
2.75 to 6 psig / 0.19 to 0.41 bar 5 psig / 0.34 bar ±1% psia / bar T13671T0012 Orange	10	0.69	1390	37.3	2800	75.0	5000	134	8000	214
	15	1.0	1870	50.1	3750	101	7000	188	13,000	348
	20	1.4	2240	60.0	4700	126	8500	228	17,000	456
	25	1.7	2570	68.9	5700	153	9500	255	20,000	536
	30	2.1	2890	77.5	6430	172	11,000	295	23,000	616
	40	2.8	3530	94.6	7900	212	13,000	348	29,000	777
	50	3.4	4180	112	9300	249	16,000	429	30,000	804
	60	4.1	4790	128	10,700	287	18,000	482	20,000	536
	80	5.5	5740	154	13,350	358	23,000	616	20,000	536
	100	6.9	6680	179	16,000	429	8000	214	20,000	536
	125	8.6	7170	192	12,800	343	8000	214	20,000	536
	150	10.3	7650	205	9600	257	8000	214	20,000	536
	175	12.1	7650	205	9600	257	8000	214		
5 to 16 psig / 0.34 to 1.1 bar 10 psig / 0.69 bar ±1% psia / bar T13600T0012 Red	15	1.0	1800	48.2	3200	85.8	4000	107	8500	228
	20	1.4	2200	59.0	4300	115	12,000	322	14,000	375
	25	1.7	2600	69.7	5400	145	9000	241	19,000	509
	30	2.1	3000	80.4	6600	177	10,000	268	22,000	590
	40	2.8	3650	97.8	7800	209	13,000	348	28,000	750
	50	3.4	4300	115	9000	241	16,000	429	34,000	911
	60	4.1	4950	133	10,460	280	18,000	482	39,000	1045
	80	5.5	6250	168	13,400	359	23,000	616	25,000	670
	100	6.9	7600	204	16,110	432	29,000	777	25,000	670
	125	8.6	9300	249	19,500	523	35,000	938	25,000	670
	150	10.3	9900	265	15,050	403	10,000	268	25,000	670
	175	12.1	10,500	281	10,600	284	10,000	268		
5 to 16 psig / 0.34 to 1.1 bar 15 psig / 1.0 bar ±1% psia / bar T13600T0012 Red	20	1.4	1900	50.9	3400	91.1	6000	161	10,000	268
	25	1.7	2450	65.7	4550	122	8000	214	15,000	402
	30	2.1	3000	80.4	5700	153	10,000	268	20,000	536
	40	2.8	3700	99.2	7600	204	13,000	348	28,000	750
	50	3.4	4320	116	8900	239	15,000	402	35,000	938
	60	4.1	4950	133	10,330	277	18,000	482	40,000	1072
	80	5.5	6200	166	13,200	354	23,000	616	51,000	1367
	100	6.9	7350	197	16,000	429	29,000	777	35,000	938
	125	8.6	8800	236	19,500	523	36,000	965	30,000	804
	150	10.3	10,220	274	22,950	615	40,000	1072	30,000	804
	175	12.1	11,650	312	26,400	708	40,000	1072		

1. Capacities are limited to 15,000 SCFH / 402 Nm³/h when the Type VSX-2 is used without a control line.
2. Due to slam-shut properties, capacities cannot be calculated with critical flow equation.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

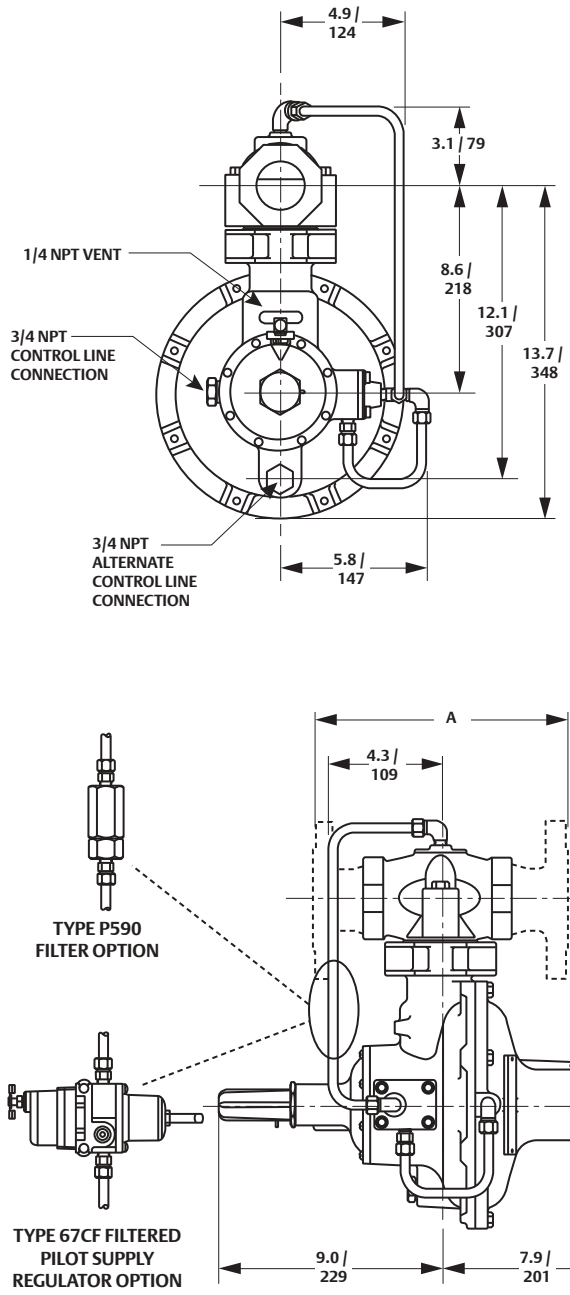


Figure 5. *Types 299H and 299HR Dimensions*

Table 13. Types 299H and 299HR Dimensions

DIMENSION	END CONNECTION STYLE AND FACE-TO-FACE DIMENSION											
	NPT		CL125 FF(1)		CL125 FF		CL150 RF		CL250 RF(2)		PN 10 or 16(2)	
	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
A	6.12	155	7.50	199	10.00	254	10.00	254	10.50	267	9.06	230

1. Available in Cast iron only.
2. Available in Ductile iron only.

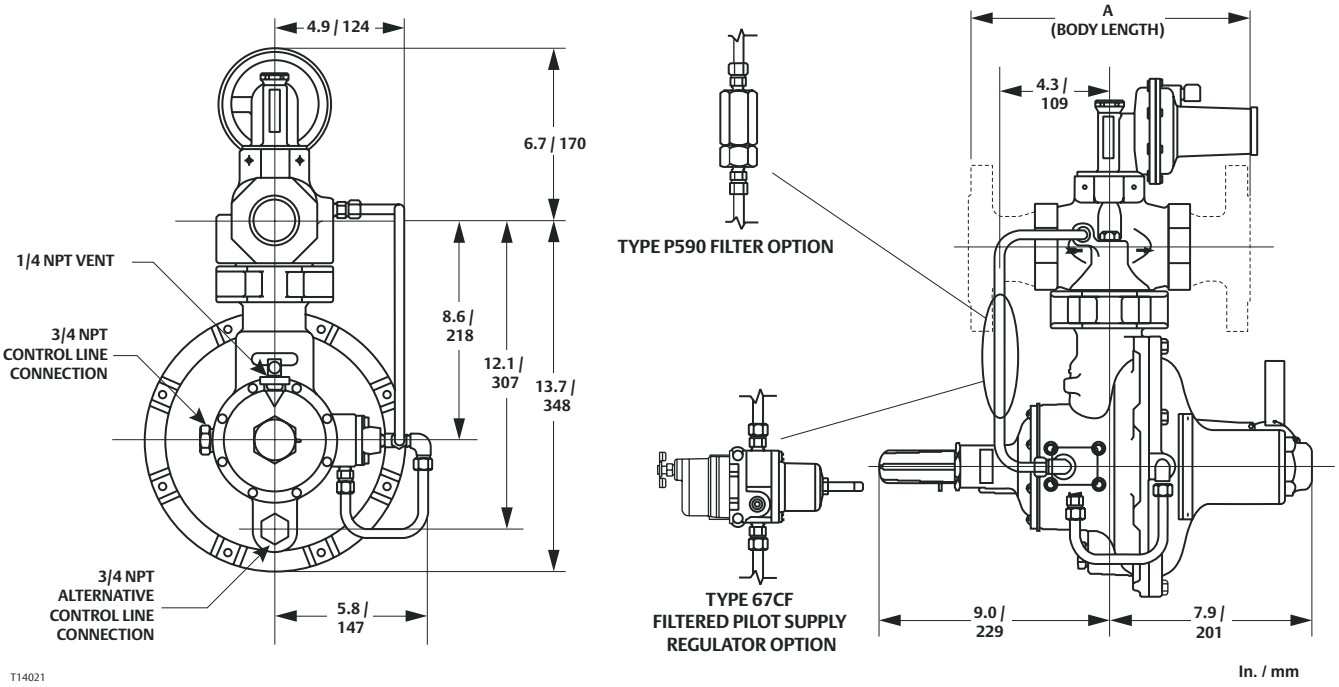


Figure 6. *Types 299HS and 299HSR Dimensions*

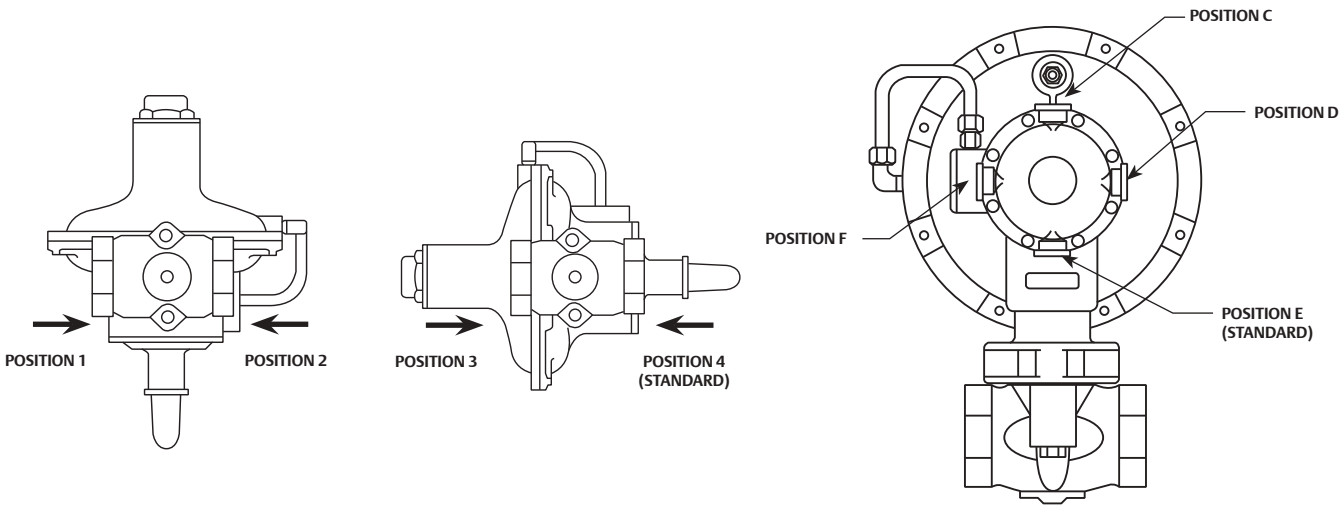


Figure 7. *Body and Vent Positions*

Table 14. Types 299HS and 299HSR Dimensions (See Figure 6)

DIMENSION	BODY SIZE AND END CONNECTION									
	1-1/2 NPT		2 NPT		NPS 2 / DN 50, CL125 FF		NPS 2 / DN 50, CL250 RF		NPS 2 / DN 50, PN 10/16 RF	
	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
A	6.12	155	6.12	155	10.00	254	10.50	267	9.06	230

Ordering Guide

Type (Select One)

- ☐ 299H***
- ☐ 299HR***
- ☐ 299HS***
- ☐ 299HSR***

Body Size, Material and End Connection Style (Select One)

1-1/4 NPT

- ☐ Cast iron (For Types 299H and 299HR only)***

1-1/2 NPT

- ☐ Cast iron (For Types 299H and 299HR only)***
- ☐ Ductile iron***
- ☐ Steel (For Types 299H and 299HR only)***

NPS 2 / DN 50

Cast iron (For Types 299H and 299HR only)

- ☐ NPT***
- ☐ CL125 FF - 7.5 In. / 191 mm***
- ☐ CL125 FF - 10 In. / 254 mm***

Ductile iron

- ☐ NPT***
- ☐ CL125 FF - 10 In. / 254 mm***
- ☐ CL250 RF***
- ☐ PN 10 RF*
- ☐ PN 16 RF*

Steel (For Types 299H and 299HR only)

- ☐ NPT***
- ☐ CL150 RF***

Orifice Size (Select One)

- ☐ 1/4 x 3/8 In. / 6.4 x 9.5 mm***
- ☐ 3/8 In. / 9.5 mm***
- ☐ 1/2 In. / 13 mm***
- ☐ 3/4 In. / 19 mm***
- ☐ 7/8 In. / 22 mm (For Types 299H and 299HR only)***
- ☐ 1 In. / 25 mm (For Types 299H and 299HR only)***
- ☐ 1-3/16 In. / 30 mm (For Types 299H and 299HR only)***

Outlet Pressure Range (Select One)

- ☐ 3.5 to 6 In. w.c. / 9 to 15 mbar, Black***
- ☐ 5 to 9 In. w.c. / 12 to 22 mbar, Yellow***
- ☐ 7 to 20 In. w.c. / 17 to 50 mbar, Unpainted***
- ☐ 16 to 40 In. w.c. / 40 to 99 mbar, Purple***
- ☐ 1 to 3.25 psig / 69 mbar to 0.22 bar, Light Blue***
- ☐ 2.75 to 6 psig / 0.19 to 0.41 bar, Orange***
- ☐ 5 to 16 psig / 0.34 to 1.1 bar, Red***
- ☐ 14 to 35 psig / 0.97 to 2.4 bar (Type 299H only), Zinc***
- ☐ 30 to 60 psig / 2.1 to 4.1 bar (Type 299H only), Green***

Pressure Registration (Select One)

- ☐ Internal***
- ☐ External***
- ☐ Dual***

Fixed Restriction (Select One)

- ☐ 0.044 In. / 1.1 mm, Red (**standard** gain)***
- ☐ 0.071 In. / 1.8 mm, Green (low gain)***
- ☐ 0.082 In. / 2.1 mm, Blue (lower gain)***

Type VSX-2 Trip Pressure Range

High Pressure Trip (Select One)
(For OPSO or OPSO/UPSO)

- ☐ 12 to 25 In. w.c. / 30 to 62 mbar***
- ☐ 20 to 52 In. w.c. / 50 to 129 mbar***
- ☐ 1.4 to 3.9 psig / 97 to 269 mbar***
- ☐ 3.8 to 8.7 psig / 262 to 600 mbar***
- ☐ 5.8 to 16 psig / 400 to 1103 mbar***
- ☐ 11.6 to 23 psig / 800 to 1586 mbar***

Low Pressure Trip (Select One) (For OPSO/UPSO only)

- ☐ 2 to 12 In. w.c. / 5 to 30 mbar***
- ☐ 4 to 30 In. w.c. / 10 to 75 mbar***
- ☐ 0.36 to 2.3 psig / 25 to 159 mbar***
- ☐ 1.5 to 10.8 psig / 103 to 745 mbar***

Type P590 Pilot Supply Filter (Optional)

- ☐ Type P593-1, Aluminum
- ☐ Type 594-1, Brass

Type 67CF Filtered Pilot Supply Regulator (Optional)

- ☐ Yes, please add a Type 67CF regulator to this order.

Main Valve Parts Kit (Optional)

- ☐ Yes, please send one parts kit to match this order.

Pilot Parts Kit (Optional)

- ☐ Yes, please send one parts kit to match this order.

- continued -

Ordering Guide (continued)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

When adjusting setpoint, the regulator should be flowing at least five percent of the normal operating flow.

Introduction

The Type 310A pilot-operated high-pressure regulator is used where high capacity and accurate control are essential. This regulator includes one Type 32A pilot assembly mounted on the main valve for pressure-reducing or wide-open monitor applications (see Figure 2) or two Type 32A pilots mounted on the main valve for working monitor applications (see Figure 3).

Body Sizes and End Connection Styles

See Table 1

Flow Capacities

See Tables 10 through 14

Flow and Sizing Coefficients

See Tables 6 through 8

IEC Sizing Coefficients

See Table 9

Maximum Inlet and Pilot Supply Pressures

NPT or CL600 RF: 1500 psig / 103 bar

CL300 RF: 750 psig / 51.7 bar

Maximum Outlet Pressure

Operating: 700 psig / 48.3 bar

To Avoid Internal Part Damage: 800 psig / 55.2 bar, exceeding this pressure may result in gas venting from pilot spring case

Emergency (Casing): 1500 psig / 103 bar or maximum inlet pressure whichever is lower

Maximum Pressure Drop

NPT or CL600 RF: 1425 psig / 98.3 bar

CL300 RF: 720 psig / 49.6 bar

Minimum Differential Pressure

15 psig / 1.0 bar

Outlet Pressure Ranges

10 to 700 psig / 0.69 to 48.3 bar in five ranges

See Table 5

Pressure Registration

External

Temperature Capabilities

Nitrile (NBR) With Wiper Ring: -20 to 150°F / -29 to 66°C

Fluorocarbon (FKM) With Wiper Ring: 0 to 150°F / -18 to 66°C

Fluorocarbon (FKM) Without Wiper Ring: 0 to 300°F / -18 to 149°C

Options

- Main valve body without pilot for on-off service
- Type 252 pilot supply filter
- Remote-mounted pilot
- Electrically controlled pilot using Type 662 Kixcel™
- Travel indicator
- Pressure loaded pilot
- Backpressure protection system
- Restricted Trim (30%, 50% or 70%)
- NACE construction
- Inlet tap

Approximate Shipping Weights

See Table 15

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **High Capacity**
- **Tight Shutoff**
- **Accurate Control**
- **Minimum Installation Space Required**
- **Fast Speed of Response**
- **Reduced Relief Requirements**



W6278

Figure 1. *Type 310A Pressure Reducing Regulator with Type 32A Pilot*

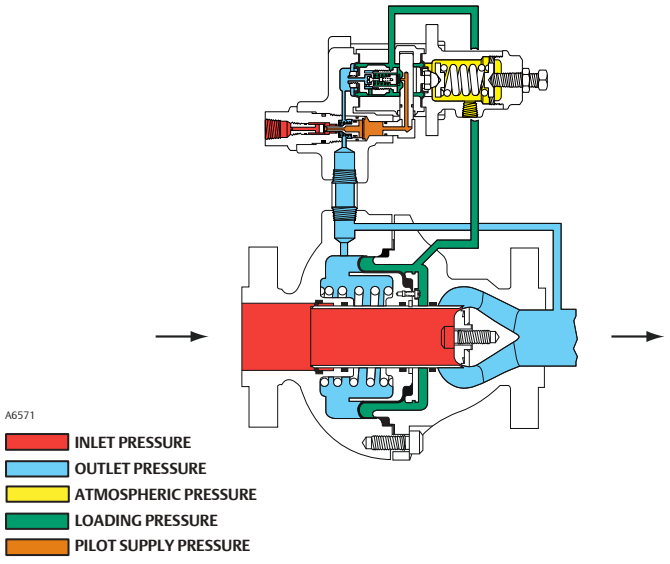


Figure 2. *Type 310A-32A Operational Schematic*

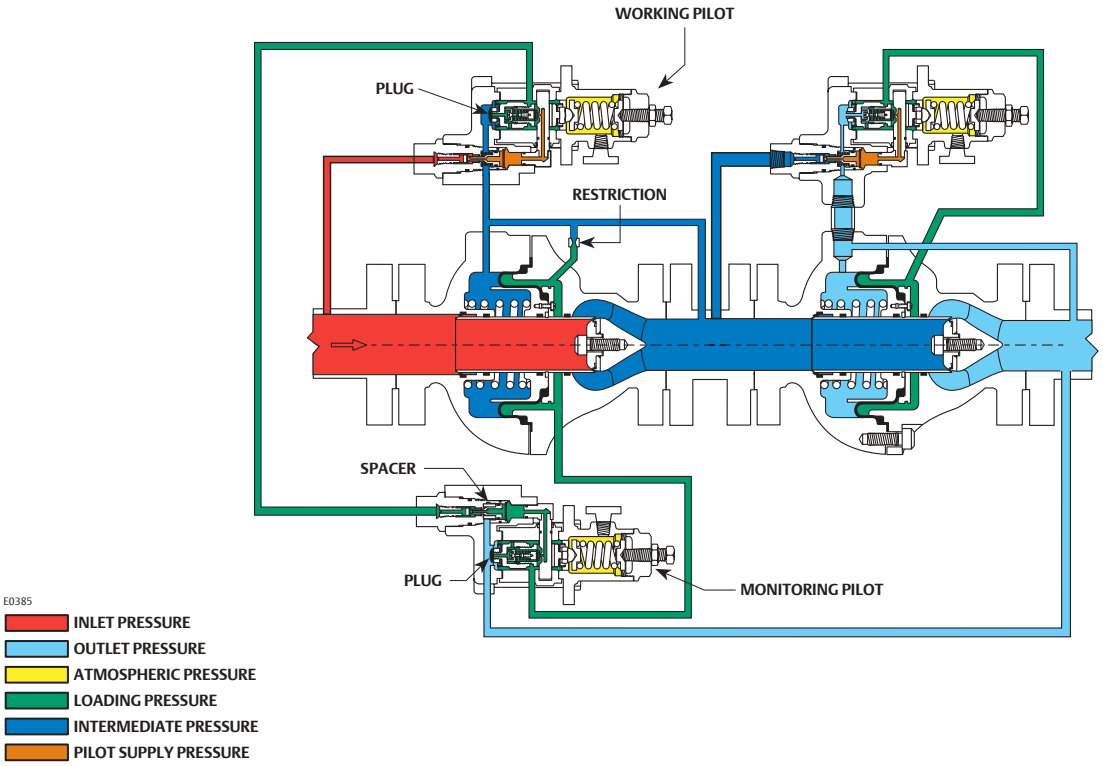


Figure 3. *Type 310A-32A-32A Working Monitor Regulator Operational Schematic*

Table 1. Body Size and End Connection Style

BODY SIZE		END CONNECTION STYLE
NPS	DN	
1	25	NPT, CL300 RF or CL600 RF
2, 3, 4 or 4 x 6	50, 80, 100 or 100 x 150	CL300 RF or CL600 RF

Table 2. Maximum Travel

BODY SIZE		MAXIMUM TRAVEL	
NPS	DN	Inches	mm
1	25	0.5	13
2	50	0.875	22
3	80	1	25
4	100	1.125	29
4 x 6	100 x 150	1.5	38

Table 3. Main Valve Construction Material

BODY	THROTTLING SLEEVE AND VALVE PLUG	SEAT	MAIN SPRING AND DIAPHRAGM PLATE	O-RING AND DIAPHRAGM
WCC Steel	Stainless steel	Polytetrafluoroethylene (PTFE)	Steel	Nitrile (NBR) **(standard)** or Fluorocarbon (FKM)

Table 4. Type 32A Pilot Construction Material

SPRING CASE AND PILOT BODY	DIAPHRAGM	YOKE ORIFICE ASSEMBLY AND BLEED VALVE	PILOT MAIN SPRING	VALVE DISK ASSEMBLY
Cast Steel	Nitrile (NBR) **(standard)** or Fluorocarbon (FKM)	Stainless steel	Plated steel	Stainless steel / Nitrile (NBR) **(standard)** or Stainless steel / Fluorocarbon (FKM)

Table 5. Outlet Pressure Range and Proportional Band

OUTLET PRESSURE RANGE		PILOT SPRING PART NUMBER	SPRING COLOR	PROPORTIONAL BAND		WIRE DIAMETER		FREE LENGTH		RECOMMENDED MINIMUM DIFFERENTIAL BETWEEN MONITORING PILOT SETTING AND DISTRIBUTION PRESSURE
psig	bar			psig	bar	In.	mm	In.	mm	
10 to 20 10 to 100	0.69 to 1.4 0.69 to 6.9	1D809627022 1E392527022	Silver Yellow	0.5 2	0.03 0.14	0.10 0.15	2.41 3.76	1.84 2.00	46.7 50.8	3.0 psig / 0.21 bar, over normal distribution pressure 5.0 psig / 0.34 bar, over normal distribution pressure
100 to 250 250 to 600 400 to 700(1)	6.9 to 17.2 17.2 to 41.4 27.6 to 48.3(1)	1D387227022 1D465127142 13A5543X012	Blue Red Green	5 12 20	0.34 0.83 1.4	0.20 0.24 0.28	5.08 6.17 7.19	1.69 1.69 2.00	42.9 42.9 50.8	10 psig / 0.69 bar, over normal distribution pressure 15 psig / 1.0 bar, over normal distribution pressure 20 psig / 1.4 bar, over normal distribution pressure

1. Available with Nitrile (NBR) pilot diaphragm only.

Table 6. Wide-Open Flow Coefficient for Relief Valve Sizing

TRIM SIZE		BODY SIZE, NPS / DN				
		1 / 25	2 / 50	3 / 80	4 / 100	4 x 6 / 100 x 150
30%	C_g	238	835	1810	3080	4400
	C_v	8.6	30.6	64.6	114.9	181.8
	C_1	27.7	27.3	28	26.8	24.2
50%	C_g	313	1240	2810	4620	6600
	C_v	10.3	46.3	99.3	172.4	280.9
	C_1	30.4	26.8	28.3	26.8	23.5
70%	C_g	----	1800	3780	6660	9000
	C_v	----	69	129	213	360
	C_1	----	26.2	29.3	31.3	25
100%	C_g	612	2610	5510	8830	16,200
	C_v	22	95	200	322	661
	C_1	28.1	27.5	27.5	27.4	24.5

Table 7. Regulating Flow Coefficient for Body Size Piping

COEFFICIENT AT PERCENT OF MAXIMUM TRAVEL		TRIM SIZE (PERCENT OF FLOW CAPACITY) BY BODY SIZE, NPS / DN																		
		1 / 25			2 / 50				3 / 80				4 / 100				4 x 6 / 100 x 150			
		100%	50%	30%	100%	70%	50%	30%	100%	70%	50%	30%	100%	70%	50%	30%	100%	70%	50%	30%
10%	C_g	65	60	56	210	200	190	185	346	340	325	305	805	725	615	510	895	800	780	760
	C_v	2.2	2.0	2.0	7.6	7.5	6.9	7.0	12.5	11.6	11.3	10.8	29.6	24.0	22.6	19.2	41.6	32.0	33.2	31.4
20%	C_g	115	93	83	460	396	311	260	810	735	615	460	1800	1310	1040	705	2235	1680	1420	1160
	C_v	4.0	3.2	3.0	16.6	14.9	11.3	9.8	29.3	25.2	21.4	16.3	66.2	43.4	38.2	26.6	104.0	67.2	60.4	47.9
30%	C_g	210	124	107	810	583	430	325	1520	1120	85	606	3100	1990	1480	917	3800	2550	2050	1550
	C_v	7.3	4.2	3.8	29.2	21.9	15.6	12.3	55.1	38.4	3.0	21.4	114.0	65.9	54.4	34.6	176.7	102.0	87.2	64.0
40%	C_g	343	151	126	1120	758	540	385	2380	1480	1130	755	4350	2650	1900	1130	5510	3300	2650	1940
	C_v	11.9	5.1	4.5	40.4	28.5	19.6	14.6	86.2	50.7	39.4	26.7	159.9	87.7	69.9	42.6	256.3	132.0	112.8	80.2
50%	C_g	427	178	140	1440	925	646	444	3270	1840	1380	902	5480	3280	2300	1340	7300	4150	3250	2330
	C_v	14.8	6.0	5.0	52.0	34.8	23.4	16.8	118.5	63.0	48.1	31.9	201.5	108.6	84.6	50.6	339.5	166.0	138.3	96.3
60%	C_g	485	204	150	1750	1090	744	502	3890	2190	1630	1060	6310	3950	2730	1540	9010	5010	3840	2720
	C_v	16.8	6.9	5.4	63.2	41.0	27.0	19.0	140.9	75.0	56.8	37.5	232.0	130.8	110.4	58.1	419.1	200.4	163.4	112.4
70%	C_g	523	226	159	2040	1240	841	561	4410	2540	1880	1210	7040	4550	3140	1740	10,580	5870	4430	3110
	C_v	18.2	7.7	5.7	73.6	46.6	30.5	21.3	159.8	87.0	65.5	42.8	258.8	150.7	115.4	65.7	492.1	234.8	188.5	128.5
80%	C_g	549	250	168	2260	1400	946	624	4820	2900	2130	1360	7640	5110	3540	1950	12,100	6720	5030	3500
	C_v	19	8	6	82	53	34	24	175	99	74	48	281	169	130	74	563	269	214	145
90%	C_g	573	272	177	2430	1550	1040	690	5080	3210	2380	1510	8140	5700	3950	2200	13,600	7570	5650	3870
	C_v	20	9	6	88	58	38	26	184	110	83	53	299	189	145	83	633	303	240	160
100%	C_g	597	289	184	2520	1700	1130	761	5330	3530	2640	1670	8670	6390	4390	2680	14,900	8450	6320	4120
	C_v	21	10	7	91	64	41	29	193	121	92	59	319	212	161	101	693	338	269	174
C_1		28.8	29.5	28	27.7	26.6	27.6	26.4	27.6	29.2	28.7	28.3	27.2	30.2	27.2	26.5	24.5	25	23.5	24.2

Table 8. Regulating Flow Coefficient for 2:1 Swaged Piping and 100% Trim

COEFFICIENT AT PERCENT OF MAXIMUM TRAVEL		TRIM SIZE (PERCENT OF FLOW CAPACITY) BY BODY SIZE, NPS / DN				
		1 / 25	2 / 50	3 / 80	4 / 100	4 x 6 / 100 x 150
10%	C_g	60	210	340	810	850
	C_v	2.0	7.1	11.6	28.1	29.8
20%	C_g	115	450	825	1700	2050
	C_v	3.8	15.2	28.3	59.0	71.9
30%	C_g	205	795	1540	3050	3300
	C_v	6.7	26.8	52.7	105.9	115.8
40%	C_g	330	1110	2350	4300	4650
	C_v	10.8	37.4	80.5	149.3	163.2
50%	C_g	395	1380	3025	5400	6050
	C_v	13.0	46.5	103.6	187.5	212.3
60%	C_g	450	1610	3550	6200	7430
	C_v	14.8	54.2	121.6	215.3	260.7
70%	C_g	490	1800	3900	3900	8700
	C_v	16.1	60.6	133.6	135.4	305.3
80%	C_g	515	1960	4200	7400	9860
	C_v	17	66	144	257	346
90%	C_g	533	2055	4440	7800	10,800
	C_v	17	69	152	271	379
100%	C_g	548	2140	4610	8150	11,600
	C_v	18	72	158	283	407
C_1		30.5	29.7	29.2	28.8	28.5

Table 9. IEC Sizing Coefficient

BODY SIZE, NPS / DN	1 / 25	2 / 50	3 / 80	4 / 100	4 x 6 / 100 x 150
X_T	0.53	0.49	0.48	0.47	0.29
F_D	0.66	0.59	0.56	0.48	0.58
F_L	0.74	0.74	0.74	0.74	0.74

Table 10. NPS 1 / DN 25 Body Size Capacities with 100% Trim and Body Size Piping

INLET PRESSURE, psig / bar	CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Outlet Pressure, psig / bar													
	25 / 1.7	50 / 3.4	100 / 6.9	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 / 38.0	600 / 41.4	700 / 48.3
50 / 3.5	48 / 1.3													
100 / 6.9	88 / 2.4	87 / 2.3												
200/ 13.8	165 / 4.4	165 / 4.4	163 / 4.4	139 / 3.7										
300 / 20.7	243 / 6.5	243 / 6.5	243 / 6.5	240 / 6.4	223 / 6.0	178 / 4.8								
400 / 27.6	320 / 8.6	320 / 8.6	320 / 8.6	320 / 8.6	317 / 8.5	303 / 8.1	272 / 7.3	211 / 5.7						
500 / 34.5	397 / 10.6	397 / 10.6	397 / 10.6	397 / 10.6	397 / 10.6	393 / 10.5	381 / 10.2	357 / 9.6	314 / 8.4	239 / 6.4				
600 / 41.4	474 / 12.7	474 / 12.7	474 / 12.7	474 / 12.7	474 / 12.7	474 / 12.7	470 / 12.6	459 / 12.3	438 / 11.7	404 / 10.8	351 / 9.4	264 / 7.1		
700/ 48.3	551 / 14.8	551 / 14.8	551 / 14.8	551 / 14.8	551 / 14.8	551 / 14.8	551 / 14.8	547 / 14.7	536 / 14.4	518 / 13.9	490 / 13.1	448 / 12.0	385 / 10.3	
800 / 55.2	628 / 16.8	628 / 16.8	628 / 16.8	628 / 16.8	628 / 16.8	628 / 16.8	628 / 16.8	628 / 16.8	623 / 16.7	614 / 16.5	597 / 16.0	572 / 15.3	537 / 14.4	416 / 11.1
1000 / 69.0	782 / 21.0	782 / 21.0	782 / 21.0	782 / 21.0	782 / 21.0	782 / 21.0	782 / 21.0	782 / 21.0	782 / 21.0	781 / 20.9	777 / 20.8	768 / 20.6	754 / 20.2	705 / 18.9
1200 / 82.7	936 / 25.1	936 / 25.1	936 / 25.1	936 / 25.1	936 / 25.1	936 / 25.1	936 / 25.1	936 / 25.1	936 / 25.1	936 / 25.1	936 / 25.1	935 / 25.1	930 / 24.9	908 / 24.3
1400 / 96.5	1090 / 29.2	1090 / 29.2	1090 / 29.2	1090 / 29.2	1090 / 29.2	1090 / 29.2	1090 / 29.2	1090 / 29.2	1090 / 29.2	1090 / 29.2	1090 / 29.2	1090 / 29.2	1090 / 29.2	1082 / 29.0

☐ - Blank areas indicate where no flow occurs because outlet pressure is equal to or greater than inlet pressure.

Table 11. NPS 2 / DN 50 Body Size Capacities with 100% Trim and Body Size Piping

INLET PRESSURE, psig / bar	CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Outlet Pressure, psig / bar													
	25 / 1.7	50 / 3.4	100 / 6.9	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 / 38.0	600 / 41.4	700 / 48.3
50 / 3.4	205 / 5.5													
100 / 6.9	373 / 10.0	369 / 9.9												
200 / 13.8	698 / 18.7	698 / 18.7	695 / 18.6	602 / 16.1										
300 / 20.7	1024 / 27.4	1024 / 27.4	1024 / 27.4	1020 / 27.3	959 / 25.7	775 / 20.8								
400 / 27.6	1349 / 36.2	1349 / 36.2	1349 / 36.2	1349 / 36.2	1345 / 36.0	1298 / 34.8	1175 / 31.5	917 / 24.6						
500 / 34.5	1674 / 44.9	1674 / 44.9	1674 / 44.9	1674 / 44.9	1674 / 44.9	1670 / 44.8	1631 / 43.7	1537 / 41.2	1361 / 36.5	1041 / 27.9				
600 / 41.4	2000 / 53.6	2000 / 53.6	2000 / 53.6	2000 / 53.6	2000 / 53.6	2000 / 53.6	1995 / 53.5	1961 / 52.6	1884 / 50.5	1748 / 46.8	1526 / 40.9	1152 / 30.9		
700 / 48.3	2325 / 62.3	2325 / 62.3	2325 / 62.3	2325 / 62.3	2325 / 62.3	2325 / 62.3	2325 / 62.3	2320 / 62.2	2289 / 61.3	2223 / 59.6	2112 / 56.6	1939 / 52	1677 / 44.9	
800 / 55.2	2650 / 71.0	2650 / 71.0	2650 / 71.0	2650 / 71.0	2650 / 71.0	2650 / 71.0	2650 / 71.0	2650 / 71.0	2645 / 70.9	2617 / 70.1	2558 / 68.6	2463 / 66.0	2321 / 62.2	1814 / 48.6
1000 / 69.0	3301 / 88.5	3301 / 88.5	3301 / 88.5	3301 / 88.5	3301 / 88.5	3301 / 88.5	3301 / 88.5	3301 / 88.5	3301 / 88.5	3301 / 88.5	3295 / 88.3	3270 / 87.6	3222 / 86.4	3038 / 81.4
1200 / 82.7	3952 / 106	3952 / 106	3952 / 106	3952 / 106	3952 / 106	3952 / 106	3952 / 106	3952 / 106	3952 / 106	3952 / 106	3952 / 106	3952 / 106	3945 / 106	3878 / 104
1400 / 96.5	4602 / 123	4602 / 123	4602 / 123	4602 / 123	4602 / 123	4602 / 123	4602 / 123	4602 / 123	4602 / 123	4602 / 123	4602 / 123	4602 / 123	4602 / 123	4602 / 123

☐ - Blank areas indicate where no flow occurs because outlet pressure is equal to or greater than inlet pressure.

Table 12. NPS 3 / DN 80 Body Sizes Capacities with 100% Trim and Body Size Piping

INLET PRESSURE, psig / bar	CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Outlet Pressure, psig / bar													
	25 / 1.7	50 / 3.4	100 / 6.9	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 / 38.0	600 / 41.4	700 / 48.3
50 / 3.4	434 / 11.6													
100 / 6.9	739 / 19.8	781 / 20.9												
200 / 13.8	1477 / 39.6	1477 / 39.6	1471 / 39.4	1276 / 34.2										
300 / 20.7	2165 / 58.0	2165 / 58.0	2165 / 58.0	2159 / 57.9	2032 / 54.5	1643 / 44.0								
400 / 27.6	2854 / 76.5	2854 / 76.5	2854 / 76.5	2854 / 76.5	2847 / 76.3	2749 / 73.7	2491 / 66.8	1946 / 52.2						
500 / 34.5	3542 / 94.9	3542 / 94.9	3542 / 94.9	3542 / 94.9	3542 / 94.9	3534 / 94.7	3453 / 92.5	3256 / 87.3	2886 / 77.3	2209 / 59.2				
600 / 41.4	4230 / 113	4230 / 113	4230 / 113	4230 / 113	4230 / 113	4230 / 113	4222 / 113	4151 / 111	3990 / 107	3705 / 99.3	3237 / 86.8	2445 / 65.5		
700 / 48.3	4918 / 132	4918 / 132	4918 / 132	4918 / 132	4918 / 132	4918 / 132	4918 / 132	4909 / 132	4846 / 130	4709 / 126	4475 / 120	4111 / 110	3556 / 95.3	
800 / 55.2	5606 / 150	5606 / 150	5606 / 150	5606 / 150	5606 / 150	5606 / 150	5606 / 150	5606 / 150	5597 / 150	5539 / 148	5418 / 145	5219 / 140	4919 / 132	3847 / 103
1000 / 69.0	6982 / 187	6982 / 187	6982 / 187	6982 / 187	6982 / 187	6982 / 187	6982 / 187	6982 / 187	6982 / 187	6982 / 187	6972 / 187	6922 / 186	6823 / 183	6437 / 173
1200 / 82.7	8358 / 224	8358 / 224	8358 / 224	8358 / 224	8358 / 224	8358 / 224	8358 / 224	8358 / 224	8358 / 224	8358 / 224	8358 / 224	8358 / 224	8347 / 224	8210 / 220
1400 / 96.5	9735 / 261	9735 / 261	9735 / 261	9735 / 261	9735 / 261	9735 / 261	9735 / 261	9735 / 261	9735 / 261	9735 / 261	9735 / 261	9735 / 261	9735 / 261	9375 / 251

☐ - Blank areas indicate where no flow occurs because outlet pressure is equal to or greater than inlet pressure.

Table 13. NPS 4 / DN 100 Body Size Capacities with 100% Trim and Body Size Piping

INLET PRESSURE, psig / bar	CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Outlet Pressure, psig / bar													
	25 / 1.7	50 / 3.4	100 / 6.9	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 / 38.0	600 / 41.4	700 / 48.3
50 / 3.4	709 / 19.0													
100 / 6.9	1284 / 34.4	1274 / 34.1												
200 / 13.8	2403 / 64.4	2403 / 64.4	2396 / 64.2	2094 / 56.1										
300 / 20.7	3522 / 94.4	3522 / 94.4	3522 / 94.4	3517 / 94.3	3327 / 89.2	2701 / 72.4								
400 / 27.6	4642 / 124	4642 / 124	4642 / 124	4642 / 124	4636 / 124	4495 / 120	4087 / 110	3202 / 85.8						
500 / 34.5	5761 / 154	5761 / 154	5761 / 154	5761 / 154	5761 / 154	5756 / 154	5641 / 151	5335 / 143	4741 / 127	3638 / 97.5				
600 / 41.4	6880 / 184	6880 / 184	6880 / 184	6880 / 184	6880 / 184	6880 / 184	6875 / 184	6778 / 182	6531 / 175	6078 / 163	5322 / 143	4027 / 108		
700 / 48.3	8000 / 214	8000 / 214	8000 / 214	8000 / 214	8000 / 214	8000 / 214	8000 / 214	7994 / 214	7909 / 212	7701 / 206	7334 / 197	6751 / 181	5850 / 157	
800 / 55.2	9119 / 244	9119 / 244	9119 / 244	9119 / 244	9119 / 244	9119 / 244	9119 / 244	9119 / 244	9113 / 244	9038 / 242	8857 / 237	8546 / 229	8070 / 216	6331 / 170
1000 / 69.0	11,357 / 304	11,357 / 304	11,357 / 304	11,357 / 304	11,357 / 304	11,357 / 304	11,357 / 304	11,357 / 304	11,357 / 304	11,357 / 304	11,352 / 304	11,288 / 303	11,144 / 299	10,545 / 283
1200 / 82.7	13,596 / 364	13,596 / 364	13,596 / 364	13,596 / 364	13,596 / 364	13,596 / 364	13,596 / 364	13,596 / 364	13,596 / 364	13,596 / 364	13,596 / 364	13,596 / 364	13,590 / 364	13,403 / 359
1400 / 96.5	15,835 / 424	15,835 / 424	15,835 / 424	15,835 / 424	15,835 / 424	15,835 / 424	15,835 / 424	15,835 / 424	15,835 / 424	15,835 / 424	15,835 / 424	15,835 / 424	15,835 / 424	15,835 / 424

▭ - Blank areas indicate where no flow occurs because outlet pressure is equal to or greater than inlet pressure.

Table 14. NPS 4 x 6 / DN 100 x 150 Body Size Capacities with 100% Trim and 2:1 Swaged Piping

INLET PRESSURE, psig / bar	CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS														
	Outlet Pressure, psig / bar														
	25 / 1.7	50 / 3.4	100 / 6.9	150 / 10.3	200 / 13.8	250 / 17.2	300 / 20.7	325 / 22.4	350 / 24.1	400 / 27.6	425 / 29.3	450 / 31.0	500 / 34.5	550 / 38.0	600 / 41.4	700 / 48.3
50 / 3.4	933 / 25.0															
100 / 6.9	1716 / 46.0	1686 / 45.2														
200 / 13.8	3213 / 86.1	3213 / 86.1	3180 / 85.2	2720 / 72.9												
300 / 20.7	4709 / 126	4709 / 126	4709 / 126	4672 / 125	4353 / 117	3488 / 93.5										
400 / 27.6	6206 / 166	6206 / 166	6206 / 166	6206 / 166	6163 / 165	5906 / 158	5312 / 142	4822 / 129	4123 / 110							
500 / 34.5	7702 / 206	7702 / 206	7702 / 206	7702 / 206	7702 / 206	7653 / 205	7430 / 199	7233 / 194	6965 / 187	6139 / 165	5519 / 148	4675 / 125				
600 / 41.4	9198 / 247	9198 / 247	9198 / 247	9198 / 247	9198 / 247	9198 / 247	9144 / 245	9064 / 243	8943 / 240	8552 / 229	8266 / 222	7903 / 212	6874 / 184	5170 / 139		
700 / 48.3	10,695 / 287	10,695 / 287	10,695 / 287	10,695 / 287	10,695 / 287	10,695 / 287	10,695 / 287	10,679 / 286	10,634 / 285	10,449 / 280	10,299 / 276	10,107 / 271	9565 / 256	8753 / 235	7542 / 202	
800 / 55.2	12,191 / 327	12,191 / 327	12,191 / 327	12,191 / 327	12,191 / 327	12,191 / 327	12,191 / 327	12,191 / 327	12,190 / 327	12,125 / 325	12,052 / 323	11,950 / 320	11,643 / 312	11,173 / 299	10,494 / 281	8159 / 219
1000 / 69.0	15,184 / 407	15,184 / 407	15,184 / 407	15,184 / 407	15,184 / 407	15,184 / 407	15,184 / 407	15,184 / 407	15,184 / 407	15,184 / 407	15,184 / 407	15,177 / 407	15,105 / 405	14,946 / 401	14,686 / 394	13,783 / 369
1200 / 82.7	18,177 / 487	18,177 / 487	18,177 / 487	18,177 / 487	18,177 / 487	18,177 / 487	18,177 / 487	18,177 / 487	18,177 / 487	18,177 / 487	18,177 / 487	18,177 / 487	18,177 / 487	18,162 / 487	18,086 / 485	17,706 / 475
1400 / 96.5	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,170 / 567	21,066 / 565

▭ - Blank areas indicate where no flow occurs because outlet pressure is equal to or greater than inlet pressure.

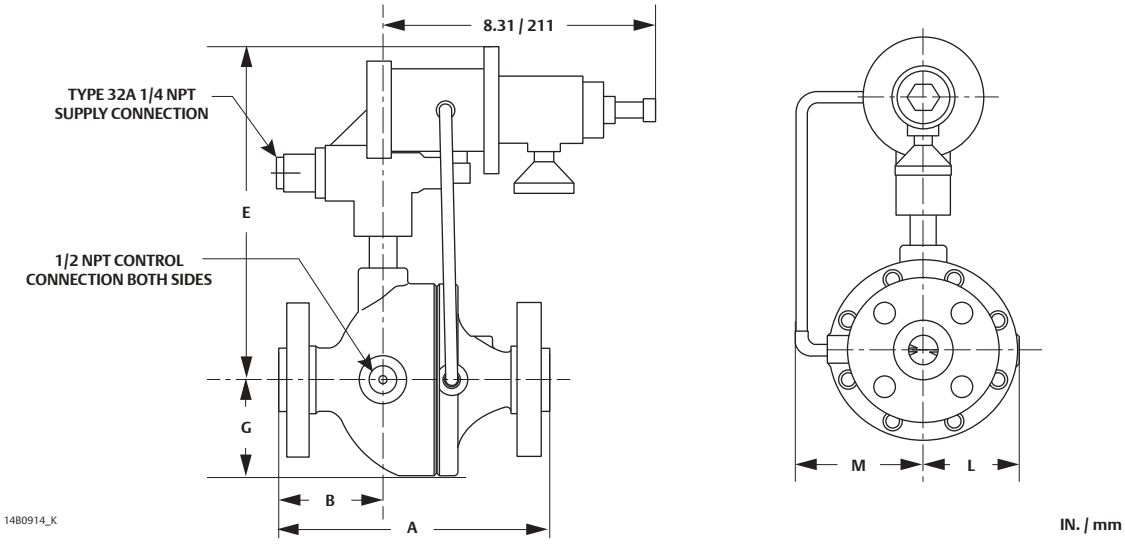


Figure 4. *Dimensions*

Table 15. Dimension and Shipping Weight

BODY SIZE, NPS / DN	DIMENSION, IN. / mm										APPROXIMATE SHIPPING WEIGHT, LBS / kg
	A			B			E	G	L	M	
	NPT	CL300 RF	CL600 RF	NPT	CL300 RF	CL600 RF					
1 / 25	8.25 / 210	7.78 / 198	8.28 / 210	2.94 / 75	2.94 / 75	3.19 / 81	10.56 / 268	3.06 / 78	3.56 / 90	4.00 / 102	45 / 20
2 / 50	----	10.53 / 267	11.28 / 287	----	3.44 / 87	3.81 / 97	11.56 / 294	4.44 / 113	4.56 / 116	5.44 / 138	90 / 41
3 / 80	----	12.53 / 318	13.28 / 337	----	3.81 / 97	4.19 / 106	12.38 / 314	5.25 / 133	5.38 / 137	6.25 / 159	145 / 66
4 / 100	----	14.53 / 369	15.53 / 394	----	4.88 / 124	5.38 / 137	14.25 / 362	7.12 / 181	7.25 / 184	8.12 / 206	190 / 86
4 x 6 / 100 x 150	----	16.19 / 411	17.38 / 441	----	4.88 / 124	5.38 / 137	14.25 / 362	7.12 / 181	7.25 / 184	8.00 / 203	235 / 107

Ordering Guide

Type (Select One)

- ☐ 310A-32A (one pilot for standard pressure reducing and wide-open monitor applications)***
- ☐ 310A-32A-32A (two pilots for working monitor applications)***

Body Size and Material (Select One)

- ☐ NPS 1 / DN 25***
- ☐ NPS 2 / DN 50***
- ☐ NPS 3 / DN 80***
- ☐ NPS 4 / DN 100***
- ☐ NPS 4 x 6 / DN 100 x 150***

End Connection Style (Select One)

- ☐ NPT (available for NPS 1 / DN 25 body only)***
- ☐ CL300 RF***
- ☐ CL600 RF***

Trim, Percent of Full Capacity (Select One)

- ☐ 100 % **(standard)***
- ☐ 70 % (Not Available for NPS 1 / DN 25 body)
- ☐ 50 %
- ☐ 30 %

Outlet Pressure Range (Select One)

- ☐ 10 to 20 psig / 0.69 to 1.4 bar***
- ☐ 10 to 100 psig / 0.69 to 6.9 bar***
- ☐ 100 to 250 psig / 6.9 to 17.2 bar***
- ☐ 250 to 600 psig / 17.2 to 41.4 bar***
- ☐ 400 to 700 psig / 27.6 to 48.3 bar, [only available in Nitrile (NBR)]***

Main Valve Diaphragm and O-rings (Select One)

- ☐ Nitrile (NBR) **(standard)***
- ☐ Fluorocarbon (FKM)**

- continued -

Ordering Guide (continued)

Pilot Diaphragm (Select One)

- ☐ Stainless Steel/Nitrile (NBR) **(standard)** * * *
- ☐ Stainless Steel/Fluorocarbon (FKM) * *

Inlet Body Tap with Prepiped Pilot Supply (Optional)

- ☐ Yes*

Type 252 Pilot Supply Filter (Optional)

Material	Length	Drain Valve
☐ Stainless steel * * *	☐ Standard * * *	☐ Yes * * *
☐ Aluminum * *	☐ Extended * *	☐ No * *

DVGW Approval Required (Optional)

- ☐ Yes*

NACE MR0175 Construction (Optional)(1)

- ☐ Yes*

Main Valve Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

Pilot Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

1. Product complies with the material requirements of NACE MR0175. Environmental limits may apply.

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Do not undersize the monitor set. It is important to realize that the monitor regulator, even though it is wide-open, will require pressure drop for flow. Using two identical regulators in a monitor set will yield approximately 70 percent of the capacity of a single regulator.

Introduction

The 627 Series direct-operated pressure reducing regulators are for low-pressure and high-pressure systems. The 627 Series can be used as farm tap or small city gate regulators, monitoring regulators or high-pressure industrial gases. See Table 1 for available constructions.

Body Sizes and End Connection Styles

See Table 3

Flow Coefficients

See Table 4

IEC Sizing Coefficients

See Table 5

Maximum Inlet Pressure

NPT Stainless steel:
2000 psig / 138 bar

Flanged Stainless steel:
1440 psig / 99.2 bar

NPT Steel:
2000 psig / 138 bar

Flanged Steel:
1500 psig / 103 bar

Ductile Iron:
1000 psig / 69 bar

Maximum Spring and Diaphragm Casing Pressures

See Table 7

Outlet Pressure Range

5 to 500 psig / 0.34 to 34.5 bar in 6 ranges
See Table 8

Internal Relief Performance

Type 627R:
See Table 9

Type 627LR:
See Table 10

Type 627MR:
Limited by field-installed control line piping

Pressure Registration

See Table 1

Shipping Weights

See Table 23

Temperature Capabilities

-40 to 180°F / -40 to 82°C

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Extended Body Option**
- **Internal Relief Valve Available**
- **Relief Operation Indicator**
- **Easy to Maintain**
- **Installation Adaptability**
- **Application Versatility**
- **Tamper-Resistant**
- **Wide Range of Flow Capabilities**
- **Tight Shutoff Capability**
- **NACE Configuration Available**
- **DVGW Approved**



W4793

Figure 1. *Type 627 Direct-Operated Pressure Reducing Regulator*

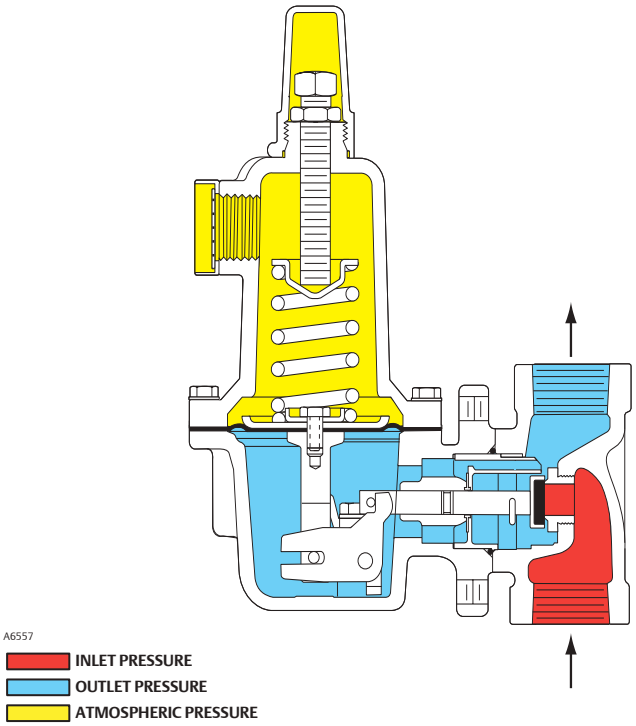


Figure 2. *Type 627 Operational Schematic*

Table 1. Available Construction

TYPE	CONFIGURATION
627	Direct-operated pressure reducing regulator equipped with a pitot tube for greater regulated capacities.
627R	Type 627 with internal relief and open throat.
627LR	Type 627R with light rate relief spring.
627M	Type 627 with a stem seal between the body outlet pressure and diaphragm case. Pressure is measured under the diaphragm through the 1/4 NPT downstream control line connection.
627MR	Type 627M with internal relief.
627H	Type 627 with a diaphragm limiter to deliver a higher outlet pressure.
627HM	Type 627H with a stem seal between the body outlet pressure and diaphragm case. Pressure is measured under the diaphragm through the 1/4 NPT downstream control line connection.

Table 2. Construction Material

BODY	SPRING AND DIAPHRAGM CASING	ORIFICE	DIAPHRAGM		DISK HOLDER	DISK
			Types 627H and 627HM	All Other		
Ductile iron, WCC steel or Stainless steel	Ductile iron, Aluminum, WCC steel or Stainless steel	Aluminum **(standard)** or Stainless steel	Neoprene (CR)	Nitrile (NBR) or Fluorocarbon (FKM)	Aluminum or Stainless steel	Nylon (PA), Nitrile (NBR) or Fluorocarbon (FKM)

Table 3. Body Size and End Connection Style

BODY SIZE		END CONNECTION STYLE	CONSTRUCTION AVAILABLE
NPS	DN		
3/4	----	NPT(1)	All
1	25	NPT(1), CL150 RF, CL300 RF, CL600 RF and Long Body	
2	50	NPT(1), CL150 RF, CL300 RF, CL600 RF and Long Body	

1. Ductile iron bodies are only available with NPT end connection.

Table 4. Wide-Open Flow Coefficient for Relief Sizing

ORIFICE SIZE		3/4 NPT BODY			NPS 1 / DN 25 BODY			NPS 2 / DN 50 BODY		
In.	mm	Wide-Open		C_1	Wide-Open		C_1	Wide-Open		C_1
		C_g	C_v		C_g	C_v		C_g	C_v	
3/32	2.4	6.9	0.24	29.2	6.9	0.24	28.5	6.9	0.23	29.7
1/8	3.2	12.5	0.43	29.1	12.5	0.43	29.4	12.5	0.42	29.5
3/16	4.8	29	1.01	28.6	29	0.93	31.2	29	1.02	28.5
1/4	6.4	50	1.63	30.6	50	1.71	29.3	52	1.66	31.3
3/8	9.5	108	2.99	36.1	108	3.42	31.6	115	3.39	33.9
1/2	13	190	4.87	39.0	190	5.29	35.9	200	5.01	39.9

Table 5. IEC Sizing Coefficient

ORIFICE SIZE		X_T			F_D	F_L
In.	mm	3/4 NPT Body	NPS 1 / DN 25 Body	NPS 2 / DN 50 Body		
3/32	2.4	0.539	0.514	0.558	0.50	0.85
1/8	3.2	0.536	0.547	0.539		0.79
3/16	4.8	0.517	0.616	0.514		0.85
1/4	6.4	0.592	0.543	0.620		0.87
3/8	9.5	0.824	0.632	0.727		0.89
1/2	13	0.962	0.815	1.01		0.86

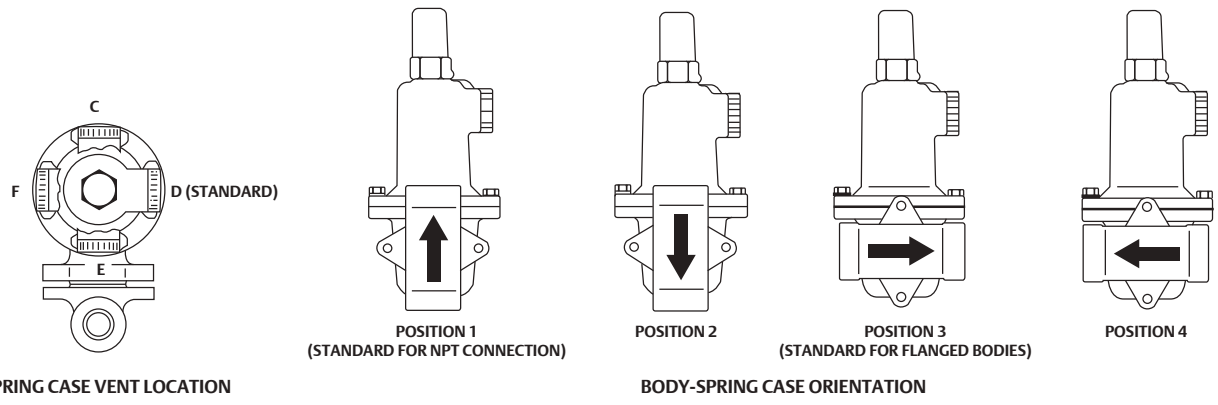


Figure 3. *Spring Case Orientation and Vent Location*

Table 6. Maximum Cold Working Pressure of Body Inlet (Body Rating)(1)(2)

BODY SIZE		BODY MATERIAL	END CONNECTION	MAXIMUM INLET PRESSURE	
NPS	DN			psig	bar
3/4	20	Ductile iron	NPT	1000	69.0
		Steel	NPT	2000	138
		Stainless steel	NPT	2000	138
1 and 2	25 and 50	Ductile iron	NPT	1000	69.0
		Steel	NPT	2000	138
			CL150 RF	290	20.0
			CL300 RF	750	51.7
			CL600 RF	1500	103
			PN 16/25/40	580	40.0
1 and 2	25 and 50	Stainless steel	CL150 RF	275	19.0
			CL300 RF	720	49.6
			CL600 RF	1440	99.3
			PN 16/25/40	580	40.0

1. The pressure/temperature limits in this Application Guide, and any applicable standard or code should not be exceeded.
2. Temperature may decrease these maximum pressures.

Table 7. Maximum Spring and Diaphragm Casing Pressure(1)

MAXIMUM PRESSURE DESCRIPTION	DIAPHRAGM CASING MATERIAL	TYPE 627		TYPES 627R AND 627LR		TYPE 627M		TYPE 627MR		TYPES 627H AND 627HM	
		psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
Maximum pressure to spring and diaphragm casings to prevent leak to atmosphere other than relief action (internal parts damage may occur).	Die cast aluminum	250	17.2	250	17.2	Not Available		Not Available		Not Available	
	Ductile iron	250	17.2	250	17.2	250	17.2	Not Available		Not Available	
	Steel or Stainless steel	250	17.2	250	17.2	250	17.2	250	17.2	800	55.2
Maximum pressure to spring and diaphragm casings to prevent burst of casings during abnormal operation (leak to atmosphere and internal parts damage may occur).	Die cast aluminum	375	25.9	375	25.9	Not Available		Not Available		Not Available	
	Ductile iron	465	32.1	465	32.1	465	32.1	465	32.1	Not Available	
	Steel or Stainless steel	1500	103	1500	103	1500	103	1500	103	1500	103
Maximum diaphragm casing overpressure (above setpoint) to prevent damage to internal parts.	All materials	60	4.1	120	8.3	60	4.1	120	8.3	120	8.3

1. If the spring case is pressurized, a metal adjusting screw cap is required. Contact your local Sales Office for details.

Table 8. Maximum Inlet and Outlet Pressure Range

TYPE	OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	ORIFICE SIZE		MAXIMUM INLET PRESSURE[1]					
				Nylon (PA) Disk		Nitrile (NBR) Disk		Fluorocarbon (FKM) Disk	
		In.	mm	psig	bar	psig	bar	psig	bar
627 and 627M[3]	5[2] to 20 psig / 0.34 to 1.4 bar 10B3076X012 Yellow	3/32 1/8 3/16 1/4 3/8 1/2	2.4 3.2 4.8 6.4 9.5 13	2000 1000 750 500 300 250	138 69.0 51.7 34.5 20.7 17.2	1000 1000 750 500 300 250	69.0 69.0 51.7 34.5 20.7 17.2	300 300 300 300 300 250	20.7 20.7 20.7 20.7 20.7 17.2
	15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	3/32 1/8 3/16 1/4 3/8 1/2	2.4 3.2 4.8 6.4 9.5 13	2000 1500 1000 750 500 300	138 103 69.0 51.7 34.5 20.7	1000 1000 1000 750 500 300	69.0 69.0 69.0 51.7 34.5 20.7	300 300 300 300 300 300	20.7 20.7 20.7 20.7 20.7 20.7
	35 to 80 psig / 2.4 to 5.5 bar 10B3078X012 Blue	3/32 1/8 3/16 1/4 3/8 1/2	2.4 3.2 4.8 6.4 9.5 13	2000 2000 1750 1500 1000 750	138 138 121 103 69.0 51.7	1000 1000 1000 1000 1000 750	69.0 69.0 69.0 69.0 69.0 51.7	300 300 300 300 300 300	20.7 20.7 20.7 20.7 20.7 20.7
	70 to 150 psig / 4.8 to 10.3 bar 10B3079X012 Red	3/32 1/8 3/16 1/4 3/8 1/2	2.4 3.2 4.8 6.4 9.5 13	2000 2000 2000 1750 1250 750	138 138 138 121 86.2 51.7	1000 1000 1000 1000 1000 750	69.0 69.0 69.0 69.0 69.0 51.7	300 300 300 300 300 300	20.7 20.7 20.7 20.7 20.7 20.7
627R and 627MR	5[2] to 20 psig / 0.34 to 1.4 bar 10B3076X012 Yellow	3/32 1/8 3/16 1/4 3/8 1/2	2.4 3.2 4.8 6.4 9.5 13	2000 1000 750 500 300 200	138 69.0 51.7 34.5 20.7 13.8	1000 1000 750 500 300 200	69.0 69.0 51.7 34.5 20.7 13.8	300 300 300 300 300 200	20.7 20.7 20.7 20.7 20.7 13.8
	15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	3/32 1/8 3/16 1/4 3/8 1/2	2.4 3.2 4.8 6.4 9.5 13	2000 1500 1000 750 300 200	138 103 69.0 51.7 20.7 13.8	1000 1000 1000 750 300 200	69.0 69.0 69.0 51.7 20.7 13.8	300 300 300 300 300 200	20.7 20.7 20.7 20.7 20.7 13.8
	35 to 80 psig / 2.4 to 5.5 bar 10B3078X012 Blue	3/32 1/8 3/16 1/4 3/8 1/2	2.4 3.2 4.8 6.4 9.5 13	2000 1750 1000 750 300 200	138 121 69.0 51.7 20.7 13.8	1000 1000 1000 750 300 200	69.0 69.0 69.0 51.7 20.7 13.8	300 300 300 300 300 200	20.7 20.7 20.7 20.7 20.7 13.8
	70 to 150 psig / 4.8 to 10.3 bar 10B3079X012 Red	3/32 1/8 3/16 1/4 3/8 1/2	2.4 3.2 4.8 6.4 9.5 13	2000 1000 500 300 200 200	138 69.0 34.5 20.7 13.8 13.8	1000 1000 500 300 200 200	69.0 69.0 34.5 20.7 13.8 13.8	300 300 300 300 200 200	20.7 20.7 20.7 20.7 13.8 13.8
627LR	15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	3/32 1/8 3/16 1/4	2.4 3.2 4.8 6.4			1000 1000 750 500	69.0 69.0 51.7 34.5	300 300 300 300	20.7 20.7 20.7 20.7
627H and 627HM[3]	140 to 250 psig / 9.6 to 17.2 bar 10B3078X012 Blue	3/32 1/8 3/16 1/4 3/8 1/2	2.4 3.2 4.8 6.4 9.5 13	2000 2000 1750 1500 1000 750	138 138 121 103 69.0 51.7	1000 1000 1000 1000 750 500	69.0 69.0 69.0 69.0 51.7 34.5		
	240 to 500 psig / 16.5 to 34.5 bar 10B3079X012 Red	3/32 1/8 3/16 1/4 3/8 1/2	2.4 3.2 4.8 6.4 9.5 13	2000 2000 1750 1500 1000 750	138 138 121 103 69.0 51.7	1000 1000 1000 1000 1000 750	69.0 69.0 69.0 69.0 69.0 51.7		

1. For inlet pressure in excess of 1000 psig / 69.0 bar, refer to the maximum body and disk pressure ratings in the Specification section.
2. For pressure settings under 10 psig / 0.69 bar, inlet pressure should be limited to approximately 100 psig / 6.9 bar so the setpoint adjustment can be obtained.
3. The unbalance forces change from the wide-open monitor mode to an active regulator mode such that the Type 627M or 627HM should have a 3/8 in. / 9.5 mm or larger orifice.

▭ - Shaded areas indicate that Fluorocarbon (FKM) / Nylon (PA) disk material is not available.

Table 9. Type 627R Internal Relief Performance[1]

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE		MAXIMUM INLET PRESSURE TO KEEP MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE FROM BEING EXCEEDED[2]											
					Orifice Size, In. / mm											
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
5[3] to 20 psig / 0.34 to 1.4 bar 10B3076X012 Yellow	10	0.69	60	4.1	1250	86.2	740	51.0	320	22.1	190	13.1	95	6.6	75	5.2
			100	6.9	2000	138	1500	103	620	42.7	390	26.9	180	12.4	130	9.0
			125	8.6	2000	138	1900	131	830	57.2	480	33.1	220	15.2	160	11.0
			175	12.1	2000	138	2000	138	1100	75.8	670	46.2	320	22.1	220	15.2
			200	13.8	2000	138	2000	138	1300	89.6	770	53.1	360	24.8	260	17.9
			250	17.2	2000	138	2000	138	1600	110	960	66.2	450	31.0	320	22.1
	20	1.4	60	4.1	850	58.6	490	33.8	210	14.5	130	9.0	80	5.5	65	4.5
			100	6.9	2000	138	1300	89.6	600	41.4	360	24.8	170	11.7	120	8.3
			125	8.6	2000	138	1800	124	800	55.2	480	33.1	220	15.2	160	11.0
			175	12.1	2000	138	2000	138	1100	75.8	670	46.2	320	22.1	220	15.2
			200	13.8	2000	138	2000	138	1300	89.6	770	53.1	360	24.8	260	17.9
			250	17.2	2000	138	2000	138	1600	110	960	66.2	450	31.0	320	22.1
15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	20	1.4	60	4.1	630	43.4	200	13.8	150	10.3	100	6.9	70	4.8	65	4.5
			100	6.9	2000	138	1200	82.7	550	37.9	330	22.8	160	11.0	120	8.3
			125	8.6	2000	138	1700	117	760	52.4	450	31.0	210	14.5	160	11.0
			175	12.1	2000	138	2000	138	1100	75.8	630	43.4	320	22.1	220	15.2
			200	13.8	2000	138	2000	138	1300	89.6	770	53.1	360	24.8	260	17.9
			250	17.2	2000	138	2000	138	1600	66.2	960	66.2	460	31.7	320	22.1
	30	2.1	100	6.9	2000	138	950	65.5	450	31.0	260	17.9	140	9.7	110	7.6
			125	8.6	2000	138	1500	103	670	46.2	400	27.6	190	13.1	150	10.3
			175	12.1	2000	138	2000	138	1000	69.0	610	42.1	300	20.7	220	15.2
			200	13.8	2000	138	2000	138	1200	82.7	760	52.4	360	24.8	260	17.9
			250	17.2	2000	138	2000	138	1600	110	970	66.9	460	31.7	320	22.1
	40	2.8	100	6.9	1500	103	700	48.3	330	22.8	200	13.8	120	8.3	108	7.5
			125	8.6	2000	138	1300	89.6	560	38.6	340	23.4	180	12.4	140	9.7
			175	12.1	2000	138	1800	124	1000	69.0	550	37.9	290	20.0	220	15.2
			200	13.8	2000	138	2000	138	1200	82.7	730	50.3	350	24.1	250	17.2
			250	17.2	2000	138	2000	138	1600	110	970	66.9	460	31.7	320	22.1
35 to 80 psig / 2.4 to 5.5 bar 10B3078X012 Blue	40	2.8	125	8.6	2000	138	1100	75.8	500	34.5	300	20.7	170	11.7	140	9.7
			150	10.3	2000	138	1600	110	750	51.7	440	30.3	230	15.9	180	12.4
			175	12.1	2000	138	2000	138	980	67.6	580	40.0	290	20.0	220	15.2
			200	13.8	2000	138	2000	138	1200	82.7	720	49.6	340	23.4	250	17.2
			250	17.2	2000	138	2000	138	1600	110	940	64.8	450	31.0	320	22.1
	60	4.1	125	8.6	900	62.1	450	31.0	270	18.6	190	13.1	140	9.7	130	9.0
			150	10.3	1700	117	1100	75.8	540	37.2	300	20.7	190	13.1	160	11.0
			175	12.1	2000	138	1700	117	780	53.8	470	32.4	250	17.2	200	13.8
			200	13.8	2000	138	2000	138	1000	69.0	610	42.1	310	21.4	230	15.9
			250	17.2	2000	138	2000	138	1400	96.5	880	60.7	420	29.0	310	21.4
	80	5.5	150	10.3	800	55.2	500	34.5	300	20.7	200	13.8	160	11.0	150	10.3
			175	12.1	1500	103	1200	82.7	550	37.9	330	22.8	210	14.5	190	13.1
			200	13.8	2000	138	1700	117	800	55.2	480	33.1	270	18.6	220	15.2
			250	17.2	2000	138	2000	138	1200	82.7	770	53.1	390	26.9	300	20.7
70 to 150 psig / 4.8 to 10.3 bar 10B3079X012 Red	80	5.5	175	12.1	1400	96.5	250	17.2	240	16.5	200	13.8	190	13.1	175	12.1
			200	13.8	2000	138	960	66.2	520	35.9	330	22.8	240	16.5	210	14.5
			250	17.2	2000	138	2000	138	1000	69.0	620	42.7	350	24.1	280	19.3
	100	6.9	200	13.8	1500	103	250	17.2	240	16.5	230	15.9	210	14.5	210	14.5
			250	17.2	2000	138	1600	110	770	53.1	520	35.9	320	22.1	270	18.6
	150	10.3	250	17.2	1200	82.7	260	17.9	260	17.9	260	17.9	260	17.9	260	17.9

1. The internal relief performance values are obtained by removing the disk assembly.
2. For inlet pressures in excess of 1000 psig / 69.0 bar, refer to the maximum body and disk pressure ratings in the Specifications.
3. For pressure settings under 10 psig / 0.69 bar, inlet pressure should be limited to approximately 100 psig / 6.9 bar so the setpoint adjustment can be obtained.
□ - Shaded areas indicate maximum inlet pressures allowed during system malfunction only. Table 8 gives the maximum inlet pressure for normal regulator operation.

Table 10. Type 627LR Internal Relief Performance[1]

OUTLET PRESSURE RANGE AND CONTROL SPRING INFORMATION	OUTLET PRESSURE SETTING		MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE		MAXIMUM INLET PRESSURE TO KEEP MAXIMUM ALLOWABLE DOWNSTREAM SYSTEM PRESSURE FROM BEING EXCEEDED[2]							
					Orifice Diameter, In. / mm							
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4	
	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	30	2.1	55	3.8	500	34.5	270	18.6	110	7.6	80	5.5
			60	4.1	850	58.6	480	33.1	200	13.8	120	8.3
			66	4.5	1000	69.0	660	45.5	290	20.0	175	12.1
	40	2.8	66	4.5	380	26.2	190	13.1	85	5.9	80	5.5
			70	4.8	700	48.3	370	25.5	150	10.3	115	7.9
			75	5.2	1000	69.0	560	38.6	240	16.5	160	11.0

1. The internal relief performance values are obtained by removing the disk assembly.
2. For inlet pressures in excess of 1000 psig / 69.0 bar, refer to the maximum body and disk pressure ratings in the Specifications section.

Table 11. Types 627, 627M and 627MR Capacities for 3/4 NPT Body Size[1]

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
					Orifice Size, In. / mm											
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	psig	bar												
5 to 20 psig[2] / 0.34 to 1.4 bar 10B3076X012 Yellow	10	0.69	20	1.4	280	7.5	455	12.2	1130	30.3	1790	48.0	3000	80.4	4300	115
			60	4.1	640	17.2	1170	31.4	2550	68.3	4240	114	6270	168	7370	198
			100	6.9	990	26.5	1800	48.2	3800	102	5980	160	7440	199	7900	212
			200	13.8	1850	49.6	3370	90.3	6970	187	7250	194	8200	220	8300	222
			500	34.5	4010	107	8090	217	8060	216	8100	217				
			750	51.7	4400	118	8930	239	8950	240						
			1000	69.0	4450	119	10,300	276								
			1250	86.2	4540	122										
			1500	103	4880	131										
			1750	121	5230	140										
			2000	138	5900	158										
	20	1.4	30	2.1	350	9.4	620	16.6	1400	37.5	2490	66.7	4360	117	6290	169
			60	4.1	640	17.2	1170	31.4	2640	70.8	4680	125	8340	224	8940	240
			100	6.9	990	26.5	1800	48.2	3980	107	7220	193	11,500	308	12,600	338
			200	13.8	1850	49.6	3370	90.3	7340	197	12,000	322	13,200	354	13,700	367
			500	34.5	4400	118	8090	217	18,300	490	15,100	405				
			750	51.7	6600	117	12,000	322	14,200	381						
			1000	69.0	7300	196	14,600	391								
			1250	86.2	7500	201										
			1500	103	7800	209										
			1750	121	8400	225										
			2000	138	8600	230										
15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	40	2.8	60	4.1	610	16.3	1090	29.2	2530	67.8	4350	117	8140	218	9420	252
			100	6.9	990	26.5	1790	48.0	4070	109	7220	193	13,200	354	15,300	410
			200	13.8	1850	49.6	3370	90.3	7630	204	13,500	362	18,000	482	18,500	496
			500	34.5	4400	118	8090	217	18,300	490	24,000	643	27,000	724		
			750	51.7	6600	177	12,000	322	23,000	616	24,200	649				
			1000	69.0	8700	233	16,000	429	24,400	654						
			1250	86.2	11,000	295	18,000	482								
			1500	103	12,000	322	21,000	563								
			1750	121	13,000	348										
			2000	138	14,000	375										
35 to 80 psig / 2.4 to 5.5 bar 10B3078X012 Blue	60	4.1	75	5.2	700	18.8	1230	33.0	2760	74.0	4750	127	8620	231	15,200	407
			100	6.9	970	26.0	1740	46.6	4010	107	6990	187	12,800	343	17,300	464
			200	13.8	1850	49.6	3370	90.3	7630	204	13,500	362	21,600	579	27,400	734
			500	34.5	4400	118	8090	217	18,300	490	28,100	753	28,900	775	33,400	895
			750	51.8	6600	177	12,000	322	26,300	705	30,000	804	37,000	992	45,000	1206
			1000	69.0	8700	233	16,000	429	30,000	804	31,200	836	37,400	1002		
			1250	86.2	11,000	295	19,000	509	31,600	847	34,000	911				
			1500	103	13,000	348	22,000	590	30,400	815	36,000	965				
			1750	121	15,000	402	25,000	670	34,000	911						
			2000	138	17,000	456	28,000	750								
	80	5.5	100	6.9	900	24.1	1600	42.9	3750	101	6490	174	12,200	327	17,300	464
			200	13.8	1850	49.6	3370	90.3	7,630	204	13,500	362	25,400	681	29,300	785
			500	34.5	4400	118	8090	217	18,300	490	31,900	855	36,000	965	36,700	984
			750	51.8	6600	177	12,000	322	27,200	729	35,000	938	44,000	1179	46,000	1233
			1000	69.0	8700	233	16,000	429	36,100	967	38,000	1018	56,200	1506		
			1250	86.2	11,000	295	19,000	509	37,000	992	40,000	1072				
			1500	103	13,000	348	22,000	590	38,000	1018	44,000	1179				
			1750	121	15,000	402	25,000	670	42,000	1126						
			2000	138	17,000	456	28,000	750								
70 to 150 psig / 4.8 to 10.3 bar 10B3079X012 Red	100	6.9	200	13.8	1850	49.6	3370	90.3	7630	204	12,000	322	21,300	571	25,700	689
			500	34.5	4400	118	8090	217	18,300	490	31,800	852	39,000	1045	39,200	1051
			750	51.8	6600	177	12,000	322	27,200	729	39,000	1045	39,200	1051	45,900	1230
			1000	69.0	8700	233	16,000	429	36,100	967	40,000	1072	40,500	1085		
			1250	86.2	11,000	295	19,000	509	39,000	1045	40,500	1085	41,000	1099		
			1500	103	13,000	348	22,000	590	43,000	1152	44,000	1179				
			1750	121	15,000	402	25,000	670	45,000	1206	47,000	1260				
			2000	138	17,000	456	28,000	750	46,000	1233						
	150	10.3	200	13.8	1760	47.2	3200	85.8	7290	195	12,500	335	21,400	574	30,600	820
			500	34.5	4400	118	8090	217	18,300	490	32,500	871	48,900	1311	59,700	1600
			750	51.8	6600	177	12,000	322	27,200	729	48,300	1294	59,000	1581	72,000	1930
			1000	69.0	8700	233	16,000	429	36,100	967	64,100	1718	81,100	2173	85,000	2278
			1250	86.2	11,000	295	19,000	509	45,000	1206	68,000	1822	90,000	2412		
			1500	103	13,000	348	22,000	590	54,000	1447	72,000	1930				
			1750	121	15,000	402	25,000	670	63,000	1688	77,000	2064				
			2000	138	17,000	456	28,000	750	71,000	1903						

1. Capacity is based on 20% droop unless otherwise noted below.
2. For pressure settings under 10 psig / 0.69 bar, inlet pressure should be limited to approximately 100 psig / 6.9 bar so the setpoint adjustment can be obtained.

□ - Blank areas indicate where maximum operating inlet pressure for a given orifice is exceeded.

▨ - Shaded areas indicate where a Type 627MR regulator should not be used because unbalanced forces can cause the internal relief valve to start-to-discharge during normal operation. Refer to Table 9.

Table 12. Types 627, 627M and 627MR Capacities for NPS 1 / DN 25 Body Size[1]

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
					Orifice Size, In. / mm											
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	psig	bar												
5 to 20 psig[2] / 0.34 to 1.4 bar 10B3076X012 Yellow	10	0.69	20	1.4	280	7.5	490	13.1	1150	30.8	2050	54.9	3380	90.6	4410	118
			60	4.1	640	17.2	1170	31.4	2600	69.7	4710	126	8140	218	13,700	367
			100	6.9	990	26.5	1800	48.2	4070	109	7310	196	12,500	335	16,000	429
			200	13.8	1850	49.6	3370	90.3	7630	204	13,700	367	18,000	482	18,500	496
			500	34.5	4400	118	8090	217	15,700	421	20,000	536				
			750	51.7	5400	145	12,000	322	18,000	482						
			1000	69.0	5800	155	14,000	375								
			1250	86.2	6300	169										
			1500	103	6600	177										
			1750	121	6800	182										
			2000	138	7600	204										
	20	1.4	30	2.1	350	9.4	620	16.6	1450	38.9	2580	69.1	4360	117	6290	169
			60	4.1	640	17.2	1170	31.4	2640	70.8	4750	127	9690	260	14,500	389
			100	6.9	990	26.5	1800	48.2	4070	109	7310	196	13,900	373	23,300	624
			200	13.8	1850	49.6	3370	90.3	7630	204	13,700	367	26,600	713	39,100	1048
			500	34.5	4400	118	8090	217	18,300	490	32,900	882				
			750	51.7	6600	177	12,000	322	23,600	632						
			1000	69.0	8900	239	16,000	429								
			1250	86.2	10,000	268										
			1500	103	10,400	279										
			1750	121	12,000	322										
			2000	138	14,000	375										
15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	40	2.8	60	4.1	610	16.3	1090	29.2	2530	67.8	4510	121	9290	249	9420	252
			100	6.9	990	26.5	1790	48.0	4070	109	7310	196	14,700	394	21,900	587
			200	13.8	1850	49.6	3370	90.3	7630	204	13,700	367	27,100	726	46,400	1244
			500	34.5	4400	118	8090	217	18,300	490	32,900	882	63,900	1713		
			750	51.7	6600	177	12,000	322	27,200	729	39,400	1056				
			1000	69.0	8700	233	16,000	429	36,100	967						
			1250	86.2	11,000	295	19,000	509								
			1500	103	13,000	348	22,000	590								
			1750	121	15,000	402										
			2000	138	17,000	456										
35 to 80 psig / 2.4 to 5.5 bar 10B3078X012 Blue	60	4.1	100	6.9	970	26.0	1740	46.6	4010	107	7000	188	13,000	348	19,300	517
			200	13.8	1850	49.6	3370	90.3	7630	204	13,700	367	24,000	643	42,200	1131
			500	34.5	4400	118	8090	217	18,300	490	32,900	882	64,000	1715	94,300	2527
			750	51.8	6600	177	12,000	322	27,200	729	43,380	1163	66,000	1769	130,000	3484
			1000	69.0	8700	233	16,000	429	36,100	967	50,300	1348	67,700	1814		
			1250	86.2	11,000	295	19,000	509	45,000	1206	57,000	1528				
			1500	103	13,000	348	22,000	590	54,000	1447	63,000	1688				
			1750	121	15,000	402	25,000	670	63,000	1688						
			2000	138	17,000	456	28,000	750								
	80	5.5	100	6.9	900	24.1	1600	42.9	3750	101	6650	178	12,200	327	18,600	498
			200	13.8	1850	49.6	3370	90.3	7630	204	13,700	367	28,400	761	44,100	1182
			500	34.5	4400	118	8090	217	18,300	490	32,900	882	71,600	1919	110,000	2948
			750	51.8	6600	177	12,000	322	27,200	729	48,900	1311	105,500	2827	135,000	3618
			1000	69.0	8700	233	16,000	429	36,100	967	64,900	1739	118,000	3162		
			1250	86.2	11,000	295	19,000	509	45,000	1206	80,000	2144				
			1500	103	13,000	348	22,000	590	54,000	1447	96,000	2573				
			1750	121	15,000	402	25,000	670	63,000	1688						
			2000	138	17,000	456	28,000	750								
70 to 150 psig / 4.8 to 10.3 bar 10B3079X012 Red	100	6.9	200	13.8	1850	49.6	3370	90.3	7630	204	12,000	322	21,300	571	34,100	914
			500	34.5	4400	118	8090	217	18,300	490	31,800	852	66,500	1782	83,900	2249
			750	51.8	6600	177	12,000	322	27,200	729	47,300	1268	95,300	2554	117,000	3136
			1000	69.0	8700	233	16,000	429	36,100	967	59,700	1600	100,000	2680		
			1250	86.2	11,000	295	19,000	509	45,000	1206	72,000	1930	114,000	3055		
			1500	103	13,000	348	22,000	590	54,000	1447	86,000	2305				
			1750	121	15,000	402	25,000	670	63,000	1688	95,000	2546				
			2000	138	17,000	456	28,000	750	71,000	1903						
	150	10.3	200	13.8	1760	47.2	3200	85.8	7290	195	12,900	346	21,400	574	33,600	900
			500	34.5	4400	118	8090	217	18,300	490	32,900	882	70,300	1884	111,000	2975
			750	51.8	6600	177	12,000	322	27,200	729	48,900	1311	104,000	2787	160,000	4288
			1000	69.0	8700	233	16,000	429	36,100	967	64,800	1737	138,000	3698	162,000	4342
			1250	86.2	11,000	295	19,000	509	45,000	1206	80,000	2144	150,000	4020		
			1500	103	13,000	348	22,000	590	54,000	1447	96,000	2573				
			1750	121	15,000	402	25,000	670	63,000	1688	112,000	3002				
			2000	138	17,000	456	28,000	750	71,000	1903						

1. Capacity is based on 20% droop unless otherwise noted below.
2. For pressure settings under 10 psig / 0.69 bar, inlet pressure should be limited to approximately 100 psig / 6.9 bar so the setpoint adjustment can be obtained.

□ - Blank areas indicate where maximum operating inlet pressure for a given orifice is exceeded.

▨ - Shaded areas indicate where a Type 627MR regulator should not be used because unbalanced forces can cause the internal relief valve to start-to-discharge during normal operation. Refer to Table 9.

Table 13. Type 627 Capacities for NPS 2 / DN 50 Body Size[1]

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
					Orifice Size, In. / mm											
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	psig	bar												
5 to 20 psig[2] / 0.34 to 1.4 bar 10B3076X012 Yellow	10	0.69	20 60	1.4 4.1	280 640	7.5 17.2	490 1170	13.1 31.4	1150 2600	30.8 69.7	1880 4750	50.4 127	2610 7250	69.9 194	3830 17,800	103 477
			100 200 500	6.9 13.8 34.5	990 1850 4400	26.5 49.6 118	1790 3370 8090	48.0 90.3 217	4070 7630 18,300	109 204 490	7310 13,700 21,000	196 367 563	16,200 22,700	434 608	28,700 24,000	769 643
			750 1000 1250 1500 1750 2000	51.7 69.0 86.2 103 121 138	6600 8700 11,000 13,000 15,000 6300	177 233 295 348 402 169	12,000 16,000	322 429	27,200	729						
	20	1.4	30 60 100	2.1 4.1 6.9	350 640 990	9.4 17.2 26.5	620 1170 1800	16.6 31.4 48.2	1450 2640 4070	38.9 70.8 109	2350 4750 7310	63.0 127 196	4300 8400 16,200	115 225 434	6110 15,700 28,700	164 421 769
			200 500 750 1000	13.8 34.5 51.7 69.0	1850 4400 6600 8700	49.6 118 177 233	3370 8090 12,000 16,000	90.3 217 322 429	7630 18,300 27,200	204 490 729	13,700 32,900	367 882	24,000	643	33,000	884
			1250 1500 1750 2000	86.2 103 121 138	11,000 13,000 15,000 6300	295 348 402 169										
15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	40	2.8	60 100 200	4.1 6.9 13.8	610 990 1850	16.3 26.5 49.6	1090 1800 3370	29.2 48.2 90.3	2530 4070 7630	67.8 109 204	4370 7310 13,700	117 196 367	8680 16,200 30,400	233 434 815	13,300 25,400 53,900	356 681 1445
			500 750 1000 1250	34.5 51.7 69.0 86.2	4400 6600 8700 11,000	118 177 233 295	8090 12,000 16,000 19,000	217 322 429 509	18,300 27,200 36,100	490 729 967	32,900 28,000	882 750	22,000	590		
			1500 1750 2000	103 121 138	13,000 15,000 17,000	348 402 456	22,000	590								
35 to 80 psig / 2.4 to 5.5 bar 10B3078X012 Blue	60	4.1	75 100 200 500	5.2 6.9 13.8 34.5	700 970 1850 4400	18.8 26.0 49.6 118	1260 1740 3370 8090	33.8 46.6 90.3 217	2760 4010 7630 18,300	74.0 107 204 490	4900 7000 13,700 32,900	131 188 367 882	9000 15,000 30,400 73,000	241 402 815 1956	12,300 20,400 53,900 38,800	330 547 1445 1040
			750 1000 1250 1500 1750 2000	51.8 69.0 86.2 103 121 138	6600 8700 11,000 13,000 15,000 17,000	177 233 295 348 402 456	12,000 16,000 19,000 22,000 25,000 28,000	322 429 509 590 670 750	27,200 36,100 45,000 54,000 26,000	729 967 1206 1447 697	48,900 43,000 70,000 43,000	1311 1152 1876 1152	53,000 52,000	1420 1394	32,000	858
	80	5.5	100 200 500	6.9 13.8 34.5	900 1850 4400	24.1 49.6 118	1630 3370 8090	43.7 90.3 217	3750 7630 18,300	101 204 490	6400 13,700 32,900	172 367 882	12,800 30,400 73,000	343 815 1956	20,400 53,900 48,000	547 1445 1286
			750 1000 1250 1500 1750 2000	51.8 69.0 86.2 103 121 138	6600 8700 11,000 13,000 15,000 17,000	177 233 295 348 402 456	12,000 16,000 19,000 22,000 25,000 28,000	322 429 509 590 670 750	27,200 36,100 45,000 54,000 63,000	729 967 1206 1447 1688	48,900 65,000 63,000 86,000	1311 1742 1688 2305	87,000 63,000	2332 1688	44,000	1179
70 to 150 psig / 4.8 to 10.3 bar 10B3079X012 Red	100	6.9	200 500 750	13.8 34.5 51.8	1850 4400 6600	49.6 118 177	3370 8090 12,000	90.3 217 322	7630 18,300 27,200	204 490 729	13,700 32,900 48,900	367 882 1311	22,000 73,000 108,000	590 1956 2894	33,000 129,000 54,000	884 3457 1447
			1000 1250 1500 1750 2000	69.0 86.2 103 121 138	8700 11,000 13,000 15,000 17,000	233 295 348 402 456	16,000 19,000 22,000 25,000 28,000	429 509 590 670 750	36,100 45,000 54,000 63,000 71,000	967 1206 1447 1688 1903	64,800 80,000 96,000 112,000	1737 2144 2573 3002	82,000 110,000	2198 2948		
	150	10.3	200 500 750 1000	13.8 34.5 51.8 69.0	1760 4400 6600 8700	47.2 118 177 233	3200 8090 12,000 16,000	85.8 217 322 429	7290 18,300 27,200 36,100	195 490 729 967	13,000 32,900 48,900 64,800	348 882 1311 1737	24,000 73,000 108,000 144,000	643 1956 2894 3859	38,000 129,000 62,000	1018 3457 1662
			1250 1500 1750 2000	86.2 103 121 138	11,000 13,000 15,000 17,000	295 348 402 456	19,000 22,000 25,000 28,000	509 590 670 750	45,000 54,000 63,000 71,000	1206 1447 1688 1903	80,000 96,000 112,000	2144 2573 3002	81,000	2171		

1. Capacity is based on 20% droop unless otherwise noted below.
2. For pressure settings under 10 psig / 0.69 bar, inlet pressure should be limited to approximately 100 psig / 6.9 bar so the setpoint adjustment can be obtained.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice is exceeded.

Table 14. Types 627M and 627MR Capacities for NPS 2 / DN 50 Body Size[1]

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
					Orifice Size, In. / mm											
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	psig	bar												
5 to 20 psig[2] / 0.34 to 1.4 bar 10B3076X012 Yellow	10	0.69	20 60	1.4 4.1	280 640	7.5 17.2	490 1170	13.1 31.4	1150 2600	30.8 69.7	1880 4750	50.4 127	2610 7250	69.9 194	3830 15,000	103 402
			100 200 500	6.9 13.8 34.5	990 1850 4400	26.5 49.6 118	1790 3370 8090	48.0 90.3 217	4070 7630 18,300	109 204 490	7310 13,700 32,900	196 367 882	14,600 27,300	391 732	23,000 43,000	616 1152
			750 1000 1250 1500 1750 2000	51.7 69.0 86.2 103 121 138	6600 8700 11,000 13,000 15,000 17,000	177 233 295 348 402 456	12,000 16,000	322 429	27,200	729						
	20	1.4	30 60 100	2.1 4.1 6.9	350 640 990	9.4 17.2 26.5	620 1170 1800	16.6 31.4 48.2	1450 2640 4070	38.9 70.8 109	2480 4750 7310	66.5 127 196	4300 8400 14,600	115 225 391	6110 15,000 23,000	164 402 616
			200 500 750 1000	13.8 34.5 51.7 69.0	1850 4400 6600 8700	49.6 118 177 233	3370 8090 12,000 16,000	90.3 217 322 429	7630 18,300 27,200	204 490 729	13,700 32,900	367 882	27,300	732	43,000	1152
			1250 1500 1750 2000	86.2 103 121 138	11,000 13,000 15,000 17,000	295 348 402 456										
15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	40	2.8	60 100 200	4.1 6.9 13.8	610 990 1850	16.3 26.5 49.6	1090 1800 3370	29.2 48.2 90.3	2530 4070 7630	67.8 109 204	4370 7310 13,700	117 196 367	8680 14,600 27,300	233 391 732	13,300 25,400 48,000	356 681 1286
			500 750 1000 1250	34.5 51.7 69.0 86.2	4400 6600 8700 11,000	118 177 233 295	8090 12,000 16,000 19,000	217 322 429 509	18,300 27,200 36,100	490 729 967	32,900 48,900	882 1311	65,000	1742		
			1500 1750 2000	103 121 138	13,000 15,000 17,000	348 402 456	22,000	590								
35 to 80 psig / 2.4 to 5.5 bar 10B3078X012 Blue	60	4.1	100 200 500	6.9 13.8 34.5	970 1850 4400	26.0 49.6 118	1740 3370 8090	46.6 90.3 217	4010 7630 18,300	107 204 490	7000 13,700 32,900	188 367 882	15,000 30,400 73,000	402 815 1956	20,400 48,500 116,000	547 1300 3109
			750 1000 1250 1500 1750 2000	51.8 69.0 86.2 103 121 138	6600 8700 11,000 13,000 15,000 17,000	177 233 295 348 402 456	12,000 16,000 19,000 22,000 25,000 28,000	322 429 509 590 670 750	27,200 36,100 45,000 54,000 63,000	729 967 1206 1447 1688	48,900 65,000 81,000 97,000	1311 1742 2171 2600	108,000 144,000	2894 3859	172,000	4610
	80	5.5	100 200 500	6.9 13.8 34.5	900 1850 4400	24.1 49.6 118	1630 3370 8090	43.7 90.3 217	3750 7630 18,300	101 204 490	6400 13,700 32,900	172 367 882	12,800 30,400 73,000	343 815 1956	20,400 48,500 116,000	547 1300 3109
			750 1000 1250 1500 1750 2000	51.8 69.0 86.2 103 121 138	6600 8700 11,000 13,000 15,000 17,000	177 233 295 348 402 456	12,000 16,000 19,000 22,000 25,000 28,000	322 429 509 590 670 750	27,200 36,100 45,000 54,000 63,000	729 967 1206 1447 1688	48,900 65,000 81,000 97,000	1311 1742 2171 2600	108,000 144,000	2894 3859	172,000	4610
70 to 150 psig / 4.8 to 10.3 bar 10B3079X012 Red	100	6.9	200 500 750	13.8 34.5 51.8	1850 4400 6600	49.6 118 177	3370 8090 12,000	90.3 217 322	7630 18,300 27,200	204 490 729	13,700 32,900 48,900	367 882 1311	22,000 73,000 108,000	590 1956 2894	33,000 116,000 172,000	884 3109 4610
			1000 1250 1500 1750 2000	69.0 86.2 103 121 138	8700 11,000 13,000 15,000 17,000	233 295 348 402 456	16,000 19,000 22,000 25,000 28,000	429 509 590 670 750	36,100 45,000 54,000 63,000 71,000	967 1206 1447 1688 1903	64,800 80,000 96,000 112,000	1737 2144 2573 3002	144,000 179,000	3859 4797		
	150	10.3	200 500 750 1000	13.8 34.5 51.8 69.0	1760 4400 6600 8700	47.2 118 177 233	3200 8090 12,000 16,000	85.8 217 322 429	7290 18,300 27,200 36,100	195 490 729 967	13,000 32,900 48,900 64,800	348 882 1311 1737	24,000 73,000 108,000 144,000	643 1956 2894 3859	38,000 116,000 172,000	1018 3109 4610
			1250 1500 1750 2000	86.2 103 121 138	11,000 13,000 15,000 17,000	295 348 402 456	19,000 22,000 25,000 28,000	509 590 670 750	45,000 54,000 63,000 71,000	1206 1447 1688 1903	80,000 96,000 112,000	2144 2573 3002	179,000	4797		

1. Capacity is based on 20% droop unless otherwise noted below.
2. For pressure settings under 10 psig / 0.69 bar, inlet pressure should be limited to approximately 100 psig / 6.9 bar so the setpoint adjustment can be obtained.

□ - Blank areas indicate where maximum operating inlet pressure for a given orifice is exceeded.

▨ - Shaded areas indicate where a Type 627MR regulator should not be used because unbalanced forces can cause the internal relief valve to start-to-discharge during normal operation. Refer to Table 9.

Table 15. Types 627H and 627HM Capacities for 3/4 NPT Body Size(1)

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
					Orifice Size, In. / mm											
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	psig	bar												
140 to 250 psig / 9.7 to 17.2 bar 10B3078X012 Blue	150	10.3	200	13.8	1760	47.2(2)	3200	85.8(2)	7290	195	11,500	308	21,600	579	31,000	831
			250	17.2	2260	60.6(2)	4100	110(2)	9200	247	15,400	413	28,600	766	40,000	1072
			300	20.7	2700	72.4	4910	132	11,200	300	19,300	517	31,000	831	46,000	1233
			400	27.6	3600	96.5	6500	174	14,800	397	24,700	662	40,000	1072	50,000	1340
			500	34.5	4400	118	8090	217	18,300	490	29,700	796	51,000	1367		
			750	51.7	6600	177	12,000	322	27,200	729	43,000	1152				
			1000	69.0	8700	233	16,000	429	36,100	967	57,000	1528				
			1250	86.2	11,000	295	19,000	509	45,000	1206						
			1500	103	13,000	348	22,000	590	54,000	1447						
			1750	121	15,000	402	25,000	670	63,000	1688						
			2000	138	17,000	456	28,000	750								
	200	13.8	250	17.2	2160	57.9(2)	3850	103(2)	8400	225	15,000	402	31,000	831	41,000	1099
			300	20.7	2700	72.4(2)	4910	132(2)	11,200	300	19,500	523	36,000	965	52,000	1394
			400	27.6	3600	96.5	6500	174	14,800	397	25,500	683	52,000	1394	68,000	1822
			500	34.5	4400	118	8090	217	18,300	490	31,000	831	61,000	1635		
			750	51.7	6600	177	12,000	322	27,200	729	45,500	1219				
			1000	69.0	8700	233	16,000	429	36,100	967	60,000	1608				
			1250	86.2	11,000	295	19,000	509	45,000	1206						
			1500	103	13,000	348	22,000	590	54,000	1447						
			1750	121	15,000	402	25,000	670	63,000	1688						
			2000	138	17,000	456	28,000	750								
	250	17.2	300	20.7	2500	67.0(2)	4500	121(2)	9900	265	18,500	496	37,000	992	52,000	1394
			400	27.6	3600	96.5(2)	6400	172(2)	14,300	383	26,000	697	55,000	1474	74,000	1983
			500	34.5	4400	118	8090	217	18,300	490	33,000	884	64,000	1715	87,000	2332
			750	51.7	6600	177	12,000	322	27,200	729	49,000	1313	93,000	2492		
			1000	69.0	8700	233	16,000	429	36,100	967	65,000	1742				
			1250	86.2	11,000	295	19,000	509	45,000	1206	81,000	2171				
			1500	103	13,000	348	22,000	590	54,000	1447						
			1750	121	15,000	402	25,000	670	63,000	1688						
			2000	138	17,000	456	28,000	750	71,000	1903						
240 to 500 psig / 16.5 to 34.5 bar 10B3079X012 Red	250	17.2	300	20.7	2500	67.0(2)	4500	121(2)	9300	249	14,000	375	25,000	670	37,000	992
			400	27.6	3600	96.5(2)	6400	172(2)	14,300	383	21,400	574	36,000	965	49,000	1313
			500	34.5	4400	118	8090	217	18,300	490	26,300	705	42,000	1126	62,000	1662
			750	51.7	6600	177	12,000	322	27,200	729	37,100	994	57,000	1528		
			1000	69.0	8700	233	16,000	429	36,100	967	47,400	1270				
			1250	86.2	11,000	295	19,000	509	45,000	1206	57,000	1528				
			1500	103	13,000	348	22,000	590	54,000	1447						
			1750	121	15,000	402	25,000	670	63,000	1688						
			2000	138	17,000	456	28,000	750	71,000	1903						
	500	34.5	550	37.9	4300	115(2)	7700	206(2)	16,800	450	33,000	884	62,000	1662	90,000	2412
			600	41.4	4900	131(2)	8800	236(2)	19,400	520	37,000	992	70,000	1876	104,000	2787
			750	51.7	6600	177	12,000	322	27,200	729	49,000	1313	88,000	2358	137,000	3672
			1000	69.0	8700	233	16,000	429	36,100	967	65,000	1742	130,000	3484		
			1250	86.2	11,000	295	19,000	509	45,000	1206	81,000	2171				
			1500	103	13,000	348	22,000	590	54,000	1447	97,000	2600				
			1750	121	15,000	402	25,000	670	63,000	1688						
			2000	138	17,000	456	28,000	750	71,000	1903						

1. Capacity is based on 20% droop unless otherwise noted.
2. Small orifices and low-pressure drops may cause the setpoint to shift ±15 psig / 1.0 bar.
- Blank areas indicate where maximum operating inlet pressure for a given orifice is exceeded.

Table 16. Types 627H and 627HM Capacities for NPS 1 / DN 25 Body Size[1]

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
					Orifice Size, In. / mm											
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	psig	bar												
140 to 250 psig / 9.7 to 17.2 bar 10B3078X012 Blue	150	10.3	200	13.8	1760	47.2[2]	3200	85.8[2]	7290	195	11,500	308	21,600	579	31,000	831
			250	17.2	2260	60.6[2]	4100	110[2]	9200	247	15,400	413	28,600	766	40,000	1072
			300	20.7	2700	72.4	4910	132	11,200	300	19,300	517	31,000	831	46,000	1233
			400	27.6	3600	96.5	6500	174	14,800	397	25,000	670	40,000	1072	50,000	1340
			500	34.5	4400	118	8090	217	18,300	490	32,000	858	51,000	1367		
			750	51.7	6600	177	12,000	322	27,200	729	46,000	1233				
			1000	69.0	8700	233	16,000	429	36,100	967	57,000	1528				
			1250	86.2	11,000	295	19,000	509	45,000	1206						
			1500	103	13,000	348	22,000	590	54,000	1447						
			1750	121	15,000	402	25,000	670	63,000	1688						
			2000	138	17,000	456	28,000	750								
	250	17.2	300	20.7	2500	67.0[2]	4500	121[2]	9900	265	18,500	496	37,000	992	52,000	1394
			400	27.6	3600	96.5[2]	6400	172[2]	14,300	383	26,000	697	55,000	1474	74,000	1983
			500	34.5	4400	118	8090	217	18,300	490	33,000	884	64,000	1715	87,000	2332
			750	51.7	6600	177	12,000	322	27,200	729	49,000	1313	102,000	2734		
			1000	6.9	8700	233	16,000	429	36,100	967	65,000	1742				
			1250	86.2	11,000	295	19,000	509	45,000	1206	81,000	2171				
			1500	103	13,000	348	22,000	590	54,000	1447						
			1750	121	15,000	402	25,000	670	63,000	1688						
			2000	138	17,000	456	28,000	750	71,000	1903						
240 to 500 psig / 16.5 to 34.5 bar 10B3079X012 Red	250	17.2	300	20.7	2500	67.0[2]	4500	121[2]	9300	249	14,000	375	25,000	670	37,000	992
			500	34.5	4400	118	8090	217	18,300	490	26,300	705	42,000	1126	62,000	1662
			750	51.7	6600	177	12,000	322	27,200	729	37,100	994	57,000	1528		
			1000	69.0	8700	233	16,000	429	36,100	967	47,400	1270				
			1250	86.2	11,000	295	19,000	509	45,000	1206	57,000	1528				
			1500	103	13,000	348	22,000	590	54,000	1447						
			1750	121	15,000	402	25,000	670	63,000	1688						
			2000	138	17,000	456	28,000	750	71,000	1903						
	500	34.5	550	37.9	4300	115[2]	7700	206[2]	16,800	450	33,000	884	62,000	1662	90,000	2412
			750	51.7	6600	177	12,000	322	27,200	729	49,000	1313	88,000	2358	140,000	3752
			1000	69.0	8700	233	16,000	429	36,100	967	65,000	1742	130,000	3484		
			1250	86.2	11,000	295	19,000	509	45,000	1206	81,000	2171				
			1500	103	13,000	348	22,000	590	54,000	1447	97,000	2600				
			1750	121	15,000	402	25,000	670	63,000	1688						
			2000	138	17,000	456	28,000	750	71,000	1903						

1. Capacity is based on 20% droop unless otherwise noted.
2. Small orifices and low-pressure drops may cause the setpoint to shift ±15 psig / 1.0 bar.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice is exceeded.

Table 17. Types 627H and 627HM Capacities for NPS 2 / DN 50 Body Size[1]

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
					Orifice Size, In. / mm											
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	psig	bar												
140 to 250 psig / 9.7 to 17.2 bar 10B3078X012 Blue	150	10.3	200 400 500	13.8 27.6 34.5	1760 3600 4400	47.2[2] 96.5 118	3200 6500 8090	85.8[2] 174 217	7290 14,800 18,300	195 397 490	13,700 25,000 32,000	367 670 858	24,100 40,000	646 1072	31,000 50,000	831 1340
			750 1000 1250 1500 1750 2000	51.7 69.0 86.2 103 121 138	6600 8700 11,000 13,000 15,000 17,000	177 233 295 348 402 456	12,000 16,000 19,000 22,000 25,000 28,000	322 429 509 590 670 750	27,200 36,100 45,000 54,000 63,000	729 967 1206 1447 1688	48,000 65,000	1286 1742				
	250	17.2	300 500 750	20.7 34.5 51.7	2500 4400 6600	67.0[2] 118 177	4500 8090 12,000	121[2] 217 322	9900 18,300 27,200	265 490 729	18,500 33,000 49,000	496 884 1313	37,000 64,000 102,000	992 1715 2734	75,000 95,000	2010 2546
			1000 1250 1500 1750 2000	69.0 86.2 103 121 138	8,700 11,000 13,000 15,000 17,000	233 295 348 402 456	16,000 19,000 22,000 25,000 28,000	429 509 590 670 750	36,100 45,000 54,000 63,000 71,000	967 1206 1447 1688 1903	65,000 81,000	1742 2171				
240 to 500 psig / 16.5 to 34.5 bar 10B3079X012 Red	250	17.2	300 500 750 1000	20.7 34.5 51.7 69.0	2500 4400 6600 8700	67.0[2] 118 177 233	4500 8090 12,000 16,000	121[2] 217 322 429	9300 18,300 27,200 36,100	249 490 729 967	14,000 26,300 37,100 47,400	375 705 994 1270	25,000 42,000 57,000	670 1126 1528	37,000 62,000	992 1662
			1250 1500 1750 2000	86.2 103 121 138	11,000 13,000 15,000 17,000	295 348 402 456	19,000 22,000 25,000 28,000	509 590 670 750	45,000 54,000 63,000 71,000	1206 1447 1688 1903	57,000	1528				
	300	20.7	350 500 750 1000	24.2 34.5 51.7 69.0	2900 4400 6600 8700	77.7[2] 118 177 233	5150 8090 12,000 16,000	138[2] 217 322 429	11,300 18,300 27,200 36,100	303 490 729 967	18,400 32,000 48,000 62,000	493 858 1286 1662	31,000 53,000 80,000	831 1420 2144	45,000 67,000	1206 1796
			1250 1500 1750 2000	86.2 103 121 138	11,000 13,000 15,000 17,000	295 348 402 456	19,000 22,000 25,000 28,000	509 590 670 750	45,000 54,000 63,000 71,000	1206 1447 1688 1903	79,000	2117				
	400	27.6	450 500 750 1000	31.1 34.5 51.7 69.0	3600 4400 6600 8700	96.5[2] 118[2] 177 233	6400 8090 12,000 16,000	172[2] 217[2] 322 429	14,000 18,300 27,200 36,100	375 490 729 967	25,000 32,000 49,000 65 000	670 858 1313 1742	47,000 54,000 91,000	1260 1447 2439	67,000 77,000	1796 2064
			1250 1500 1750 2000	86.2 103 121 138	11,000 13,000 15,000 17,000	295 348 402 456	19,000 22,000 25,000 28,000	509 590 670 750	45,000 54,000 63,000 71,000	1206 1447 1688 1903	81,000	2171				
	500	34.5	550 600 750 1000	37.9 41.4 51.7 69.0	4300 4900 6600 8700	115[2] 131[2] 177 233	7700 8800 12,000 16,000	206[2] 236[2] 322 429	16,800 19,400 27,200 36,100	450 520 729 967	33,000 37,000 49,000 65,000	884 992 1313 1742	62,000 70,000 88,000 130,000	1662 1876 2358 3484	90,000 104,000 140,000	2412 2787 3752
			1250 1500 1750 2000	86.2 103 121 138	11,000 13,000 15,000 17,000	295 348 402 456	19,000 22,000 25,000 28,000	509 590 670 750	45,000 54,000 63,000 71,000	1206 1447 1688 1903	81,000 97,000	2171 2600				

1. Capacity is based on 20% droop unless otherwise noted.
2. Small orifices and low-pressure drops may cause the setpoint to shift ±15 psig / 1.0 bar.
☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice is exceeded.

Table 18. Type 627R Capacities for 3/4 NPT Body Size[1]

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
					Orifice Size, In. / mm											
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	psig	bar												
5 to 20 psig[2] / 0.34 to 1.4 bar 10B3076X012 Yellow	10	0.69	20 60	1.4 4.1	280 640	7.5 17.2	450 1170	12.1 31.4	1070 2460	28.7 65.9	1740 3690	46.6 98.9	2700 5270	72.4 141	3800 6120	102 164
			100 200 500	6.9 13.8 34.5	990 1850 4010	26.5 49.6 107	1690 3070 4240	45.3 82.3 114	3540 4200 5640	94.9 113 151	4790 6200 6520	128 166 175	6200 6380	166 171	7600 7680	204 206
			750 1000 1250 1500 1750 2000	51.7 69.0 86.2 103 121 138	4400 4450 4540 4880 5230 5900	118 119 122 131 140 158	5120 6220	137 167	6400	172						
	20	1.4	30 60 100	2.1 4.1 6.9	350 640 990	9.4 17.2 26.5	590 1170 1800	15.8 31.4 48.2	1390 2610 3980	37.3 69.9 107	2480 4680 6700	66.5 125 180	4350 7800 9750	117 209 261	4970 8900 10,400	133 239 279
			200 500 750 1000	13.8 34.5 51.7 69.0	1850 4400 6600 7300	49.6 118 177 196	3370 5200 5360 6500	90.3 139 144 174	7050 7400 8870	189 198 238	9000 9760	241 262	10,200	273	10,800	289
			1250 1500 1750 2000	86.2 103 121 138	7500 7800 8400 8600	201 209 225 230										
15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	40	2.8	60 100 200 500	4.1 6.9 13.8 34.5	610 990 1850 4400	16.3 26.5 49.6 118	1090 1790 3370 8090	29.2 48.0 90.3 217	2270 4070 7630 14,500	60.8 109 204 389	4230 6840 11,000 14,800	113 183 295 397	8100 11,900 16,300	217 319 437	9100 13,400 17,100	244 359 458
			750 1000 1250 1500 1750 2000	51.8 69.0 86.2 103 121 138	6600 8700 11,000 12,000 13,000 14,000	177 233 295 322 348 375	10,800 13,100 13,800 14,000	289 351 370 375	14,800 16,300	397 437	14,900	399				
35 to 80 psig / 2.4 to 5.5 bar 10B3078X012 Blue	60	4.1	75 100 200 500	5.2 6.9 13.8 34.5	700 970 1850 4400	18.8 26.0 49.6 118	1230 1740 3370 8090	33.0 46.6 90.3 217	2760 3910 7630 18,300	74.0 105 204 490	4700 6690 12,400 20,000	126 179 332 536	8170 11,900 18,400	219 319 493	12,600 14,400 21,200	338 386 568
			750 1000 1250 1500 1750 2000	51.8 69.0 86.2 103 121 138	6600 8700 11,000 13,000 15,000 17,000	177 233 295 348 402 456	12,000 16,000 18,700 19,000 20,000	322 429 501 509 536	18,900 19,000	507 509	21,400	574				
	80	5.5	100 200 500	6.9 13.8 34.5	900 1850 4400	24.1 49.6 118	1630 3370 8090	43.7 90.3 217	3570 7630 18,300	95.7 204 490	6490 13,700 29,000	174 367 777	12,000 23,000	322 616	17,200 29,000	461 777
			750 1000 1250 1500 1750 2000	51.8 69.0 86.2 103 121 138	6600 8700 11,000 13,000 15,000 17,000	177 233 295 348 402 456	12,000 16,000 19,000 22,000 25,000	322 429 509 590 670	23,100 27,400	619 734	30,900	828				
70 to 150 psig / 4.8 to 10.3 bar 10B3079X012 Red	100	6.9	150 200 500 750	10.3 13.8 34.5 51.8	1170 1850 4400 6600	31.4 49.6 118 177	2510 3370 8090 12,000	67.3 90.3 217 322	5540 7630 18,300	148 204 490	8310 12,000	223 322	15,500 20,100	415 539	20,300 25,700	544 689
			1000 1250 1500 1750 2000	69.0 86.2 103 121 138	8700 11,000 13,000 15,000 17,000	233 295 348 402 456	16,000	429								
	150	10.3	200 500 750 1000	13.8 34.5 51.8 69.0	1760 4400 6600 8700	47.2 118 177 233	3200 8090 12,000 16,000	85.8 217 322 429	7020 18,300	188 490	12,500	335	21,400	574	30,600	820
			1250 1500 1750 2000	86.2 103 121 138	11,000 13,000 15,000 17,000	295 348 402 456										

1. Capacity is based on 20% droop unless otherwise noted below.
2. For pressure setting under 10 psig / 0.69 bar, inlet pressure should be limited to approximately 100 / 6.9 bar so that setpoint adjustment can be obtained.
▭ - Blank areas indicate where maximum operating inlet pressure for a given orifice is exceeded.

Table 19. Type 627R Capacities for NPS 1 and 2 / DN 25 and 50 Body Size[1]

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
					Orifice Size, In. / mm											
					3/32 / 2.4		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	psig	bar												
5 to 20 psig[2] / 0.34 to 1.4 bar 10B3076X012 Yellow	10	0.69	15	1.0	210	5.6	390	10.5	840	22.5	1480	39.7	2300	61.6	2930	78.5
			20	1.4	280	7.5	500	13.4	1100	29.5	1880	50.4	2700	72.4	3830	103
			60	4.1	640	17.2	1170	31.4	2460	65.9	3690	98.9	5650	151	6900	185
			100	6.9	990	26.5	1800	48.2	3540	94.9	4790	128	7520	202	8150	218
			200	13.8	1850	49.6	3370	90.3	5620	151	6360	170	11,000	295	12,900	346
			500	34.5	4400	118	6720	180	8570	230	11,600	311				
			750	51.7	5400	145	8850	237	9000	241						
			1000	69.0	5800	155	9500	255								
			1250	86.2	6300	169										
			1500	103	6600	177										
			1750	121	6800	182										
			2000	138	7600	204										
	20	1.4	30	2.1	350	9.4	600	16.1	1390	37.3	2580	69.1	4350	117	6290	169
			60	4.1	640	17.2	1170	31.4	2630	70.5	4750	127	7800	209	10,600	284
			100	6.9	990	26.5	1800	48.2	4070	109	7310	196	10,800	289	13,400	359
			200	13.8	1850	49.6	3370	90.3	7050	189	10,500	281	14,000	375	14,400	386
			500	34.5	4400	118	7830	210	11,800	316	13,300	356				
			750	51.7	6600	177	9000	241	12,000	322						
			1000	69.0	8700	233	9660	259								
			1250	86.2	10,000	268										
			1500	103	10,400	279										
			1750	121	12,000	322										
			2000	138	14,000	375										
15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	40	2.8	60	4.1	610	16.3	1090	29.2	2430	65.1	4510	121	9200	247	9400	252
			100	6.9	990	26.5	1790	48.0	4070	109	7310	196	13,500	362	17,600	472
			200	13.8	1850	49.6	3370	90.3	7630	204	11,000	295	21,400	574	24,600	659
			500	34.5	4400	118	8090	217	16,300	437	21,800	584				
			750	51.7	6600	177	12,000	322	20,200	541	23,600	632				
			1000	69.0	8700	233	16,000	429	23,200	622						
			1250	86.2	11,000	295	19,000	509								
			1500	103	13,000	348	21,000	563								
			1750	121	15,000	402										
			2000	138	17,000	456										
35 to 80 psig / 2.4 to 5.5 bar 10B3078X012 Blue	60	4.1	75	5.2	700	18.8	1230	33.0	2760	74.0	4860	130	8600	230	12,800	343
			100	6.9	970	26.0	1740	46.6	3910	105	7000	188	12,500	335	16,700	448
			200	13.8	1850	49.6	3370	90.3	7630	204	13,700	367	20,900	560	27,700	742
			500	34.5	4400	118	8090	217	18,300	490	28,500	764				
			750	51.8	6600	177	12,000	322	22,800	611	29,500	791				
			1000	69.0	8700	233	16,000	429	26,800	718						
			1250	86.2	11,000	295	19,000	509								
			1500	103	13,000	348	22,000	590								
			1750	121	15,000	402	25,000	670								
			2000	138	17,000	456										
	80	5.5	100	6.9	900	24.1	1630	43.7	3570	95.7	6650	178	12,000	322	17,400	466
			200	13.8	1850	49.6	3370	90.3	7630	204	13,700	367	25,100	673	31,800	852
			500	34.5	4400	118	8090	217	18,300	490	30,300	812				
			750	51.8	6600	177	12,000	322	27,200	729	37,400	1002				
			1000	69.0	8700	233	16,000	429	33,300	892						
			1250	86.2	11,000	295	19,000	509								
			1500	103	13,000	348	22,000	590								
			1750	121	15,000	402	25,000	670								
			2000	138	17,000	456										
70 to 150 psig / 4.8 to 10.3 bar 10B3079X012 Red	100	6.9	150	10.3	1170	31.4	2510	67.3	5540	148	8310	223	15,500	415	20,300	544
			200	13.8	1850	49.6	3370	90.3	7630	204	12,000	322	20,100	539	26,700	716
			500	34.5	4400	118	8090	217	18,300	490						
			750	51.8	6600	177	12,000	322								
			1000	69.0	8700	233	16,000	429								
			1250	86.2	11,000	295										
			1500	103	13,000	348										
			1750	121	15,000	402										
			2000	138	17,000	456										
	150	10.3	200	13.8	1760	47.2	3200	85.8	7020	188	12,900	346	21,400	574	33,300	892
			500	34.5	4400	118	8090	217	18,300	490						
			750	51.8	6600	177	12,000	322								
			1000	69.0	8700	233	16,000	429								
			1250	86.2	11,000	295										
			1500	103	13,000	348										
			1750	121	15,000	402										
			2000	138	17,000	456										

1. Capacity is based on 20% droop unless otherwise noted below.
2. For pressure setting under 10 psig / 0.69 bar, inlet pressure should be limited to approximately 100 / 6.9 bar so that setpoint adjustment can be obtained.
□ - Blank areas indicate where maximum operating inlet pressure for a given orifice is exceeded.

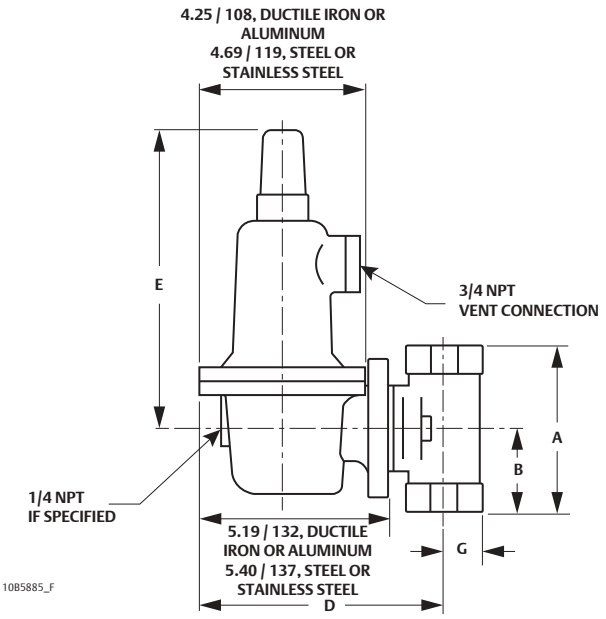


Figure 4. *NPT Dimensions*

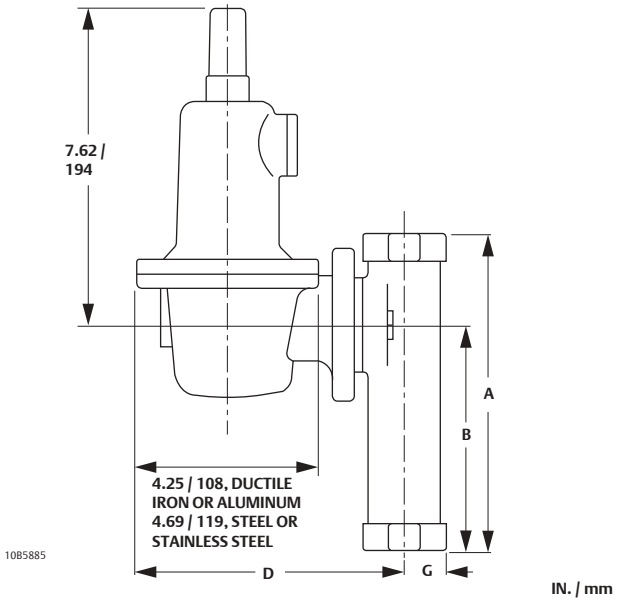


Figure 5. *Long Body Dimensions*

Table 20. NPT Dimension

BODY SIZE, NPT	DIMENSION													
	A		B		D				E				G	
					Aluminum / Ductile Iron		Steel / Stainless steel		Types 627, 627R, 627LR, 627M and 627MR		Types 627H and 627HM			
	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
3/4 and 1	4.06	103	2.03	52	6.50	165	6.75	172	7.62	194	7.94	202	1.00	25
2	5.00	127	2.50	64	6.88	175	7.12	181					1.69	43

Table 21. Long Body Dimension

BODY SIZE		DIMENSION									
		A		B		D				G	
						Aluminum / Ductile Iron		Steel / Stainless steel			
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1	25	7.38	187	5.25	133	6.50	165	6.75	172	1.00	25
2	50	7.88	200	5.38	137	6.88	175	7.12	181	1.69	43

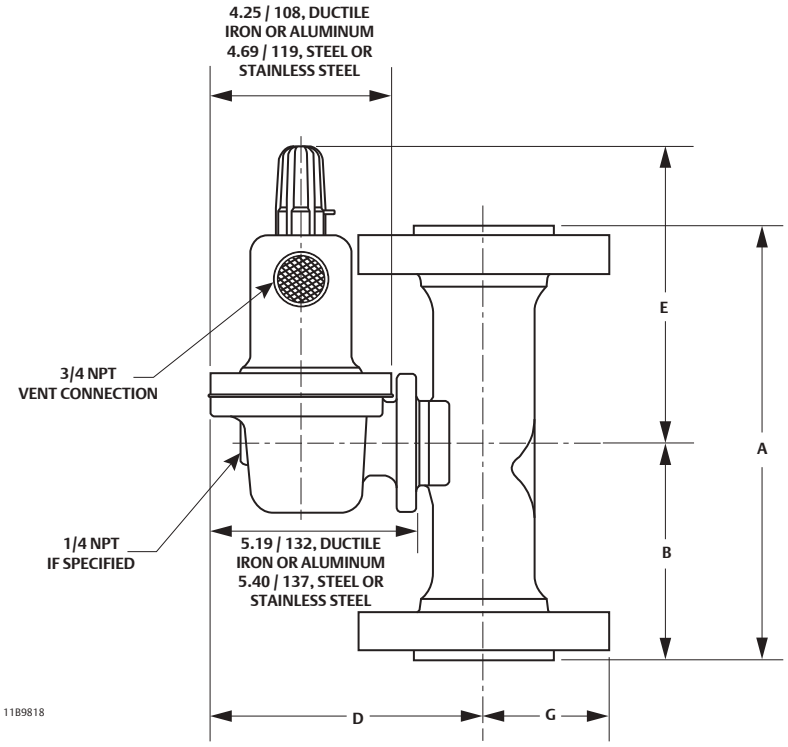


Figure 6. *Flanged Dimensions*

Table 22. Flanged Dimension

BODY SIZE		DIMENSION															
		A						B						D			
		CL150 RF		CL300 RF		CL600 RF		CL150 RF		CL300 RF		CL600 RF		Aluminum / Ductile Iron		Steel / Stainless steel	
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1	25	7.25	184	7.75	197	8.25	210	3.62	92	3.88	99	4.12	105	6.50	165	6.75	171
2	50	10	254	10.5	267	11.25	286	5	127	5.25	133	5.62	143	6.88	175	7.12	181

Table 22. Flanged Dimension (continued)

BODY SIZE		DIMENSION									
		E				G					
		Types 627, 627R, 627LR and 627MR		Types 627H and 627HM		CL150 RF		CL300 RF		CL600 RF	
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1	25	7.62	194	7.94	202	2.12	54	2.44	62	2.44	62
2	50	7.62	194	7.94	202	3	76	3.25	83	3.25	83

Table 23. Shipping Weight

CASING MATERIAL	APPROXIMATE SHIPPING WEIGHT	
	lbs	kg
Ductile iron, Steel or Stainless steel	10	5
Aluminum	6.3	3

Ordering Guide

Type (Select One)

- ☐ 627 (basic construction)***
- ☐ 627H (high-pressure version) (WCC steel / Stainless steel only)***
- ☐ 627M (external pressure registration)***
- ☐ 627HM***
- ☐ 627R (internal relief)***
- ☐ 627LR***
- ☐ 627MR***

Body Sizes (Select One)

- ☐ 3/4 NPT***
- ☐ NPS 1 / DN 25***
- ☐ NPS 2 / DN 50***
- ☐ 1 NPT Long Body**
- ☐ 2 NPT Long Body**

Body Material and End Connection Style (Select One)

Ductile Iron (not available for Types 627H and 627HM)

- ☐ NPT***

WCC Steel (required for Types 627H and 627HM)

- ☐ NPT (available end connection for Type 627 long body)***
- ☐ CL150 RF**
- ☐ CL300 RF***
- ☐ CL600 RF***
- ☐ PN 16/25/40**

Stainless steel (available only for Types 627, 627R and 627H)

- ☐ NPT***
- ☐ CL150 RF**
- ☐ CL300 RF***
- ☐ CL600 RF***
- ☐ PN 16/25/40**

Spring Case and Diaphragm Casing Material (Select One)

- ☐ Aluminum (Types 627, 627R and 627LR only)***
- ☐ Ductile iron***
- ☐ WCC steel***
- ☐ Stainless steel (Types 627, 627R and 627H only)***

Diaphragm Material (Select One)

- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)***
- ☐ Neoprene (CR) (for Types 627H and 627HM only)***

Trim Material (Select One)

- ☐ Aluminum (Types 627, 627R and 627LR only)***
- ☐ Stainless steel***

Valve Disk Material (Select One)

- ☐ Nitrile (NBR)***
- ☐ Nylon (PA) (not available to Type 627LR)***
- ☐ Fluorocarbon (FKM) (not available to Types 627H and 627HM)**

Orifice Sizes (Select One)

- ☐ 3/32 in. / 2.4 mm***
- ☐ 1/8 in. / 3.2 mm***
- ☐ 3/16 in. / 4.8 mm***
- ☐ 1/4 in. / 6.4 mm***
- ☐ 3/8 in. / 9.5 mm (not available to Type 627LR)***
- ☐ 1/2 in. / 13 mm (not available to Type 627LR)***

Outlet Pressure Ranges (Select One)

Types 627, 627M, 627R and 627MR

- ☐ 5 to 20 psig / 0.34 to 1.4 bar, Yellow***
- ☐ 15 to 40 psig / 1.0 to 2.8 bar, Green***
- ☐ 35 to 80 psig / 2.4 to 5.5 bar, Blue***
- ☐ 70 to 150 psig / 4.8 to 10.3 bar, Red***

Type 627LR

- ☐ 15 to 40 psig / 1.0 to 2.8 bar, Green***

Types 627H and 627HM

- ☐ 140 to 250 psig / 9.7 to 17.2 bar, Blue***
- ☐ 240 to 500 psig / 16.5 to 34.5 bar, Red***

Body Position (Select One)

- ☐ Position 1 (**standard** for NPT connections)***
- ☐ Position 2**
- ☐ Position 3 (**standard** for flanged bodies)**
- ☐ Position 4**

Vent Position (Select One)

- ☐ Position C**
- ☐ Position D **(standard)*****
- ☐ Position E**
- ☐ Position F**

DVGW Approval Required (Optional)

- ☐ Yes***

Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

Ordering Guide (continued)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Use control lines of equal or greater size than the control tap on the regulator. If a long control line is required, make it bigger. A rule of thumb is to use the next nominal pipe size for every 20 feet / 6.1 m of control line. Small control lines cause a delayed response of the regulator, leading to increased chance of instability. 3/8-inch / 9.5 mm OD tubing is the minimum recommended control line size.

Introduction

The Type 627F pilot-operated pressure reducing regulator provides superior performance when used in pressure- factor measurement (fixed-factor billing) applications. The Type 627F includes a factory-installed Type 6351F pilot and has external registration that requires a downstream control line.

Body Sizes and End Connection Styles

See Table 1

Maximum Inlet Pressure

See Table 2

Maximum Outlet (Casing) Pressure

250 psig / 17.2 bar

Outlet Pressure Ranges

5 to 100 psig / 0.34 to 6.9 bar in two ranges
See Table 9

Temperature Capabilities

-20 to 180°F / -29 to 82°C

Outlet Pressure Accuracy

±1% of absolute outlet pressure setting (psia or bar absolute) when inlet pressure is held within allowable variations; droop does not exceed 1% of absolute pressure setting for flow rates

Flow Coefficients

See Table 3

IEC Sizing Coefficients

See Table 4

Pressure Registration

External

Pilot Spring Case Vent Connection

1/4 NPT with removable screened vent assembly

Approximate Weights

NPT body with Ductile Iron or Steel Casings: 10 lbs / 4.5 kg

NPT body with Aluminum Casings: 6.3 lbs / 2.9 kg

Flanged body with Steel Casings: 18 lbs / 8.2 kg

Flanged body with Ductile Iron Casings: 14 lbs / 6.4 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Fixed Factor Accuracy**
- **Wide Range of Flow Capabilities**
- **Tight Shutoff Capability**
- **Easy to Maintain**
- **Installation Adaptability**
- **Tamper-Resistant**



Figure 1. *Type 627F Pressure Reducing Regulators*

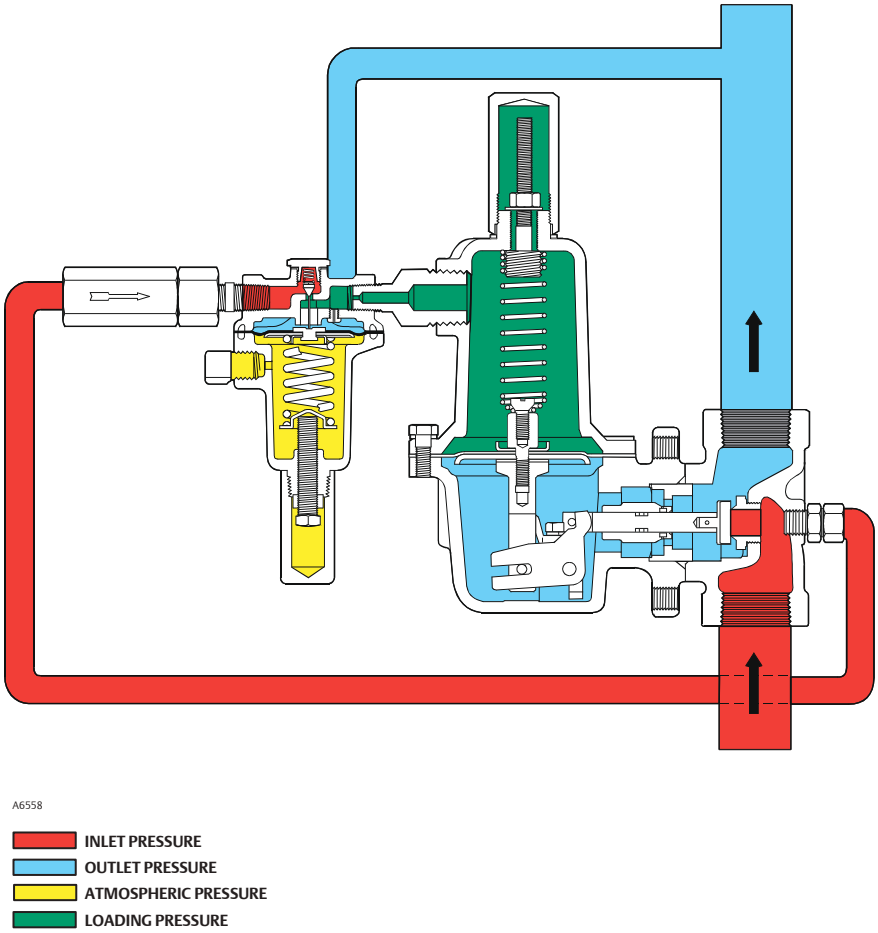


Figure 2. *Type 627F Operational Schematic*

Table 1. Body Size and End Connection Style

BODY SIZE		BODY MATERIAL	
In.	DN	Ductile Iron	WCC Steel
3/4		NPT	NPT
1 or 2	25 or 50	NPT	NPT, CL150 RF, CL300 RF, CL600 RF or PN 16/25/40 RF

Table 2. Maximum Allowable Inlet and Differential Pressure

ORIFICE SIZE		MAXIMUM INLET PRESSURE		MAXIMUM DIFFERENTIAL PRESSURE	
In.	mm	psig	bar	psi	bar
3/8 x 1/8	9.5 x 3.2	250	17.2	250	17.2
3/8 x 1/4	9.5 x 6.4	250	17.2	250	17.2
3/8	9.5	250	17.2	250	17.2
1/2	13	125	8.6	125	8.6

Table 3. Flow Coefficient

ORIFICE SIZE		3/4 NPT BODY			NPS 1 / DN 25 BODY			NPS 2 / DN 50 BODY		
		Wide-Open	Wide-Open	C_1	Wide-Open	Wide-Open	C_1	Wide-Open	Wide-Open	C_1
In.	mm	C_g	C_v		C_g	C_v		C_g	C_v	
3/8 x 1/8	9.5 x 3.2	12.5	0.43	29.1	12.5	0.43	29.4	12.5	0.43	29.2
3/8 x 1/4	9.5 x 6.4	50	1.63	30.6	50	1.71	29.3	52	1.66	31.3
3/8	9.5	108	2.99	36.1	108	3.42	31.6	115	3.39	33.9
1/2	13	190	4.87	39.0	190	5.29	35.9	200	5.01	39.9

Table 4. IEC Sizing Coefficient

ORIFICE SIZE		X_T			F_D	F_L
In.	mm	3/4 NPT body	NPS 1 / DN 25 body	NPS 2 / DN 50 body		
1/8	3.2	0.54	0.55	0.54	0.50	0.79
1/4	6.4	0.59	0.54	0.62		0.87
3/8	9.5	0.82	0.63	0.73		0.89
1/2	13	0.96	0.82	1.01		0.86

Table 5. Additional Specification

ORIFICE SIZE		ALLOWABLE INLET PRESSURE RANGE FOR MAINTAINING OUTLET PRESSURE WITHIN ±1% OF THE ABSOLUTE OUTLET PRESSURE SETTING[1]									
		5 psig / 0.34 bar		30 psig / 2.1 bar		40 psig / 2.8 bar		60 psig / 4.1 bar		100 psig / 6.9 bar	
In.	mm	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
3/8 x 1/8	9.5 x 3.2	30 to 250	2.1 to 17.2	55 to 250	3.8 to 17.2	65 to 250	4.5 to 17.2	85 to 250	5.9 to 17.2	125 to 250	8.6 to 17.2
3/8 x 1/4	9.5 x 6.4	30 to 250	2.1 to 17.2	55 to 250	3.8 to 17.2	65 to 250	4.5 to 17.2	85 to 250	5.9 to 17.2	125 to 250	8.6 to 17.2
3/8	9.5	30 to 250	2.1 to 17.2	55 to 250	3.8 to 17.2	65 to 250	4.5 to 17.2	85 to 250	5.9 to 17.2	125 to 250	8.6 to 17.2
1/2	13	25 to 125	1.7 to 8.6	50 to 125	3.4 to 8.6	60 to 125	4.1 to 8.6	80 to 125	5.5 to 8.6	120 to 125	8.3 to 8.6

1. For best performance, outlet pressure setting should be made using an inlet pressure that is midway between the highest and lowest expected inlet pressure.

Table 6. Main Regulator Construction Material

BODY	SPRING CASE AND DIAPHRAGM CASE	O-RING AND DIAPHRAGM	ORIFICE	DISK ASSEMBLY	TENSION SPRING
Ductile iron **(standard)** or WCC Steel	Die cast aluminum **(standard)**, Ductile iron or Steel	Nitrile (NBR)	Aluminum **(standard)** or Stainless steel	Aluminum **(standard)** or Stainless steel with Nitrile (NBR) disk	Plated steel

Table 7. Type 6351F Pilot Construction Material

BODY	SPRING CASE	DIAPHRAGM	DIAPHRAGM PLATE, SPRING GUIDE AND ADJUSTING SCREW	INNER VALVE PLUG	VALVE SPRING
Stainless steel	Aluminum	Nylon (PA) fabric coated with Nitrile (NBR)	Zinc-plated steel	Stainless steel/Nitrile (NBR) or Stainless steel/ Fluorocarbon (FKM)	Stainless steel

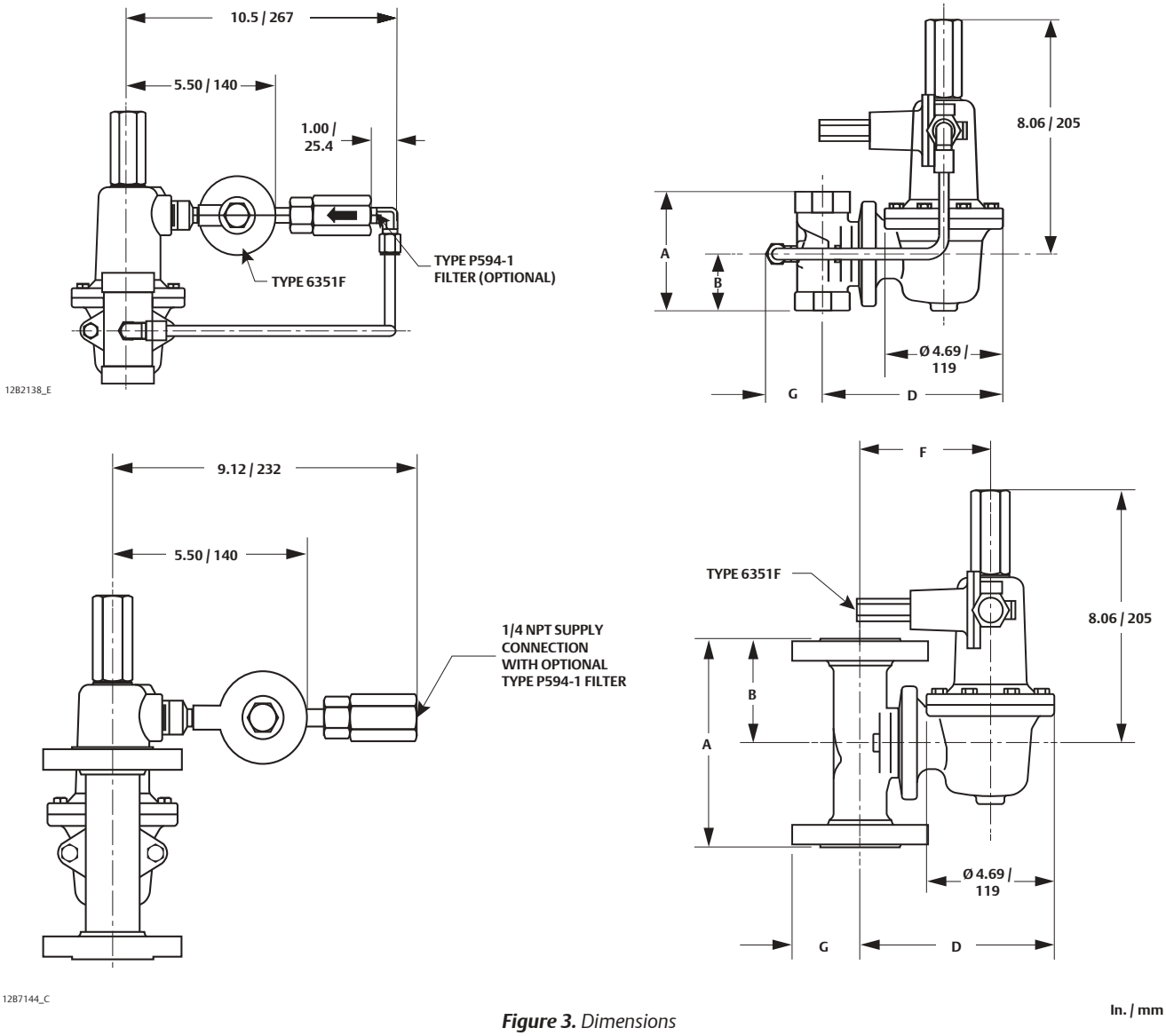


Figure 3. *Dimensions*

Table 8. Dimension

BODY SIZE		END CONNECTION STYLE	DIMENSION									
			A		B		D		F		G	
In.	DN		In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
3/4		NPT	4.06	103	1.94	49	6.75	171	----	----	2.00	51
1		NPT	4.06	103	1.94	49	6.75	171	----	----	2.00	51
1	25	CL150 RF	7.25	184	3.62	92	6.75	171	4.38	111	2.12	54
		CL300 RF	7.75	197	3.88	99					2.44	62
		CL600 RF	8.25	210	4.12	105					2.44	62
		PN 16/25/40	7.80	198	3.90	99					2.31	59
2	50	NPT	5.00	127	2.50	64	7.12	181	----	----	2.62	67
		CL150 RF	10.00	254	5.00	127	7.12	181	4.75	121	3.00	76
		CL300 RF	10.50	267	5.25	133					3.25	83
		CL600 RF	11.25	286	5.62	143					3.25	83
		PN 16/25/40	10.31	262	5.16	131					3.25	83

Table 9. Capacities Based on 1% Droop in Absolute Outlet Pressure

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING, psig / bar	INLET PRESSURE, psig / bar	CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS (DOWNSTREAM CONTROL LINE IN BODY SIZE PIPING)											
			Orifice Size, In. / mm											
			3/4 NPT Body Size				1 In. / DN 25 Body Size				2 In. / DN 50 Body Size			
			3/8x1/8 / 9.5x3.2	3/8x1/4 / 9.5x6.4	3/8 / 9.5	1/2 / 13	3/8x1/8 / 9.5x3.2	3/8x1/4 / 9.5x6.4	3/8 / 9.5	1/2 / 13	3/8x1/8 / 9.5x3.2	3/8x1/4 / 9.5x6.4	3/8 / 9.5	1/2 / 13
5 to 35 psig / 0.34 to 2.4 bar 1B788327022 Silver	5 / 0.34	30 / 2.1	700 / 18.8	2840 / 76.1	5780 / 155	9730 / 261	700 / 18.8	2840 / 76.1	6040 / 162	10,100 / 271	700 / 18.8	2840 / 76.1	6150 / 165	10,100 / 271
		40 / 2.8	860 / 23.1	3500 / 93.8	7480 / 200	13,100 / 351	860 / 23.1	3500 / 93.8	7480 / 200	13,100 / 351	860 / 23.1	3500 / 93.8	7760 / 208	13,800 / 370
		60 / 4.1	1170 / 31.4	4780 / 128	10,200 / 273	15,500 / 415	1170 / 31.4	4780 / 128	10,200 / 273	17,800 / 477	1170 / 31.4	4780 / 128	10,600 / 284	18,800 / 504
		80 / 5.5	1490 / 39.9	6060 / 162	12,900 / 346	15,500 / 415	1490 / 39.9	6060 / 162	12,900 / 346	18,500 / 496	1490 / 39.9	6060 / 162	13,400 / 359	23,800 / 638
		100 / 6.9	1800 / 48.2	7340 / 197	15,500 / 415	15,500 / 415	1800 / 48.2	7340 / 197	15,700 / 421	18,500 / 496	1800 / 48.2	7340 / 197	16,300 / 437	28,900 / 775
		150 / 10.3	2580 / 69.1	10,500 / 281	15,500 / 415		2580 / 69.1	10,500 / 281	18,500 / 496		2580 / 69.1	10,500 / 281	23,400 / 627	
		200 / 13.8	3370 / 90.3	13,700 / 367	15,500 / 415		3370 / 90.3	13,700 / 367	18,500 / 496		3370 / 90.3	13,700 / 367	30,000 / 804	
		250 / 17.2	4170 / 112	15,500 / 415	15,500 / 415		4170 / 112	16,900 / 453	18,500 / 496		4170 / 112	16,900 / 453	30,000 / 804	
	10 / 0.69	30 / 2.1	690 / 18.5	2760 / 74.0	5480 / 147	8500 / 228	690 / 18.5	2760 / 74.0	5840 / 157	8930 / 239	690 / 18.5	2760 / 74.0	5870 / 157	9500 / 255
		40 / 2.8	860 / 23.1	3500 / 93.8	7480 / 200	13,100 / 351	860 / 23.1	3500 / 93.8	7480 / 200	13,100 / 351	860 / 23.1	3500 / 93.8	7760 / 208	13,800 / 370
		60 / 4.1	1170 / 31.4	4780 / 128	10,200 / 273	17,800 / 477	1170 / 31.4	4780 / 128	10,200 / 273	17,800 / 477	1170 / 31.4	4780 / 128	10,600 / 284	18,800 / 504
		80 / 5.5	1490 / 39.9	6060 / 162	12,900 / 346	19,500 / 523	1490 / 39.9	6060 / 162	12,900 / 346	22,600 / 606	1490 / 39.9	6060 / 162	13,400 / 359	23,800 / 638
		100 / 6.9	1800 / 48.2	7340 / 197	15,700 / 421	19,500 / 523	1800 / 48.2	7340 / 197	15,700 / 421	22,600 / 606	1800 / 48.2	7340 / 197	16,300 / 437	28,900 / 775
		150 / 10.3	2580 / 69.1	10,500 / 281	19,500 / 523		2580 / 69.1	10,500 / 281	22,500 / 603		2580 / 69.1	10,500 / 281	23,400 / 627	
		200 / 13.8	3370 / 90.3	13,700 / 367	19,500 / 523		3370 / 90.3	13,700 / 367	22,600 / 606		3370 / 90.3	13,700 / 367	30,500 / 817	
		250 / 17.2	4170 / 112	16,900 / 453	19,500 / 523		4170 / 112	16,900 / 453	22,600 / 606		4170 / 112	16,900 / 453	37,600 / 1008	
	20 / 1.4	30 / 2.1	590 / 15.8	2310 / 61.9	4360 / 117	6000 / 161	590 / 15.8	2310 / 61.9	4820 / 129	6400 / 172	590 / 15.8	2310 / 61.9	4750 / 127	7000 / 188
		40 / 2.8	820 / 22.0	3250 / 87.1	6320 / 169	10,000 / 268	820 / 22.0	3250 / 87.1	6830 / 183	10,500 / 281	820 / 22.0	3250 / 87.1	6820 / 183	10,900 / 292
		60 / 4.1	1170 / 31.4	4780 / 128	10,200 / 273	17,800 / 477	1170 / 31.4	4780 / 128	10,200 / 273	17,800 / 477	1170 / 31.4	4780 / 128	10,600 / 284	18,800 / 504
		80 / 5.5	1490 / 39.9	6060 / 162	12,900 / 346	22,600 / 606	1490 / 39.9	6060 / 162	12,900 / 346	22,600 / 606	1490 / 39.9	6060 / 162	13,400 / 359	23,800 / 638
		100 / 6.9	1800 / 48.2	7340 / 197	15,700 / 421	24,000 / 643	1800 / 48.2	7340 / 197	15,700 / 421	27,400 / 734	1800 / 48.2	7340 / 197	16,300 / 437	28,900 / 775
		150 / 10.3	2580 / 69.1	10,500 / 281	22,500 / 603		2580 / 69.1	10,500 / 281	22,500 / 603		2580 / 69.1	10,500 / 281	23,400 / 627	
		200 / 13.8	3370 / 90.3	13,700 / 367	28,000 / 750		3370 / 90.3	13,700 / 367	29,400 / 788		3370 / 90.3	13,700 / 367	30,500 / 817	
		250 / 17.2	4170 / 112	16,900 / 453	28,000 / 750		4170 / 112	16,900 / 453	33,300 / 892		4170 / 112	16,900 / 453	37,600 / 1008	
	30 / 2.1	50 / 3.4	930 / 24.9	3680 / 98.6	7090 / 190	11,000 / 295	930 / 24.9	3680 / 98.6	7720 / 207	11,700 / 314	930 / 24.9	3680 / 98.6	7670 / 206	12,100 / 324
		60 / 4.1	1140 / 30.6	4530 / 121	8880 / 238	14,800 / 397	1140 / 30.6	4530 / 121	9540 / 256	15,300 / 410	1140 / 30.6	4530 / 121	9540 / 256	15,300 / 410
		80 / 5.5	1490 / 39.9	6060 / 162	12,900 / 346	22,600 / 606	1490 / 39.9	6060 / 162	12,900 / 346	22,600 / 606	1490 / 39.9	6060 / 162	13,500 / 362	23,800 / 638
		100 / 6.9	1800 / 48.2	7340 / 197	15,700 / 421	27,400 / 734	1800 / 48.2	7340 / 197	15,700 / 421	27,400 / 734	1800 / 48.2	7340 / 197	16,300 / 437	28,900 / 775
		150 / 10.3	2580 / 69.1	10,500 / 281	22,500 / 603		2580 / 69.1	10,500 / 281	22,500 / 603		2580 / 69.1	10,500 / 281	23,400 / 627	
		200 / 13.8	3370 / 90.3	13,700 / 367	28,000 / 750		3370 / 90.3	13,700 / 367	29,400 / 788		3370 / 90.3	13,700 / 367	30,500 / 817	
		250 / 17.2	4170 / 112	16,900 / 453	28,000 / 750		4170 / 112	16,900 / 453	36,200 / 970		4170 / 112	16,900 / 453	37,600 / 1008	

▭ - Shaded areas indicate maximum operating inlet pressure is exceeded.

- continued -

Table 9. Capacities Based on 1% Droop in Absolute Outlet Pressure (continued)

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING, psig / bar	INLET PRESSURE, psig / bar	CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS (DOWNSTREAM CONTROL LINE IN BODY SIZE PIPING)											
			Orifice Size, In. / mm											
			3/4 NPT Body Size				1 In. / DN 25 Body Size				2 In. / DN 50 Body Size			
			3/8 x 1/8 / 9.5 x 3.2	3/8 x 1/4 / 9.5 x 6.4	3/8 / 9.5	1/2 / 13	3/8 x 1/8 / 9.5 x 3.2	3/8 x 1/4 / 9.5 x 6.4	3/8 / 9.5	1/2 / 13	3/8 x 1/8 / 9.5 x 3.2	3/8 x 1/4 / 9.5 x 6.4	3/8 / 9.5	1/2 / 13
35 to 100 psig / 2.4 to 6.9 bar 1K748527202 Red	40 / 2.8	60 / 4.1	1030 / 27.6	4070 / 109	7770 / 208	10,400 / 279	1030 / 27.6	4070 / 109	8530 / 229	11,000 / 295	1030 / 27.6	4070 / 109	8440 / 226	12,000 / 322
		80 / 5.5	1450 / 38.9	5790 / 155	11,400 / 306	19,000 / 509	1450 / 38.9	5790 / 155	12,200 / 327	20,000 / 536	1450 / 38.9	5790 / 155	12,300 / 330	19,700 / 528
		100 / 6.9	1790 / 48.0	7340 / 197	15,700 / 421	27,400 / 734	1790 / 48.0	7340 / 197	15,700 / 421	27,400 / 734	1790 / 48.0	7340 / 197	16,300 / 437	28,900 / 775
		150 / 10.3	2580 / 69.1	10,400 / 279	20,000 / 536		2580 / 69.1	10,400 / 279	22,500 / 603		2580 / 69.1	10,400 / 279	23,400 / 627	
		200 / 13.8	3370 / 90.3	13,500 / 362	20,000 / 536		3370 / 90.3	13,500 / 362	29,400 / 788		3370 / 90.3	13,500 / 362	30,500 / 817	
		250 / 17.2	4170 / 112	16,900 / 453	20,000 / 536		4170 / 112	16,900 / 453	36,200 / 970		4170 / 112	16,900 / 453	37,600 / 1008	
	60 / 4.1	80 / 5.5	1220 / 32.7	4790 / 128	9050 / 243	12,000 / 322	1220 / 32.7	4790 / 128	9860 / 264	12,900 / 346	1220 / 32.7	4790 / 128	9860 / 264	14,000 / 375
		100 / 6.9	1700 / 45.6	6730 / 180	13,100 / 351	21,600 / 579	1700 / 45.6	6730 / 180	14,100 / 378	22,400 / 600	1700 / 45.6	6730 / 180	14,100 / 378	22,400 / 600
		150 / 10.3	2580 / 69.1	10,300 / 276	22,500 / 603		2580 / 69.1	10,300 / 276	22,500 / 603		2580 / 69.1	10,300 / 276	23,400 / 627	
		200 / 13.8	3370 / 90.3	13,500 / 362	29,400 / 788		3370 / 90.3	13,500 / 362	29,400 / 788		3370 / 90.3	13,500 / 362	30,500 / 817	
		250 / 17.2	4170 / 112	16,900 / 453	32,000 / 858		4170 / 112	16,900 / 453	36,200 / 970		4170 / 112	16,900 / 453	37,600 / 1008	
	100 / 6.9	125 / 8.6	1660 / 44.5	6680 / 179	12,500 / 335	18,000 / 482	1660 / 44.5	6680 / 179	13,900 / 373	19,400 / 520	1660 / 44.5	6680 / 179	13,700 / 367	21,200 / 568
		150 / 10.3	2360 / 63.2	9320 / 250	17,900 / 480		2360 / 63.2	9320 / 250	19,400 / 520		2360 / 63.3	9320 / 250	19,400 / 520	
		200 / 13.8	3330 / 89.2	13,400 / 359	26,600 / 713		3330 / 89.2	13,400 / 359	28,300 / 758		3330 / 89.2	13,400 / 359	28,500 / 764	
		250 / 17.2	4170 / 112	16,900 / 453	36,200 / 970		4170 / 112	16,900 / 453	36,200 / 970		4170 / 112	16,900 / 453	37,600 / 1008	

▭ - Shaded areas indicate maximum operating inlet pressure is exceeded.

Ordering Guide

Body Material, Body Size and End Connection Style (Select One)

Ductile Iron
- ☐ 3/4 NPT***
- ☐ 1 NPT***
- ☐ 2 NPT***

WCC Steel
- ☐ 3/4 NPT***
- ☐ 1 NPT***
- ☐ NPS 1 / DN 25, CL150 RF**
- ☐ NPS 1 / DN 25, CL300 RF**
- ☐ NPS 1 / DN 25, CL600 RF**
- ☐ NPS 1 / DN 25, PN 16/25/40**
- ☐ 2 NPT***
- ☐ NPS 2 / DN 50, CL150 RF**
- ☐ NPS 2 / DN 50, CL300 RF**
- ☐ NPS 2 / DN 50, CL600 RF**
- ☐ NPS 2 / DN 50, PN 16/25/40**

Spring Case and Diaphragm Casing Material (Select One)
- ☐ Aluminum***
- ☐ Ductile iron***
- ☐ WCC steel***

Trim Material (Select One)
- ☐ Aluminum***
- ☐ Stainless steel***

- continued -

Ordering Guide (continued)

Orifice Size (Select One)

- ☐ 3/8 x 1/8 in. / 9.5 x 3.2 mm**
- ☐ 3/8 x 1/4 in. / 9.5 x 6.4 mm**
- ☐ 3/8 in. / 9.5 mm***
- ☐ 1/2 in. / 13 mm***

Outlet Pressure Range (Select One)

- ☐ 5 to 35 psig / 0.34 to 2.4 bar, Unpainted***
- ☐ 35 to 100 psig / 2.4 to 6.9 bar, Red***

Pilot Supply Filter (Optional)

- ☐ Type P594-1

Pilot Supply Steel Tubing (Optional)

- ☐ With Type P594-1 Filter
- ☐ Without Filter

Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.

Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Make control line connections in a straight run of pipe about 10 pipe diameters downstream of any area of turbulence, such as elbows, pipe swages or block valves.

Introduction

Type 630 Big Joe™ regulators are spring-loaded, direct-operated regulators. Variations of the Type 630 can be used as first-stage farm tap regulators or high-pressure industrial regulators. These regulators are very durable and built to take rugged use.

Body Sizes and End Connection Styles

See Table 1

Flow and Sizing Coefficients

See Table 2

Flow Capacities

See Tables 6 and 7

Maximum Allowable Inlet Pressure and Pressure Drop

1500 psi / 103 bar

Maximum Outlet Pressure

500 psig / 34.5 bar

Outlet Pressure Ranges

3 to 500 psig / 0.21 to 34.5 bar

See Table 4

Pressure Registration

Internal

Temperature Capabilities

Nitrile (NBR), Nylon (PA) and Neoprene (CR):
-20 to 180°F / -29 to 82°C
Fluorocarbon (FKM) and Polytetrafluoroethylene (PTFE):
0 to 300°F / -18 to 149°C

Approximate Shipping Weight

1 in. / DN 25 End Connection:
25 lbs / 11.3 kg
2 in. / DN 50 End Connection:
30 lbs / 13.6 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **High-Pressure Capabilities**
- **Rugged Construction**
- **Better Low-Pressure Control**



Figure 1. *Type 630 Big Joe™ High-Pressure Regulator*

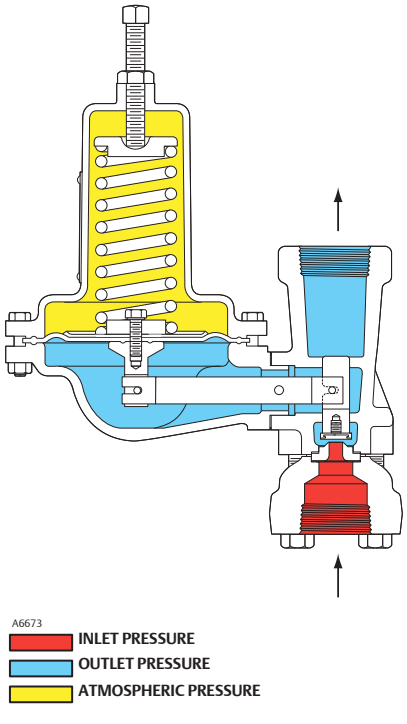


Figure 2. *Type 630 Operational Schematic*

Table 1. Body Size and End Connection Style

BODY SIZE		BODY MATERIAL	
In.	DN	Cast Iron	Steel
1 2	25 50	NPT	NPT, CL150 RF, CL300 RF or CL600 RF

Table 2. Flow and Sizing Coefficient

ORIFICE SIZE		WIDE-OPEN COEFFICIENT (FOR RELIEF SIZING)		C_1	X_T	F_D	F_L
In.	mm	C_g	C_v				
1/8 3/16 1/4 3/8 1/2	3.2 4.8 6.4 9.5 13	13.9 31.3 55.1 122.5 216.0	0.49 1.11 2.03 4.61 8.18	28.4 28.2 27.2 26.6 26.4	0.51 0.50 0.47 0.45 0.44	0.50	0.89

Table 3. Maximum Inlet Pressure and Pressure Drop

ORIFICE SIZE		MAXIMUM ALLOWABLE INLET PRESSURE(1)		MAXIMUM ALLOWABLE PRESSURE DROP					
				Nylon (PA) and PTFE Disk		Fluorocarbon (FKM) Disk		Nitrile (NBR) Disk	
In.	mm	psig	bar	psid	bar d	psid	bar d	psid	bar d
1/8 and 3/16	3.2 and 4.8	1500	103	1500	103	200	13.8	600	41.4
1/4	6.4	1500	103	1000	69.0				
3/8	9.5	1000	69.0	500	34.5			500	34.5
1/2	13	750	51.7	250	17.2			250	17.2

1. Inlet pressure must not exceed the sum of the actual outlet pressure setting and the maximum allowable pressure drop. For example, with an outlet pressure setting of 200 psig / 13.8 bar and a 3/8 in. / 9.5 mm orifice with a maximum allowable pressure drop of 500 psid / 34.5 bar d, the maximum allowable inlet pressure is 700 psig / 48.3 bar.
2. Nitrile (NBR) valve disks are normally furnished for pressure drops to 200 psi / 13.8 bar, differential. For better erosion resistance, Nylon (PA) valve disks are normally furnished for higher pressure drops. Some erosion of valve disks occurs at all pressure drops due to solid particles in the flow stream. The rate of erosion is higher with large amounts of impurities in the flow stream and with high pressure drops. Valve disks and other regulator parts must be inspected periodically for erosion and damage and must be replaced as necessary.

Table 4. Outlet Pressure Range

REGULATOR CONSTRUCTION	OUTLET PRESSURE RANGE		SPRING PART NUMBER	SPRING COLOR CODE	SPRING WIRE DIAMETER		SPRING FREE LENGTH		MAXIMUM OUTLET PRESSURE OVER SETPOINT(1)		MAXIMUM EMERGENCY OUTLET (CASING) PRESSURE(4)	
	psig	bar			In.	mm	In.	mm	psig	bar	psig	bar
Low pressure	3 to 10	0.21 to 0.69	0W019227022	Red Stripe	0.23	5.8	6.0	152	20(2)	1.4(2)	66	4.6
	8 to 20	0.55 to 1.4	0W019127022	Olive Drab	0.28	7.1						
	17 to 30	1.2 to 2.1	0W019027022	Unpainted	0.34	8.6						
	27 to 40	1.9 to 2.8	0Y066427022	Green Stripe	0.36	9.1			Limited by Maximum Emergency Outlet Pressure			
High pressure	27 to 50	1.9 to 3.5	0W019227022	Red Stripe	0.23	5.8	6.0	152	200	13.8	550	37.9
	46 to 95	3.2 to 6.6	0W019127022	Olive Drab	0.28	7.1						
	90 to 150	6.2 to 10.3	0W019027022	Unpainted	0.34	8.6						
	150 to 200	10.3 to 13.8	0Y066427022	Green Stripe	0.36	9.1						
	200 to 275	13.8 to 19.0	1J146927142	Blue Stripe	0.38	9.7	6.1	155				
	275 to 500	19.0 to 34.5	1K370927082	Yellow Stripe	0.44	11	6.2	157	200(3)	13.8(3)		

1. Damage to internal parts of the regulator may occur if outlet pressure exceeds the actual pressure setting by amounts greater than those shown in this column.
2. For outlet pressure settings to 25 psig / 1.72 bar only. For pressure settings over 25 psig / 1.72 bar, outlet pressure is limited by maximum emergency outlet pressure of 45 psig / 3.10 bar.
3. For outlet pressure settings to 350 psig / 24.1 bar only. For pressure settings over 350 psig / 24.1 bar, outlet pressure is limited by maximum emergency outlet pressure of 550 psig / 37.9 bar.
4. Leakage or bursting of pressure-containing parts may occur if outlet pressure exceeds these values.

Table 5. Construction Material

BODY, SPRING CASE AND DIAPHRAGM ADAPTOR	VALVE DISK	DIAPHRAGM	ORIFICE	VALVE DISK HOLDER	GASKET
Cast iron or Steel	Nitrile (NBR), Nylon (PA), PTFE or Fluorocarbon (FKM)	Neoprene (CR) or Fluorocarbon (FKM)	Brass or Stainless steel	Brass or Stainless steel	**Inlet Body Gaskets:** Copper with brass trim or Stainless steel with Stainless steel trim **Other Gaskets:** Composition

Table 6. Capacities for 1 in. / DN 25 Body Size Based on 20% Droop

	OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	INLET PRESSURE		OUTLET PRESSURE		1 IN. / DN 25 BODY CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY OF NATURAL GAS									
						Orifice Size, In. / mm									
						1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
LOW PRESSURE	3 to 10 psig / 0.21 to 0.69 bar 0W019227022 Red Stripe	10	0.69	5	0.34	200	5	510	14	990	27	1700	46	2200	59
		20	1.4			400	11	770	21	1200	32	2000	54	2700	72
		30	2.1			600	16	1100	29	1500	40	2200	59	3300	88
		50	3.4			950	25	1500	40	2100	56	2800	75	4200	113
		60	4.1			1100	29	1750	47	2400	64	3000	80	4100	110
		100	6.9			1700	46	2400	64	2900	78	4000	107	4900	131
		200	13.8			3000	80	3400	91	4200	113	5100	137	6100	163
		400	27.6			3700	99	3900	105	4500	121	6400	172	----	----
		500	34.5			4100	110	4300	115	4700	126	7400	198	----	----
		600	41.4			4300	115	4600	123	5000	134	----	----	----	----
		1000	69.0			4600	123	4900	131	5600	150	----	----	----	----
		1500	103			5000	134	5400	145	----	----	----	----	----	----
		20	1.4	10	0.69	500	13	1200	32	1800	48	4200	113	4900	131
		30	2.1			700	19	1400	38	2800	75	4100	110	5300	142
		50	3.4			1000	27	2300	62	4100	110	5100	137	6200	166
		60	4.1			1150	31	2700	72	4200	113	5500	147	6500	174
		100	6.9			1600	43	3800	102	5000	134	6400	172	7300	196
		200	13.8			3300	88	5800	155	6900	185	7700	206	8200	220
		400	27.6			5400	145	6900	185	7600	204	9000	241	----	----
		500	34.5			6000	161	7100	190	7900	212	9700	260	----	----
		600	41.4			6500	174	7300	196	8200	220	----	----	----	----
		1000	69.0			7200	193	7700	206	8400	225	----	----	----	----
		1500	103			7400	198	8400	225	----	----	----	----	----	----
	8 to 20 psig / 0.55 to 1.4 bar 0W019127022 Olive Drab	20	1.4	10	0.69	500	13	700	19	1400	38	2200	59	3600	96
		30	2.1			700	19	1300	35	2100	56	3100	83	4300	115
		50	3.4			900	24	1900	51	3200	86	4300	115	5400	145
		60	4.1			1050	28	2300	62	3500	94	4700	126	5800	155
		100	6.9			1600	43	3500	94	4600	123	5700	153	6900	185
		200	13.8			3300	88	4800	129	6200	166	7500	201	8200	220
		400	27.6			5400	145	6500	174	7600	204	8900	239	----	----
		500	34.5			6000	161	6900	185	7900	212	9400	252	----	----
		600	41.4			6500	174	7000	188	8200	220	----	----	----	----
		1000	69.0			7200	193	7700	206	8400	225	----	----	----	----
		1500	103			7400	198	8100	217	----	----	----	----	----	----
		20	1.4	15	1.0	470	13	1000	27	1700	46	3300	88	4900	131
		30	2.1			600	16	1500	40	2500	67	4600	123	5200	139
		50	3.4			1000	27	2300	62	3800	102	5500	147	5700	153
		60	4.1			1150	31	2700	72	4300	115	6100	163	6800	182
		100	6.9			1900	51	4300	115	6200	166	7600	204	9600	257
		200	13.8			3600	96	7500	201	8500	228	9600	257	10,000	268
		400	27.6			7100	190	8700	233	10,000	268	11,000	295	----	----
		500	34.5			8300	222	8800	236	10,500	281	12,000	322	----	----
		600	41.4			8600	230	9600	257	10,800	289	----	----	----	----
		1000	69.0			9600	257	10,000	268	11,000	295	----	----	----	----
		1500	103			10,000	268	11,000	295	----	----	----	----	----	----

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Table 6. Capacities for 1 in. / DN 25 Body Size Based on 20% Droop (continued)

	OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	INLET PRESSURE		OUTLET PRESSURE		1 IN. / DN 25 BODY CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY OF NATURAL GAS									
						Orifice Size, In. / mm									
						1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
LOW PRESSURE	8 to 20 psig / 0.55 to 1.4 bar 0W019127022 Olive Drab	30	2.1	20	1.4	600	16	1500	40	2500	67	4600	123	6800	182
		40	2.8			800	21	2000	54	3400	91	5700	153	8100	217
		50	3.4			1000	27	2300	62	4200	113	6800	182	9000	241
		60	4.1			1150	31	2700	72	4900	131	7500	201	9800	263
		100	6.9			1800	48	4100	110	7400	198	9500	255	11,000	295
		200	13.8			3600	96	8000	214	10,000	268	12,000	322	13,000	348
		400	27.6			7200	193	10,000	268	13,000	348	14,000	375	----	----
		500	34.5			8500	228	10,800	289	13,400	359	14,800	397	----	----
		600	41.4			10,000	268	12,000	322	13,800	370	----	----	----	----
		1000	69.0			11,000	295	12,300	330	15,000	402	----	----	----	----
		1500	103			12,000	322	13,000	348	----	----	----	----	----	----
	17 to 30 psig / 1.17 to 2.1 bar 0W019027022 Silver	30	2.1	20	1.4	590	16	900	24	1700	46	3300	88	4700	126
		40	2.8			790	21	1700	46	2400	64	4000	107	6100	163
		50	3.4			900	24	2200	59	3600	96	4900	131	6900	185
		60	4.1			1050	28	2500	67	4000	107	5500	147	7400	198
		100	6.9			1700	46	4000	107	5500	147	7600	204	9700	260
		200	13.8			3400	91	6400	172	9100	244	11,000	295	12,000	322
		400	27.6			7000	188	8700	233	11,000	295	13,000	348	----	----
		500	34.5			8000	214	9800	263	11,800	316	13,700	367	----	----
		600	41.4			9600	257	11,000	295	13,000	348	----	----	----	----
		1000	69.0			10,000	268	12,000	322	14,000	375	----	----	----	----
		1500	103			12,000	322	13,000	348	----	----	----	----	----	----
		40	2.8	30	2.1	820	22	1700	46	2700	72	5100	137	7600	204
		50	3.4			900	24	2200	59	3600	96	6400	172	8700	233
		60	4.1			1100	29	2600	70	4400	118	7500	201	9800	263
		100	6.9			1700	46	4100	110	6800	182	10,000	268	12,000	322
		200	13.8			3500	94	8000	214	11,000	295	14,000	375	16,000	429
		400	27.6			6900	185	13,000	348	15,000	402	17,000	456	----	----
		500	34.5			8800	236	14,000	375	15,600	418	18,500	496	----	----
		600	41.4			9700	260	15,000	402	16,000	429	----	----	----	----
		1000	69.0			15,500	415	17,800	477	17,900	480	----	----	----	----
		1500	103			16,400	440	18,500	496	----	----	----	----	----	----
	27 to 40 psig / 1.9 to 2.8 bar 0Y066427022 Green Stripe	40	2.8	30	2.1	800	21	1500	40	2400	64	4400	118	6400	172
		50	3.4			900	24	2000	54	3200	86	5600	150	7700	206
		60	4.1			1100	29	2500	67	3900	105	6300	169	8900	239
		100	6.9			1700	46	3900	105	6400	172	9400	252	11,000	295
		200	13.8			3500	94	7000	188	9400	252	14,000	375	15,000	402
		400	27.6			6900	185	12,000	322	15,000	402	17,000	456	----	----
		500	34.5			8800	236	12,500	335	15,600	418	17,800	477	----	----
		600	41.4			9700	260	13,400	359	16,000	429	----	----	----	----
		1000	69.0			15,600	418	15,800	423	17,900	480	----	----	----	----
		1500	103			16,400	440	18,000	482	----	----	----	----	----	----
		50	3.4	40	2.8	950	25	1800	48	3200	86	5500	147	8900	239
		60	4.1			1100	29	2300	67	4100	110	7500	201	10,000	268
		100	6.9			1800	48	4100	110	7000	188	11,000	295	14,000	375
		200	13.8			3500	94	7800	209	12,000	322	17,000	456	19,000	509
		400	27.6			7100	190	15,000	402	18,000	482	21,000	563	----	----
		500	34.5			8800	236	16,500	442	18,700	501	21,700	582	----	----
		600	41.4			9800	263	18,000	482	21,000	563	----	----	----	----
		1000	69.0			16,800	450	19,800	531	22,800	611	----	----	----	----
		1500	103			20,000	536	22,000	590	----	----	----	----	----	----

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Table 6. Capacities for 1 in. / DN 25 Body Size Based on 20% Droop (continued)

	OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	INLET PRESSURE		OUTLET PRESSURE		1 IN. / DN 25 BODY CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY OF NATURAL GAS									
						Orifice Size, In. / mm									
						1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
HIGH PRESSURE	27 to 50 psig / 1.9 to 3.4 bar 0W019227022 Red Stripe	60	4.1	50	3.4	900	24	2000	54	3100	83	5200	139	8100	217
		100	6.9			1700	46	3500	94	5700	153	10,500	281	13,000	348
		200	13.8			3500	94	7800	209	11,000	295	16,000	429	19,000	509
		300	20.7			5300	142	10,500	281	14,000	375	20,000	536	23,000	616
		400	27.6			6900	185	13,000	348	17,000	456	23,000	616	----	----
		500	34.5			8700	233	15,000	402	19,000	509	25,000	670	----	----
		600	41.4			9800	263	17,000	456	21,000	563	----	----	----	----
		1000	69.0			16,200	434	22,300	598	26,300	705	----	----	----	----
		1500	103			19,000	509	25,000	670	----	----	----	----	----	----
	46 to 95 psig / 3.2 to 6.6 bar 0W019127022 Olive Drab	60	4.1	50	3.4	800	21	1500	40	2400	64	4300	115	6400	172
		100	6.9			1500	40	3100	83	4200	113	7500	201	10,000	268
		200	13.8			3400	91	6800	182	9400	252	14,000	375	17,000	456
		300	20.7			5200	139	8900	239	11,000	295	16,000	429	20,000	536
		400	27.6			6800	182	11,000	295	15,000	402	20,000	536	----	----
		500	34.5			8600	230	12,300	330	16,300	437	22,000	590	----	----
		600	41.4			9800	263	14,000	375	19,000	509	----	----	----	----
		1000	69.0			13,500	362	18,400	493	21,700	582	----	----	----	----
		1500	103			18,000	482	24,000	643	----	----	----	----	----	----
		100	6.9	75	5.17	1700	46	3200	86	5000	134	8000	214	13,000	348
		200	13.8			3500	94	7300	196	10,000	268	16,000	429	22,000	590
		400	27.6			7100	190	14,000	375	19,000	509	27,000	724	----	----
		500	34.5			8600	230	16,300	437	21,300	571	28,700	769	----	----
		600	41.4			9900	265	19,000	509	25,000	670	----	----	----	----
		1000	69.0			16,700	448	25,800	691	31,000	831	----	----	----	----
		1500	103			23,000	616	32,000	858	----	----	----	----	----	----
	90 to 150 psig / 6.2 to 10.3 bar 0W019027022 Sliver	125	8.62	100	6.9	2000	54	3600	96	5500	147	9200	247	13,000	348
		150	10.3			2500	67	4600	123	6800	182	11,000	295	16,000	429
		200	13.8			3600	96	6600	177	9400	252	13,000	348	22,000	590
		300	20.7			5300	142	9800	263	14,000	375	21,000	5603	30,000	804
		400	27.6			7000	188	13,000	348	18,000	482	27,000	724	----	----
		500	34.5			8300	222	15,500	415	20,500	549	31,000	831	----	----
		1000	69.0			17,500	469	26,000	697	32,600	874	----	----	----	----
		1500	103			25,000	670	35,000	938	----	----	----	----	----	----
		150	10.3	125	8.62	2400	64	4600	123	6700	180	11,000	295	17,000	456
		200	13.8			3500	94	6800	182	10,000	268	15,000	402	23,000	616
		300	20.7			5200	139	10,000	268	15,000	402	25,000	670	34,000	911
		400	27.6			7300	196	14,500	389	19,000	509	29,000	777	----	----
		500	34.5			7900	212	15,000	402	25,000	670	36,000	965	----	----
		1000	69.0			16,000	429	30,300	812	38,800	1040	----	----	----	----
		1500	103			26,000	697	43,000	1152	----	----	----	----	----	----
		200	13.8	150	10.3	3400	91	6800	182	10,000	268	16,000	429	26,000	697
		300	20.7			5300	142	10,000	268	15,000	402	24,000	643	35,000	938
		400	27.6			7100	190	14,000	375	22,000	590	34,000	911	42,000	1126
		500	34.5			8000	214	18,800	504	26,300	705	39,300	1053	----	----
		800	55.2			13,000	348	29,000	777	38,000	1018	----	----	----	----
		1000	69.0			17,000	456	34,000	911	44,300	1187	----	----	----	----
		1500	103			26,000	697	47,000	1260	----	----	----	----	----	----
	150 to 200 psig / 10.3 to 13.8 bar 0Y066427022 Green Stripe	200	13.8	150	10.3	3400	91	6200	166	9300	249	16,000	429	26,000	697
		300	20.7			5300	142	10,000	268	15,000	402	24,000	643	30,000	804
		400	27.6			7100	190	14,000	375	21,000	563	32,000	858	38,000	1018
		500	34.5			8000	214	16,500	442	26,300	705	39,000	1045	----	----
		800	55.2			13,000	348	27,000	724	37,000	992	----	----	----	----
		1000	69.0			16,700	448	31,000	831	43,900	1177	----	----	----	----
		1500	103			26,000	697	44,000	1179	----	----	----	----	----	----

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Table 6. Capacities for 1 in. / DN 25 Body Size Based on 20% Droop (continued)

	OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	INLET PRESSURE		OUTLET PRESSURE		1 IN. / DN 25 BODY CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY OF NATURAL GAS									
						Orifice Size, In. / mm									
						1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
HIGH PRESSURE	150 to 200 psig / 10.3 to 13.8 bar 0Y066427022 Green Stripe	250 300 600 700	17.2 20.7 41.4 48.3	200	13.8	4200 5200 9500 11,000	113 139 255 295	8300 10,000 22,000 25,000	222 268 590 670	12,000 16,000 34,000 40,000	322 429 911 1072	20,000 25,000 55,000 61,500	536 670 1474 1648	30,000 35,000 ---- ----	804 938 ---- ----
		800 1000 1200 1500	55.2 69.0 82.7 103			13,000 16,000 20,000 26,000	348 429 536 697	30,000 37,000 41,000 53,000	804 992 1099 1420	43,000 50,000 59,000 ----	1152 1340 1581 ----	---- ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----
	200 to 275 psig / 13.8 to 19.0 bar 1J146927142 Blue Stripe	250 300 600 700	17.2 20.7 41.4 48.3	200	13.8	4200 5200 9500 11,000	113 139 255 295	8200 10,000 22,000 25,000	220 268 590 670	11,000 14,500 31,000 35,000	295 389 831 938	20,000 25,000 51,000 55,000	536 670 1367 1474	29,000 35,000 ---- ----	777 938 ---- ----
		800 1000 1200 1500	55.2 69.0 82.7 103			13,000 16,000 19,000 26,000	348 429 509 697	29,000 36,000 41,000 51,000	777 965 1099 1367	42,000 50,000 55,000 ----	1126 1340 1474 ----	---- ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----
		300 400 500 600	20.7 27.6 34.5 41.4	250	17.2	4900 7000 8500 9500	131 188 228 255	9000 14,000 18,000 22,000	241 375 482 590	15,000 23,000 29,000 34,000	402 616 777 911	28,000 40,000 51,000 59,000	750 1072 1367 1581	42,000 56,000 65,000 ----	1126 1501 1742 ----
		1000 1500	69.0 103			16,000 26,000	429 697	39,000 59,000	1045 1581	58,000 ----	1554 ----	---- ----	---- ----	---- ----	---- ----
		300 400 600 1000 1500	20.7 27.6 41.4 69.0 103	275	19.0	4700 6900 9300 16,000 26,000	126 185 249 429 697	9000 14,000 21,000 39,000 60,000	241 375 563 1045 1608	15,000 25,000 39,800 67,000 ----	402 670 1067 1796 ----	28,000 40,000 76,100 ---- ----	750 1072 2039 ---- ----	39,000 54,000 ---- ---- ----	1045 1447 ---- ---- ----
	275 to 500 psig / 19.0 to 34.5 bar 1K370927082 Yellow Stripe	300 400 600 1000 1500	20.7 27.6 41.4 69.0 103	275	19.0	4500 6600 9300 17,000 26,000	121 177 249 456 697	7500 12,000 18,400 32,000 46,000	201 322 493 858 1233	10,000 16,000 24,300 43,000 ----	268 429 651 1152 ----	20,000 31,000 43,800 ---- ----	536 831 1174 ---- ----	31,000 43,000 ---- ---- ----	831 1152 ---- ---- ----
		400 600 700 800	27.6 41.4 48.3 55.2	300	20.7	6600 9900 11,000 13,000	177 265 295 348	11,000 19,000 23,000 26,000	295 509 616 697	16,000 26,000 30,000 35,000	429 697 804 938	31,000 48,000 54,000 61,000	831 1286 1447 1635	42,000 ---- ---- ----	1126 ---- ---- ----
		1000 1300 1500	69.0 89.6 103			16,800 22,000 26,000	450 590 697	32,500 43,000 49,000	871 1152 1313	43,800 58,000 ----	1174 1554 ----	---- ---- ----	---- ---- ----	---- ---- ----	---- ---- ----
		500 600 800 900 1000	34.5 41.4 55.2 62.1 69.0	400	27.6	8300 9400 13,000 15,000 17,000	222 252 348 402 456	16,000 21,300 30,000 34,000 38,000	429 571 804 911 1018	24,000 30,000 41,000 49,000 54,000	643 804 1099 1313 1447	44,000 55,300 76,000 85,000 ----	1179 1482 2037 2278 ----	62,000 ---- ---- ---- ----	1662 ---- ---- ---- ----
		1200 1400 1500	82.7 96.5 103			20,000 24,000 26,000	536 643 697	46,000 55,000 60,000	1233 1474 1608	63,000 76,000 ----	1688 2037 ----	---- ---- ----	---- ---- ----	---- ---- ----	---- ---- ----
		550 600 900 1000 1500	37.9 41.4 62.1 69.0 103	500	34.5	8700 9500 15,000 17,000 26,000	233 255 402 456 697	16,000 19,000 34,000 39,000 59,000	429 509 911 1045 1581	26,000 36,800 52,000 60,000 72,000	697 986 1394 1608 1930	50,000 57,000 92,000 100,000 ----	1340 1528 2466 2680 ----	77,000 ---- ---- ---- ----	2064 ---- ---- ---- ----

Table 7. Capacities for 2 in. / DN 50 Body Size Based on 20% Droop

	OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	INLET PRESSURE		OUTLET PRESSURE		2 IN. / DN 50 BODY CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY OF NATURAL GAS									
						Orifice Size, In. / mm									
						1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
LOW PRESSURE	3 to 10 psig / 0.21 to 0.69 bar 0W019227022 Red Stripe	10 20 30 50 60	0.69 1.4 2.1 3.4 4.1	5	0.34	290 500 760 1100 1250	8 13 20 29 34	830 1200 1600 2200 2700	22 32 43 59 72	1300 2100 2700 3900 4500	35 56 72 105 121	3300 4800 7000 9800 11,100	88 129 188 263 297	5900 9100 11,000 17,000 19,500	158 244 295 456 523
		100 200	6.9 13.8			1900 3700	51 99	4300 8200	115 220	7000 13,000	188 348	17,000 32,000	456 858	30,000 57,000	804 1528
		400 500 600 1000 1500	27.6 34.5 41.4 69.0 103			7200 9100 10,000 18,000 22,000	193 244 268 482 590	16,000 19,000 24,000 39,000 60,000	429 509 643 1045 1608	28,000 35,000 42,000 69,000 ----	750 938 1126 1849 ----	64,000 79,000 ---- ---- ----	1715 2117 ---- ---- ----	---- ---- ---- ---- ----	---- ---- ---- ---- ----
		20 30 50 60	1.4 2.1 3.4 4.1	10	0.69	560 770 1100 1250	15 21 29 34	1300 1500 2400 2800	35 40 64 75	2200 3000 4300 5000	59 80 115 134	5100 7000 9800 11,100	137 188 263 297	9000 11,000 17,000 19,500	241 295 456 523
		100 200 400	6.9 13.8 27.6			1900 3700 7200	51 99 193	4400 8100 16,000	118 217 429	7600 14,000 28,000	204 375 750	17,000 33,000 62,000	456 884 1662	30,000 57,000 ----	804 1528 ----
		500 600 1000 1500	34.5 41.4 69.0 103			8900 10,000 18,000 27,000	239 268 482 724	19,000 23,000 40,000 60,000	509 616 1072 1608	35,000 42,000 72,000 ----	938 1126 1930 ----	76,000 ---- ---- ----	2037 ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----
	8 to 20 psig / 0.55 to 1.4 bar 0W019127022 Olive Drab	20 30 50 60	1.4 2.1 3.4 4.1	10	0.69	550 760 1000 1200	15 20 27 32	1200 1500 2300 2700	32 40 62 72	1700 2500 3800 4500	46 67 102 121	2500 4600 7800 9900	67 123 209 265	4900 8800 16,000 18,500	131 236 429 496
		100 200 400	6.9 13.8 27.6			1900 3600 7200	51 96 193	4300 8000 15,000	115 214 402	7400 14,000 28,000	198 375 750	17,000 32,000 60,000	456 858 1608	30,000 57,000 ----	804 1528 ----
		500 600 1000 1500	34.5 41.4 69.0 103			8800 10,000 18,000 27,000	236 268 482 724	19,000 23,000 39,000 60,000	509 616 1045 1608	35,000 42,000 72,000 ----	938 1126 1930 ----	74,000 ---- ---- ----	1983 ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----
		20 30 50 60	1.4 2.1 3.4 4.1	15	1.0	520 740 1100 1250	14 20 29 34	1100 1600 2400 2800	29 43 64 75	1800 2800 4300 5000	48 75 115 134	3500 5900 9800 11,100	94 158 263 297	5700 10,000 16,000 18,500	153 268 429 496
		100 200 400	6.9 13.8 27.6			1900 3700 7200	51 99 193	4400 8300 16,000	118 222 429	7800 14,000 29,000	209 375 777	17,000 31,000 64,000	456 831 1715	30,000 57,000 ----	804 1528 ----
		500 600 1000 1500	34.5 41.4 69.0 103			9200 11,000 18,000 27,000	247 295 482 724	20,000 23,000 40,000 60,000	536 616 1072 1608	37,000 42,000 71,000 ----	992 1126 1903 ----	82,000 ---- ---- ----	2198 ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----

- continued -

Table 7. Capacities for 2 in. / DN 50 Body Size Based on 20% Droop (continued)

	OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	INLET PRESSURE		OUTLET PRESSURE		2 IN. / DN 50 BODY CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY OF NATURAL GAS									
						Orifice Size, In. / mm									
						1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
LOW PRESSURE	8 to 20 psig / 0.55 to 1.4 bar 0W019127022 Olive Drab	30	2.1	20	1.4	700	19	1600	43	2600	70	5200	139	9200	247
		40	2.8			900	24	2100	56	3500	94	7500	201	12,000	322
		50	3.4			1100	29	2400	64	4300	115	9400	252	15,000	402
		60	4.1			1250	34	2800	75	5100	137	11,000	295	18,000	482
		100	6.9			1900	51	4300	115	7800	209	17,000	456	29,000	777
		200	13.8			3700	99	8200	220	14,000	375	32,000	858	59,000	1581
		400	27.6			7300	196	16,000	429	28,000	750	63,000	1688	----	----
		500	34.5			9100	244	19,300	517	35,500	951	78,800	2112	----	----
		600	41.4			11,000	295	24,000	643	43,000	1152	----	----	----	----
		1000	69.0			17,700	474	39,200	1051	71,600	1919	----	----	----	----
		1500	103			27,000	724	60,000	1608	----	----	----	----	----	----
	17 to 30 psig / 1.17 to 2.1 bar 0W019027022 Silver	30	2.1	20	1.4	680	18	1300	35	2100	56	3500	94	6000	161
		40	2.8			890	24	1800	48	2800	75	5100	137	8200	220
		50	3.4			1000	27	2300	62	3700	99	6200	166	10,000	268
		60	4.1			1200	32	2700	72	4300	115	7400	198	12,500	335
		100	6.9			1900	51	4200	113	6900	185	12,000	322	24,000	643
		200	13.8			3500	94	8000	214	13,000	348	32,000	858	56,000	1501
		400	27.6			7100	190	15,000	402	28,000	750	63,000	1688	----	----
		500	34.5			8900	239	19,200	515	35,500	951	78,800	2112	----	----
		600	41.4			10,000	268	24,000	643	42,000	1126	----	----	----	----
		1000	69.0			17,700	474	39,200	1051	70,600	1892	----	----	----	----
		1500	103			27,000	724	60,000	1608	----	----	----	----	----	----
		40	2.8	30	2.1	860	23	1800	48	2900	78	5300	142	8500	228
		50	3.4			1000	27	2300	62	3800	102	7300	196	11,000	295
		60	4.1			1200	32	2700	72	4700	126	8900	239	14,000	375
		100	6.9			1800	48	4200	113	7800	209	16,000	429	28,000	750
		200	13.8			3600	96	8100	217	14,000	375	24,000	643	58,000	1554
		400	27.6			7000	188	16,000	429	28,000	750	64,000	1715	----	----
		500	34.5			8900	239	19,100	512	34,900	935	80,900	2168	----	----
		600	41.4			10,000	268	23,000	616	42,000	1126	----	----	----	----
		1000	69.0			18,400	493	39,800	1067	70,900	1900	----	----	----	----
		1500	103			27,000	724	61,000	1635	----	----	----	----	----	----
	27 to 40 psig / 1.9 to 2.8 bar 0Y066427022 Green Stripe	40	2.8	30	2.1	850	23	1600	43	2600	70	4500	121	7200	193
		50	3.4			1000	27	2200	59	3500	94	5900	158	9700	260
		60	4.1			1200	32	2600	70	4200	113	7300	196	12,000	322
		100	6.9			1800	48	4200	113	6900	185	12,000	322	23,000	616
		200	13.8			3600	96	8100	217	13,000	348	24,000	643	57,000	1528
		400	27.6			7000	188	15,000	402	28,000	750	64,000	1715	----	----
		500	34.5			8900	239	18,800	504	34,900	935	80,200	2149	----	----
		600	41.4			10,000	268	23,000	616	42,000	1126	----	----	----	----
		1000	69.0			18,400	493	39,700	1064	70,800	1897	----	----	----	----
		1500	103			27,000	724	61,000	1635	----	----	----	----	----	----
		50	3.4	40	2.8	1000	27	2100	56	3400	91	5900	158	9900	265
		60	4.1			1200	32	2600	70	4300	115	7900	212	12,000	322
		100	6.9			1900	51	4300	115	7200	193	13,000	348	24,000	643
		200	13.8			3600	96	8200	220	14,000	375	30,000	804	56,000	1501
		400	27.6			7200	193	16,000	429	28,000	750	63,000	1688	----	----
		500	34.5			8900	239	19,600	525	35,100	941	79,400	2128	----	----
		600	41.4			10,000	268	23,000	616	42,000	1126	----	----	----	----
		1000	69.0			17,300	464	39,400	1056	70,200	1881	----	----	----	----
		1500	103			27,000	724	61,000	1635	----	----	----	----	----	----

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Table 7. Capacities for 2 in. / DN 50 Body Size Based on 20% Droop (continued)

	OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	INLET PRESSURE		OUTLET PRESSURE		2 IN. / DN 50 BODY CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY OF NATURAL GAS									
						Orifice Size, In. / mm									
						1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
HIGH PRESSURE	27 to 50 psig / 1.9 to 3.4 bar 0W019227022 Red Stripe	60 100 200	4.1 6.9 13.8	50	3.4	1000 1800 3600	27 48 96	2100 3600 7900	56 96 212	3200 5800 12,000	86 155 322	5300 10,000 21,000	142 268 563	12,000 21,000 55,000	322 563 1474
		300 400 500 600 1000 1500	20.7 27.6 34.5 41.4 69.0 103			5500 7000 8800 10,000 18,000 27,000	147 188 236 268 482 724	11,000 15,000 19,000 23,000 39,900 60,000	295 402 509 616 1069 1608	19,000 27,000 34,300 42,000 70,400 ----	509 724 919 1126 1887 ----	48,000 63,000 79,700 ---- ---- ----	1286 1688 2136 ---- ---- ----	83,000 ---- ---- ---- ---- ----	2224 ---- ---- ---- ---- ----
	46 to 95 psig / 3.2 to 6.6 bar 0W019127022 Olive Drab	60 100 200	4.1 6.9 13.8	50	3.4	900 1600 3500	24 43 94	1600 3400 6700	43 91 180	2500 4300 9600	67 115 257	4400 7600 16,000	118 204 429	7300 12,000 27,000	196 322 724
		300 400 500 600 1000 1500	20.7 27.6 34.5 41.4 69.0 103			5300 6900 8700 10,000 17,100 26,000	142 185 233 268 458 697	10,000 13,000 16,300 20,000 38,700 59,000	268 348 437 536 1037 1581	14,000 21,000 26,300 35,000 68,800 ----	375 563 705 938 1844 ----	27,000 46,000 73,300 ---- ---- ----	724 1233 1964 ---- ---- ----	51,000 ---- ---- ---- ---- ----	1367 ---- ---- ---- ---- ----
		100 200	6.9 13.8	75	5.17	1800 3600	48 96	3300 7400	88 198	5200 11,000	139 295	9000 19,000	241 509	14,000 30,000	375 804
		400 500 600 1000 1500	27.6 34.5 41.4 69.0 103			7200 8700 10,000 17,600 24,000	193 233 268 472 643	15,000 19,000 23,000 39,000 60,000	402 509 616 1045 1608	24,000 31,400 39,000 69,300 ----	643 842 1045 1857 ----	---- ---- ---- ---- ----	---- ---- ---- ---- ----	---- ---- ---- ---- ----	---- ---- ---- ---- ----
	90 to 150 psig / 6.2 to 10.3 bar 0W019027022 Silver	150 200 300	10.3 13.8 20.7	100	6.9	2600 3700 5400	70 99 145	4900 6900 10,000	131 185 268	7400 10,000 16,000	198 268 429	12,000 17,000 27,000	322 456 724	18,000 27,000 44,000	482 724 1179
		400 500 1000 1500	27.6 34.5 69.0 103			7200 8600 17,200 27,000	193 230 461 724	14,000 17,500 38,600 59,000	375 469 1034 1581	21,000 27,500 66,000 ----	563 737 1769 ----	39,000 54,000 ---- ----	1045 1447 ---- ----	---- ---- ---- ----	---- ---- ---- ----
		150 200 300	10.3 13.8 20.7	125	8.62	2500 3600 5300	67 96 142	5000 7400 11,000	134 198 295	8100 11,000 17,000	217 295 456	12,000 19,000 31,000	322 509 831	20,000 30,000 48,000	536 804 1286
		400 500 1000 1500	27.6 34.5 69.0 103			7000 8800 17,000 27,000	188 236 456 724	15,000 19,000 39,000 60,000	402 509 1045 1608	24,000 30,000 69,300 ----	643 804 1857 ----	43,000 59,000 ---- ----	1152 1581 ---- ----	65,000 ---- ---- ----	1742 ---- ---- ----
		200 300 400 500	13.8 20.7 27.6 69.0	150	10.3	3500 5400 7200 8600	94 145 193 230	7300 11,000 15,000 19,800	196 295 402 531	11,000 19,000 26,000 32,800	295 509 697 879	18,000 32,000 46,000 62,500	482 858 1233 1675	30,000 52,000 77,000 ----	804 1394 2064 ----
		800 1000 1500	55.2 69.0 103			14,000 18,000 27,000	375 482 724	30,000 39,100 60,000	804 1048 1608	54,000 67,700 ----	1447 1814 ----	---- ---- ----	---- ---- ----	---- ---- ----	---- ---- ----
	150 to 200 psig / 10.3 to 13.8 bar 0Y066427022 Green Stripe	200 300 400	13.8 20.7 27.6	150	10.3	3500 5400 7200	94 145 193	6900 11,000 15,000	185 295 402	10,000 17,000 24,000	268 456 643	17,000 28,000 40,000	456 750 1072	28,000 47,000 66,000	750 1260 1769
		500 800 1000 1500	34.5 55.2 69.0 103			8500 14,000 17,400 27,000	228 375 466 724	18,300 30,000 38,600 60,000	490 804 1034 1608	30,250 51,000 66,400 ----	811 1367 1780 ----	53,000 ---- ---- ----	1420 ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----

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Table 7. Capacities for 2 in. / DN 50 Body Size Based on 20% Droop (continued)

	OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	INLET PRESSURE		OUTLET PRESSURE		2 IN. / DN 50 BODY CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY OF NATURAL GAS									
						Orifice Size, In. / mm									
						1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
HIGH PRESSURE	150 to 200 psig / 10.3 to 13.8 bar 0Y066427022 Green Stripe	250 300 600 700	17.2 20.7 41.4 48.3	200	13.8	4300 5300 10,000 12,000	115 142 268 322	9100 11,000 23,000 27,000	244 295 616 724	13,000 18,000 40,000 47,000	348 482 1072 1260	23,000 33,000 75,000 90,000	616 884 2010 2412	42,000 52,000 ---- ----	1126 1394 ---- ----
		800 1000 1200 1500	55.2 69.0 82.7 103			14,000 17,000 21,000 27,000	375 456 563 724	31,000 39,000 48,000 60,000	831 1045 1286 1608	54,000 69,000 83,000 ----	1447 1849 2224 ----	---- ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----
	150 to 275 psig / 10.3 to 19.0 bar 1J146927142 Blue Stripe	250 300 600 700	17.2 20.7 41.4 48.3	200	13.8	4300 5300 10,000 12,000	115 142 268 322	8900 11,000 23,000 27,000	239 295 616 724	12,000 18,000 38,000 45,000	322 482 1018 1206	23,000 31,000 70,000 83,000	616 831 1876 2224	35,000 46,000 ---- ----	938 1233 ---- ----
		800 1000 1200 1500	55.2 69.0 82.7 103			14,000 17,000 20,000 27,000	375 456 536 724	31,000 39,000 46,000 60,000	831 1045 1233 1608	52,000 68,000 83,000 ----	1394 1822 2224 ----	---- ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----
		300 400 500 600	20.7 27.6 34.5 41.4	250	17.2	5000 7100 8600 10,000	134 190 230 268	10,000 15,000 19,000 23,000	268 402 509 616	17,000 25,000 34,000 41,000	456 670 911 1099	30,000 47,000 62,000 78,000	804 1260 1662 2090	52,000 76,000 103,000 ----	1394 2037 2760 ----
		1000 1500	69.0 103			17,000 27,000	456 724	40,000 60,000	1072 1608	68,000 ----	1822 ----	---- ----	---- ----	---- ----	---- ----
		300 400 600 1000 1500	20.7 27.6 41.4 69.0 103	275	19.0	4800 7000 10,000 17,000 26,000	129 188 268 456 697	10,000 15,000 23,000 40,000 61,000	268 402 616 1072 1635	17,000 26,000 40,800 68,000 ----	456 697 1093 1822 ----	29,000 47,000 81,900 ---- ----	777 1260 2195 ---- ----	43,000 73,000 ---- ---- ----	1152 1956 ---- ---- ----
	275 to 500 psig / 19.0 to 34.5 bar 1K370927082 Yellow Stripe	300 400 600 1000 1500	20.7 27.6 41.4 69.0 103	275	19.0	4600 7000 10,000 18,000 27,000	123 188 268 482 724	8400 13,000 23,000 37,000 57,000	225 348 616 992 1528	13,000 20,000 40,800 57,000 ----	348 536 1093 1528 ----	23,000 32,000 81,900 ---- ----	616 858 2195 ---- ----	37,000 53,000 ---- ---- ----	992 1420 ---- ---- ----
		400 600 700 800	27.6 41.4 48.3 55.2	300	20.7	7000 10,000 12,000 14,000	188 268 322 375	13,000 21,000 26,000 29,000	348 563 697 777	21,000 34,000 40,000 47,000	563 911 1072 1260	35,000 59,000 72,000 81,000	938 1581 1930 2171	54,000 ---- ---- ----	1447 ---- ---- ----
		1000 1300 1500	69.0 89.6 103			15,800 23,000 27,000	423 616 724	33,200 50,000 58,000	890 1340 1554	53,600 80,000 ----	1436 2144 ----	---- ---- ----	---- ---- ----	---- ---- ----	---- ---- ----
		500 600 800 900 1000	34.5 41.4 55.2 62.1 69.0	400	27.6	8800 10,300 14,000 16,000 18,000	236 276 375 429 482	17,000 22,300 31,000 36,000 40,000	456 598 831 965 1072	28,000 36,000 51,000 58,000 66,000	750 965 1367 1554 1769	49,000 66,300 95,000 110,000 ----	1313 1777 2546 2948 ----	77,000 100,300 ---- ---- ----	2064 2688 ---- ---- ----
		1200 1400 1500	82.7 96.5 103			21,000 25,000 27,000	563 670 724	48,000 57,000 61,000	1286 1528 1635	80,000 96,000 ----	2144 2573 ----	---- ---- ----	---- ---- ----	---- ---- ----	---- ---- ----
		550 600 900 1000 1500	37.9 41.4 62.1 69.0 103	500	34.5	9000 10,000 16,000 18,000 27,000	241 268 429 482 724	18,000 20,800 35,000 40,000 60,000	482 557 938 1072 1608	30,000 34,500 60,000 67,000 82,000	804 925 1608 1796 2198	53,000 62,300 113,000 130,000 ----	1420 1670 3028 3484 ----	89,000 102,000 ---- ---- ----	2385 2734 ---- ---- ----

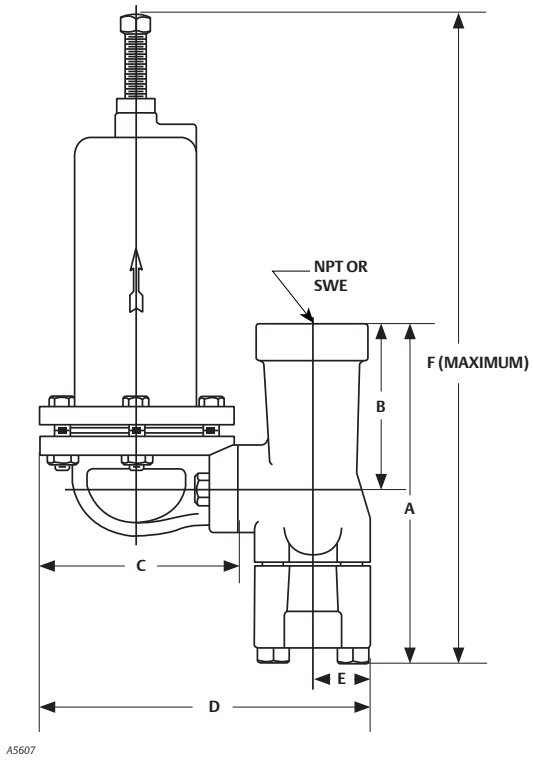


Figure 3. *NPT Dimensions*

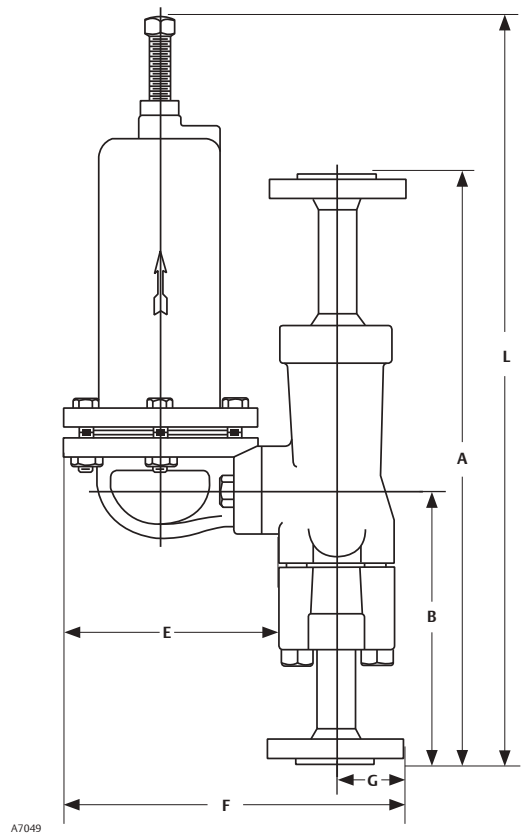


Figure 4. *Flanged Dimensions*

Table 8. NPT Dimension

BODY SIZE		NPT DIMENSION, In. / mm											
		A		B		C		D		E		F	
Low-Pressure Regulator													
In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1	25	7.38	187	3.69	94	7.19	183	10.31	262	1.38	35	15.88	403
2	50	7.88	200	3.94	100	7.19	183	10.94	278	2.00	51	16.38	416
High-Pressure Regulator													
1	25	7.38	187	3.69	94	4.69	119	7.81	198	1.38	35	15.88	403
2	50	7.88	200	3.94	100	4.69	119	8.44	214	2.00	51	16.38	416

Table 9. Flanged Dimension

BODY SIZE		FLANGED DIMENSION, In. / mm															
		A		B		E		F				G				L	
								CL150 RF		CL300 RF and CL600 RF		CL150 RF		CL300 RF and CL600 RF			
Low-Pressure Regulator																	
In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1	25	17.9	455	8	203	7.2	183	11.1	282	11.4	290	2.1	53	2.4	61	20.7	526
2	50	19.9	505	9	229	7.2	183	11.9	302	12.2	310	3	76	3.3	83.8	21.9	556
High-Pressure Regulator																	
1	25	17.9	455	8	203	4.7	119	8.6	218	8.9	226	2.1	53	2.4	61	21.2	538
2	50	19.9	505	11.2	284	4.7	119	9.4	238	9.7	246	3	76	3.3	84	21.4	544

Ordering Guide

Body Size (Select One)

- ☐ 1 in. / DN 25***
- ☐ 2 in. / DN 50***

Body Material and End Connection Style (Select One)

Cast Iron

- ☐ NPT***

Steel

- ☐ NPT***
- ☐ CL150 RF**
- ☐ CL300 RF**
- ☐ CL600 RF**

Trim Material (Select One)

- ☐ Brass***
- ☐ Stainless steel**

Disk and Holder Material (Select One)

- ☐ Nitrile (NBR) and Brass***
- ☐ Nitrile (NBR) and Stainless steel*
- ☐ Nylon (PA) and Brass**
- ☐ Nylon (PA) and Stainless steel*

Orifice Material (Select One)

- ☐ Brass***
- ☐ Stainless steel*

Orifice Size (Select One)

- ☐ 1/8 in. / 3.2 mm**
- ☐ 3/16 in. / 4.8 mm**
- ☐ 1/4 in. / 6.4 mm**
- ☐ 3/8 in. / 9.5 mm**
- ☐ 1/2 in. / 13 mm**

Outlet Pressure Range (Select One)

Low Pressure

- ☐ 3 to 10 psig / 0.21 to 0.69 bar, Red Stripe**
- ☐ 8 to 20 psig / 0.55 to 1.4 bar, Olive Drab**
- ☐ 17 to 30 psig / 1.2 to 2.1 bar, Unpainted**
- ☐ 27 to 40 psig / 1.9 to 2.8 bar, Green Stripe**

High Pressure

- ☐ 27 to 50 psig / 1.9 to 3.5 bar, Red Stripe**
- ☐ 46 to 95 psig / 3.2 to 6.6 bar, Olive Drab**
- ☐ 90 to 150 psig / 6.2 to 10.3 bar, Unpainted**
- ☐ 150 to 200 psig / 10.3 to 13.8 bar, Green Stripe**
- ☐ 200 to 275 psig / 13.8 to 19.0 bar, Blue Stripe**
- ☐ 275 to 500 psig / 19.0 to 34.5 bar, Yellow Stripe**

Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

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**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Does the application require overpressure protection?
☐ Yes, which is preferred? ☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device
Is overpressure protection equipment selection assistance desired?
Pressure
Maximum Inlet Pressure (P_{1max}):
Minimum Inlet Pressure (P_{1min}):
Downstream Pressure Setting(s) (P_2):
Maximum Flow (Q_{max}):
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

The recommended selection for orifice diameters is the smallest orifice that will handle the flow.

Introduction

The Types 634 and 634M high-pressure shutoff valves provide overpressure protection by containment. The Type 634 shutoff valve with internal registration is installed between a pressure-reducing regulator and a downstream system or equipment. The Type 634M shutoff valve with external registration requires a control line and is installed upstream of a pressure reducing regulator.

Regulator outlet pressure registers on the side of the diaphragm opposite the fracture disk. An excessive rise in outlet pressure provides enough force on the diaphragm to drive the stem through the fracture disk. This lets the plug close, and stay closed until upstream and downstream pressure are relieved and a new fracture disk is installed.

Regulator outlet pressure registers on the side of the diaphragm opposite the fracture disk. An excessive rise in outlet pressure provides enough force on the diaphragm to drive the stem through the fracture disk. This lets the plug close, and stay closed until upstream and downstream pressure are relieved and a new fracture disk is installed.

Body Sizes and End Connection Style

3/4 or 1 NPT

Wide-Open Flow Coefficients to Determine Capacities

NPS 3/4: C_g: 268, C_v: 7.37, C_1: 36.4
NPS 1: C_g: 319, C_v: 8.32, C_1: 38.3

Maximum Inlet Pressure

1500 psig / 103 bar

Maximum Body Outlet Pressure

Type 634: 150 psig / 10.3 bar
Type 634M: 1500 psig / 103 bar

Maximum Diaphragm Pressure

Operating: 150 psig / 10.3 bar
Emergency: 225 psig / 15.5 bar

Pressure Registration

Type 634: Internal
Type 634M: External through 1/4 NPT control line connection in the diaphragm case

Construction Materials

Body: WCC Steel
Casing and Fracture Disk: Cast Iron
Disk Retainer: Aluminum
Diaphragm: Neoprene (CR) and Nylon (PA) fabric
Plug Assembly: Aluminum and Nitrile (NBR)
O-rings: Nitrile (NBR)
Other Metal Parts: Steel and Stainless steel

Temperature Capabilities

-20 to 180°F / -29 to 82°C

Approximate Weight

13 pounds / 6.0 kg

Options

- One bleed valve in side tapping in upstream half of body
- Two bleed valves in side tappings in both upstream and downstream halves of body

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com



Figure 1. *Type 634 Shutoff Valve*



Figure 2. *Type 634M Shutoff Valve*

Features

- **Overpressure Protection Without Discharge of Gas or Liquid**
- **Positive Shutoff**
- **Application Versatility**
- **Easy Maintenance**

Table 1. Fracture Disk Selection

SHATTER PRESSURE		FRACTURE DISK	
Type 634 Shutoff Valve	Type 634M Shutoff Valve	Color Code	Part Number
20 to 28 psig / 1.4 to 1.9 bar	20 to 28 psig / 1.4 to 1.9 bar at 0 psig / 0 bar inlet pressure; see curve A for other inlet pressures	Red	29A1936X012
50 to 60 psig / 3.4 to 4.1 bar	50 to 60 psig / 3.4 to 4.1 bar at 0 psig / 0 bar inlet pressure; see curve B for other inlet pressures	Yellow	29A1936X022
72 to 88 psig / 5.0 to 6.1 bar	72 to 88 psig / 4.9 to 6.1 bar at 0 psig / 0 bar inlet pressure; see curve C for other inlet pressures	White	29A1936X032

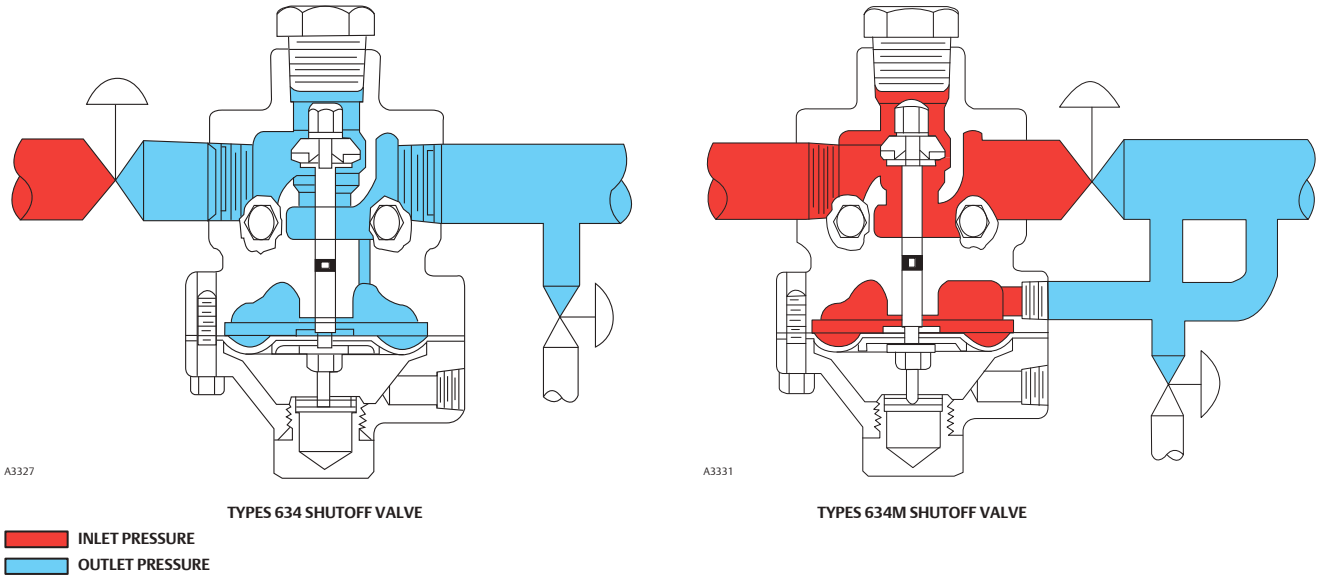


Figure 3. *Types 634 and 634M Shutoff Valves Operational Schematic*

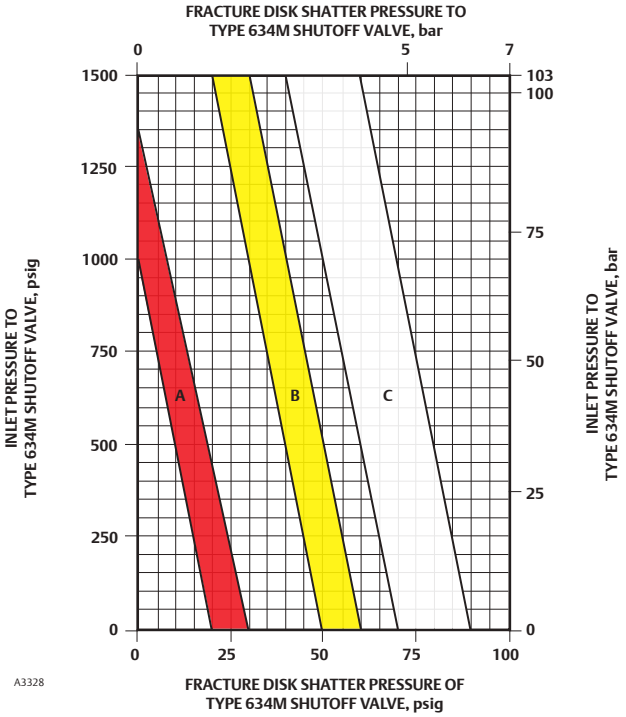


Figure 4. *Fracture Disk Selection*

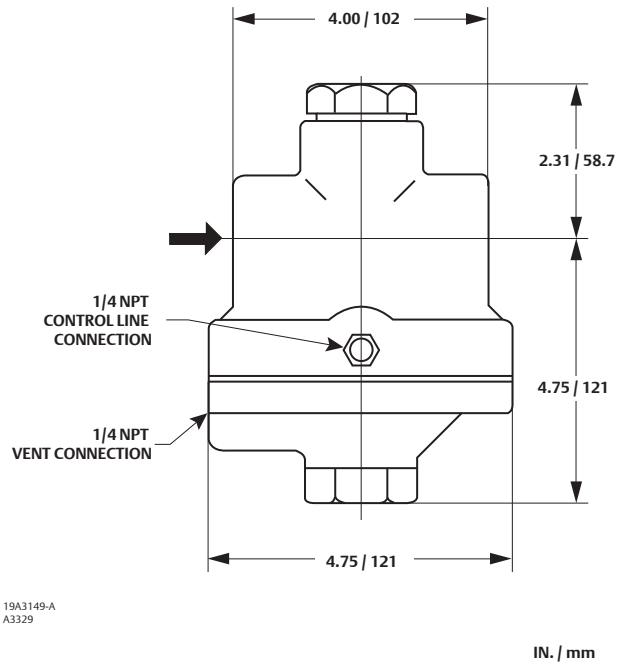


Figure 5. *Dimensions*

Table 2. Typical Capacities

INLET PRESSURE TO SHUTOFF VALVE		WIDE-OPEN PRESSURE DROP THROUGH SHUTOFF VALVE		FLOW IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS			
				3/4 NPT Body Size		1 NPT Body Size	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h
100	69.0	1 5 10	0.07 0.34 0.69	6000 13,000 18,000	161 348 482	7000 15,000 21,000	188 402 563
500	34.5	1 5 10	0.07 0.34 0.69	13,000 29,000 40,000	348 777 1072	15,000 34,000 46,000	402 911 1233
1000	69.0	1 5 10	0.07 0.34 0.69	18,000 40,000 56,000	482 1072 1501	21,000 46,000 65,000	563 1233 1742

Ordering Guide

Type (Select One)

- ☐ 634 (internal pressure registration)
- ☐ 634M (external pressure registration)

Body Size and End Connection Style (Select One)

- ☐ 3/4 NPT
- ☐ 1 NPT

Shatter Pressure (Select One)

- ☐ 20 to 28 psig / 1.4 to 1.9 bar, Red
- ☐ 50 to 60 psig / 3.4 to 4.1 bar, Yellow
- ☐ 72 to 88 psig / 5.0 to 6.1 bar, White

Bleed Valves (Optional)

- ☐ Inlet
- ☐ Inlet and outlet

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

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Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

All regulators should be installed and used in accordance with federal, state and local codes and regulations.

912N Series

Pressure Reducing Regulator

FISHER

Introduction

The 912N Series direct-operated, spring-loaded regulators are used in a variety of service and industrial applications. These regulators have limited-capacity internal relief across the diaphragm (see Figure 2) to help minimize overpressure.

Body Sizes and End Connection Style

Inlet: 1/4 NPT
Outlet: 1/4 or 3/8 NPT

Flow Coefficients

Wide-Open C_g for Relief Sizing: 4

Maximum Allowable Inlet Pressure

250 psig / 17.2 bar

Maximum Allowable Outlet Pressure

Emergency Outlet Pressure: 20 psig / 1.4 bar

Recommended Outlet Pressure to Avoid Internal Part Damage: 3 psid / 0.21 bar differential above outlet pressure setting; provide external relief if start-to- discharge point exceeds 3 psid / 0.21 bar differential

See Table 1

Outlet Pressure Ranges

See Table 2

Pressure Registration

Internal

Temperature Capabilities

-20 to 160°F / -29 to 71°C

Spring Case Vent

Standard Construction: 1/8 NPT tapped with removable screen

Standard Location:
Constructions Without Handwheel: Over body outlet
Handwheel Constructions: Over body inlet

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Accurate, Sensitive Control**
- **Versatility**
- **Weather and Insect Protection**
- **Easy Maintenance**



W2217

Figure 1. *912N Series Regulator*

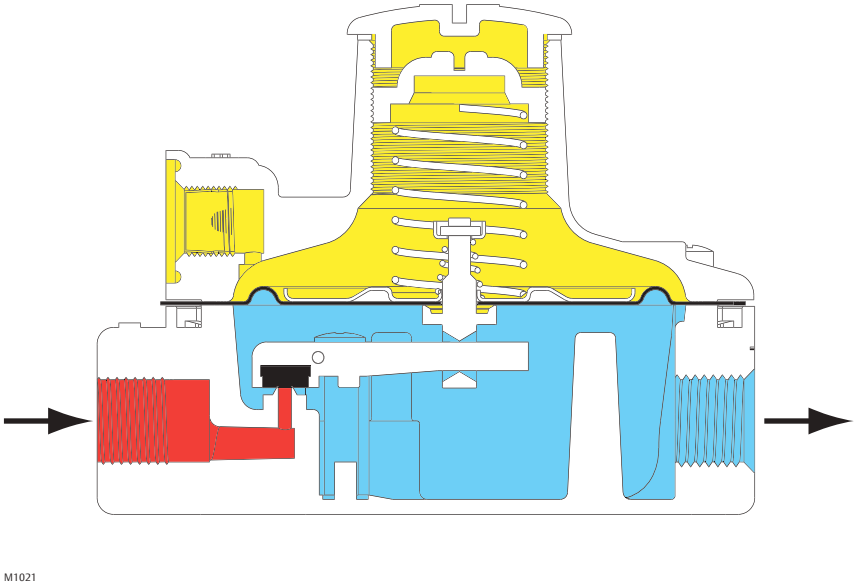


Figure 2. *912N Series Operational Schematic*

Table 1. Construction Materials

BODY AND SPRING CASE	DISK AND LEVER ASSEMBLY	DIAPHRAGM	DIAPHRAGM PLATE	SPRING SEAT	RELIEF VALVE ASSEMBLY
Zinc	Fluorocarbon (FKM) disk with zinc lever, stainless steel lever pin and rod and plated carbon steel lever screws	Nitrile (NBR) or Nylon (PA)	Plated Steel	Plated Steel	Brass and Zinc

EMERSON. Process Management

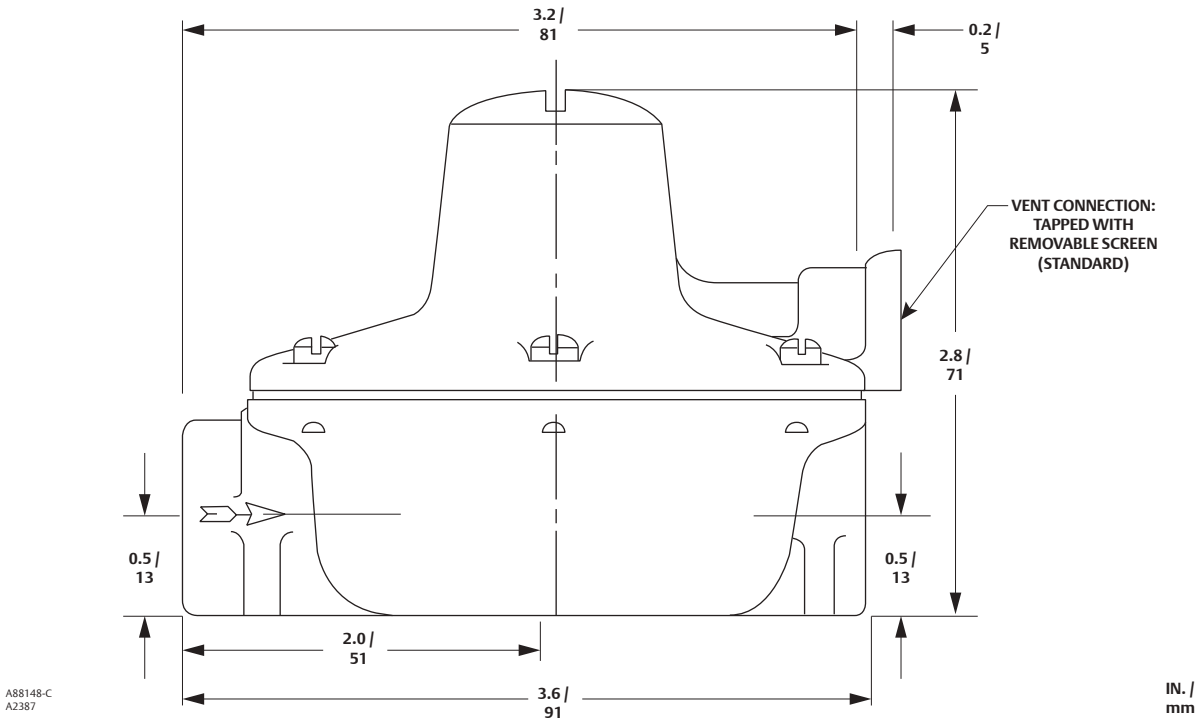


Figure 3. *Dimensions*

Table 2. Outlet Pressure Ranges

AVAILABLE CONSTRUCTION	OUTLET PRESSURE RANGE		APPROXIMATE POINT ABOVE OUTLET PRESSURE SETTING AT WHICH INTERNAL RELIEF STARTS-TO-DISCHARGE		CONTROL SPRING SELECTION					
					Part Number	Color Code	Spring Free Length		Spring Wire Diameter	
	In. w.c.	mbar	In. w.c.	mbar			In.	mm	In.	mm
912N Series without handwheel	3 to 7 5 to 10 9.25 to 13 12 to 24	7 to 17 12 to 25 23 to 32 30 to 60	5 to 21 8 to 30 16 to 39 17 in. w.c. to 3 psig	12 to 52 20 to 75 40 to 97 42 mbar to 0.21 bar	1B784327222 1B784427222 1L507937022 1B784527222	Red Orange Unpainted Blue	1.09 1.37 1.78 1.34	27.7 34.8 45.2 34.0	0.035 0.037 0.038 0.047	0.89 0.94 0.97 1.19
	0.5 to 2.7 psig 2.7 to 5 psig	0.03 to 0.18 bar 0.18 to 0.34 bar	0.70 to 6.80 psig 3.80 to 12.5 psig	0.05 to 0.47 bar 0.26 to 0.86 bar	1B784627222 1B784727222	Yellow Green	1.19 1.31	30.2 33.3	0.075 0.080	1.91 2.03
912N Series with handwheel	8 to 24	20 to 60	30.3 to 35.4	75 to 88	1B784527222	Blue	1.34	34.0	0.047	1.19
	2.7 to 5 psig	0.18 to 0.34 bar	5.4 to 6.7 psig	0.37 to 0.46 bar	1B784727222	Green	1.31	33.3	0.080	2.03

1. Internal Relief Performance is only adequate for relieving minor buildup situations. External relief is required if start-to-discharge point exceeds 3 psid / 0.21 bar differential.

Table 3. Capacities for Type 912N Regulators without Handwheel (Body Size 1/4 x 3/8 NPT)

OUTLET PRESSURE SETTING	OUTLET PRESSURE RANGE	SPRING PART NUMBER	OFFSET	ORIFICE SIZE	CAPACITY IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS								
					Inlet Pressure, psig / bar								
					5 / 0.34	10 / 0.69	25 / 1.7	50 / 3.4	75 / 5.2	100 / 6.9	150 / 10.3	200 / 13.8	250 / 17.2
5 in. w.c. / 12 mbar	3 to 7 in. w.c./ 7 to 17 mbar	1B784327222	1 in. w.c. / 2 mbar	0.073 in. / 1.9 mm	53 / 1.42	73 / 1.96	136 / 3.65	199 / 5.33	----	----	----	----	----
7 in. w.c. / 17 mbar	5 to 10 in. w.c. / 12 to 25 mbar	1B784427222	1 in. w.c. / 2 mbar		----	72 / 1.93	122 / 3.27	171 / 4.58	187 / 5.01	222 / 5.95	222 / 5.95	232 / 6.22	----
11 in. w.c. / 27 mbar	9.25 to 13 in. w.c. / 23 to 32 mbar	1L507937022	1 in. w.c. / 2 mbar		----	61 / 1.64	100 / 2.68	144 / 3.86	163 / 4.37	180 / 4.82	210 / 5.63	234 / 6.27	259 / 6.94
20 in. w.c. / 50 mbar	12 to 24 in. w.c. / 30 to 60 mbar	1B784527222	2 in. w.c. / 5 mbar		----	58 / 1.55	95 / 2.55	137 / 3.67	163 / 4.37	189 / 5.07	243 / 6.51	303 / 8.12	315 / 8.44
1 psig / 69 mbar	0.5 to 2.7 psig / 0.03 to 0.18 bar	1B784627222	10%	0.094 in / 2.4 mm	----	51 / 1.37	63 / 1.69	83 / 2.22	99 / 2.65	105 / 2.81	148 / 3.97	204 / 5.47	236 / 6.33
			20%		----	70 / 1.88	100 / 2.68	140 / 3.75	177 / 4.74	201 / 5.39	302 / 8.09	377 / 10.1	440 / 11.8
2 psig / 138 mbar	0.5 to 2.7 psig / 0.03 to 0.18 bar	1B784627222	10%		----	62 / 1.66	91 / 2.44	120 / 3.22	155 / 4.15	178 / 4.77	249 / 6.67	304 / 8.15	358 / 9.59
			20%		----	85 / 2.28	146 / 3.91	220 / 5.90	300 / 8.04	348 / 9.33	480 / 12.9	576 / 15.4	683 / 18.3
5 psig / 345 mbar	2.7 to 5 psig / 0.18 to 0.34 bar	1B784727222	10%		----	68 / 1.82	107 / 2.87	149 / 3.99	207 / 5.55	329 / 8.82	329 / 8.82	425 / 11.4	618 / 16.6
			20%		----	94 / 2.52	169 / 4.53	283 / 7.58	386 / 10.3	486 / 13.0	711 / 19.1	860 / 23.0	1030 /27.6

---- Not recommended for the given pressure range.

Table 4. Capacities for Type 912N Regulators with Handwheel (Body Size 1/4 x 3/8 NPT)

OUTLET PRESSURE SETTING	OUTLET PRESSURE RANGE	SPRING PART NUMBER	OFFSET	ORIFICE SIZE, IN. / mm	CAPACITY IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS								
					Inlet Pressure, psig / bar								
					5 / 0.34	10 / 0.69	25 / 1.7	50 / 3.4	75 / 5.2	100 / 6.9	150 / 10.3	200 / 13.8	250 / 17.2
14 in. w.c. / 35 mbar	8 to 24 in. w.c. / 20 to 60 mbar	1B784527222	2 in. w.c. / 5 mbar	0.094 / 2,4	70 / 1.88	96 / 2.57	121 / 3.24	129 / 3.46	143 / 3.83	156 / 4.18	156 / 4.18	190 / 5.09	212 / 5.68
3 psig / 207 mbar	2.7 to 5 psig / 0.18 to 0.34 bar	1B784727222	10%		----	92 / 2.47	153 / 4.10	261 / 7.00	354 / 9.49	459 / 12.3	587 / 15.7	716 / 19.2	731 / 19.6

---- Not recommended for the given pressure range.

Table 5. Shipping Weight

END CONNECTION STYLE		APPROXIMATE SHIPPING WEIGHT	
Inlet	Outlet	LB	kg
1/4 NPT	1/4 or 3/8 NPT	1.3	0.6

Ordering Guide

Body Size and End Connection Style (Select One)

- ☐ 1/4 x 3/8 NPT***
- ☐ 1/4 x 1/4 NPT***

Outlet Pressure Range (Select One)

- ☐ 3 to 7 in. w.c. / 7 to 17 mbar, Red***
- ☐ 5 to 10 in. w.c. / 12 to 25 mbar, Orange***
- ☐ 9.25 to 13 in. w.c. / 23 to 32 mbar, Unpainted***
- ☐ 12 to 24 in. w.c. / 30 to 60 mbar, Blue***
- ☐ 0.5 to 2.7 psig / 0.03 to 0.18 bar, Yellow***
- ☐ 2.7 to 5 psig / 0.18 to 0.34 bar, Green***
- ☐ 8 to 24 in. w.c. / 20 to 60 mbar, Blue***
- ☐ 2.7 to 5 psig / 0.18 to 0.34 bar, Green***

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Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

Specification Worksheet

Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Does the application require overpressure protection?
☐ Yes, which is preferred? ☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No
Pressure
Maximum Inlet Pressure (P_{1max}):
Minimum Inlet Pressure (P_{1min}):
Downstream Pressure Setting(s) (P_2):
Maximum Flow (Q_{max}):
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Downstream pressures significantly higher than the regulator's pressure setting may damage soft seats and other internal parts.

Introduction

The 971 Series regulators feature simple seat and counterbalanced valve. The "top entry" design allows to execute maintenance operations without disassembling the regulator from the line. They assure high accuracy of the regulated pressure even when the inlet pressure is extremely variable.

Available Configurations

Type 971: Pilot-operated pressure reducing regulator for medium to high outlet pressures.

Type 971-E: Monitor version installed upstream or downstream of the working regulator for overpressure protection.

Maximum Inlet (Casing) Pressure

1450 psig / 100 bar

Maximum Outlet (Casing) Pressure

1015 psig / 70.0 bar

Outlet Pressure Range

7.3 to 1015 psig / 0.50 to 70.0 bar
See Table 1

Minimum Operating Differential Pressure

Start Open: 7.3 psid / 0.50 bar d
Full Open: 14.5 psid / 1.00 bar d

Pressure Registration

External

Flow Coefficients

Regulating–C_g: 32,500; **C_v:** 1048
Wide-Open–C_g: 32,500; **C_v:** 1048
C_1: 31

Body Size and End Connection Styles

NPS 10 / DN 250 body with CL300 or CL600 RF Flanges

Pressure Ratings

CL300 RF: 740 psig / 51.0 bar
CL600 RF: 1450 psig / 100 bar

Temperature Capabilities

Standard Version:
Working: 14 to 140°F / -10 to 60°C
Low Temperature Version:
Working: -4 to 140°F/ -20 to 60°C

Available Options

- Built-in silencer
- Prearrangement for remote alarms and controls

Applications

- Non-corrosive gases (natural gas, compressed air, nitrogen, etc.)
- Sour gases (NACE standards)

Approximate Weight (Including Pilot)

3748 lbs / 1700 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Accuracy Maintained With Variable Inlet Pressures**
- **Easy Setpoint Adjustment**
- **High Versatility for Different Applications**
- **Built-in Safety: Regulator Closes if Diaphragm Fails**



Figure 1. *971 Series with Type PS/79*

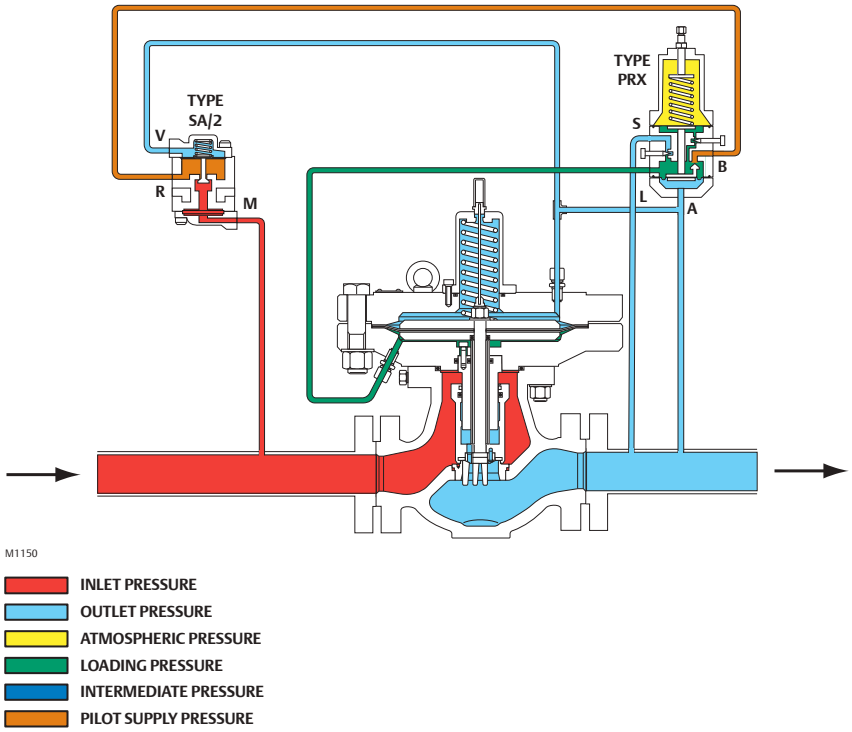


Figure 2. *Type 971 Operational Schematic*

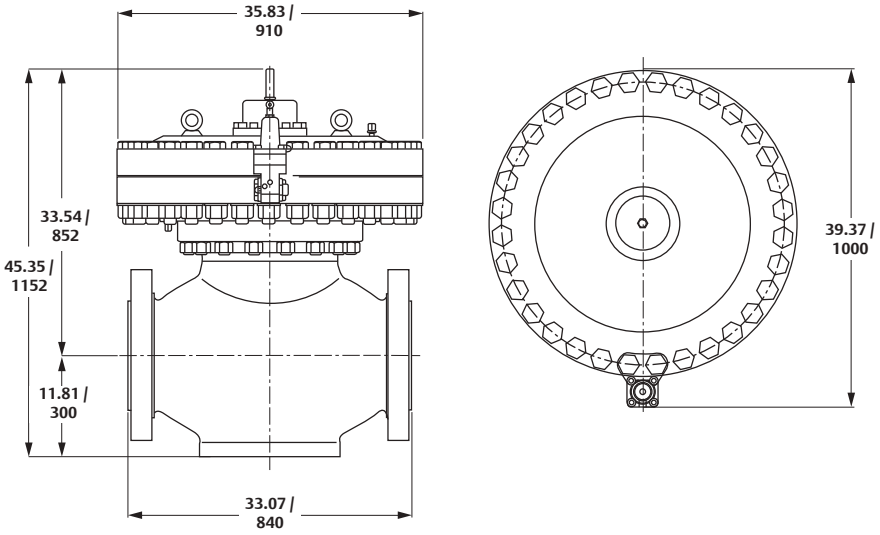


Figure 3. *Type 971 Dimensions*

Table 1. Outlet Pressure Range of Service Regulator or Monitor Pilot

TYPE	USE	OUTLET PRESSURE RANGE		ALLOWABLE PRESSURE		BODY AND COVER MATERIAL
		psig	bar	psig	bar	
PS/79[1]	Regulator or Monitor	7.3 to 580	0.50 to 40.0	1450	100	Steel
PSO/79[1]	Operating Monitor - Regulator					
REO/79[1]	Operating Monitor - Monitor					
PS/80[1]	Regulator or Monitor	22 to 580	1.5 to 40.0			
PSO/80[1]	Operating Monitor - Regulator					
REO/80[1]	Operating Monitor - Monitor					
PRX/120[2]	Regulator or Monitor	14.5 to 26 23 to 44 41 to 80 73 to 123 116 to 210 203 to 334 319 to 435	1.00 to 1.8 1.6 to 3.0 2.8 to 5.5 5.0 to 8.5 8.0 to 14.5 14.0 to 23.0 22.0 to 30.0			
PRX/125[2]	Monitor					
PRX/120-AP[2]	Regulator or Monitor	435 to 1015	30.0 to 70.0			
PRX/125-AP[2]	Monitor					

1. All PS Series pilots are supplied with a filter (5-micron filtering degree) and built-in pressure stabilizer, with the exception of Types PSO/79 and PSO/80.
2. The Type SA/2 pressure pre-reducer must be used with PRX Series pilots.

Ordering Guide

Configuration
☐ Type 971**
☐ Type 971-E**

Built-In Silencer - For Clean Gas Only (Select One)
☐ Type SR**
☐ None

End Connection Style (Select One)
☐ CL300 RF**
☐ CL600 RF**

Elastomer Part (Select One)
☐ Nitrile (NBR)***
☐ Fluorocarbon (FKM)**

Working Temperature Range (Select One)
☐ **Standard Version:** 14 to 140°F / -10 to 60°C**
☐ **Low Temperature Version:** -4 to 140°F / -20 to 60°C**

Pilot (Select One)
☐ Type PS/79**
☐ Type REO/79**
☐ Type PSO/80**
☐ Type PRX/120**
☐ Type PRX/120-AP**
☐ Type PSO/79**
☐ Type PS/80**
☐ Type REO/80**
☐ Type PRX125**
☐ Type PRX125-AP**

Outlet Pressure (See Table 1) (Specify)

Monitor Booster Valve (Optional)
☐ Type PRX/131**

PED Certificate (Mandatory Only for CE Marker)
☐ Yes**

Replacement Parts Kit (Optional)
☐ Yes, send me one replacement parts kit to match this order.

Replacement Parts Kit (Optional)
Horizontal Flow
☐ Left to Right
☐ Right to Left

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Does the application require overpressure protection?
☐ Yes, which is preferred? ☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No
Pressure
Maximum Inlet Pressure (P_{1max}):
Minimum Inlet Pressure (P_{1min}):
Downstream Pressure Setting(s) (P_2):
Maximum Flow (Q_{max}):
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Regulator body size should not be larger than the pipe size. In many cases, the regulator body is one size smaller than the pipe size.

Types 1098-EGR and 1098H-EGR

Pressure Reducing Regulators

FISHER

Introduction

Types 1098-EGR and 1098H-EGR regulators provide economical and accurate pressure control in a variety of applications: natural gas distribution systems; fuel gas supply to industrial boilers, furnaces, ovens and mixers; and commercial or industrial businesses such as steel mills, asphalt plants and shopping centers. This regulator is used with a Type 6351, 6352, 6353, 6354, Y600AM or 61 Series pilot.

The superior performance of this regulator is due to the amplifying effect of the pilot and the two-path control system. Changes in outlet pressure act quickly on the actuator diaphragm to provide fast response to system changes. The pilot amplifies small system changes to position the main valve for precise pressure control.

Body Sizes and End Connection Styles

See Table 1

Flow Capacities

See Table 9

Flow and IEC Sizing Coefficients

See Table 4

Maximum Inlet Pressure

400 psig / 27.6 bar or body rating limit, whichever is lower

Maximum Outlet (Casing) Pressure

See Table 2

Differential Pressures

See Table 6

Outlet Pressure (Control) Ranges

4 in. w.c. to 300 psig /
10 mbar to 20.7 bar

See Table 5

Pressure Registration

External

Temperature Capabilities

Nitrile (NBR):
-20 to 180°F / -29 to 82°C

Fluorocarbon (FKM):
0 to 300°F / -18 to 149°C except water which is limited to 0 to 200°F / -18 to 93°C

Ethylenepropylene (EPR):
-20 to 275°F / -29 to 135°C

Approximate Shipping Weight

See Table 12

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Differential as Low as 1 psid / 69 mbar d**
- **Quick Change Trim Package**
- **Optional Noise Abatement Trim (Up to 30 dBA reduction)**
- **No Atmospheric Bleed**
- **Easy Top Entry In-Line Maintenance**
- **Stainless steel Construction for Corrosive Environments and Oxygen Service**
- **Aqueous Trim Packages (Application Specific)**
- **In-Service Travel Inspection**
- **Materials of Construction Compatible with Below Grade Installations**



Figure 1. *Type 1098-EGR*

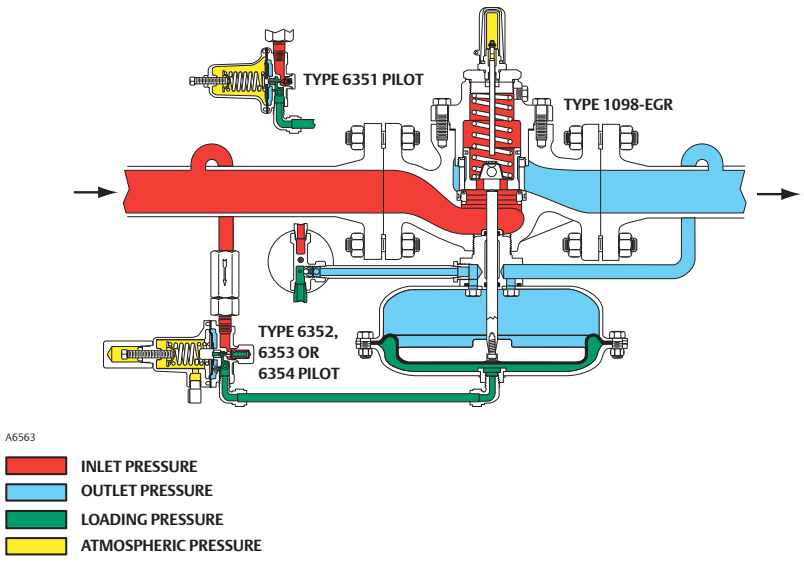


Figure 2. *Type 1098-EGR with 6350 Series Pilot Operational Schematic*

EMERSON
Process Management

Table 1. Body Size and End Connection Style

BODY SIZE		BODY MATERIAL	
NPS	DN	Cast Iron	Steel or Stainless steel
1 or 2	25 or 50	NPT, CL125 FF or CL250 RF	NPT, CL150 RF, CL300 RF, CL600 RF, BWE, SWE or PN 16/25/40
3, 4 or 6	80, 100, 150	CL125 FF or CL250 RF	CL150 RF, CL300 RF, CL600 RF, BWE or PN 16/25/40
8 x 6, 12 x 6	200 x 150, 300 x 150	----	CL150 RF, CL300 RF, CL600 RF, BWE

Table 2. Actuator Size and Maximum Pressure

ACTUATOR		OUTLET PRESSURE		EMERGENCY CASING PRESSURE	
Type	Size	psig	bar	psig	bar
1098	30 40 **(standard)** 70	100 75 50	6.9 5.2 3.4	115 82 65	7.9 5.6 4.5
1098H	30	350	24.1	400	27.6

Table 3. Construction Material

MAIN VALVE BODY	BONNET	VALVE PLUG AND SEAT RING	CAGE	PISTON RING	ACTUATOR DIAPHRAGM AND O-RING	MAIN VALVE PORT AND UPPER SEAL AND O-RING	ACTUATOR STEM	PILOT BODY AND CASING
Cast Iron, WCC Steel or CF8M Stainless steel	Zinc-plated steel or 304 Stainless steel	Hardened 416 Stainless steel or 316 Stainless steel	CF8M Stainless steel (linear), 416 or 316 Stainless steel (Whisper Trim™) or hardened ENC coated Cast Iron (quick opening)	Polytetrafluoroethylene (PTFE)	Nitrile (NBR) **(standard)**, Fluorocarbon (FKM) or Ethylenepropylene (EPDM)	Nitrile (NBR) **(standard)**, Fluorocarbon (FKM) or Ethylenepropylene (EPR)	17-4 PH Stainless steel **(standard)** or 316 Stainless steel	Aluminum or Stainless steel (for Type 6351, 6352, 6353, 6354L, 6354M or 6354H Pilot); or Cast Iron (for 61 Series and Type Y600AM Pilot)

Table 4. Flow and Sizing Coefficient

BODY SIZE		LINEAR CAGE												
		1:1 Line Size to Body Size					2:1 Line Size to Body Size					IEC Sizing Coefficient		
		C_g		C_v		C_1	C_g		C_v		C_1	X_T	F_D	F_L
NPS	DN	Regulating	Wide-Open	Regulating	Wide-Open		Regulating	Wide-Open	Regulating	Wide-Open				
1	25	600	632	16.8	17.7	35.7	568	598	17.2	18.1	33.0	0.806	0.43	
2	50	2280	2400	63.3	66.7	36.0	2050	2160	59.6	62.8	34.4	0.820	0.35	
3	80	4630	4880	132	139	35.1	4410	4650	128	135	34.4	0.779	0.30	
4	100	7320	7710	202	213	36.2	6940	7310	198	209	35.0	0.829	0.28	0.84
6	150	12,900	13,600	397	418	32.5	12,100	12,800	381	404	31.7	0.668	0.28	
8 x 6	200 x 150	18,480	19,450	578	608	32.0	17,370	18,280	543	571	32.0	0.648	0.28	
12 x 6	300 x 150	21,180	22,290	662	697	32.0	19,900	20,950	622	655	32.0	0.648	0.28	
BODY SIZE		WHISPER TRIM™ CAGE												
		1:1 Line Size to Body Size					2:1 Line Size to Body Size					IEC Sizing Coefficient		
		C_g		C_v		C_1	C_g		C_v		C_1	X_T	F_D	F_L
NPS	DN	Regulating	Wide-Open	Regulating	Wide-Open		Regulating	Wide-Open	Regulating	Wide-Open				
1	25	576	607	16.7	17.6	34.5	529	557	15.6	16.4	34.0	0.753	0.10	
2	50	1970	2080	54.7	57.8	36.0	1830	1930	52.3	55.1	35.0	0.820	0.07	
3	80	3760	3960	107	113	35.0	3630	3830	106	110	34.2	0.775	0.05	
4	100	6280	6610	180	190	34.8	6020	6340	171	180	35.2	0.766	0.04	0.89
6	150	9450	9950	295	310	32.0	9240	9730	291	306	31.7	0.648	0.03	
8 x 6	200 x 150	10,660	11,220	305	321	35.0	10,020	10,550	286	301	35.0	0.775	0.03	
12 x 6	300 x 150	11,050	11,630	316	332	35.0	10,380	10,930	297	312	35.0	0.775	0.03	

Table 5. Outlet (Control) Pressure Range

PILOT TYPE	OUTLET (CONTROL) PRESSURE RANGE		SPRING COLOR	SPRING PART NUMBER
6351	3 to 20 psig 5 to 35 psig 35 to 100 psig	0.21 to 1.4 bar 0.34 to 2.4 bar 2.4 to 6.9 bar	Green Unpainted Red	1B986027212 1B788327022 1K748527202
6352	14 in. w.c. to 2 psig 2 to 10 psig	35 mbar to 0.14 bar 0.14 to 0.69 bar	Yellow Black	14A9672X012 14A9673X012
6353	3 to 40 psig 35 to 125 psig	0.21 to 2.8 bar 2.4 to 8.6 bar	Yellow Red	1E392527022 1K748527202
6354L(1) 6354M(2) 6354H(2)	85 to 200 psig 175 to 220 psig 200 to 300 psig	5.9 to 13.8 bar(1) 12.1 to 15.2 bar(2) 13.8 to 20.7 bar(2)	Blue Blue Green	1L346127142 1L346127142 15A9258X012
61L 61LD 61LE	0.25 to 2 psig 1 to 5 psig 2 to 10 psig 5 to 15 psig 10 to 20 psig	0.02 to 0.14 bar 0.07 to 0.34 bar 0.14 to 0.69 bar 0.35 to 1.0 bar 0.7 to 1.4 bar	Red Yellow Blue Brown Green	1B886327022 1J857827022 1B886427022 1J857927142 1B886527022
61H	10 to 65 psig	0.7 to 4.5 bar	Green Stripe	0Y066427022
61HP	15 to 45 psig 35 to 100 psig 100 to 300 psig	1.0 to 3.1 bar 2.4 to 6.9 bar 6.9 to 20.7 bar	Yellow Blue Red	1E392527022 1D387227022 1D465127142
Y600AM	4 to 8 in. w.c. 7 to 16 in. w.c. 15 in w.c. to 1.2 psig 1.2 to 2.5 psig 2.5 to 4.5 psig 4.5 to 7 psig	10 to 20 mbar 17 to 40 mbar 37 mbar to 0.08 bar 0.08 to 0.17 bar 0.17 to 0.31 bar 0.31 to 0.48 bar	Red Unpainted Yellow Light Green Light Blue Black	1B653827052 1B653927022 1B537027052 1B537127022 1B537227022 1B537327052

1. Without diaphragm limiter.
2. With diaphragm limiter.

Table 6. Maximum and Minimum Differential Pressures for Main Valve Spring Selection

BODY SIZE		SPRING PART NUMBER AND COLOR	MAXIMUM ALLOWABLE DIFFERENTIAL PRESSURE(1)		MINIMUM DIFFERENTIAL PRESSURE REQUIRED FOR FULL STROKE					
					Size 30 Actuator		Size 40 Actuator		Size 70 Actuator	
NPS	DN		psid	bar d	psid	bar d	psid	bar d	psid	bar d
1	25	14A9687X012, Green	60	4.1	3.5	0.24	2.5	0.17	1	0.07
		14A9680X012, Blue	125	8.6	5	0.35	3	0.21	1.5	0.10
		14A9679X012, Red	400 / 27.6 or body rating limit, whichever is lower		7	0.48	5	0.35	2.5	0.17
2	50	14A6768X012, Yellow	20	1.4	----	----	----	----	1	0.07
		14A6626X012, Green	60	4.1	4	0.28	3	0.21	1.5	0.10
		14A6627X012, Blue	125	8.6	6	0.41	5	0.35	2	0.14
		14A6628X012, Red	400 / 27.6 or body rating limit, whichever is lower		11	0.76	10	0.69	3	0.21
3	80	14A6771X012, Yellow	20	1.4	----	----	----	----	1	0.07
		14A6629X012, Green	60	4.1	5	0.35	4	0.28	2	0.14
		14A6630X012, Blue	125	8.6	8	0.55	6	0.41	2.5	0.17
		14A6631X012, Red	400 / 27.6 or body rating limit, whichever is lower		14	0.97	11	0.76	4	0.28
4	100	14A6770X012, Yellow	20	1.4	----	----	----	----	1.3	0.09
		14A6632X012, Green	60	4.1	10	0.69	5	0.35	2.5	0.17
		14A6633X012, Blue	125	8.6	13	0.90	8	0.55	3	0.21
		14A6634X012, Red	400 / 27.6 or body rating limit, whichever is lower		22	1.5	13	0.90	5	0.35
6, 8 x 6 and 12 x 6	150, 200 x 150 and 300 x 150	15A2253X012, Yellow	20	1.4	----	----	----	----	2.2	0.15
		14A9686X012, Green	60	4.1	13	0.90	9.5	0.66	4	0.28
		14A9685X012, Blue	125	8.6	19	1.3	14	0.97	6	0.41
		15A2615X012, Red	400 / 27.6 or body rating limit, whichever is lower		28(2)	1.9(2)	19	1.3	8	0.55

1. Maximum inlet pressure is equal to set pressure plus maximum differential.
2. Requires special 6300 Series pilot construction without integral relief valve and with external Type 1806, 40 psid / 2.8 bar d relief valve.

Table 7. Proportional Band (Standard Pilot Restriction and Size 40 Type 1098 Actuator[1])

BODY SIZE		PILOT		PROPORTIONAL BAND					
		Type	Control Spring Color	Yellow or Green Main Valve Spring		Blue Main Valve Spring		Red Main Valve Spring	
NPS	DN			psi	mbar	psi	mbar	psi	mbar
1	25	6351	Green	0.1	7	0.2	14	0.4	28
			Unpainted	0.2	14	0.4	28	0.8	55
			Red	0.4	28	0.8	55	1.0	69
		6352	Yellow	0.04	3	0.1	7	0.2	14
			Black	0.08	6	0.2	14	0.4	28
		6353	Yellow	0.2	14	0.4	28	0.8	55
			Red	0.4	28	0.8	55	1.0	69
		61L	All	0.09	6	0.16	11	0.3	21
		61LD		0.04	3	0.08	6	0.2	14
		61LE, 61H and 61HP		0.4	28	0.8	55	1.0	69
		Y600AM[2]	Red	0.01	0.6	0.02	1	0.04	3
			Unpainted	0.01	0.6	0.02	1	0.04	3
			Yellow	0.05	3	0.1	7	0.15	10
			Light Green	0.10	7	0.15	10	0.2	14
			Light Blue	0.15	10	0.2	14	0.25	17
			Black	0.2	14	0.25	17	0.3	21
2	50	6351	Green	0.2	14	0.3	21	0.5	34
			Unpainted	0.3	21	0.5	34	1.0	69
			Red	0.5	34	1.0	69	1.4	97
		6352	Yellow	0.05	3	0.15	10	0.3	21
			Black	0.1	7	0.3	21	0.6	41
		6353	Yellow	0.3	21	0.5	34	1.0	69
			Red	0.5	34	1.0	69	1.4	97
		61L	All	0.1	7	0.2	14	0.6	41
		61LD		0.05	3	0.1	7	0.3	21
		61LE, 61H and 61HP		0.5	34	1.0	69	1.4	97
		Y600AM[2]	Red	0.01	0.6	0.02	1	0.04	3
			Unpainted	0.01	0.6	0.02	1	0.04	3
			Yellow	0.05	3	0.1	7	0.15	10
			Light Green	0.1	7	0.15	10	0.2	14
			Light Blue	0.15	10	0.2	14	0.25	17
			Black	0.2	14	0.25	17	0.3	21
3	80	6351	Green	0.3	21	0.4	28	0.6	41
			Unpainted	0.4	28	0.6	41	1.2	83
			Red	0.9	62	1.2	83	1.5	103
		6352	Yellow	0.1	7	0.2	14	0.4	28
			Black	0.2	14	0.4	28	0.8	55
		6353	Yellow	0.4	28	0.6	41	1.2	83
			Red	0.9	62	1.2	83	1.5	103
		61L	All	0.2	14	0.4	28	1.0	69
		61LD		0.1	7	0.2	14	0.5	34
		61LE, 61H and 61HP		0.9	62	1.2	83	1.5	103
		Y600AM[2]	Red	0.01	0.6	0.02	1	0.04	3
			Unpainted	0.01	0.6	0.02	1	0.04	3
			Yellow	0.05	3	0.1	7	0.15	10
			Light Green	0.1	7	0.15	10	0.2	14
			Light Blue	0.15	10	0.2	14	0.25	17
			Black	0.2	14	0.25	17	0.3	21

1. For other combinations, multiply table values by 1.6 for a size 30 actuator, 0.4 for a size 70 actuator, 2.0 for a low-gain Type 6352 or 6353 pilot restriction and 0.5 for a high-gain Type 6352 or 6353 pilot restriction. For instance, a standard NPS 2 / DN 50 Type 1098-EGR-6352 regulator with black pilot control spring and blue main valve spring has a proportional band of 0.3 psi / 21 mbar as given in the table, but this same regulator with low-gain restriction and size 70 actuator has a proportional band of 0.3 psi / 21 mbar x 2.0 x 0.4 = 0.24 psi / 17 mbar.
2. The configuration utilized in determining the proportional band of the Type Y600AM included the 95 Series pilot supplying the Type Y600AM for improved stability and a fixed restrictor, part number 1K9484X0022 or an optional Type 112 variable restrictor with a setting of 3.

- continued -

Table 7. Proportional Band (Standard Pilot Restriction and Size 40 Type 1098 Actuator(1)) (continued)

BODY SIZE		PILOT		PROPORTIONAL BAND					
		Type	Control Spring Color	Yellow or Green Main Valve Spring		Blue Main Valve Spring		Red Main Valve Spring	
NPS	DN			psi	mbar	psi	mbar	psi	mbar
4	100	6351	Green	0.4	28	0.5	34	0.8	55
			Unpainted	0.7	48	0.8	55	1.4	97
			Red	1.2	83	2.0	138	3.0	207
		6352	Yellow	0.15	10	0.3	21	0.6	41
			Black	0.3	21	0.6	41	1.2	83
		6353	Yellow	0.7	48	0.8	55	1.4	97
			Red	1.2	83	2.0	138	3.0	207
		61L	All	0.3	21	0.6	41	1.4	97
		61LD		0.15	10	0.3	21	0.7	48
		61LE, 61H and 61HP		1.2	83	2.0	138	3.0	207
		Y600AM(2)	Red	0.01	0.6	0.02	1	0.04	3
			Unpainted	0.01	0.6	0.02	1	0.04	3
			Yellow	0.05	3	0.1	7	0.15	10
			Light Green	0.1	7	0.15	10	0.2	14
			Light Blue	0.15	10	0.2	14	0.25	17
			Black	0.2	14	0.25	17	0.3	21
6, 8 x 6 and 12 x 6	150, 200 x 150 and 300 x 150	6351	Green	0.5	34	0.6	41	1.0	69
			Unpainted	0.9	62	1.5	103	2.0	138
			Red	1.5	103	2.5	172	3.5	241
		6352	Yellow	0.2	14	0.4	28	0.8	55
			Black	0.4	28	0.8	55	1.6	110
		6353	Yellow	0.9	62	1.5	103	2.0	138
			Red	1.5	103	2.5	172	3.5	241
		61L	All	0.6	41	1.2	83	2.0	138
		61LD		0.3	21	0.6	41	1.0	69
		61LE, 61H and 61HP		1.5	103	2.5	172	3.5	241
		Y600AM(2)	Red	0.01	0.6	0.02	1	0.04	3
			Unpainted	0.01	0.6	0.02	1	0.04	3
			Yellow	0.05	3	0.10	7	0.15	10
			Light Green	0.05	3	0.15	10	0.2	14
			Light Blue	0.15	10	0.2	14	0.25	17
			Black	0.2	14	0.25	17	0.3	21

1. For other combinations, multiply table values by 1.6 for a size 30 actuator, 0.4 for a size 70 actuator, 2.0 for a low-gain Type 6352 or 6353 pilot restriction and 0.5 for a high-gain Type 6352 or 6353 pilot restriction. For instance, a standard NPS 2 / DN 50 Type 1098-EGR-6352 regulator with black pilot control spring and blue main valve spring has a proportional band of 0.3 psi / 21 mbar as given in the table, but this same regulator with low-gain restriction and size 70 actuator has a proportional band of 0.3 psi / 21 mbar x 2.0 x 0.4 = 0.24 psi / 17 mbar.
2. The configuration utilized in determining the proportional band of the Type Y600AM included the 95 Series pilot supplying the Type Y600AM for improved stability and a fixed restrictor, part number 1K9484X0022 or an optional Type 112 variable restrictor with a setting of 3.

Table 8. Approximate Proportional Band Range (Standard Pilot Restriction, Size 30 Type 1098H Actuator(1))

BODY SIZE		PILOT		APPROXIMATE PROPORTIONAL BAND RANGE					
		Type	Control Spring Color	Green Main Valve Spring		Blue Main Valve Spring		Red Main Valve Spring	
NPS	DN			psi	bar	psi	bar	psi	bar
1	25	6354L, 6354M or 6354H	Blue or Green	1.0	0.07	1.5	0.10	2.5	0.17
2	50			1.5	0.10	2.0	0.14	3.0	0.21
3	80			2.5	0.17	3.0	0.21	4.0	0.28
4	100			3.5	0.24	4.0	0.28	5.0	0.34
6, 8 x 6 or 12 x 6	150, 200 x 150 or 300 x 150			4.0	0.28	5.0	0.34	Not Available	

1. For other restrictions, multiply table values by 2.0 for a low-gain restriction or by 0.5 for a high-gain restriction. For instance, a standard NPS 2 / DN 50 Type 1098H-EGR-6354L regulator with blue control spring and blue main valve spring has a proportional band of 2.0 psi / 0.14 bar as given in the table. But this same regulator with low-gain restriction has a proportional band of 2.0 psi / 0.14 bar x 2.0 = 4.0 psi / 0.28 bar.

Table 9. Capacities

INLET PRESSURE		OUTLET PRESSURE SETTING		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS FOR REGULATORS WITH STANDARD LINEAR CAGE, STANDARD TRAVEL AND LINE SIZE EQUALS MAIN VALVE BODY SIZE													
				NPS 1 / DN 25 Body Size		NPS 2 / DN 50 Body Size		NPS 3 / DN 80 Body Size		NPS 4 / DN 100 Body Size		NPS 6 / DN 150 Body Size		NPS 8 x 6 / DN 200 x 150 Body Size		NPS 12 x 6 / DN 300 x 150 Body Size	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
3	0.21	7 in. w.c.	17 mbar	8	0.2	32	0.9	66	1.8	101	2.7	----		----		----	
5	0.35	7 in. w.c. 1 2	17 mbar 0.07 0.14	11 10 9	0.3 0.3 0.2	42 39 35	1.1 1.0 0.9	87 82 73	2.3 2.2 2.0	135 126 112	3.6 3.4 3.0	257 241 ----	6.9 6.5 ----	372 350 ----	10.0 9.4 ----	427 401 ----	11.4 10.7 ----
10	0.69	7 in. w.c. 3 5 7	17 mbar 0.21 0.35 0.48	17 15 13 11	0.5 0.4 0.3 0.3	63 56 49 40	1.7 1.5 1.3 1.1	129 116 102 82	3.5 3.1 2.7 2.2	201 180 158 127	5.4 4.8 4.2 3.4	376 341 302 ----	10.1 9.1 8.1 ----	542 493 438 ----	14.5 13.2 11.7 ----	622 565 502 ----	16.7 15.1 13.5 ----
15	1.0	1 4 8 12	0.07 0.28 0.55 0.83	21 20 17 12	0.6 0.5 0.5 0.3	79 74 63 44	2.1 2.0 1.7 1.2	163 153 130 91	4.4 4.1 3.5 2.4	254 237 201 140	6.8 6.4 5.4 3.8	471 445 385 ----	12.6 11.9 10.3 ----	678 642 557 ----	18.2 17.2 14.9 ----	777 735 638 ----	20.8 19.7 17.1 ----
20	1.4	1 10 15 17	0.07 0.69 1.0 1.2	27 21 16 13	0.7 0.6 0.4 0.3	102 79 60 48	2.7 2.1 1.6 1.3	207 164 125 99	5.5 4.4 3.4 2.7	328 254 192 153	8.8 6.8 5.1 4.1	577 482 371 ----	15.5 12.9 9.9 ----	827 696 538 ----	22.1 18.7 14.4 ----	948 798 616 ----	25.4 21.4 16.5 ----
30	2.1	4 or less 15 20 25	0.28 or less 1.0 1.4 1.7	35 29 25 18	0.9 0.8 0.7 0.5	131 108 93 69	3.5 2.9 2.5 1.8	267 223 192 144	7.2 6.0 5.1 3.9	422 345 297 221	11.3 9.2 8.0 5.9	744 651 568 429	19.9 17.5 15.2 11.5	1066 940 822 622	28.6 25.2 22.0 16.7	1221 1077 942 713	32.7 28.9 25.2 19.1
40	2.8	9 or less 20 30 35	0.62 or less 1.4 2.1 2.4	42 36 28 21	1.1 1.0 0.8 0.6	161 136 105 77	4.3 3.6 2.8 2.1	327 280 217 161	8.8 7.5 5.8 4.3	517 434 335 247	13.9 11.6 9.0 6.6	910 816 644 480	24.4 21.9 17.3 12.9	1304 1178 933 697	34.9 31.6 25.0 18.7	1495 1350 1069 798	40.1 36.2 28.6 21.4
50	3.4	13 or less 20 30 40 45	0.90 or less 1.4 2.1 2.8 3.1	50 45 40 31 22	1.3 1.2 1.1 0.8 0.6	190 172 152 115 85	5.1 4.6 4.1 3.1 2.3	386 354 313 240 176	10.3 9.5 8.4 6.4 4.7	611 551 485 369 270	16.4 14.8 13.0 9.9 7.2	1077 1023 919 712 526	28.9 27.4 24.6 19.1 14.1	1542 1473 1327 1032 764	41.3 39.5 35.6 27.7 20.5	1768 1688 1521 1182 875	47.4 45.2 40.8 31.7 23.5
75	5.2	24 or less 50 60 70	1.7 or less 3.4 4.1 4.8	69 54 44 27	1.8 1.4 1.2 0.7	264 203 166 101	7.1 5.4 4.4 2.7	536 419 343 209	14.4 11.2 9.2 5.6	847 648 529 322	22.7 17.4 14.2 8.6	1493 1232 1019 627	40.0 33.0 27.3 16.8	2138 1781 1476 911	57.3 47.7 39.6 24.4	2451 2041 1692 1044	65.7 54.7 45.3 28.0
100	6.9	35 or less 60 75	2.4 or less 4.1 5.2	89 74 62	2.4 2.0 1.7	337 280 236	9.0 7.5 6.3	685 578 489	18.4 15.5 13.1	1083 896 754	29.0 24.0 20.2	1909 1689 1444	51.2 45.3 38.7	2734 2438 2090	73.2 65.3 56.0	3134 2794 2396	84.0 74.9 64.2
125	8.6	46 or less 75	3.2 or less 5.2	108 91	2.9 2.4	411 344	11.0 9.2	834 710	22.4 19.0	1319 1101	35.3 29.5	2325 2072	62.3 55.5	3330 2990	89.2 80.1	3817 3427	102 91.8
150	10.3	57 or less 75	3.9 or less 5.2	127 115	3.4 3.1	484 436	13.0 11.7	984 897	26.4 24.0	1555 1396	41.7 37.4	2741 2593	73.5 69.5	3926 3735	105 100	4500 4281	121 115
175	12.1	68 or less	4.7 or less	147	3.9	558	15.0	1133	30.4	1791	48.0	3157	84.6	4522	121	5183	139
200	13.8	75 or less	5.2 or less	166	4.4	631	16.9	1282	34.4	2027	54.3	3573	95.8	5118	137	5866	157
250	17.2			205	5.5	779	20.9	1581	42.4	2500	67.0	4405	118	6310	169	7232	194
300	20.7			244	6.5	926	24.8	1880	50.4	2972	79.6	5237	140	7502	201	8598	230
350	24.1			282	7.6	1073	28.8	2178	58.4	3444	92.3	6069	163	8694	234	9964	267
400	27.6			321	8.6	1220	32.7	2477	66.4	3916	105	6901	185	9886	265	11,331	304

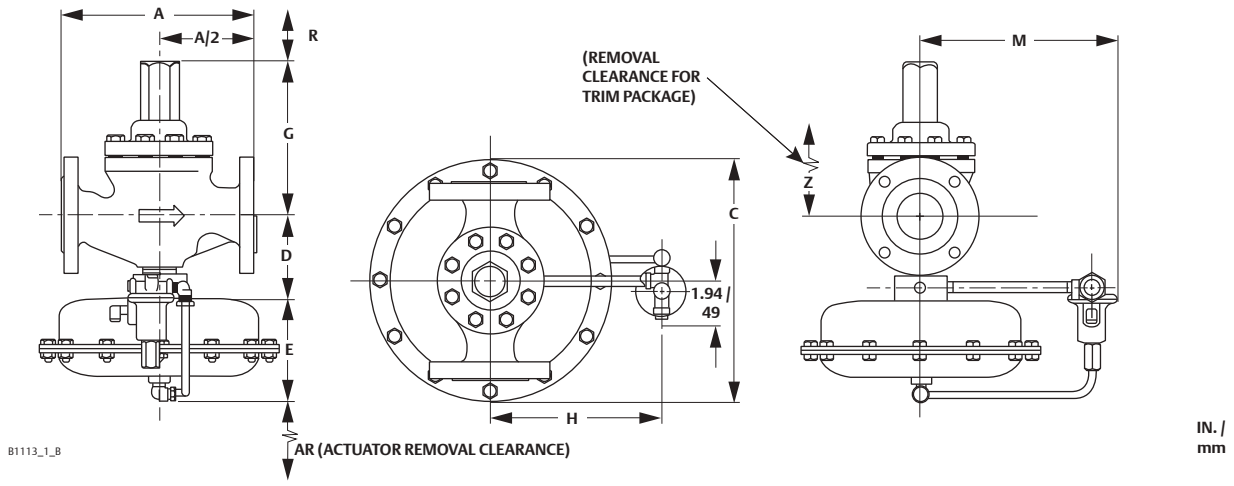


Figure 3. *Dimensions*

Table 10. Main Valve Dimension

BODY SIZE		DIMENSION																			
		A								D		G		R		Z				AR	
		NPT Cast Iron, CL600 RF, BWE or NPT Steel and Stainless steel		CL125 FF Cast Iron or CL150 RF Steel and Stainless steel		CL250 RF Cast Iron or CL300 RF Steel and Stainless steel		PN 16/25/40 Steel and Stainless steel								Cast Iron		Steel and Stainless steel			
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1	25	8.25	210	7.25	184	7.75	197	7.62	194	3.88	99	8.62	219	4.06	103	12.00	305	13.75	349	3.00	76
2	50	11.25	286	10.00	254	10.50	267	10.19	259	4.56	116	9.12	232			13.31	338	15.06	383	3.12	79
3	80	13.25	337	11.75	298	12.50	317	11.81	300	5.31	135	11.31	287	5.06	129	16.50	419	18.25	464	3.88	99
4	100	15.50	394	13.88	353	14.50	368	13.56	344	6.56	167	12.69	322			19.12	486	21.12	536	5.12	130
6	150	20.00	508	17.75	451	18.62	473	17.48	444	8.06	205	13.62	346	8.00	203	20.25	514	23.25	591	6.62	168
8 x 6	200 x 150	24.0	610	21.4	544	22.4	569	----		9.76	248	15.02	382								
12 x 6	300 x 150	32.3	820	29.0	737	30.5	775			12.56	319	17.72	450								

Table 11. Actuator Dimension

TYPE AND ACTUATOR SIZE	DIMENSION									
	C (Diameter)		E		H		M			
							With Pilot Spring Case Vent		Without Pilot Spring Case Vent	
	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1098 - 30	11.38	289	5.69	145	7.88	200	9.50	241	9.31	236
1098H - 30	11.38	289	6.06	154	7.88	200	9.50	241	9.31	236
1098 - 40	13.12	333	5.75	146	7.88	200	9.50	241	9.31	236
1098 - 70	21.12	536	7.44	189	14.19	360	15.81	402	15.62	397

Table 12. Shipping Weight

BODY SIZE		APPROXIMATE SHIPPING WEIGHT, LB / kg							
		Type 1098 Size 30 Actuator		Type 1098H Size 30 Actuator		Type 1098 Size 40 (Standard) Actuator		Type 1098 Size 70 Actuator	
NPS	DN	LB	kg	LB	kg	LB	kg	LB	kg
1	25	55	25	80	36	65	29	140	64
2	50	75	34	100	45	85	39	160	73
3	80	115	52	140	64	125	57	200	91
4	100	165	75	190	86	175	79	250	113
6	150	350	159	375	170	360	163	435	197
8 x 6	200 x 150	625	284	650	295	635	288	710	322
12 x 6	300 x 150	1102	500	1127	511	1112	504	1187	538

Ordering Guide

Main Valve Body Size (Select One)

- ☐ NPS 1 / DN 25***
- ☐ NPS 2 / DN 50***
- ☐ NPS 3 / DN 80***
- ☐ NPS 4 / DN 100***
- ☐ NPS 6 / DN 150***
- ☐ NPS 8 x 6 / DN 200 x 150 (Not available in Cast Iron)***
- ☐ NPS 12 x 6 / DN 300 x 150 (Not available in Cast Iron)***

Main Valve Body Material and End Connection Style (Select One)

Cast Iron Body

- ☐ 1 or 2 NPT only***
- ☐ CL125 FF***
- ☐ CL250 RF***

WCC Steel Body

- ☐ 1 or 2 NPT only***
- ☐ CL150 RF***
- ☐ SWE (NPS 1 or 2 / DN 25 or 50 only)**
- ☐ CL300 RF***
- ☐ CL600 RF*
- ☐ Sch 40 BWE**
- ☐ Sch 80 BWE
- ☐ PN 16/25/40* (Not Available for NPS 8 x 6 or 12 x 6 / DN 200 x 150 or 300 x 150) Specify _____

CF8M Stainless steel

- ☐ NPT (1 or 2 NPT only)***
- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ CL600 RF*
- ☐ SWE (NPS 1 or 2 / DN 25 or 50 only)**
- ☐ Sch 40 BWE
- ☐ Sch 80 BWE
- ☐ PN 16/25/40* (Not Available for NPS 8 x 6 or 12 x 6 / DN 200 x 150 or 300 x 150) Specify _____

Cage and Cage Material (Select One)

- ☐ Linear Cage, CF8M Stainless steel***
- ☐ Whisper Trim™ Cage, 416 Stainless steel***
- ☐ Whisper Trim Cage, 316 Stainless steel**
- ☐ Quick Opening Cage, ENC Coated Cast Iron

Main Valve Spring (Select One)

Maximum Differential and Spring Color

- ☐ 20 psi / 1.4 bar, Yellow**
- ☐ 60 psi / 4.1 bar, Green***
- ☐ 125 psi / 8.6 bar, Blue***
- ☐ 400 psi / 27.6 bar, Red***

Spring Material (Select One)

- ☐ Steel
- ☐ Inconel® X-750

Inconel® is a mark owned by Special Metals Corporation.

Actuator Size (Select One)

- ☐ Type 1098 Size 70, maximum set pressure 50 psig / 3.4 bar
- ☐ Type 1098 Size 40, maximum set pressure 75 psig / 5.2 bar **(standard)**
- ☐ Type 1098 Size 30, maximum set pressure 100 psig / 6.9 bar
- ☐ Type 1098H Size 30, maximum set pressure 350 psig / 24.1 bar

Actuator and Bonnet Material (Select One)

- ☐ Steel casing with steel bonnet***
- ☐ Stainless steel casing with stainless steel bonnet**

Body Flange Material (Select One)

- ☐ ENC Coated cast iron***
- ☐ ENC Coated steel***
- ☐ ENC Coated CF8M Stainless steel**

Valve Plug and Seat Ring (Select One)

- ☐ 416 Stainless steel***
- ☐ 316 Stainless steel **

Diaphragms, O-rings and Other Elastomers (Select One)

- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)***
- ☐ Ethylenepropylene (EPDM)**

Outlet Pressure Range (Select One)

Type 6351 Pilot

- ☐ 3 to 20 psig / 0.21 to 1.4 bar, Green**
- ☐ 5 to 35 psig / 0.35 to 2.4 bar, Unpainted**
- ☐ 35 to 100 psig / 2.4 to 6.9 bar, Red**

Type 6352 Pilot

- ☐ 14 in. w.c. to 2 psig / 35 mbar to 0.14 bar, Yellow***
- ☐ 2 to 10 psig / 0.14 to 0.69 bar, Black**

Type 6353 Pilot

- ☐ 3 to 40 psig / 0.21 to 2.8 bar, Yellow**
- ☐ 35 to 125 psig / 2.4 to 8.6 bar, Red**

Type 6354L, 6354M or 6354H Pilot; Specify Type _____

- ☐ 85 to 200 psig / 5.9 to 13.8 bar, Blue**
- ☐ 175 to 220 psig / 12.1 to 15.2 bar, Blue**
- ☐ 200 to 300 psig / 13.8 to 20.7 bar, Green**

Type 61L, 61LD or 61LE Pilot; Specify Type _____

- ☐ 0.25 to 2 psig / 0.02 to 0.14 bar, Red**
- ☐ 1 to 5 psig / 0.07 to 0.35 bar, Yellow**
- ☐ 2 to 10 psig / 0.14 to 0.69 bar, Blue**
- ☐ 5 to 15 psig / 0.35 to 1.0 bar, Brown**
- ☐ 10 to 20 psig / 0.69 to 1.4 bar, Green**

Type 61H Pilot

- ☐ 10 to 65 psig / 0.69 to 4.5 bar, Green Stripe**

Type 61HP Pilot

- ☐ 15 to 45 psig / 1.0 to 3.1 bar, Yellow**
- ☐ 35 to 100 psig / 2.4 to 6.9 bar, Blue**
- ☐ 100 to 300 psig / 6.9 to 20.7 bar, Red**

- continued -

Ordering Guide (continued)

Outlet Pressure Range (Select One) (continued)

Type Y600AM

- ☐ 4 to 8 in. w.c. / 10 to 20 mbar, Red***
- ☐ 7 to 16 in. w.c. / 17 to 40 mbar, Unpainted**
- ☐ 15 in. w.c. to 1.2 psig / 37 mbar to 0.08 bar, Yellow***
- ☐ 1.2 to 2.5 psig / 0.08 to 0.17 bar, Light Green***
- ☐ 2.5 to 4.5 psig / 0.17 to 0.31 bar, Light Blue***
- ☐ 4.5 to 7 psig / 0.31 to 0.48 bar, Black***

6350 Series Pilot Construction (Select One)

- ☐ Aluminum***
- ☐ Stainless steel**

Tubing and Fittings (Optional)

- ☐ Stainless steel tubing and steel plated fittings**
- ☐ Stainless steel tubing and fittings**

Main Valve Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

Actuator Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

Pilot Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

Wireless Position Monitor Mounting Kit (Optional)

- ☐ Yes, send one mounting kit for mounting the Topworx™ 4310 or the Fisher™ 4320 wireless position monitor.

NACE Construction (Optional)

- ☐ Yes

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.

Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Do not place control lines immediately downstream of rotary or turbine meters.

Introduction

The proven reliability and accurate regulation of the 1301 Series regulators make them ideal for numerous high-pressure drop applications. These multi-purpose regulators can be used as pilot supply or pressure-loading regulators where high-pressure operating medium must be reduced for use by gas regulator pilots or pressure-loaded regulators. Their rugged design offers versatility for a wide variety of applications including air, gas, water and other liquids.

Body Size and End Connection Style

1/4 NPT

Spring Case Vents

Type 1301F Brass Spring Case: Four 5/32 in. / 4.0 mm holes

Type 1301F Stainless Steel Spring Case: One 1/4 NPT connection

Type 1301G: One 1/8 NPT connection with screen

Pressure Registration

Internal

Maximum Inlet Pressure

6000 psig / 414 bar at or below 200°F / 93°C and 1000 psig / 69.0 bar above 200°F / 93°C

Maximum Emergency Outlet Pressures

Type 1301F: 250 psig / 17.2 bar

Type 1301G: 550 psig / 37.9 bar

Outlet Pressure Ranges

10 to 500 psig / 0.69 to 34.5 bar in four ranges

See Table 2

Material Temperature Capabilities

Nylon (PA) Valve Disk and Neoprene (CR) Gaskets: -20 to 180°F / -29 to 82°C

PTFE Valve Disk and Fluorocarbon (FKM) Gaskets: -20 to 400°F / -29 to 204°C not recommended for hot water use

PTFE Valve Disk and Ethylenepropylene (EPDM) Gaskets: -40 to 300°F / -40 to 149°C

Flow Coefficients

Wide-Open C_g: 5.0

Wide-Open C_v: 0.13

C_1: 38.5

C_v Coefficients at 20% Droop

Type 1301F: See Table 5

Type 1301G: See Table 6

IEC Sizing Coefficients

X_T: 0.938

F_D: 0.50

F_L: 0.85

Options

- Pipe plug in second outlet
- Handwheel adjusting screw (Type 1301F only)
- Panel mounting spring case with T-handle adjusting screw (Type 1301G only)
- Bracket for mounting regulator on yoke of control valve actuator
- NACE construction
- Stainless steel construction

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Durable Stainless Steel Diaphragm**
- **Spare Valve Disk Provided**
- **Versatility**
- **ANSI Class VI Shutoff**
- **Sour Gas Service Capability**



Figure 1. *Type 1301F High Pressure Regulator*

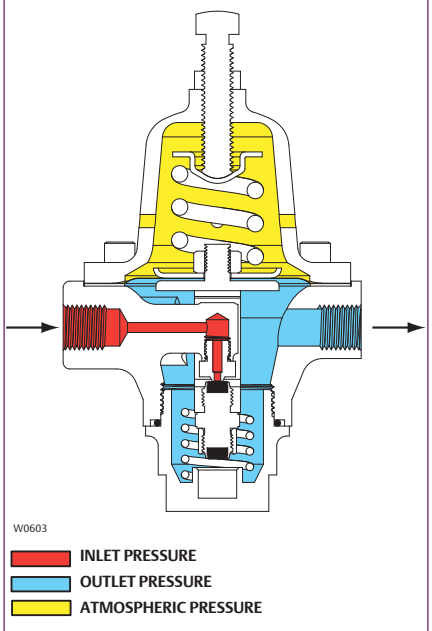


Figure 2. *Type 1301F Operational Schematic*

Table 1. Construction Materials

BODY	BOTTOM CAP AND SPRING CASE	ORIFICE	ORIFICE YOKE	GASKET	VALVE SPRING	VALVE DISKS AND HOLDER	DIAPHRAGM
Brass	Brass	303 Stainless steel	Brass	Neoprene, Fluorocarbon (FKM) or Ethylenepropylene (EPDM)	302 Stainless steel	Nylon (PA) and Zinc-plated brass or PTFE and Zinc-plated brass	302 Stainless steel
CF8M Stainless steel	304 Stainless steel 316 Stainless steel	303 Stainless steel	316 Stainless steel	Neoprene, Fluorocarbon (FKM) or Ethylenepropylene (EPDM)	302 SST or Inconel®	Nylon (PA) and 316 Stainless steel or PTFE and 316 Stainless steel	302 Stainless steel or Monel®

Table 2. Outlet Pressure Ranges

TYPE	OUTLET PRESSURE RANGE(1)		SPRING PART NUMBER	SPRING COLOR CODE	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
	psig	bar			In.	mm	In.	mm
1301F	10 to 75	0.69 to 5.2	1D387227022	Blue	0.200	5.08	1.69	42.9
	50 to 150	3.4 to 10.3	1B788527022	Silver	0.225	5.72		
	100 to 225	6.9 to 15.5	1D465127142	Red	0.243	6.17		
1301G	200 to 500	13.8 to 34.5	1K156027142	Silver	0.331	8.41	1.88	47.8

1. All springs can be backed off to 0 psig / 0 bar.

Table 3. Type 1301F Regulating Capacities

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
			Inlet Pressure, psig / bar													
			100 / 6.9		250 / 17.2		500 / 34.5		750 / 52		1000 / 69		1500 / 103		2000 / 138	
			Droop		Droop		Droop		Droop		Droop		Droop		Droop	
	psig	bar	10%	20%	10%	20%	10%	20%	10%	20%	10%	20%	10%	20%	10%	20%
10 to 75 psig / 0.69 to 5.2 bar 1D387227022 Blue	25	1.7	245 / 6.6	374 / 10.0	387 / 10.4	619 / 16.6	516 / 13.8	839 / 22.5	645 / 17.3	968 / 25.9	671 / 18.0	993 / 26.6	697 / 18.7	1032 / 27.7	722 / 19.3	1058 / 28.4
	50	3.4	361 / 9.7	516 / 13.8	619 / 16.6	1032 / 27.7	929 / 24.9	1290 / 34.6	1084 / 29.1	1548 / 41.5	1161 / 31.1	1677 / 44.9	1226 / 32.9	1806 / 48.4	1290 / 34.6	1935 / 51.9
	75	5.2	323 / 8.7	516 / 13.8	774 / 20.7	1161 / 31.1	1161 / 31.1	1806 / 48.4	1290 / 34.6	2064 / 55.3	1419 / 38.0	2193 / 58.8	1548 / 41.5	2322 / 62.2	1677 / 44.9	2451 / 65.7
50 to 150 psig / 3.4 to 10.3 bar 1B788527022 Silver	75	5.2	258 / 6.9	452 / 12.1	645 / 17.3	1032 / 27.7	1032 / 27.7	1677 / 44.9	1226 / 32.9	1935 / 51.9	1290 / 34.6	2064 / 55.3	1419 / 38.0	2193 / 58.8	1548 / 41.5	2322 / 62.2
	150	10.3	----	----	968 / 25.9	1290 / 34.6	1419 / 38.0	2322 / 62.2	1871 / 50.1	2967 / 79.5	2064 / 55.3	3354 / 89.9	2193 / 58.8	3612 / 96.8	2322 / 62.2	3870 / 104
100 to 225 psig / 6.9 to 15.5 bar 1D465127142 Red	150	10.3	----	----	839 / 22.5	1161 / 31.1	1290 / 34.6	2193 / 58.8	1742 / 46.7	2838 / 76.1	1935 / 51.9	2903 / 77.8	2129 / 57.1	3548 / 95.1	2322 / 62.2	3870 / 104
	225	15.5	----	----	645 / 17.3	1032 / 27.7	1806 / 48.4	2709 / 72.6	2451 / 65.7	3741 / 100	3096 / 83.0	4515 / 121	3483 / 93.3	5160 / 138	3870 / 104	5805 / 156

Table 4. Type 1301G Regulating Capacities

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	OUTLET PRESSURE SETTING		OFFSET		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS						
					Inlet Pressure, psig / bar						
	psig	bar	psig	bar	300 / 20.7	500 / 34.5	750 / 52	1000 / 69	1500 / 103	2000 / 138	2250 / 155
200 to 500 psig / 13.8 to 34.5 bar 1K156027142 Silver	200	13.8	10 20 30 40	0.69 1.4 2.1 2.8	452 / 12.1 839 / 22.5 1161 / 31.1 1419 / 38.0	710 / 19.0 1161 / 31.1 1742 / 46.7 2129 / 57.1	968 / 25.9 1548 / 41.5 2193 / 58.8 2709 / 72.6	1226 / 32.9 1935 / 51.9 2580 / 69.1 3225 / 86.4	1419 / 38.0 2322 / 62.2 2967 / 79.5 3870 / 104	1613 / 43.2 2580 / 69.1 3483 / 93.3 4515 / 121	1806 / 48.4 2709 / 72.6 3870 / 104 4773 / 128
	500	34.5	15 25 50	1.0 1.7 3.4	---- ---- ----	---- ---- ----	1032 / 27.7 1806 / 48.4 2838 / 76.1	1290 / 34.6 2064 / 55.3 3612 / 96.8	1677 / 44.9 2580 / 69.1 4257 / 114	1935 / 51.9 3354 / 89.9 5160 / 138	2064 / 55.3 3612 / 96.8 5808 / 156

Table 5. Type 1301F C_V Coefficients

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR, psig / bar	OUTLET PRESSURE SETTING		TYPE 1301F C_V COEFFICIENT BASED ON 20% DROOP						
			Inlet Pressure, psig / bar						
	psig	bar	100 / 6.90	250 / 17.2	500 / 34.5	750 / 51.7	1000 / 69.0	1500 / 103	2000 / 138
10 to 75 / 0.69 to 5.17 1D387227022 Blue	25 50 75	1.7 3.4 5.2	0.056 0.065 0.073	0.048 0.057 0.066	0.043 0.052 0.061	0.040 0.050 0.058	0.037 0.046 0.055	0.032 0.041 0.051	0.029 0.038 0.049
50 to 150 / 3.45 to 10.3 1B788527022 Silver	75 150	5.2 10.3	0.068 ----	0.064 0.089	0.059 0.084	0.057 0.080	0.054 0.078	0.050 0.075	0.047 0.074
100 to 225 / 6.90 to 15.5 1D4651270142 Red	150 225	10.3 15.5	---- ----	0.083 0.100	0.080 0.097	0.078 0.095	0.076 0.094	0.074 0.092	0.074 0.091

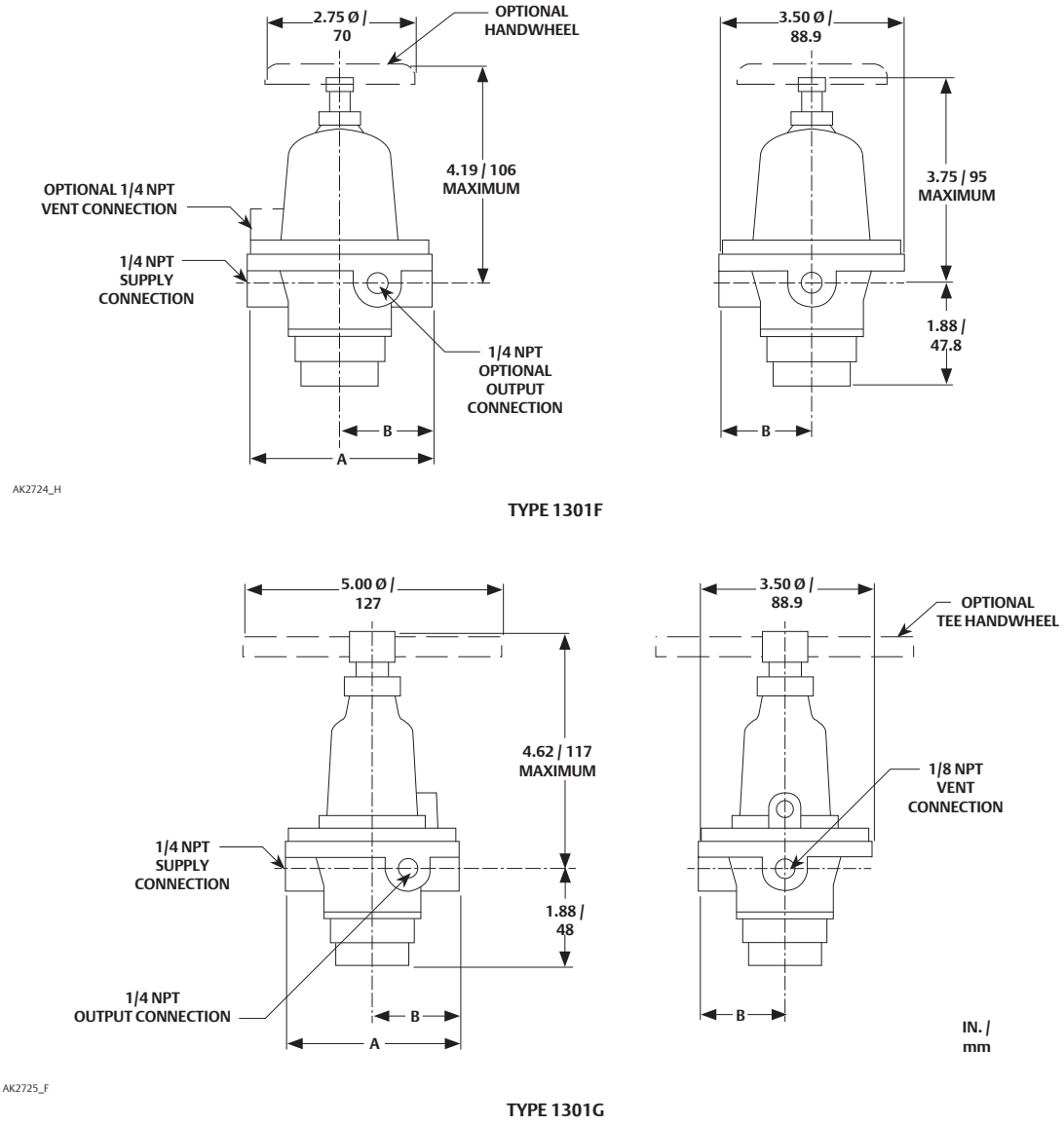


Figure 3. *1301 Series Dimensions*

Table 6. Type 1301G C_V Coefficients

OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR, psig / bar	OUTLET PRESSURE SETTING		TYPE 1301G C_V COEFFICIENT BASED ON 20% DROOP						
			Inlet Pressure, psig / bar						
	psig	bar	300 / 20.7	500 / 34.5	750 / 51.7	1000 / 69.0	1500 / 103	2000 / 138	2250 / 155
200 to 500 / 13.8 to 34.5 1K156027142 Silver	200 500	13.8 34.5	0.095 ----	0.094 ----	0.092 0.106	0.091 0.105	0.089 0.104	0.088 0.103	0.088 0.103

Table 7. Dimension

TYPE	BODY MATERIAL	DIMENSION			
		A		B	
		In.	mm	In.	mm
1301F	Brass	3.38	86	1.69	43
	Stainless steel	3.62	92	1.75	44
1301G	Brass	3.38	86	1.69	43
	Stainless steel	3.62	92	1.75	44

Ordering Guide

Type (Select One)

1301F

- ☐ 10 to 75 psig / 0.69 to 5.2 bar, Blue***
- ☐ 50 to 150 psig / 3.4 to 10.3 bar, Silver***
- ☐ 100 to 225 psig / 6.9 to 15.5 bar, Red***

1301G

- ☐ 200 to 500 psig / 13.8 to 34.5 bar, Silver***

Dual Gauge Port Construction (Optional)

- ☐ Yes

Body and Spring Case Material (Select One)

- ☐ Brass***
- ☐ CF8M Stainless steel**

Valve Disk (Select One)

- ☐ Nylon (PA) **(standard)*****
- ☐ PTFE**

Gasket (Select One)

- ☐ Neoprene (CR)***
- ☐ Fluorocarbon (FKM)**
- ☐ Ethylenepropylene (EPDM)**
- ☐ Fluorosilicone (FVMQ)**

Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
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Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired?	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

A disk with a cookie cut appearance probably means you had an overpressure situation. Thus, investigate further.

Introduction

The 1305 Series regulators are direct-operated, pressure reducing regulators that resist hydrate formation and regulator freeze-up. The regulators are suitable for service with natural gas, air, propane and other gases compatible with the internal parts. 1305 Series regulators are typically used on high-pressure lines from wellheads and separators.

Regulator freeze-up resistance occurs as the pipeline gas warms the finned inlet adaptor and the orifice area. As the gas cools within the inlet adaptor due to pressure drop and volume expansion, the warm inlet adaptor helps keep the gas temperature above the freezing point of water and the hydrate formation temperature.

Body Size and End Connection Style

1/4 NPT outlet with 1 NPT inlet adaptor connection

Orifice Size

5/64 in. / 2.0 mm

Coefficients for Relief Sizing

Wide-Open C_g: 5.5
Wide-Open C_1: 38.5

Typical Regulating Capacities

See Figure 3

Maximum Allowable Inlet Pressure

4000 psig / 276 bar

Maximum Outlet (Casing) Pressure

Type 1305C:
250 psig / 17.2 bar
Type 1305D:
550 psig / 37.9 bar

Outlet Pressure Ranges

Type 1305C:
With Spring 1D387227022 (Blue):
0 to 75 psig / 0 to 5.2 bar
With Spring 1B788527022 (Silver):
0 to 150 psig / 0 to 10.3 bar
With Spring 1D465127142 (Red):
0 to 225 psig / 0 to 15.5 bar
Type 1305D:
200 to 500 psig / 13.8 to 34.5 bar

Pressure Registration

Internal

Temperature Capabilities

-20 to 200°F / -29 to 93°C

Construction Materials

Inlet Adaptor: 416 Stainless steel or 316 Stainless steel for NACE construction

Union Nut: 416 Stainless steel

Lower Casing and Spring Case: Brass

Orifice: 416 Stainless steel or 316 Stainless steel for NACE construction

Valve Stem: 416 Stainless steel or 316 Stainless steel for NACE construction

Valve Disk: Nylon (PA)

O-rings: Nitrile (NBR)

Options

- 1/4 in. NPT connection for optional pressure gauge or relief valve

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com



Figure 1. *1305 Series Regulator with Tapped Lower Casing Connection*

Features

- **Resists Hydrate Formation and Regulator Freeze-up**
- **Durable**
- **Easy Maintenance**
- **High Pressure Capabilities**
- **NACE Construction Available**

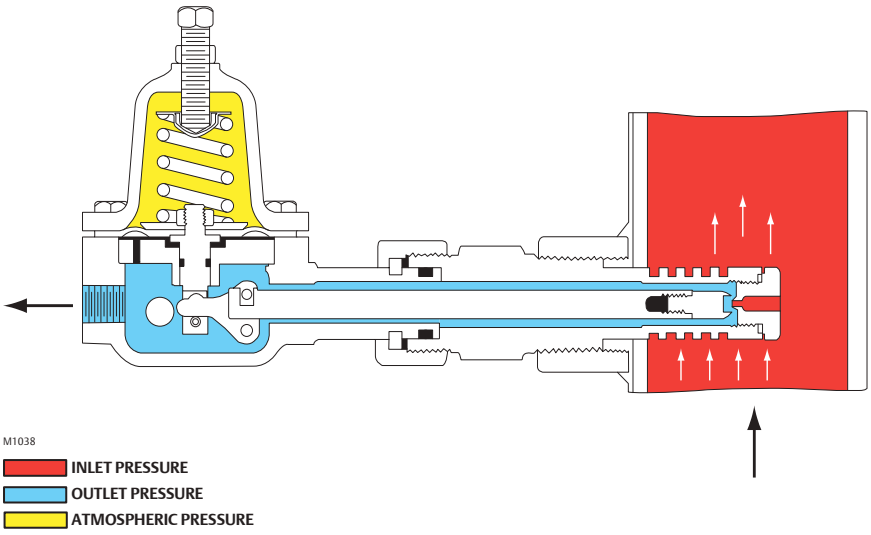


Figure 2. *Typical 1305 Operational Schematic*

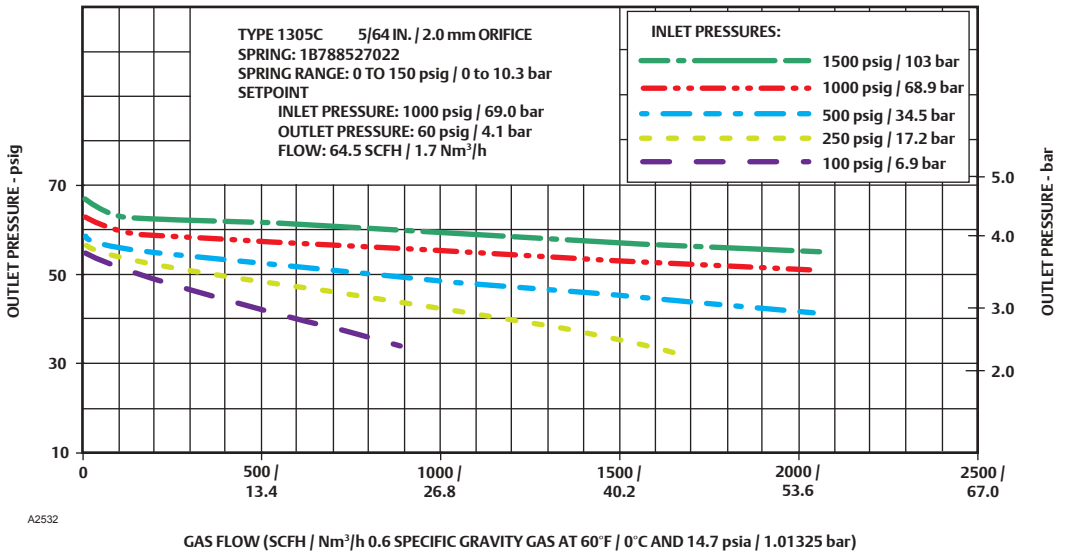


Figure 3. *Typical 1305 Regulator Capacity Curves*

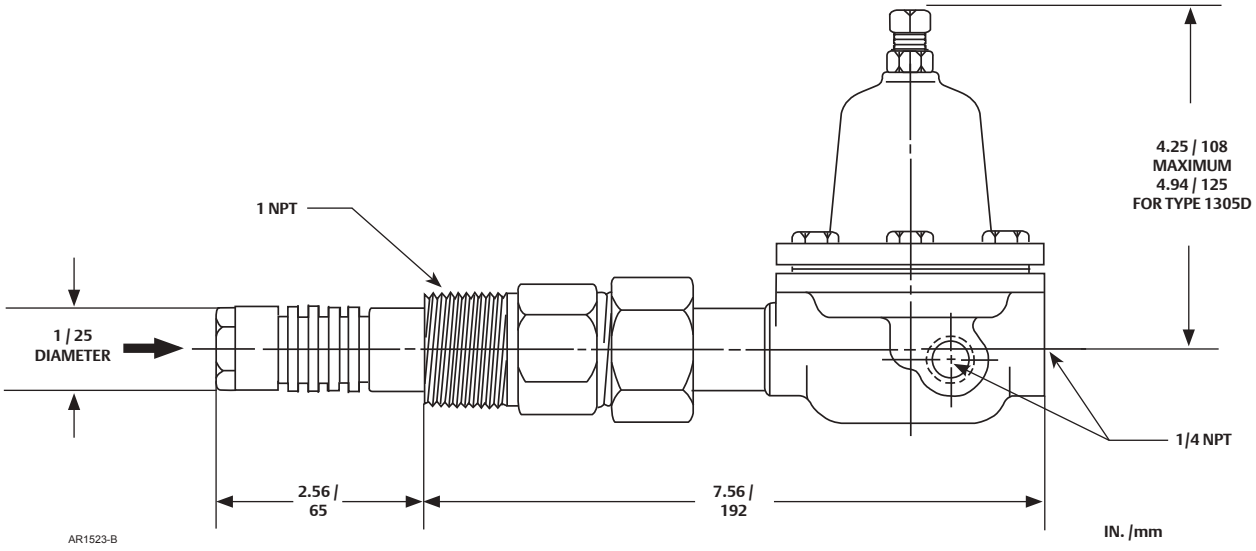


Figure 4. *Dimensions*

Ordering Guide

Outlet Pressure Range (Select One)

Type 1305C

☐ 0 to 75 psig / 0 to 5.2 bar, Blue**
☐ 0 to 150 psig / 0 to 10.3 bar, Silver**
☐ 0 to 225 psig / 0 to 15.5 bar, Red**

Type 1305D

☐ 200 to 500 psig / 13.8 to 34.5 bar, Silver**

NACE Construction Required (Optional)

☐ Yes*

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Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Burying regulators is not recommended. However, if you must, the vent should be protected from ground moisture and plugging.

Type 1367
High-Pressure Instrument Supply System

FISHER

Introduction

Type 1367 high-pressure instrument supply system takes a pressure of up to 2000 psig / 138 bar and reduces it to a controlled pressure to be used for supplying a pneumatic instrument. This system consists of the following filters, regulators and relief valves:

- A Type 252 extended body filter with drain valve
- A first-stage Type 1301F regulator with mounting bracket for an actuator yoke or casing
- A Type H120 relief valve mounted in the side outlet of the Type 1301F regulator
- A second-stage Type 67CF filter-style regulator, mounted on the Type 1301F regulator
- A Type H800 or H120 relief valve nipple-mounted in the outlet of the Type 67CF regulator

Body Size and End Connection Style

Inlet and Outlet: 1/4 NPT

Type H800 Vent: 1/2 NPT with removable screen

Fixed Relief Setting of the First Stage Type H120 Relief Valve

150 psig / 10.3 bar

Maximum Inlet Pressure

2000 psig / 138 bar

Outlet (Supply) Pressure Range

5 to 70 psig / 0.34 to 4.8 bar

Maximum Outlet (Supply) Pressure with Type 67CF Regulator Failed Wide-Open with:

Type H800 Relief Valve Relieving: 50 psig / 3.4 bar

Type H120 (Second Stage) Relief Valve Relieving: 40, 50, 70 or 75 psig / 2.8, 3.4, 4.8 or 5.2 bar

Temperature Capabilities

-20 to 150°F / -29 to 66°C

Approximate Shipping Weight

12 lbs / 5.4 kg

Pressure Registration

Internal

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Regulation and Overpressure Protection in One Complete Package**
- **Installation Flexibility**
- **Capability for Continuous Moisture Removal**
- **NACE Configuration Available**
- **Dual Gauge Port Type 1301 Configuration Available**
- **All Stainless steel Construction Available**



W8649

Figure 1. *Type 1367 High-Pressure Instrument Supply System*

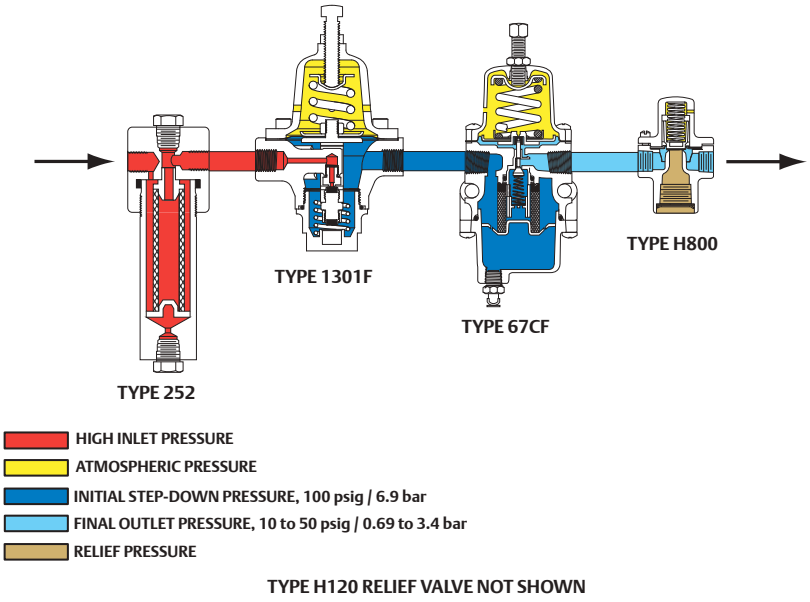
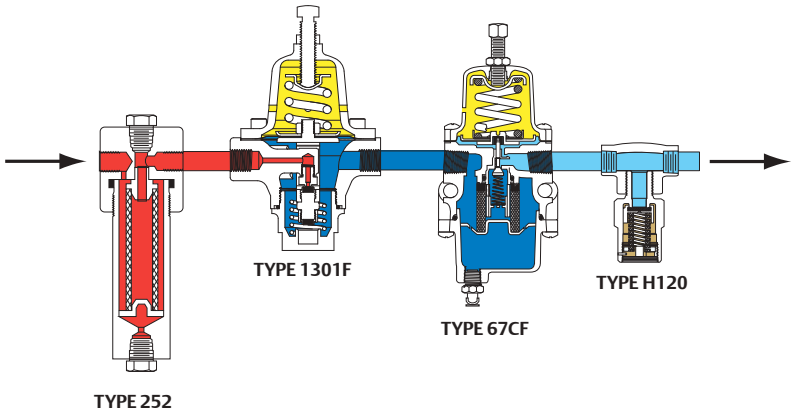


Figure 2. *Type 1367 Operational Schematic*

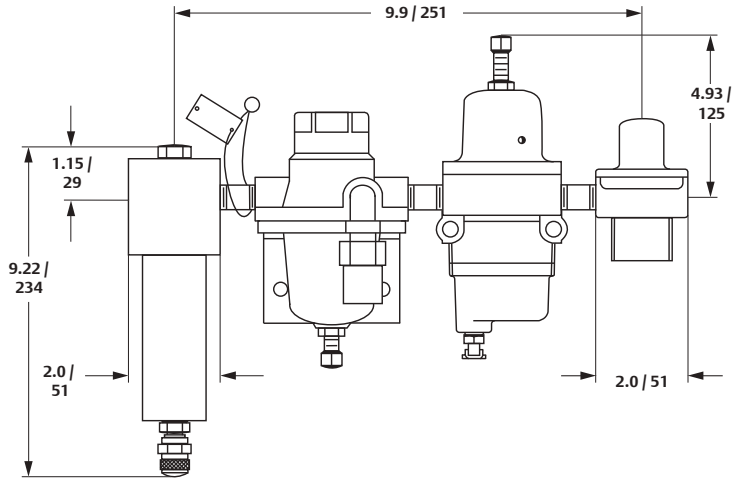
EMERSON
Process Management



FIRST STAGE TYPE H120 RELIEF VALVE NOT SHOWN

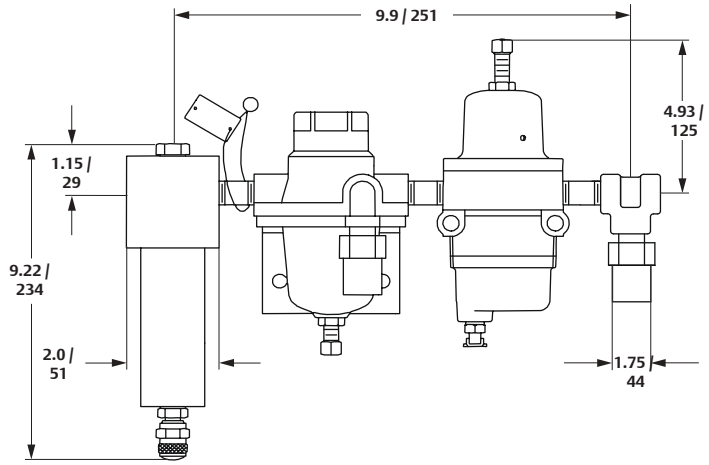
HIGH INLET PRESSURE
ATMOSPHERIC PRESSURE
INITIAL STEP-DOWN PRESSURE, 100 psig / 6.9 bar
FINAL OUTLET PRESSURE, 10 to 75 psig / 0.69 to 5.2 bar
RELIEF PRESSURE

Figure 2. *Type 1367 Operational Schematic (continued)*



39A3366_B

TYPE H120 RELIEF VALVE NOT SHOWN



ERAA03272_B

IN. / mm

FIRST STAGE TYPE H120 RELIEF VALVE NOT SHOWN

Figure 3. *Dimensions*

Table 1. Construction Material

TYPE 252 FILTER		TYPE 1301F REGULATOR		TYPE H120 RELIEF VALVE		TYPE 67CF REGULATOR		TYPE H800 RELIEF VALVE	
Part	**Material**	**Part**	**Material**	**Part**	**Material**	**Part**	**Material**	**Part**	**Material**
Body	Aluminum and Stainless steel	**Body and Spring Case**	Brass and Stainless steel	**Disk**	Nitrile (NBR)	**Body and Spring Case**	Aluminum and Stainless steel	**Body and Spring Case**	Aluminum
Filter Cartridge	Polyethylene	**Disk**	Polytetrafluoroethylene (PTFE)	**Spring and Pin**	Stainless steel	**Diaphragm and Plug**	Nitrile (NBR) or Fluorocarbon (FKM)	**Diaphragm**	Nitrile (NBR)
O-ring	Nitrile (NBR)	**Gasket**	Neoprene (CR) and Fluorocarbon (FKM)	**Other Part**	Brass and Stainless steel	**Stem**	Brass, Aluminum or Stainless steel	**Other Part**	Steel and Stainless steel
Drain Valve	316 Stainless steel	**Other Part**	Brass and Stainless steel			**Filter**	Polyethylene		
						Other Part	Steel and Stainless steel		

Ordering Guide

Type 1367 (Specify quantity)

NACE Construction Required (Optional)

☐ Yes

Dual Gauge Port Construction (Optional)

☐ Yes

All Stainless Steel Construction (Optional)

☐ Yes

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

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* * *	Readily Available for Shipment
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Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Direct-operated regulators generally have faster response to quick flow changes than pilot-operated regulators.

Introduction

The 1805 Series relief valves are designed for use in farm-tap applications where a relief valve is needed between the first and second-stage regulators. This relief valve is suitable for natural gas, air, propane or any medium compatible with the internal valve parts.

Body Size and End Connection Style

3/4, 1, 1-1/2 or 2 NPT

Flow Coefficients

C_1: 35

IEC Sizing Coefficients

3/4 to 1 NPT Bodies:
X_T: 0.73; F_D: 0.39; F_L: 0.89
1-1/2 to 2 NPT Bodies:
X_T: 0.94; F_D: 0.44; F_L: 0.89

Maximum Relief (Inlet) Pressure

150 psig / 10.3 bar, including build-up

Relief Set Pressure Ranges

5 to 125 psig / 0.34 to 8.6 bar in three ranges for each body size

See Table 3

Temperature Capabilities

-20 to 150°F / -29 to 66°C

Approximate Shipping Weights

3/4 to 1 NPT Bodies: 5 lbs / 2.3 kg
1-1/2 to 2 NPT Bodies: 13 lbs / 5.9 kg

Options

- Cast iron spring case
- Cast iron spring case with closing cap and 1/4 NPT vent placed over adjusting screw

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Tight Shutoff**
- **Easy Maintenance Simple Adjustment**
- **Complete Venting**
- **Sour Gas Service Capability**

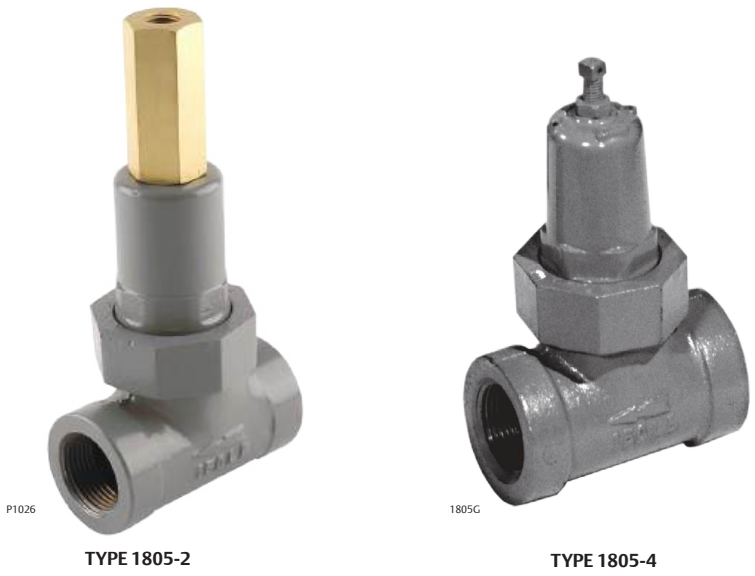


Figure 1. *Typical 1805 Series Relief Valves*

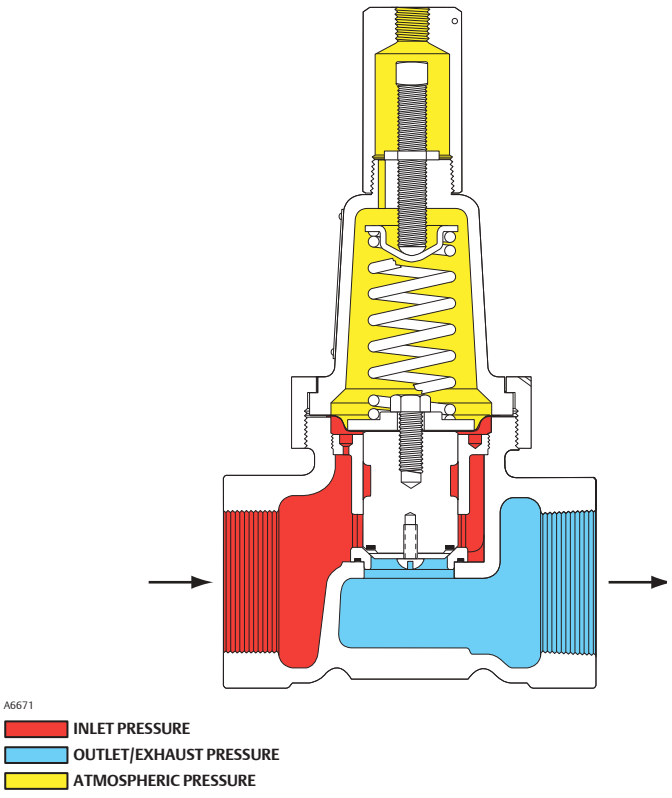
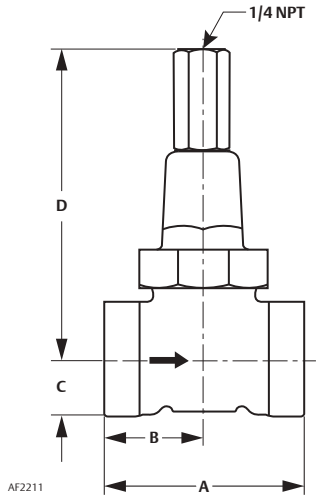
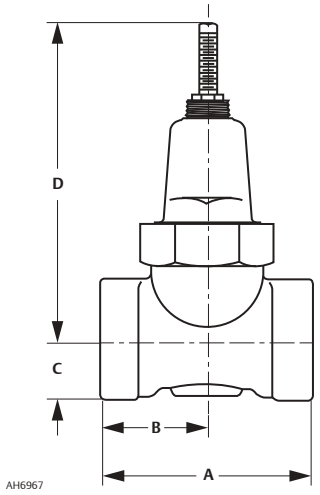


Figure 2. *Typical 1805 Series Operational Schematic*



TYPE 1805-2, 1805-3 OR 1805-7 WITH CLOSING CAP



TYPE 1805-4 OR 1805-5 WITHOUT CLOSING CAP

Figure 3. *Dimensions*

Table 1. Type Number Description

TYPE	SIZE	DISTINCTIVE CONSTRUCTION FEATURE
1805-2	3/4 or 1 NPT	Cast iron spring case, closing cap with 1/4 NPT vent placed over the adjusting screw
1805-3	1-1/2 or 2 NPT	Cast iron spring case, closing cap with 1/4 NPT vent placed over the adjusting screw
1805-4	3/4 or 1 NPT	Cast iron spring case
1805-5	1-1/2 or 2 NPT	Cast iron spring case
1805-7	3/4 or 1 NPT	Cast iron spring case, closing cap with 1/4 NPT vent placed over the adjusting screw and screen in outlet

Table 2. Construction Material

BODY MATERIAL	UPPER SPRING SEAT	DIAPHRAGM AND O-RING	O-RING HOLDER AND VALVE GUIDE ORIFICE
Cast Iron (all sizes), Ductile Iron (3/4 or 1 NPT body) (NACE)	Plated Steel	Nitrile (NBR)	Aluminum

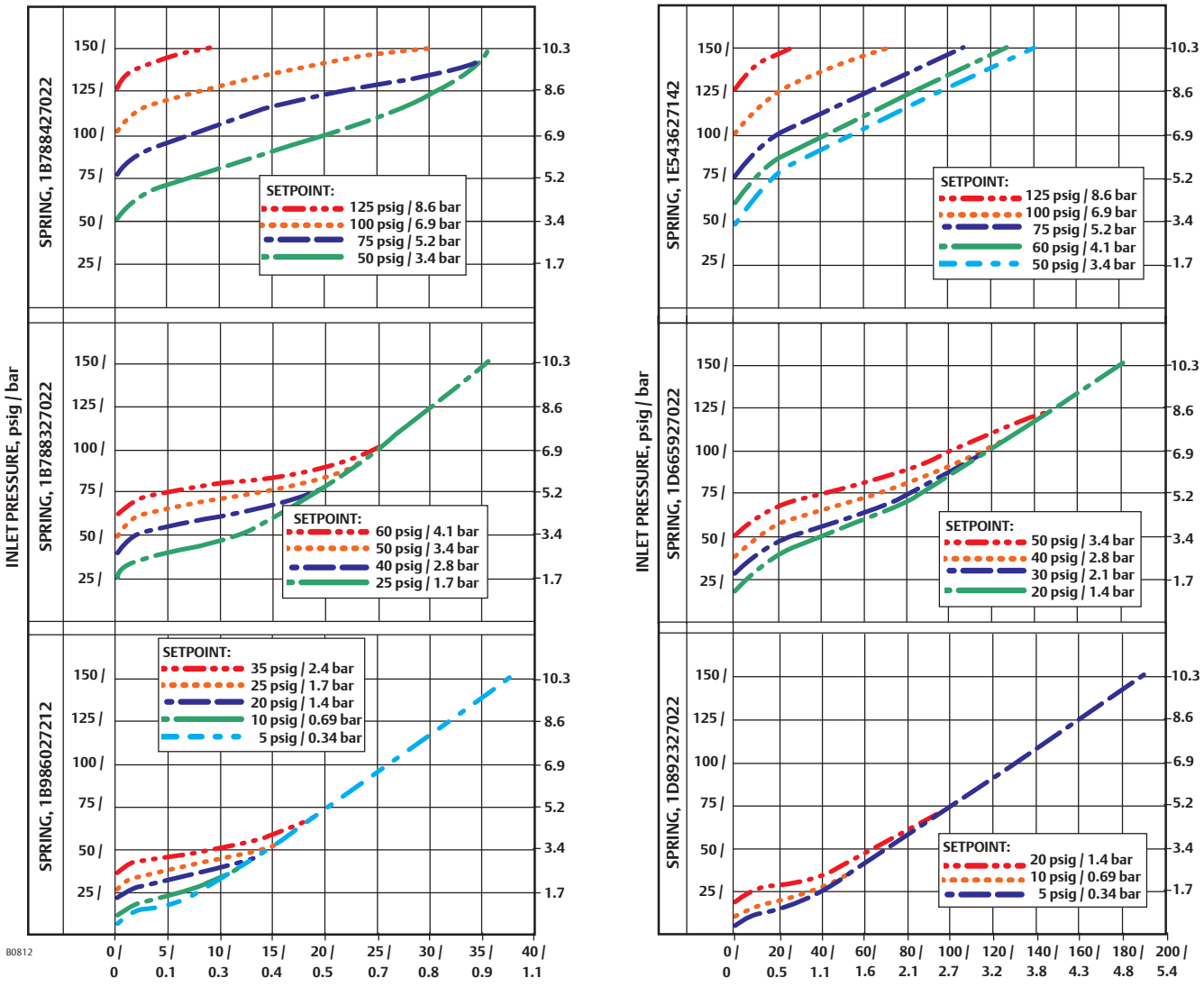
Table 3. Relief Set Pressure Range

BODY SIZE	RELIEF PRESSURE RANGE		SPRING PART NUMBER	COLOR CODE	SPRING FREE LENGTH		SPRING WIRE DIAMETER	
	psig	bar			In.	mm	In.	mm
3/4 or 1 NPT	5 to 35 10 to 60 20 to 125	0.34 to 2.4 0.69 to 4.1 1.4 to 8.6	1B986027212 1B788327022 1B788427022	Green Silver Blue	2.25 2.13 1.94	57.2 54.1 49.3	0.12 0.14 0.18	3.05 3.56 4.57
1-1/2 or 2 NPT	5 to 20 10 to 50 35 to 125	0.34 to 1.4 0.69 to 3.4 2.4 to 8.6	1D892327022 1D665927022 1E543627142	Red Blue Yellow	2.94 2.50 2.31	74.7 63.5 58.7	0.17 0.22 0.28	4.32 5.59 7.11

Table 4. Dimension

TYPE	BODY SIZE AND END CONNECTION STYLE	MATERIAL	DIMENSION							
			A		B		C		D (max)	
			In.	mm	In.	mm	In.	mm	In.	mm
1805-2(1),1805-4 and 1805-7(1)	3/4 NPT	Cast iron	3.62	92	1.81	46	1.00	25	6.44	164
		Ductile iron	3.88	99	1.94	49	1.38	35	6.44	164
	1 NPT	Cast iron	3.62	92	1.81	46	1.00	25	6.44	164
		Ductile iron	3.88	98	1.94	49	1.38	35	6.44	164
1805-3(1) and 1805-5	1-1/2 NPT	Cast iron	5.88	149	2.94	75	1.69	43	9.12	232
	2 NPT	Cast iron	5.88	149	2.94	75	1.69	43	9.12	232

1. With closing cap.



- 0.6 SPECIFIC GRAVITY NATURAL GAS FLOW RATE-THOUSAND SCFH (AT 60°F AND 14.7 psia) AND Nm³/h (AT 0°C AND 1.01 bar).
- MAXIMUM PRESSURE INCLUDING BUILD-UP 150 psi / 10.3 bar AT 150°F / 66°C.
- SETPOINT IS TO BE INTERPRETED AS BUBBLE POINT.

Figure 4. *Capacity Curves*

Ordering Guide

Type (Refer to Table 2 for Construction Features) (Select One)

- ☐ 1805-2***
- ☐ 1805-3***
- ☐ 1805-4**
- ☐ 1805-5***
- ☐ 1805-7***

Body Size and End Connection Style (Select One)

- ☐ 3/4 NPT***
- ☐ 1 NPT***
- ☐ 1-1/2 NPT**
- ☐ 2 NPT***

Body Material (Select One)

- ☐ Cast Iron (All sizes)**
- ☐ Ductile Iron (3/4 or 1 NPT body only)**

Relief Set Pressure Range (Select One)

3/4 or 1 NPT Body

- ☐ 5 to 35 psig / 0.34 to 2.4 bar, Green***
- ☐ 10 to 60 psig / 0.69 to 4.1 bar, Silver***
- ☐ 20 to 125 psig / 1.4 to 8.6 bar, Blue***

Relief Set Pressure Range (Select One) (continued)

1-1/2 or 2 NPT Body

- ☐ 5 to 20 psig / 0.34 to 1.4 bar, Red***
- ☐ 10 to 50 psig / 0.69 to 3.4 bar, Blue***
- ☐ 35 to 125 psig / 2.4 to 8.6 bar, Yellow***

Replacement Parts Kit (Optional)

- ☐ Yes, send me one replacement parts kit to match this order.

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Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.

Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.

Specification Worksheet
Application
☐ Relief Valve ☐ Backpressure Regulator
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Adequate overpressure protection should be installed to protect the regulator from overpressure. Adequate overpressure protection should also be installed to protect all downstream equipment in the event of regulator failure.

Introduction

Type 1805P relief valve is an accurate, economical, pilot-operated relief valve consisting of a Type 1805, 2 NPT main valve and a Type 6358B pilot. The relief pressure setting can be adjusted by rotating the pilot spring adjustment screw.

Body Size and End Connection Style

2 NPT

Wide-Open Flow Coefficients

C_g: 900 (without outlet piping)
C_v: 23.7
C_1: 38

IEC Sizing Coefficients

X_T: 0.91
F_D: 0.44
F_L: 0.89

Maximum Relief (Inlet) Pressure

50 psig / 3.4 bar over relief pressure setting or 150 psig / 10.3 bar, whichever is lower

Relief Set Pressure Range

10 to 100 psig / 0.69 to 6.9 bar in three ranges
See Table 3

Pressure Registration

External

Pilot Control Line and Vent Connections

1/4 NPT

Temperature Capabilities

Nitrile (NBR): -20 to 180°F / -29 to 82°C
Fluorocarbon (FKM): 0 to 300°F / -18 to 149°C

Approximate Shipping Weight

13 lbs / 6 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Fast Reseat After Operation**
- **Economical**
- **Accurate**
- **High Flow Capacity**
- **Low Build-Ups to Reach Wide-Open**
- **Tight Shutoff**
- **Rugged Construction**
- **Full Usable Capacity**
- **Powder Paint Coating**



Figure 1. *Type 1805P Pilot-Operated Relief Valve*

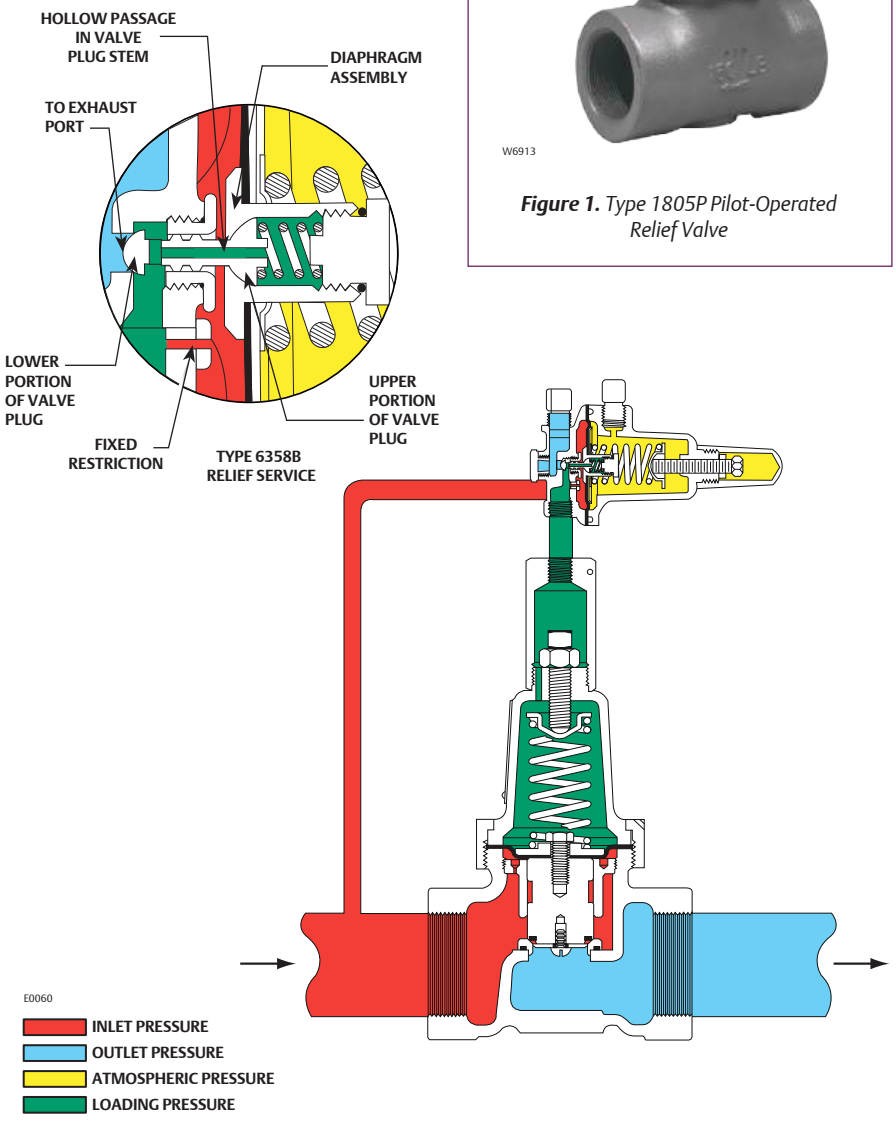


Figure 2. *Type 1805P Operational Schematic*

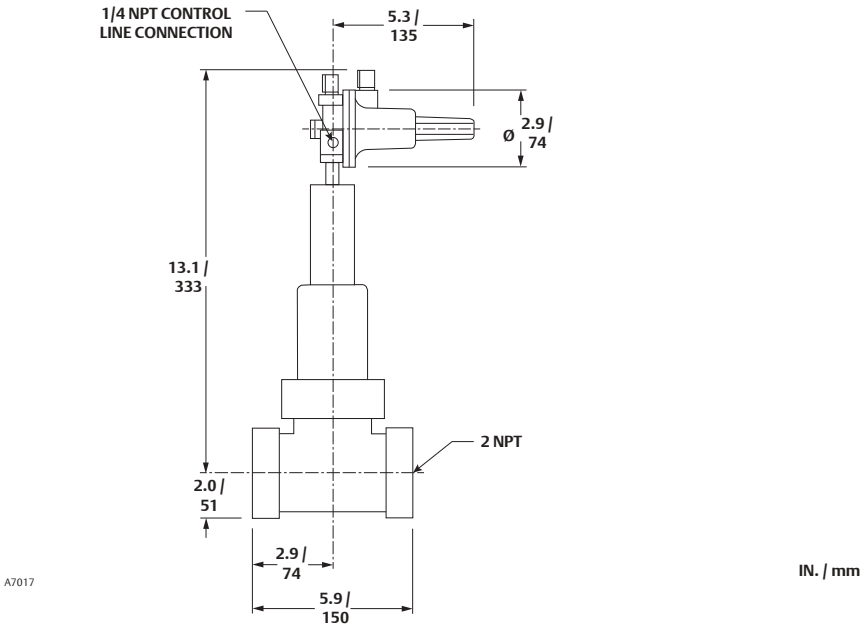


Figure 3. *Type 1805P-6358B Dimensions*

Table 1. Main Valve Construction Material

BODY AND SPRING CASE	DIAPHRAGM, O-RING AND GASKET	VALVE GUIDE, ORIFICE AND O-RING HOLDER	DIAPHRAGM PLATE	SPRING	SPRING SEAT AND CAP SCREW
Cast iron	Nitrile (NBR) **(standard)** or Fluorocarbon (FKM) (high temperature)	Aluminum	Brass	Plated Steel	Steel

Table 2. Pilot Construction Material

BODY AND SPRING CASE	VALVE PLUG AND STEM	DIAPHRAGM	O-RING AND GASKET	STEM GUIDE	VALVE SPRING	PILOT SPRING	BODY PLUG
Aluminum	Nitrile (NBR) **(standard)** or Fluorocarbon (FKM) (high temperature) plug and Stainless steel stem	Nitrile (NBR) **(standard)** or Fluorocarbon (FKM) (high temperature)	Nitrile (NBR) **(standard)** or Fluorocarbon (FKM) (high temperature)	Stainless steel	Stainless steel	Steel	Stainless steel

Table 3. Type 6358B Set Pressure Range

RELIEF SET PRESSURE		PART NUMBER	COLOR	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
psig	bar			In.	mm	In.	mm
10 to 18	0.69 to 1.2	1B986027212	Green	0.120	3.05	2.12	53.8
18 to 30	1.2 to 2.1	1B788327022	Unpainted	0.142	3.61	2.12	53.8
30 to 100	2.1 to 6.9	1K748527202	Red	0.192	4.88	2.19	55.6

Table 4. Main Valve Capacities and Pilot Information

MAIN VALVE SPRING, PART NUMBER AND COLOR	RELIEF SET PRESSURE RANGE		SET PRESSURE[1]		BUILD-UP OVER SET PRESSURE TO BEGIN OPENING MAIN VALVE[2]		BUILD-UP OVER SET PRESSURE TO FULLY OPEN MAIN VALVE[3]		PRESSURE DROP BELOW SET PRESSURE TO RESEAT PILOT		CAPACITIES OF 0.6 SPECIFIC GRAVITY NATURAL GAS[4]	
	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	SCFH	Nm³/h
For set pressures up to 30 psig / 2.1 bar 1F826927052 Pink	10 to 8	0.69 to 1.2	10 15 18	0.69 1.0 1.2	0.8	0.06	1.1	0.08	1.0	0.69	26,000 32,000 36,000	697 858 965
	18 to 30	1.2 to 2.1	18 25 30	1.2 1.7 2.1	0.9	0.06	1.3	0.09			37,000 45,000 53,000	992 1206 1420
For set pressures over 30 psig / 2.1 bar 1D751527022 Unpainted	30 to 100	2.1 to 6.9	30 40 50 60	2.1 2.8 3.4 4.1	1.5	0.10	2.2	0.15			54,000 66,000 78,000 89,000	1447 1769 2090 2385
			70 80 90 100	4.8 5.5 6.2 6.9	1.7 1.7 1.7 2.0	0.12 0.12 0.12 0.14	2.5	0.17			101,000 113,000 124,000 136,000	2707 3028 3323 3645

1. Set pressure is defined as the pressure at which the pilot exhaust starts-to-bubble (discharge).
2. Crack pressure is the inlet pressure at which the main valve starts audible flow.
3. Inlet pressure buildup over the set pressure to achieve wide-open capacity.
4. Capacities with inlet piping equal to body size and without outlet piping.

Ordering Guide

Main Valve Diaphragm Material (Select One)

- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Main Valve O-ring Material (Select One)

- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Relief Set Pressure Range (Select One)

- ☐ 10 to 18 psig / 0.69 to 1.2 bar, Green * * *
- ☐ 18 to 30 psig / 1.2 to 2.1 bar, Unpainted * * *
- ☐ 30 to 100 psig / 2.1 to 6.9 bar, Red * * *

Pilot Diaphragm Material (Select One)

- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Pilot Valve Plug Material (Select One)

- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

Pilot Gasket Material (Select One)

- ☐ Nitrile (NBR) **(standard)** * * *
- ☐ Fluorocarbon (FKM) *

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
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* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Tubing and Fittings (Select One)

- ☐ Stainless steel tubing and steel plated fittings * * *
- ☐ Stainless steel tubing and stainless steel fittings * * *

Main Valve Replacement Parts Kit (Optional)

- ☐ Yes, send one parts kit to match this order.

Pilot Replacement Parts Kit (Optional)

- ☐ Yes, send one parts kit to match this order.

Specification Worksheet
Application
☐ Relief Valve ☐ Backpressure Regulator
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Keep vents open. Do not use small diameter, long vent lines. Use the rule of thumb of the next nominal pipe size every 10 feet / 3.1 m of vent line and 3 feet / 0.9 m of vent line for every elbow in the line.

1808 Series

Relief Valves/Backpressure Regulators

FISHER™

Introduction

Types 1808 globe-style and 1808A angle-style pilot-operated backpressure regulators or relief valves are economical, compact devices used in gas or liquid service to maintain pressure on oil and gas separators and in pressure relief applications in gas distribution systems.

Body Size and End Connection Style

2 NPT

Pilot

Type 6358 for Backpressure Applications
Type 6358B for Relief Applications

Differential Pressures

Maximum: 125 psig / 8.6 bar
Minimum: 5 psig / 0.34 bar

Wide-Open Flow Coefficients

Type 1808:	**Type 1808A:**
C_g: 1410	C_g: 1,800
C_V: 40.1	C_V: 51.4
C_1: 35.2	C_1: 35.0

IEC Sizing Coefficients

Type 1808:	**Type 1808A:**
X_T: 0.78	X_T: 0.78
F_D: 0.89	F_D: 0.87
F_L: 0.50	F_L: 0.50

Maximum Relief (Inlet) Pressure

150 psig / 10.3 bar, including build-up

Relief Set Pressure Range

3 to 125 psig / 0.21 to 8.6 bar in three ranges

See Table 3

Temperature Capabilities

-20 to 180°F / -29 to 82°C

Pressure Registration

Internal **(standard)** or External (optional)

Pilot Tubing and Connections

1/4 NPT with or without P590 Series filter

Approximate Shipping Weights

Type 1808: 22 lbs / 10 kg
Type 1808A: 25 lbs / 11 kg

Options

- Upstream control line construction
- Pressure gauge (0 to 160 psig / 0 to 11 bar)
- P590 Series Pilot Supply Filter

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Simple, Reliable Design**
- **Compact and Lightweight**
- **Simplified, Convenient Installation in Any Position**
- **Quick Disassembly**
- **Optional Upstream Registration for Reduced Buildup**
- **Self-Draining Body**



W3716_1

Figure 1. *Type 1808 Relief Valve/ Backpressure Regulator with P590 Series Filter*



W3507_1

Figure 2. *Type 1808A without Filter*

Table 1. Main Valve Construction Material

BODY	DIAPHRAGM PLATE AND CASING	DIAPHRAGM	O-RING	GASKET	BACKUP RING	SPRING	VALVE PLUG GUIDE	TUBING AND FITTING
Type 1808: Cast iron or WCC Steel **Type 1808A:** Cast iron	Zinc-plated steel	Neoprene (CR) and Nitrile (NBR)	Nitrile (NBR)	Nitrile (NBR)	Polytetrafluoroethylene (PTFE)	Zinc-plated steel **(standard)**	Stainless steel	Stainless steel

Table 2. 6358 Series Pilots Construction Material

BODY	BODY PLUG	SPRING CASE	VALVE PLUG	SPRING AND SPRING SEAT	DIAPHRAGM AND O-RING	STEM GUIDE	ADJUSTING SCREW	CLOSING CAP	CONNECTOR CAP
Aluminum or CF8M Stainless steel	Aluminum, Stainless steel or Brass	Aluminum or Stainless steel	Nitrile (NBR) or thermoplastic plug with Stainless steel stem	Zinc-plated steel	Nitrile (NBR) or Fluorocarbon (FKM)	Stainless steel	Zinc-plated steel	Plastic or Stainless steel	Stainless steel

EMERSON. Process Management

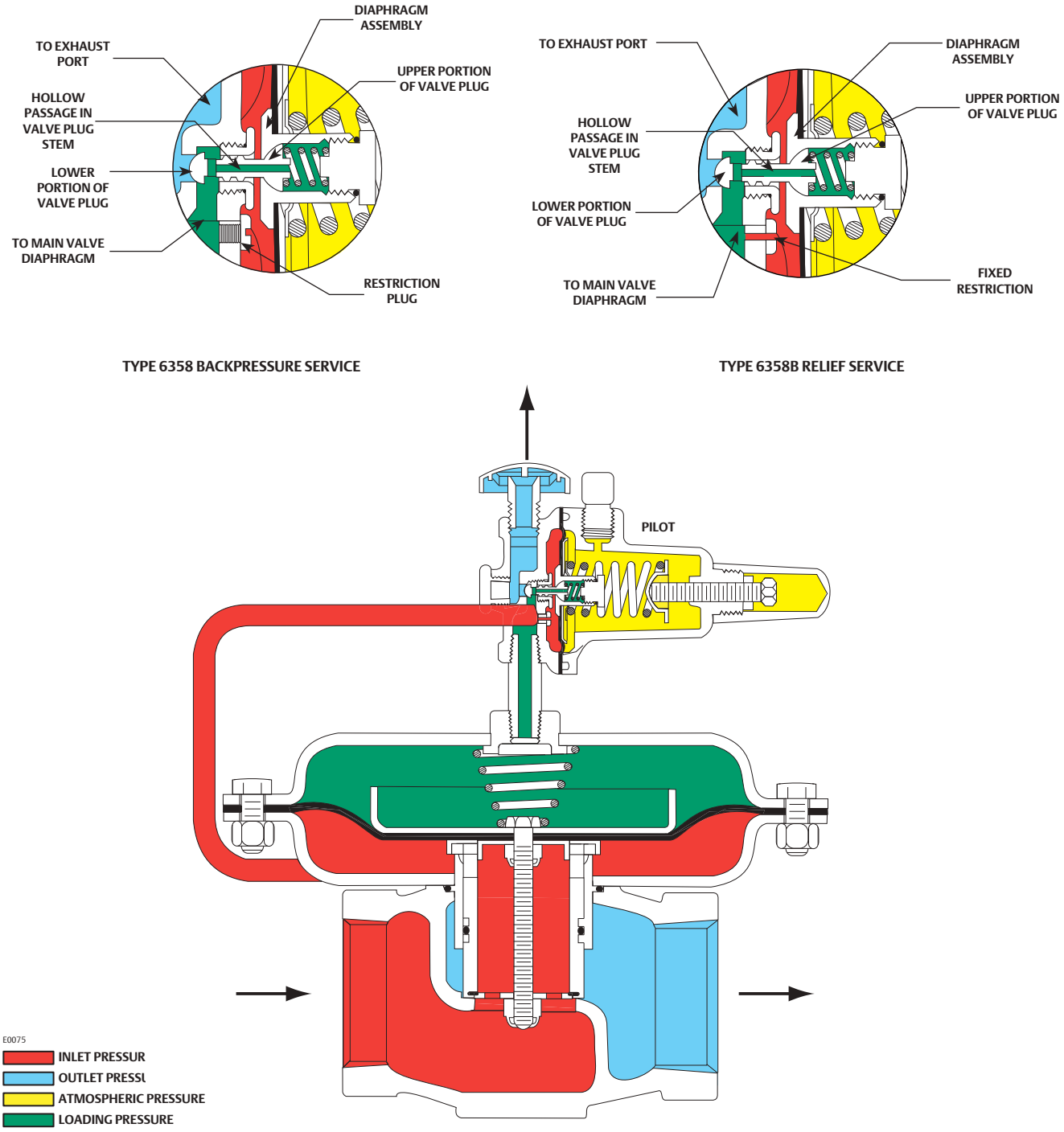


Figure 3. *Type 1808 with 6358 Series Operational Schematic*

Table 3. Relief Set Pressure Range

RELIEF SET PRESSURE RANGE		PART NUMBER	COLOR	WIRE DIAMETER		FREE LENGTH	
psig	bar			In.	mm	In.	mm
3 to 18	0.21 to 1.2	1B986027212	Green	0.120	3.05	2.12	54.0
15 to 40	1.0 to 2.8	1E392527022	Yellow	0.148	3.76	2.00	51.0
35 to 125	2.4 to 8.6	1K748527202	Red	0.192	4.88	2.19	55.6

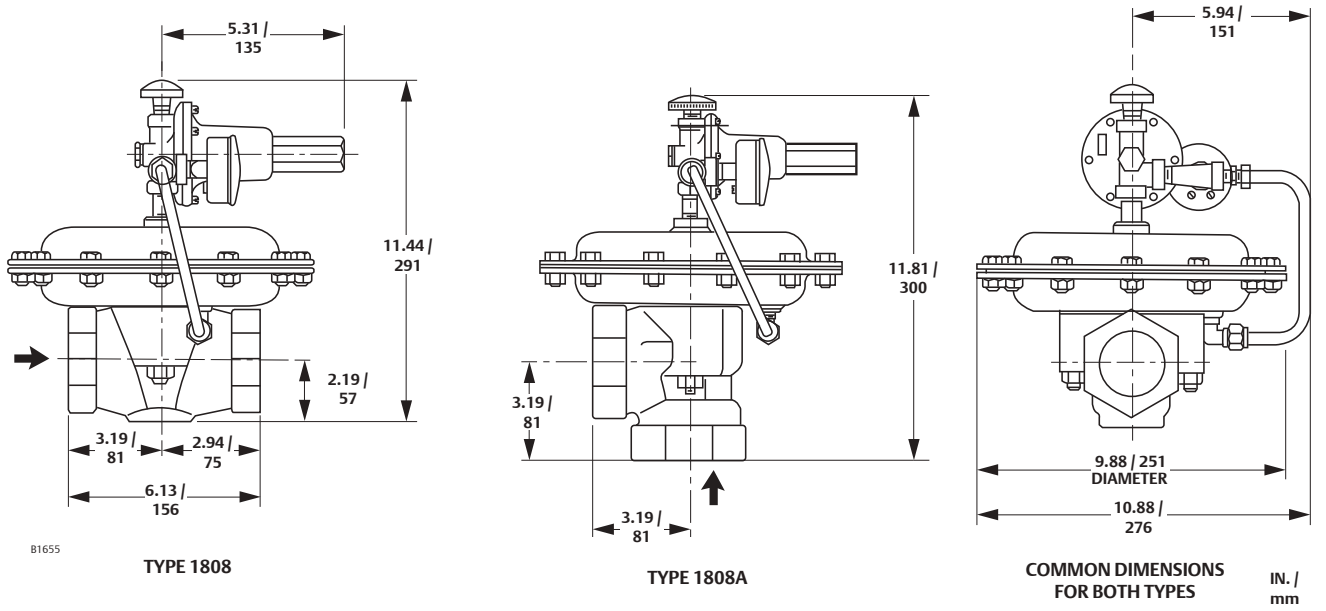


Figure 4. *Dimensions*

Table 4. Capacities for Type 1808 Using Standard Internal Control Line and Type 6358 or 6358B Pilot with High-Gain Restriction[1][2]

RELIEF PRESSURE SETTING		CAPACITY IN THOUSANDS OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
		Pressure Buildup in psig / bar Over Relief Pressure Setting													
		2 / 0.14		6 / 0.41		10 / 0.69		15 / 1.0		20 / 1.4		25 / 1.7		30 / 2.1	
psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
5	0.34	32	0.9	46	1.2	50	1.3	61	1.6	70	1.9	80	2.1	89	2.4
12	0.83	41	1.1	55	1.5	65	1.7	74	2.0	84	2.3	93	2.5	102	2.7
20	1.4	56	1.5	73	1.9	80	2.1	89	2.4	99	2.7	108	2.9	117	3.1
30	2.1	67	1.8	89	2.4	99	2.6	108	2.9	117	3.1	127	3.4	136	3.6
40	2.8	85	2.3	105	2.8	120	3.2	127	3.4	136	3.6	145	3.9	154	4.1
50	3.5	94	2.5	120	3.2	137	3.7	145	3.9	154	4.1	163	4.4	172	4.6
60	4.1	----	----	135	3.6	152	4.1	163	4.4	172	4.6	181	4.8	190	5.1
70	4.8	----	----	150	4.0	168	4.5	181	4.8	190	5.1	200	5.4	209	5.6
80	5.5	----	----	161	4.3	180	4.8	200	5.4	201	5.4	218	5.8	227	6.1
90	6.2	----		170	4.5	192	5.1	213	5.7	227	6.1	236	6.3	245	6.6
100	6.9			183	4.9	209	5.6	231	6.2	245	6.6	254	6.8	263	7.0
110	7.6			197	5.3	223	6.0	246	6.6	263	7.0	272	7.3	281	7.5
125	8.6			201	5.4	241	6.5	267	7.2	284	7.6	298	8.0	----	----

▭ - Shaded areas indicate capacities with main valve wide-open.

1. Capacities based on 0 psig / 0 bar outlet pressure. If outlet pressure is not 0 psig / 0 bar, shaded capacities may be recalculated using the wide-open C_g and the desired pressure drop.
2. For Type 1808A capacities, multiply the capacities in this table by 1.27.

Table 5. Capacities for Type 1808 Using Optional External Control Line and Type 6358B Pilot with High-Gain Restriction

SET PRESSURE RANGE		SET PRESSURE[1]		BUILD-UP OVER SET PRESSURE TO BEGIN OPENING MAIN VALVE[2]		BUILD-UP OVER SET PRESSURE TO FULLY OPEN MAIN VALVE[3]		PRESSURE DROP BELOW SET PRESSURE TO RESEAT PILOT		CAPACITIES OF 0.6 SPECIFIC GRAVITY NATURAL GAS[4]	
psig	bar	psig	bar	psig	bar	psig	bar	psi	bar	SCFH	Nm³/h
3 to 18	0.21 to 1.2	3	0.21	0.9	0.06	6.0	0.41	1.0	0.07	37,000	992
		5	0.34	0.7	0.05	4.0	0.28			37,000	992
		10	0.69	0.7	0.05	1.2	0.08			42,000	1126
		15	1.0	0.7	0.05	1.0	0.07			52,000	1394
15 to 40	1.0 to 2.8	15	1.0	0.8	0.05	1.1	0.08			53,000	1420
		20	1.4							63,000	1688
		30	2.1							82,000	2198
		40	2.8							101,000	2707
35 to 125	2.4 to 8.6	40	2.8	1.4	0.09	1.9	0.13			102,000	2734
		50	3.4							121,000	3243
		60	4.1							139,000	3725
		70	4.8							157,000	4208
		80	5.5	1.6	0.11	2.2	0.15			176,000	4717
		90	6.2							194,000	5200
		100	6.9							213,000	5708
		110	7.6							231,000	6191
		125	8.6							258,000	6914

1. Set pressure is defined as the pressure at which the pilot exhaust starts-to-bubble (discharge).
2. Crack pressure is the inlet pressure at which the main valve starts audible flow.
3. Inlet pressure build-up over the set pressure to achieve wide-open capacity.
4. Capacities with inlet piping equal to body size and without outlet piping.

Ordering Guide

Type (Select One)
- ☐ 1808 (globe body)***
- ☐ 1808A (angle body)**

Body Material (Select One)
- ☐ Cast iron***
- ☐ WCC Steel (Type 1808 only)*

Pilot (Select One)
- ☐ Type 6358 (for backpressure application)***
- ☐ Type 6358B (for relief application)***

Set Pressure (Select One)
- ☐ 3 to 18 psig / 0.21 to 1.2 bar, Green***
- ☐ 15 to 40 psig / 1.0 to 2.8 bar, Yellow***
- ☐ 35 to 125 psig / 2.4 to 8.6 bar, Red***

O-ring Material (Select One)
- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)**

Tubing and Fittings (Select One)
- ☐ Stainless steel tubing and steel fittings***
- ☐ Stainless steel tubing and stainless steel fittings***

Upstream Control Line Construction (Optional)
- ☐ Yes

Gauge (Optional)
- ☐ Yes

Pilot Supply Filter (Optional)
- ☐ Yes

Main Valve Parts Kit (Optional)
- ☐ Yes, please send one parts kit to match this order.

Pilot Parts Kit (Optional)
- ☐ Yes, please send one parts kit to match this order.

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

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☐ Relief Valve ☐ Backpressure Regulator
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Vents should be pointed down to help avoid the accumulation of water condensation or other materials in the spring case.

A/100 Series
Spring-Loaded Regulators

TARTARINI

Introduction
A/100 Series regulators ensure precise stable operation even when the requirements of the plant cause exceptionally unfavorable condition such as rapid fluctuations in demand.

These regulators are commonly used on industrial burners, with starting controlled by solenoid valves (on-off).

Type
Types A/102 and A/102-AP:
without slam-shut valve
Types A/109 and A/109-AP:
with slam-shut valve

Body Allowable Pressure
Up to 290 psig / 20.0 bar

Highest Operating Pressure
4.35 psig / 300 mbar

Maximum Inlet Pressure
116 psig / 8.0 bar

Inlet Pressure Range
1.45 to 116 psig / 0.1 to 8 bar

Set Range
0.14 to 4.35 psig / 10 to 300 mbar

Accuracy Class
Up to ±5%

Lock-up Pressure Class
Up to 10%

Maximum Flow Rate
Up to 21,189 SCFH / 568 Nm^3/h

Built-in Slam-Shut Valve
Independent pneumatic control
Accuracy class: ±5%
Response time: ≤ 1 second

Orifice
1/2, 5/8, 3/4 and 1 in. /
13, 16, 19 and 25 mm

Threaded Connections
2 in. BSP Inlet and Outlet

Operating Temperature
Standard version:
14 to 140°F / -10 to 60°C
Low-temperature version:
-4 to 140°F / -20 to 60°C

Additional Technical Data
For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

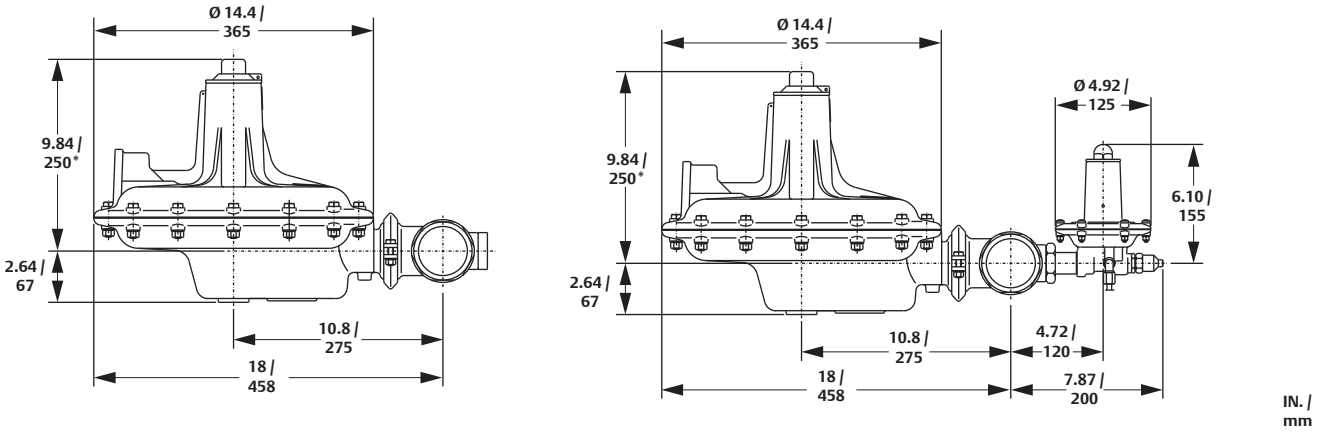
Features
- **Built-in Relief Valve**
- **Overpressure and Underpressure Slam-Shut Valve**
- **Manual Reset**
- **Inlet and Outlet In-Line**



Figure 1. *Type A/102 Spring-Loaded Regulator*



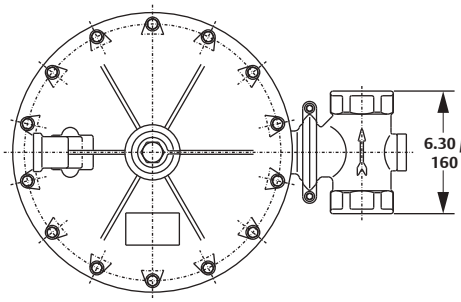
Figure 2. *Type A/109-AP Spring-Loaded Regulator*



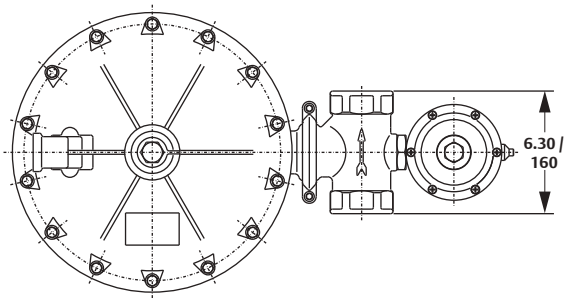
* IN HIGH PRESSURE VERSIONS (AP), THIS DIMENSION MUST BE INCREASED BY 3.94 IN. / 100 mm.

Figure 3. *A/100 Series Dimensions*

EMERSON
Process Management



TYPE A/102 OR A/102-AP



TYPE A/109 OR A/109-AP

IN. /
mm

* IN HIGH PRESSURE VERSIONS (AP), THIS DIMENSION MUST BE INCREASED BY 3.94 IN. / 100 mm.

Figure 3. *A/100 Series Dimensions (continued)*

Table 1. Construction Material

BODY	SERVOMOTOR	VALVE SEAT	DIAPHRAGM
Cast Iron GS	Aluminum	Brass	Nitrile (NBR)

Table 2. A/100 Series Capacities

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS										SEAT DIAMETER	
		Inlet Pressure, psig / bar											
psig	bar	0.435 / 0.03	1.02 / 0.07	4.35 / 0.30	7.25 / 0.50	14.5 / 1.00	21.76 / 1.5	29 / 2.0	43.5 / 3.0	58.02 / 4.0	116 / 8.0	In.	mm
0.14	0.01	---- ---- 1765 / 50.0 2472 / 70.0	1589 / 45.0 ---- 3001 / 85.0 3531 / 100	2295 / 65.0 3178 / 90.0 4414 / 125 5297 / 150	3531 / 100 3884 / 110 5297 / 150 6356 / 180	3884 / 110 4237 / 120 6003 / 170 6709 / 190	4237 / 120 4590 / 130 6356 / 180 7416 / 210	4590 / 130 4944 / 140 6356 / 180 8122 / 230	4944 / 140 4944 / 140 ---- ----	4944 / 140 4944 / 140 ---- ----	---- ---- ---- ----	1/2 5/8 3/4 1	12.7 15.8 19.5 25.4
0.29	0.02	---- ---- 1236 / 35.0 1942 / 55.0	1412 / 40.0 1765 / 50.0 2825 / 80.0 2825 / 80.0	3178 / 90.0 2825 / 80.0 4237 / 120 5650 / 160	3531 / 100 3884 / 110 6356 / 180 7062 / 200	4944 / 140 5297 / 150 7062 / 200 7416 / 210	4944 / 140 7062 / 200 7416 / 210 7769 / 220	5297 / 150 8122 / 230 7416 / 210 8828 / 250	5650 / 160 8122 / 230 ---- ----	5650 / 160 8122 / 230 ---- ----	5650 / 160 ---- ---- ----	1/2 5/8 3/4 1	12.7 15.8 19.5 25.4
0.73	0.05	---- ---- ---- ----	1412 / 40.0 ---- 3178 / 90.0 2825 / 80.0	2825 / 80.0 3178 / 90.0 6003 / 170 5297 / 150	3531 / 100 4590 / 130 7062 / 200 8828 / 250	6356 / 180 7769 / 220 8828 / 250 9534 / 270	7062 / 200 10,594 / 300 10,594 / 300 12,360 / 350	9181 / 260 12,360 / 350 13,419 / 380 14,125 / 400	12,360 / 350 14,125 / 400 15,538 / 440 ----	14,832 / 420 16,950 / 480 ---- ----	16,950 / 480 19,069 / 540 ---- ----	1/2 5/8 3/4 1	12.7 15.8 19.5 25.4
1.45	0.10	---- ---- ---- ----	---- ---- ---- ----	1412 / 40.0 3178 / 90.0 3178 / 90.0 4237 / 120	2825 / 80.0 5297 / 150 6003 / 170 7062 / 200	4237 / 120 7062 / 200 9181 / 260 10,594 / 300	6709 / 190 9181 / 260 11,300 / 320 12,006 / 340	8122 / 230 12,360 / 350 18,363 / 520 12,713 / 360	13,066 / 370 19,069 / 540 21,188 / 600 ----	17,657 / 500 21,188 / 600 21,188 / 600 21,188 / 600	21,188 / 600 21,188 / 600 ---- ----	1/2 5/8 3/4 1	12.7 15.8 19.5 25.4
2.90	0.20	---- ---- ---- ----	---- ---- ---- ----	1765 / 50.0 3178 / 90.0 3531 / 100 4237 / 120	2472 / 70.0 4237 / 120 5650 / 160 7416 / 210	3884 / 110 7062 / 200 8828 / 250 11,300 / 320	6003 / 170 8475 / 240 12,360 / 350 19,069 / 540	6709 / 190 10,594 / 300 15,538 / 440 21,188 / 600	11,653 / 330 16,950 / 480 21,188 / 600 ----	16,597 / 470 21,188 / 600 ---- ----	21,188 / 600 21,188 / 600 ---- ----	1/2 5/8 3/4 1	12.7 15.8 19.5 25.4
4.35	0.30	---- ---- ---- ----	---- ---- ---- ----	---- ---- ---- ----	1765 / 50.0 2295 / 65.0 2825 / 80.0 3531 / 100	4237 / 120 5297 / 150 6180 / 175 7062 / 200	5297 / 150 7062 / 200 8828 / 250 10,594 / 300	6356 / 180 8828 / 250 10,594 / 300 14,125 / 400	8122 / 230 10,594 / 300 ---- ----	10,594 / 300 12,360 / 350 ---- ----	12,360 / 350 14,125 / 400 ---- ----	1/2 5/8 3/4 1	12.7 15.8 19.5 25.4

Note: To determine equivalent capacities for air, propane, butane or nitrogen, multiply the capacity by the following appropriate conversion factor: 0.775 for air, 0.625 for propane, 0.548 for butane or 0.787 for nitrogen.

Ordering Guide

Type (Select One)

☐ A/102 or A/102-AP (without slam-shut valve)***
☐ A/109 or A/109-AP (with slam-shut valve)***

Inlet Pressure

_____ please specify

Outlet Pressure

_____ please specify

Set Pressure

_____ please specify

Temperature Requirement (Select One)

☐ **standard**
☐ Low Temperature

Special Requirement (Optional)

_____

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Downstream pressure always changes to some extent when inlet pressure changes.

Introduction

A/140 Series regulators are spring controlled single seated, with counterbalanced valve disc. They are usually supplied with safety valve and built in filter and can also be provided with shut-off device for minimum pressure, maximum pressure or minimum and maximum downstream pressure.

The regulators of the A/140 Series have been devised keeping in consideration the functionality of maintenance, in fact it is possible to replace the seat or the seals without removing the body from the line.

Type

Types A/142 and A/142-AP:
without shut-off device

Types A/149 and A/149-AP:
with shut-off device

Body Allowable Pressure

Up to 290 psig / 20.0 bar

Highest Operating Pressure

4.35 psig / 0.30 mbar

Maximum Inlet Pressure

87 psig / 6.0 bar

Inlet Pressure Range

1.45 to 87 psig / 0.10 to 6.0 bar

Set Range

0.14 to 4.35 psig / 10 to 300 mbar

Accuracy Class

Up to ±5%

Lockup Pressure Class

Up to ±10%

Maximum Flow Rate

Up to 31,783 SCFH / 900 Sm^3/h

Built-in Slam-Shut Valve

Built-in Pneumatic Control Accuracy Class: ±5%

Response Time: ≤1 second

Orifice

1-3/16 in. / 30 mm

Flanged Connection

2 in. / DN 50

Flange Rating

PN 16 UNI/DIN

Operating Temperature

Standard Version:
14 to 140°F / -10 to 60°C

Low Temperature Version:
-4 to 140°F / -20 to 60°C

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Counterbalanced Valve**
- **Available with or without Relief Valve**
- **AE/149 and AE/149-AP Monitor Version Available**
- **Overpressure and Underpressure Slam-Shut Valve**
- **Manual Reset**



Figure 1. *Type A/142 Spring-Loaded Regulator*

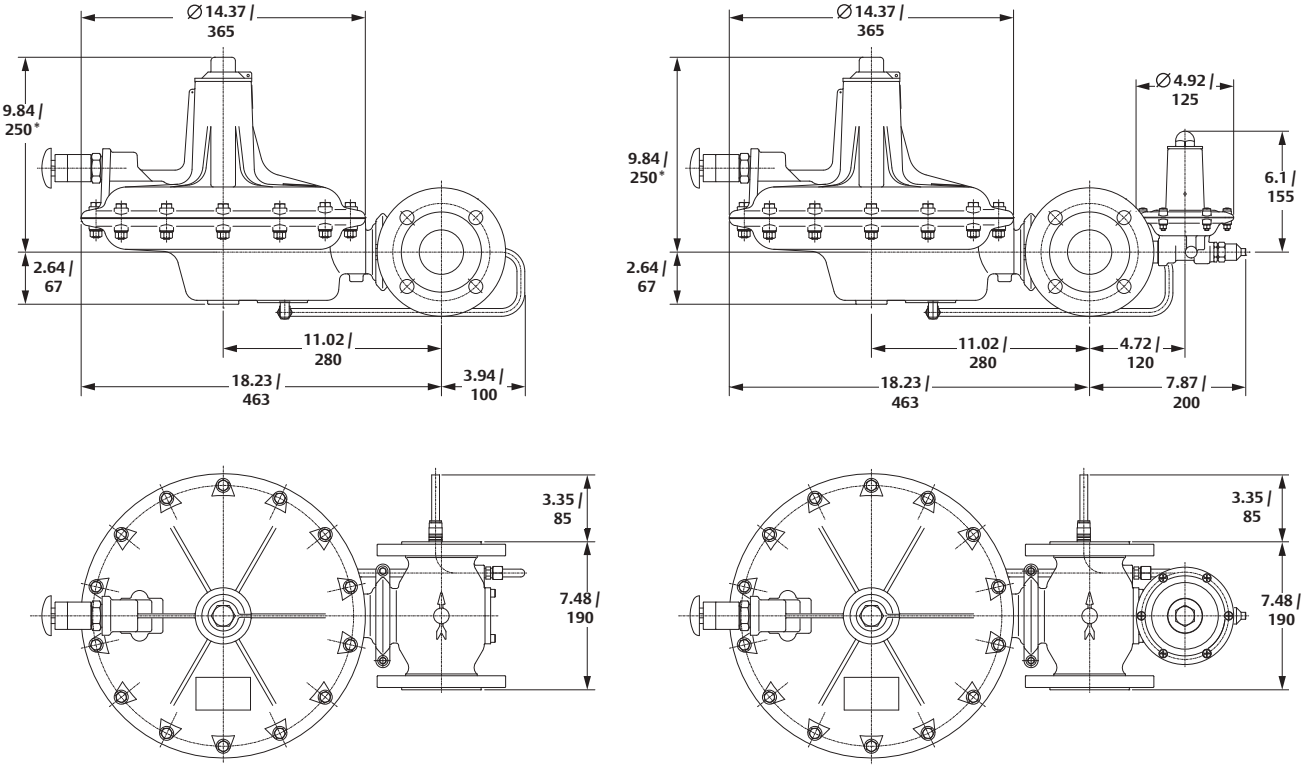


Figure 2. *Type A/149-AP Spring-Loaded Regulator*

Table 1. Construction Material

ACTUATOR CASING	Die-cast Aluminum
COVER	Die-cast Aluminum
VALVE CASING*	Cast iron
VALVE SEAT	Brass
DIAPHRAGM	Nitrile (NBR)
SEAL	Nitrile (NBR)

*Steel valve casing available on request.



*IN HIGH PRESSURE VERSIONS (AP), THIS DIMENSION MUST BE INCREASED BY 3.94 in. / 100 mm.

Figure 3. *A/140 Series Dimensions*

Table 2. A/140 Series Capacities

OUTLET PRESSURE, psig / bar		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS															
		Inlet Pressure, psig / bar															
		0.44 / 0.03	0.73 / 0.05	1.09 / 0.08	1.45 / 0.10	2.18 / 0.15	2.9 / 0.20	4.35 / 0.30	5.8 / 0.40	7.25 / 0.50	10.9 / 0.75	14.5 / 1.00	21.8 / 1.5	29.0 / 2.0	43.51 / 3.0	58.01 / 4.0	72.52 / 5.0
STANDARD	0.22 / 0.01	1765 / 50.0	2825 / 80.0	3531 / 100	4237 / 120	5297 / 150	6003 / 170	7769 / 220	8828 / 250	9888 / 280	12,006 340	14,125 / 400	17,657 / 500	21,188 / 600	22,954 / 650	26,485 / 750	31,783 / 900
	0.29 / 0.02	----	2648 / 75	3531 / 100	4237 / 120	5297 / 150	6003 / 170	7769 / 220	8828 / 250	9888 / 280	12,006 340	14,125 / 400	17,657 / 500	21,188 / 600	22,954 / 650	26,485 / 750	31,783 / 900
	0.45 / 0.03	----	2118 / 60.0	3178 / 90.0	3884 / 110	5297 / 150	6003 / 170	7769 / 220	8828 / 250	9888 / 280	12,006 340	14,125 / 400	17,657 / 500	21,188 / 600	22,954 / 650	26,485 / 750	31,783 / 900
	0.58 / 0.04	----	----	2825 / 80.0	3531 / 100	4944 / 140	6003 / 170	7416 / 210	8828 / 250	9888 / 280	12,006 340	14,125 / 400	17,657 / 500	21,188 / 600	22,954 / 650	26,485 / 750	31,783 / 900
	0.73 / 0.05	----	----	2472 / 70.0	3178 / 90.0	4944 / 140	5650 / 160	7416 / 210	8475 / 240	9534 / 270	12,006 340	14,125 / 400	17,657 / 500	21,188 / 600	22,954 / 650	26,485 / 750	31,783 / 900
	1.09 / 0.07	----	----	----	----	4237 / 120	5297 / 150	7062 / 200	8475 / 240	9534 / 270	12,006 340	14,125 / 400	17,657 / 500	21,188 / 600	22,954 / 650	26,485 / 750	31,783 / 900
A.P.	1.45 / 0.10	----	----	----	----	3531 / 100	4944 / 140	6709 / 190	8122 / 230	8828 / 250	12,006 340	14,125 / 400	17,657 / 500	21,188 / 600	22,954 / 650	26,485 / 750	31,783 / 900
	2.18 / 0.15	----	----	----	----	----	3531 / 100	6003 / 170	7769 / 220	8828 / 250	11,653 330	13,772 / 390	17,657 / 500	21,188 / 600	22,954 / 650	26,485 / 750	31,783 / 900
	2.90 / 0.20	----	----	----	----	----	----	4944 / 140	7062 / 200	8475 / 240	11,653 330	13,772 / 390	17,657 / 500	21,188 / 600	22,954 / 650	26,485 / 750	31,783 / 900
	4.35 / 0.30	----	----	----	----	----	----	----	5297 / 150	7416 / 210	10,947 310	13,419 / 380	17,657 / 500	21,188 / 600	22,954 / 650	26,485 / 750	31,783 / 900

Note: To determine equivalent capacities for air, propane, butane or nitrogen, multiply the capacity by the following appropriate conversion factor: 0.775 for air, 0.625 for propane, 0.547 for butane or 0.789 for nitrogen.

Ordering Guide

Type (Select One)

☐ A/142 or A/142-AP (without slam-shut valve)***
☐ A/149 or A/149-AP (with slam-shut valve)***

Inlet Pressure

_____ please specify

Outlet Pressure

_____ please specify

Set Pressure

_____ please specify

Temperature Requirement (Select One)

☐ **Standard**
☐ Low Temperature

Special Requirement (Optional)

_____

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

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www.emersonprocess.com/regulators

Regulators Quick Order Guide	
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**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Differential Pressure Setting:	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

If two or more available springs have published pressure ranges that include the desired pressure setting, use the spring with the lower range for better accuracy.

Type B
Pressure Reducing Regulator

FRANCEL

Introduction

The Type B regulator is a direct-operated, spring-loaded regulator providing economical, pressure reducing control in a variety of residential, commercial and industrial applications; and for a variety of gaseous fluids.

This compact regulator can be installed in a pressure reducing cabinet or a reducing and metering cabinet above ground or in underground modules.

Body Sizes

3/4 x 1-1/4 in. / DN 20 x 32

End Connections Styles

Inlet: Sphero-conical or flat joint connection

Outlet: Flat meter joint connection

Flow Capacities

0 to 1791 SCFH / 0 to 48 Nm^3/h
See Table 2

Pressure Registration

Internal

Maximum Inlet Pressure

58 psig / 4.0 bar
See Table 1

Maximum Outlet Pressure

161 in. w.c. / 400 mbar

Outlet Pressure Range

3.6 to 161 in. w.c. / 9 to 400 mbar
See Table 1

Accuracy

RG: 5
SG: 10

Construction Materials

Body and Casing: Zinc/Aluminum Alloy
Inlet and Outlet Connections: Brass
Inlet Filter: Bronze
Outlet Gasket: Composition
Plug: Brass
Disk Seat: Nitrile (NBR)
Diaphragm: Reinforced Nitrile (NBR)
Vent: Plastic

Temperature Capabilities

-22 to 140°F / -30 to 60°C

Approximate Shipping Weight

4.4 lbs / 2 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.francel.com

Features

- **Integral Slam-Shut Valve**
- **Compact Design**
- **Internal Relief**
- **Two Stages of Reduction for Constant Outlet Pressures**
- **Inlet Strainer**

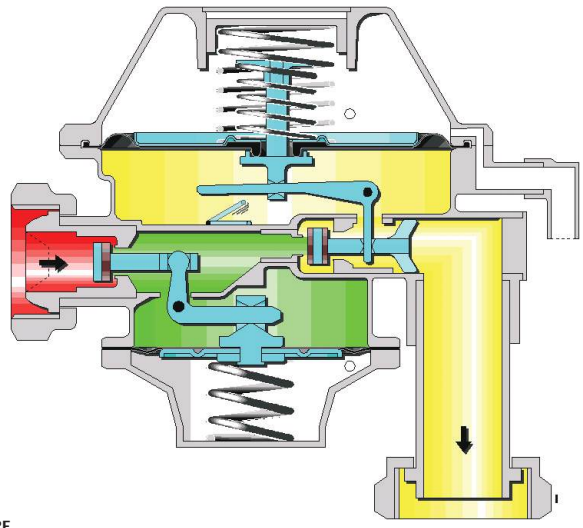


Figure 4. *Type B Operational Schematic*



Figure 1. *Type B 25 Pressure Reducing Regulator*

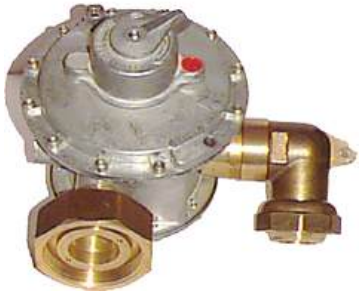


Figure 2. *Type B 50 Pressure Reducing Regulator*



Figure 3. *Type BCH 30 Pressure Reducing Regulator*

EMERSON
Process Management

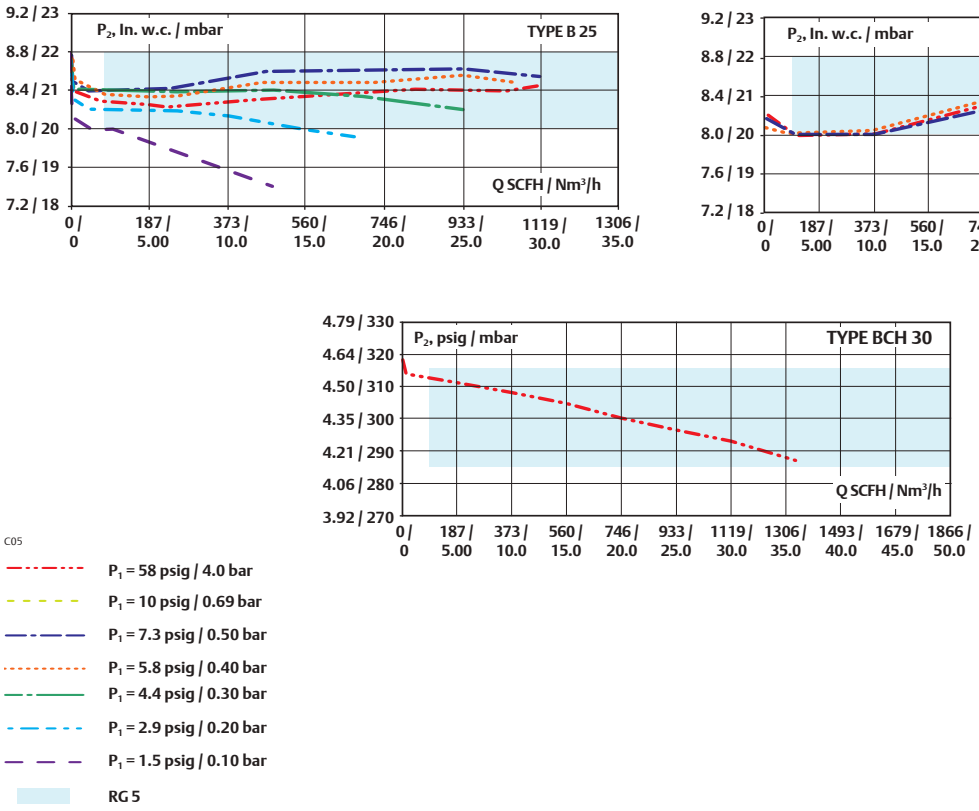


Figure 5. *Flow Curves*

Table 1. Maximum Pressure

PRESSURE		TYPE B 25		TYPE B 40		TYPE BCH 30	
		psig	bar	psig	bar	psig	bar
Inlet	Minimum	7.3	0.50	10.2	0.70	11.6	0.80
	Maximum	58	4.0	58	4.0	58	4.0
Outlet	Minimum	3.6 in. w.c.	9 mbar	3.6 in. w.c.	9 mbar	18.5-in. w.c.	46 mbar
	Maximum	18.0 in. w.c.	45 mbar	18.0 in. w.c.	45 mbar	161-in. w.c.	400 mbar
	Standard	8.4 in. w.c.	21 mbar	8.4 in. w.c.	21 mbar	121-in. w.c.	300 mbar

Table 2. Flow Capacity

INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS		
psig	bar	Type B 25	Type B 40	Type BCH 30
1.4	0.10	485 / 13.0	----	----
2.9	0.20	672 / 18.0	----	----
4.4	0.30	932 / 25.0	----	----
5.8	0.40	1045 / 28.0	----	----
7.3	0.50	1120 / 30.0	1493 / 40.0	----
10.2	0.70	1120 / 30.0	1791 / 48.0	----
11.6 to 58	0.80 to 4.0	1120 / 30.0	1791 / 48.0	1343 / 36.0
73	5.0	1120 / 30.0	1791 / 48.0	1343 / 36.0

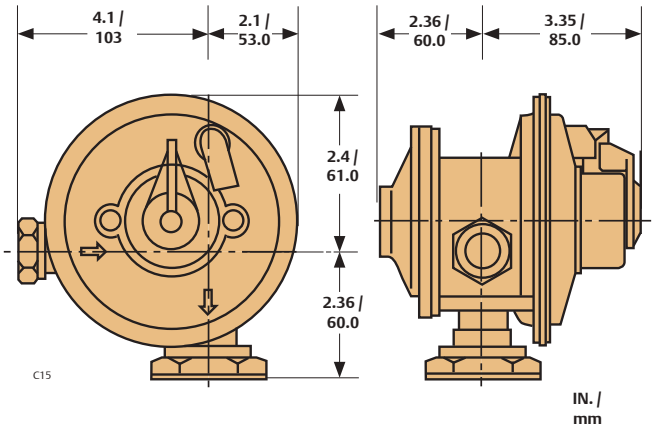


Figure 6. *Dimensions*

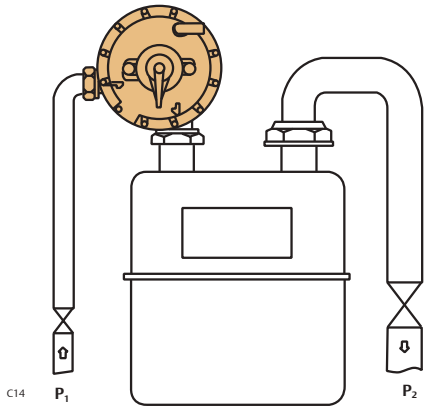


Figure 7. *Installation*

Ordering Guide

Type (Select One)
☐ B 25
☐ B 40
☐ B 50
☐ BCH 30

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

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www.emersonprocess.com/regulators

Regulators Quick Order Guide	
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Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Does the application require overpressure protection?
☐ Yes, which is preferred? ☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device
Is overpressure protection equipment selection assistance desired?
Pressure
Maximum Inlet Pressure (P_{1max}):
Minimum Inlet Pressure (P_{1min}):
Downstream Pressure Setting(s) (P_2):
Maximum Flow (Q_{max}):
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

All regulators should be installed and used in accordance with federal, state and local codes and regulations.

Introduction

The new Type B NG residential regulator is a direct-action, spring-loaded regulator, with high performance and reinforced safety features. It provides pressure reducing control in a variety of residential, commercial and industrial applications for a variety of gaseous fluids. This regulator is used in a distribution network with inlet pressure of 7.25 to 72.5 psig / 0.50 to 5.0 bar. Standard outlet pressures can be set at 8.5, 10.8 and 14.8 in. w.c. / 21, 27 and 37 mbar with a flow capacity of 224 and 373 SCFH / 6.0 to 10.0 Nm³/h. Other outlet settings available on request: 4 to 20 in. w.c. / 10 to 50 mbar with a flow capacity of 933 SCFH / 25.0 Nm³/h under specific conditions.

A shutoff valve cuts off the gas flow in the case of excessive flow, or when the outlet pressure drops below the setpoint (high gas demand or broken line) or in the case of inlet pressure dropping below the setpoint (network pressure drop or pipe damage).

The regulator can be manually reset after the safety function trips. The regulator is factory preset.

The new Type B6 NG is interchangeable with the current angle-shaped Type B6 N (same key dimensions).

Body Size

3/4 x 1-1/4 in. / DN 20 x 32

Flow Capacity

0 to 373 SCFH / 0 to 10.0 Nm³/h
See flow curves in Figure 3

Pressure Registration

Internal

Maximum Inlet Pressure

72.5 psig / 5.0 bar

Inlet Pressure Range

7.25 to 72.5 psig / 0.5 to 5 bar
(1.45 to 102 psig / 0.1 to 6 bar)
- on request

Maximum Outlet Pressure

20 in. w.c. / 50 mbar

Outlet Pressure Range

3.6 to 20 in. w.c. / 9 to 50 mbar

Accuracy Class

SG: Up to 20
AC: Up to 5

Temperature Capabilities

-4 to 140°F / -20 to 60°C
-22 to 140°F / -30 to 60°C (on request)

Approximate Shipping Weight

2.16 to 2.21 lbs / 0.98 to 1 kg



Figure 1. *Type B NG Pressure Reducing Regulator*

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Reinforced Integration**
- **Two Stages of Reduction for Constant Outlet Pressures**
- **Compact Design**
- **Internal Relief**
- **Inlet Strainer**

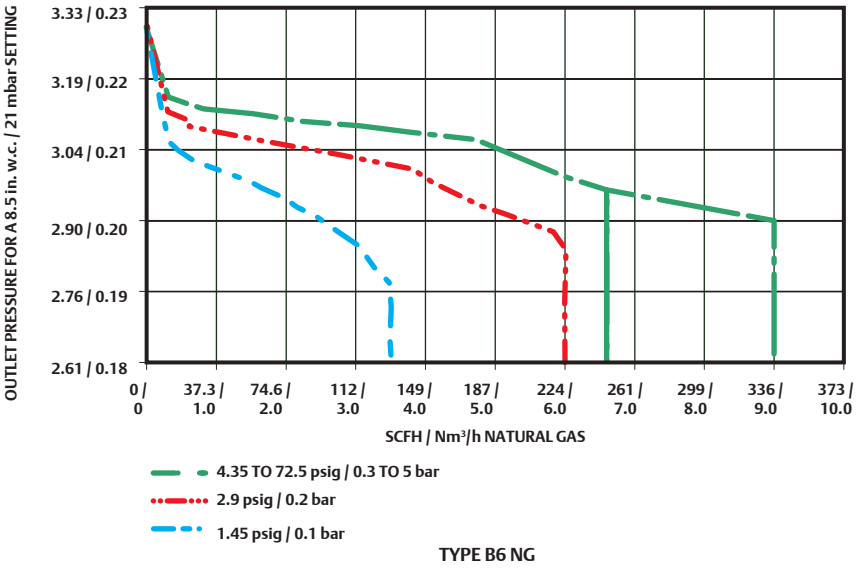


Figure 3. *Types B6 NG and B10 NG Flow Curve*

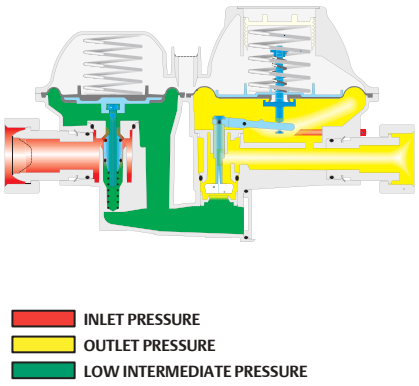


Figure 2. *Type B NG Operational Schematic*

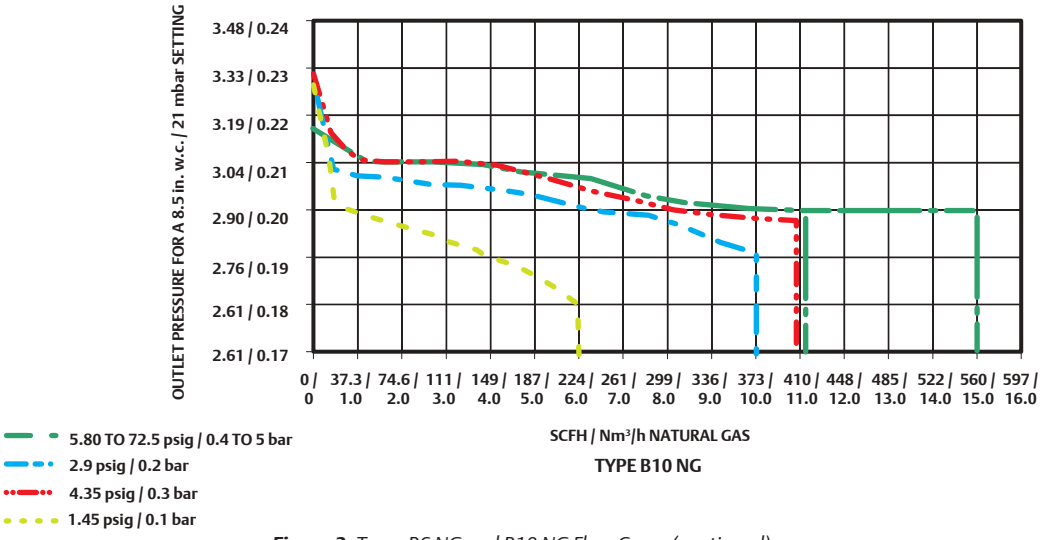
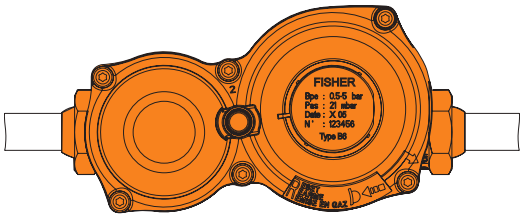
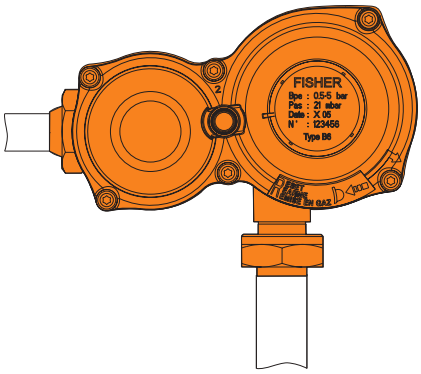


Figure 3. *Types B6 NG and B10 NG Flow Curve (continued)*

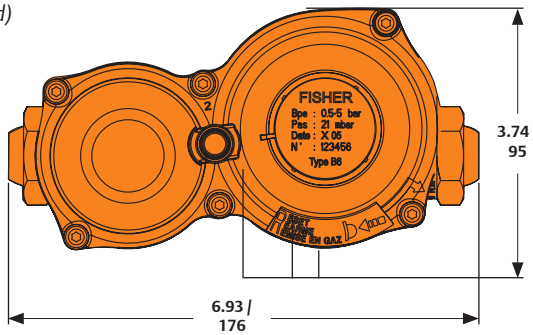


TYPE B NG LINE-SHAPE

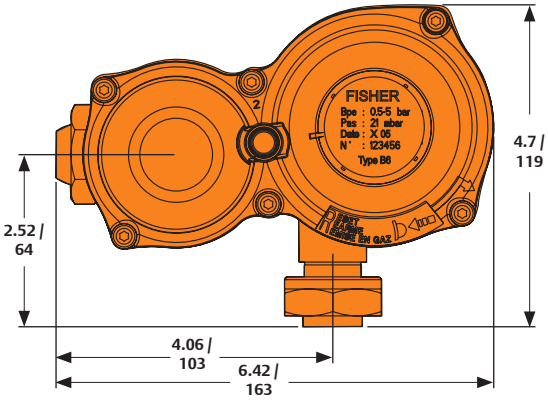


TYPE B NG ANGLE-SHAPE

Figure 4. *Type B NG Installation*



LINE-SHAPE DIMENSIONS



ANGLE-SHAPE DIMENSIONS

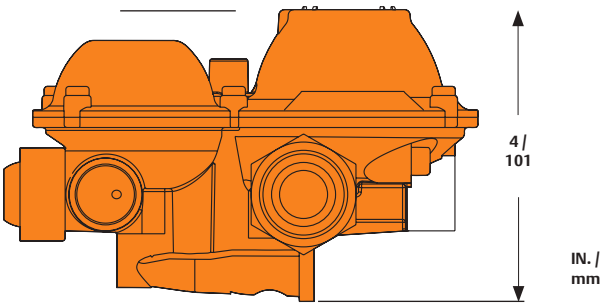


Figure 5. *Dimensions*

Table 1. Construction Materials			
BODY	Zinc/Aluminum Alloy	**1ST STAGE DISK ORIFICE**	Aluminum
CASING	Zinc/Aluminum Alloy	**2ND STAGE PLUG**	Nitrile (NBR)
INLET CONNECTION	Brass	**2ND STAGE DISK ORIFICE**	Brass
INLET FILTER	Bronze or Plastic	**DIAPHRAGM**	Nitrile (NBR)
OUTLET CONNECTION	Brass	**VENT SCREEN**	Stainless Steel
1ST STAGE PLUG	Nitrile (NBR)	**VENT**	Plastic (option)

Table 2. Capacities

INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS			
		Type B6 NG		Type B10 NG	
psig	bar	SCFH	Nm³/h	SCFH	Nm³/h
1.4	0.10	131	3.5	224	6
2.9	0.20	224	6.0	373	10
4.4	0.30	246	6.6	410	11
5.8	0.40	246	6.6	410	11
7.3	0.50	246	6.6	410	11
10.2	0.70	246	6.6	410	11
11.6 to 58	0.80 to 4.0	246	6.6	410	11
72.5	5.0	246	6.6	410	11

Ordering Guide

Type (Select One)

☐ B6 NG
☐ B10 NG

Installation Orientation (Select One)

☐ Direct Line
☐ Angle Line

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

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www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

When a regulator appears unable to pass the published flow rate, be sure to check the inlet pressure measured at the regulator body inlet connection. Piping up to and away from regulators can cause significant flowing pressure losses.

B/240 Series
Spring-Loaded Regulators

TARTARINI

Introduction

Construction and performance features make the B/240 Series spring-loaded regulators the ideal choice in applications involving sudden changes in capacity or where the gas shutoff is solenoid-controlled as with domestic or industrial burners.

These regulators can be employed with natural, manufactured, propane, air and other gases so long as they are duly filtered and do not contain high percentages of benzol.

Available Configurations

Types B/242 and B/242-AP:
Without safety shut-off device

Types B/249 and B/249-AP:
With safety shut-off device

Body Sizes and End Connection Styles

B/240 Series: NPS 1-1/2 / DN 40
BSP inlet and outlet

B/240-FS Series: NPS 1-1/2 / DN 40
PN 16 flanged

Body Allowable Pressure

Up to 290 psig / 20.0 bar

Highest Operating Pressure

4.35 psig / 0.30 bar

Maximum Inlet Pressure

87 psig / 6.0 bar

Inlet Pressure Range

1.45 to 87 psig / 0.10 to 6.0 bar

Outlet Pressure Ranges

Types B/242 and B/249:
0.14 to 1.1 psig / 10 to 75 mbar

Types B/242-AP and B/249-AP:
0.73 to 4.35 psig / 50 to 300 mbar
Range 300 to 500 mbar available on request

Accuracy Class

Up to ±5%

Lock-up Pressure Class

Up to 10%

Built-in Slam-Shut Valve

Independent pneumatic control
Accuracy class: ±5%
Response time: ≤1 second

Maximum Flow Rate

Up to 10,594 SCFH / 300 Stm³/h

Orifice

11/16 in. / 18 mm

Operating Temperature

Standard version:
14 to 140°F / -10 to 60°C

Low-temperature version:
-4 to 140°F / -20 to 60°C

Weights

Types B/242 and B/242-AP:
7.7 lbs / 3.5 kg

Types B/242-FS and B/242-AP-FS:
16.5 lbs / 7.5 kg

Types B/249 and B/249-AP:
9.9 lbs / 4.5 kg

Types B/249-FS and B/249-AP-FS:
18.7 lbs / 8.5 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Counterbalanced Valve**
- **Built-in Relief Valve**
- **Overpressure and Underpressure Slam-Shut Valve**
- **Manual Reset**
- **Inlet and Outlet In-line**



Figure 1. *Type B/242 Spring-loaded Regulator Balanced Plug*



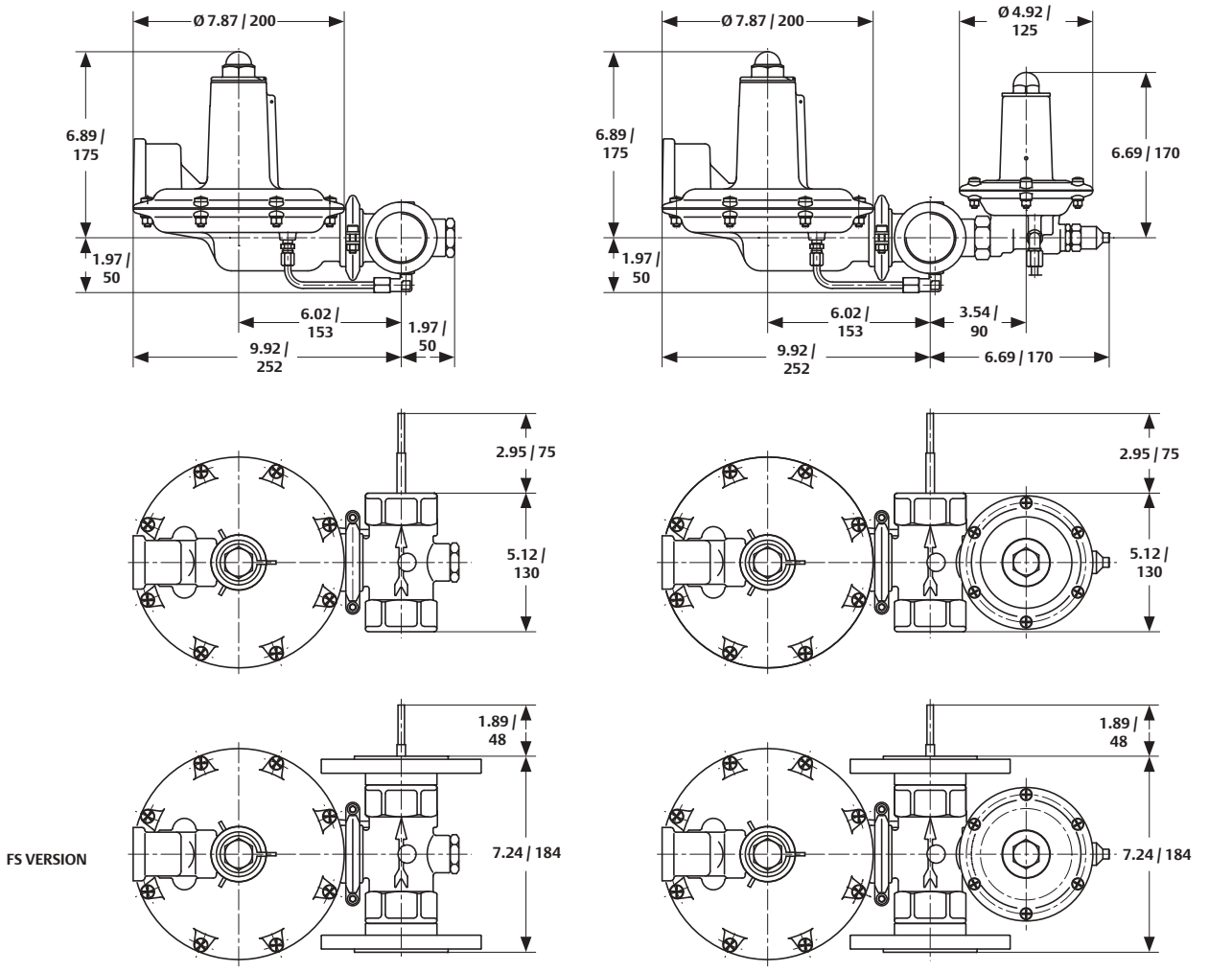
Figure 2. *Type B/249 Spring-loaded Regulator Balanced Plug*

Table 1. Construction Material

ACTUATOR CASING	Die-cast aluminum
COVER	Die-cast aluminum
VALVE CASING	Cast iron
VALVE DISK	Brass
VALVE SEAT	Brass
DIAPHRAGM	Nitrile (NBR)
SEAL	Nitrile (NBR)

TYPES B/242 AND B/242-AP

TYPES B/249 AND B/249-AP



IN. / mm

Figure 3. *Outline Dimensions*

Table 2. B/240 Series Capacities

OUTLET PRESSURE, In. w.c. / mbar		CAPACITIES IN SCFH / Stm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS															
		Inlet Pressure, psig / bar															
		0.4 / 28 mbar	0.7 / 48 mbar	1.09 / 75 mbar	1.45 / 0.10	2.17 / 0.15	2.9 / 0.20	4.35 / 0.30	5.8 / 0.40	7.2 / 0.50	10.9 / 0.75	14.5 / 1.0	21.7 / 1.5	29 / 2.0	43.5 / 3.0	58 / 4.0	72.5 and 87 / 5.0 and 6.0
STANDARD	6 / 15	424 / 12	530 / 15	706 / 20	1059 / 30	1413 / 40	1766 / 50	2295 / 65	2825 / 80	3531 / 100	4238 / 120	4238 / 120	6003 / 170	7063 / 200	8829 / 250	8829 / 250	8829 / 250
	8 / 20	----	530 / 15	706 / 20	1059 / 30	1413 / 40	1766 / 50	2295 / 65	2825 / 80	3531 / 100	4238 / 120	4238 / 120	6003 / 170	7063 / 200	8829 / 250	8829 / 250	8829 / 250
	12 / 30	----	424 / 12	706 / 20	1059 / 30	1413 / 40	1766 / 50	2295 / 65	2825 / 80	3531 / 100	4238 / 120	4238 / 120	6003 / 170	7063 / 200	8829 / 250	8829 / 250	8829 / 250
	16 / 40	----	----	530 / 15	883 / 25	1413 / 40	1766 / 50	2295 / 65	2825 / 80	3531 / 100	4238 / 120	4238 / 120	6003 / 170	7063 / 200	8829 / 250	8829 / 250	8829 / 250
	20 / 50	----	----	530 / 15	706 / 20	1413 / 40	1766 / 50	2295 / 65	2825 / 80	3531 / 100	4238 / 120	4238 / 120	6003 / 170	7063 / 200	8829 / 250	8829 / 250	8829 / 250
	30 / 75	----	----	----	530 / 15	1059 / 30	1589 / 45	2119 / 60	2825 / 80	3531 / 100	4238 / 120	4238 / 120	6003 / 170	7063 / 200	8829 / 250	8829 / 250	8829 / 250
A.P.	40 / 100	----	----	----	----	706 / 20	1413 / 40	1766 / 50	2825 / 80	3531 / 100	4238 / 120	4238 / 120	6003 / 170	7063 / 200	8829 / 250	9888 / 280	10,594 / 300
	60 / 150	----	----	----	----	----	1059 / 30	1413 / 40	2472 / 70	3531 / 100	4238 / 120	4238 / 120	6003 / 170	7063 / 200	8829 / 250	9888 / 280	10,594 / 300
	80 / 200	----	----	----	----	----	----	1059 / 30	2119 / 60	3531 / 100	4238 / 120	4238 / 120	6003 / 170	7063 / 200	8829 / 250	9888 / 280	10,594 / 300
	120 / 300	----	----	----	----	----	----	----	1766 / 50	2825 / 80	3885 / 110	3885 / 110	6003 / 170	7063 / 200	8829 / 250	9888 / 280	10,594 / 300

Note: To determine equivalent capacities for air, propane, butane or nitrogen, multiply the capacity by the following appropriate conversion factor: 0.78 for air, 0.63 for propane, 0.55 for butane or 0.79 for nitrogen.

Ordering Guide

Main Valve Diaphragm Material (Select One)

- ☐ Type B/242 or B/242-AP (without safety shut-off device)***
- ☐ Type B/249 or B/249-AP (with safety shut-off device)***

End Connection Style (Select One)

- ☐ NPS 1-1/2 / DN 40 BSP
- ☐ NPS 1-1/2 / DN 40 PN 16

Inlet Pressure (Specify)

Outlet Pressure (Specify)

Set Pressure (Select One)

Temperature Requirement (Select One)

- ☐ **Standard**
- ☐ Low Temperature

Special Requirements (Optional)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

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www.emersonprocess.com/regulators

Regulators Quick Order Guide	
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Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

When adjusting setpoint, the regulator should be flowing at least five percent of the normal operating flow.

Introduction

The Types BLE and BLX throttle valves functions as a bypass on transmission stations reducing pressure up to 1450 psig / 100 bar.

The Type BLX version is equipped with a Type OSE valve plug and a Type OS2 release relay to cut off pressure flow in case of outlet over pressure.

The Type BLE version consists of:

- A body (type E body) with removable orifice, closed with a cap which can also be used as a valve guide
- A balanced valve plug, opened by fluid flow, with linear characteristics
- A valve plug/orifice Nitrile (NBR) disk plug, removable and tight shutoff
- A valve plug guide with plastic rings and manual handwheel
- A button used as an opening indicator

The Type BLX version consists of:

- A body (type X body) including an inferior opening for lodging the slam-shut

The slam-shut includes:

- A valve plug/orifice assembly with connecting part
- A release relay Type OS2 including a mechanism box (Type BM) and a safety manometric box (Type BMS)

The Types BLE and BLX are in conformity with the Pressure Equipment Directive PED 97/23/CE and are classified in Category IV.

Maximum Operating Pressure

LCC Body: 1450 psig / 100 bar

WCB-20 Body: 1402 psig / 96.7 bar

Operating Temperature

LCC Body: -22 to 160°F / -30 to 71°C

WCB-20 Body: -4 to 160°F / -20 to 71°C

Slam-Shut (Type BLX only)

Response time: <1 second

Accuracy: 2.5; 5 (piston)

Setpoint range: 0.14 to 1450 psig / 0.01 to 100 bar

Resetting:
Manually after fault rectification

Position indicator:
On the mechanism box

Connections

Inlet/Outlet:

DN 25, 50, 80
ISO PN 100 B (CL600 RF)
ISO PN 50 B (CL300 RF)
ISO PN 20 B (CL150 RF)
Other connections available (contact factory)
ISO PN 16 B, 25 B, 40 B

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.francel.com

Features

- **Robust**
- **High Precision**
- **Progressive Opening**



Figure 1. *Type BLX Throttle Valve*

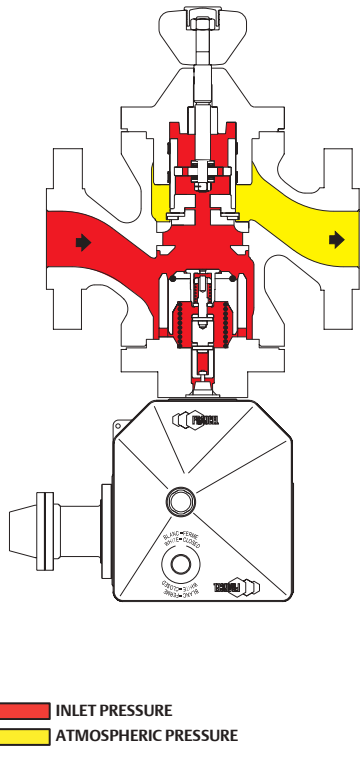


Figure 2. *Type BLX Operational Schematic*

Table 1. Construction Material

BODY	BONNET	SCREW HOLDER	ORIFICE	VALVE PLUG	DISK PLUG
Steel	Steel	Bronze	Stainless steel	Steel	Nitrile (NBR)

Table 2. Flow Coefficient

BODY SIZE		Q_f	C_g	C_1
In.	DN			
1	25	230	450	35
2	50	970	1880	
3	80	2150	4170	

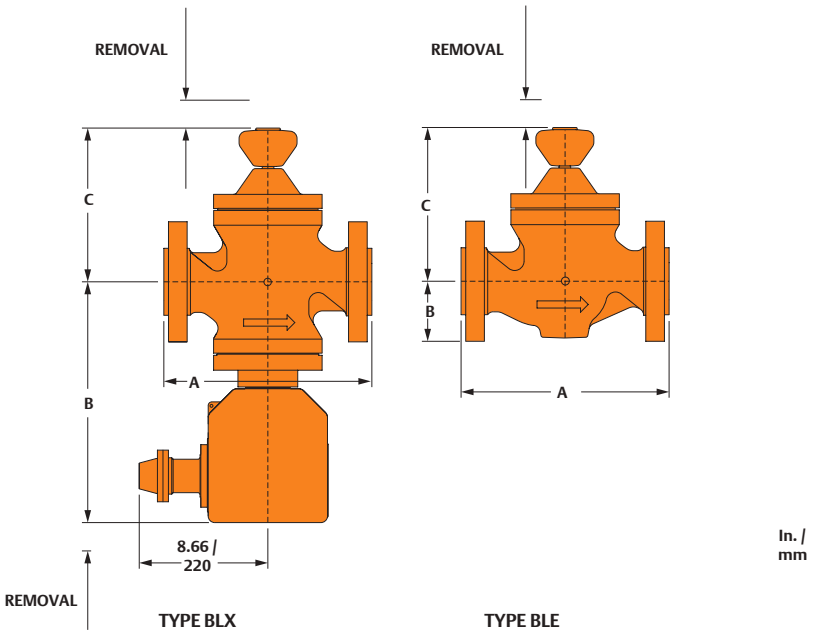


Figure 3. *Dimensions*

Table 3. Dimension and Shipping Weight

BODY SIZE		PN	DIMENSION FOR TYPES BLE (WITHOUT SLAM-SHUT) AND BLX (WITH SLAM-SHUT)												APPROXIMATE SHIPPING WEIGHT			
			A		B				C				REMOVAL		Type BLE		Type BLX	
					Type BLE		Type BLX		Type BLE		Type BLX							
In.	DN		In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	lbs	kg	lbs	kg
1	25	20	7.28	185	2.13	54	12.4	315	7.21	183	7.72	196	2.17	55	26.4	12	44.1	20
		50	7.77	197	2.44	62									28.6	13	46.3	21
		100	8.27	210											30.8	14	48.5	22
2	50	20	10.0	254	3.00	76	13.0	331	7.72	196	8.39	213	2.95	75	49.6	22	79.4	36
		50	10.5	267	3.27	83									54.0	24	83.8	38
		100	11.3	286											58.4	26.5	88.2	40
3	80	20	11.73	298	3.74	95	14.2	366	8.78	223	9.49	241	3.74	95	94.8	43	126	57
		50	12.52	318	4.13	105									108	49	139	63
		100	13.3	337											112	51	143	65

Ordering Guide

Type (Select One)

BLE (without slam-shut)
- ☐ 1 in. / DN 25
- ☐ 2 in. / DN 50
- ☐ 3 in. / DN 80

BLX (with slam-shut)
- ☐ 1 in. / DN 25
- ☐ 2 in. / DN 50
- ☐ 3 in. / DN 80

Inlet/Outlet Connections
- ☐ ISO PN 100 B (CL600 RF)
- ☐ ISO PN 50 B (CL300 RF)
- ☐ ISO PN 20 B (CL150 RF)
- ☐ ISO PN 16 B
- ☐ ISO PN 25 B
- ☐ ISO PN 40 B

Slam-Shut Valve (Optional, Select Range)

Maximum Only

Lowest
- ☐ 0.22 to 17.4 psig / 0.01 to 1.2 bar
- ☐ 29 to 116 psig / 2.0 to 8.0 bar
- ☐ 232 to 319 psig / 16.0 to 22.0 bar
- ☐ 580 to 798 psig / 40.0 to 55.0 bar
- ☐ 160 to 232 psig / 11.0 to 16.0 bar
- ☐ 507 psig / 35.0 bar

Highest
- ☐ 0.51 to 33 psig / 0.03 to 2.3 bar
- ☐ 74 to 232 psig / 5.1 to 16.0 bar
- ☐ 319 to 580 psig / 22.0 to 40.0 bar
- ☐ 798 to 1450 psig / 55.0 to 100 bar
- ☐ 319 to 507 psig / 22.0 to 35.0 bar
- ☐ 1044 psig / 72.0 bar

- continued -

Ordering Guide (continued)

Slam-Shut Valve (Optional, Select Range) (continued)

Minimum Only

Lowest

- ☐ 0.22 to 16 psig / 0.01 to 1.1 bar
- ☐ 29 to 116 psig / 2.0 to 8.0 bar
- ☐ 232 to 276 psig / 16.0 to 19.0 bar
- ☐ 551 to 725 psig / 38.0 to 50.0 bar
- ☐ 160 to 232 psig / 11.0 to 16.0 bar
- ☐ 406 psig / 28.0 bar

Highest

- ☐ 0.51 to 29 psig / 0.03 to 2.0 bar
- ☐ 68.2 to 209 psig / 4.7 to 14.4 bar
- ☐ 275 to 551 psig / 19.0 to 38.0 bar
- ☐ 725 to 1305 psig / 50.0 to 90.0 bar
- ☐ 232 to 406 psig / 16.0 to 28.0 bar
- ☐ 942 psig / 65.0 bar

Slam-Shut Valve (Optional, Select Range) (continued)

Minimum and Maximum

Lowest

- ☐ 0.145 to 6.53 psig / 0.01 to 0.45 bar
- ☐ 14.5 to 58 psig / 1.00 to 4.0 bar
- ☐ 79.8 to 120 psig / 5.5 to 8.3 bar
- ☐ 254 psig / 17.5 bar

Highest

- ☐ 0.51 to 33.4 psig / 0.03 to 2.3 bar
- ☐ 74 to 232 psig / 5.1 to 16.0 bar
- ☐ 319 to 507 psig / 22.0 to 35.0 bar
- ☐ 1044 psig / 72.0 bar

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www.emersonprocess.com/regulators

Regulators Quick Order Guide	
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Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

The full advertised range of a spring can be utilized without sacrificing performance or spring life.

BM5 Series
Slam-Shut Valve

TARTARINI

Introduction

The BM5 Series slam-shut valve is an automatic shut-off appliance suitable for installation as a safety device in regulating stations and gas distribution piping.

The slam-shut valve has the task to quickly shut off the gas flow when the pressure in control point(s) reaches a fixed set value.

The valve is a sleeve-type, as a consequence, does not need any external bypass to facilitate the opening of the valve itself.

The valve re-opening can be made only through a manual operation.

The BM5 Series slam-shut valves are used in natural gas regulating installations and air, propane, butane, LPG, city gas, nitrogen, carbon dioxide, hydrogen regulating or distribution installations.

Allowable Pressure

Up to 1450 psig / 100 bar

Inlet Pressure Range

0 to 1450 psig / 0 to 100 bar

Maximum Capacity

9,627,000 SCFH / 258,000 Nm^3/h

Overpressure Set Range

0.44 to 1160 psig / 0.03 to 80.0 bar

Underpressure Set Range

0.15 to 1160 psig / 0.01 to 80.0 bar

Accuracy Class

Up to ±1%

Response Time

≤ 1 second

Flow Coefficients

C_g: Up to 18,600

See Table 2

Flanged Connections

Same Inlet and Outlet:
NPS 1, 1-1/2, 2, 2-1/2, 3, 4 and 6 /
DN 25, 40, 50, 65, 80, 100 and 150

Flange Rating

PN 16/25
CL150 RF, CL300 RF and CL600 RF

Temperature Capabilities

Standard Version:
Working: 14 to 140°F / -10 to 60°C

Low Temperature Version:
Working: -4 to 140°F / -20 to 60°C

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Axial Flow**
- **Flanged Connections**
- **Protected Seal Pad**
- **Possible to Fit in all Positions**
- **Pressure Control in one or more Points of the Installation**
- **Starting up Following Overpressure and/or Underpressure**
- **Push-Button Manual Emergency Release**
- **Manual Reset through Rotation of the Reset Shaft Only**

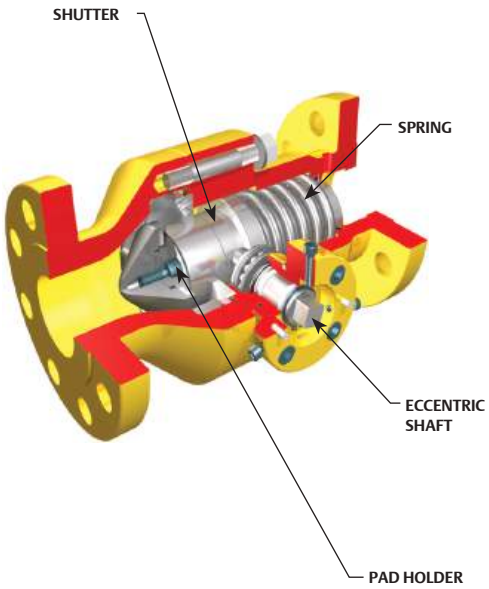


Figure 4. *BM5 Series Sectional View*



Figure 1. *Type BM5 with Type OS/80X-APA-D*



Figure 2. *Type BM5 with Type OS/84*



Figure 3. *Type BM5 with Type OS/80X-BP*

EMERSON
Process Management

Table 1. Construction Material				
BODY	SHUTTER	O-RING	PAD	PAD HOLDER
Steel	Steel	Nitrile (NBR) or Fluorocarbon (FKM)	Nitrile (NBR) or Fluorocarbon (FKM)	Steel

Table 2. Flow Coefficient			
BODY SIZE		C_g	C_1
NPS	DN		
1	25	525	29
1-1/2	40	1420	28
2	50	2250	26
2-1/2	65	3600	28
3	80	5400	30
4	100	8700	26
6	150	18,600	28

Table 3. Additional Specification										
FLANGE RATING	PN 16		PN 25		CL150 RF		CL300 RF		CL600 RF	
	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
ALLOWABLE PRESSURE	232	16.0	363	25.0	290	20.0	725	50.0	1450	100
INLET PRESSURE RANGE	0 to 232	0 to 16.0	0 to 363	0 to 25.0	0 to 290	0 to 20.0	0 to 725	0 to 50.0	0 to 1450	0 to 100
OVERPRESSURE SET RANGE	0.44 to 232	0.03 to 16.0	0.44 to 363	0.03 to 25.0	0.44 to 290	0.03 to 20.0	0.44 to 725	0.03 to 50.0	0.44 to 1160	0.03 to 80.0
UNDERPRESSURE SET RANGE	0.15 to 232	0.01 to 16.0	0.15 to 363	0.01 to 25.0	0.15 to 290	0.01 to 20.0	0.15 to 725	0.01 to 50.0	0.15 to 1160	0.01 to 80.0

Table 4. Construction and Functional Specifications of OS/80X and OS/80X-PN Series Pilots						
TYPE	SERVOMOTOR BODY RESISTANCE		OVERPRESSURE SET RANGE		UNDERPRESSURE SET RANGE	
	psig	bar	psig	bar	psig	bar
OS/80X-BP	72.5	5.00	0.44 to 29	0.03 to 2.00	0.15 to 8.7	0.01 to 0.60
OS/80X-BPA-D	290	20.0	0.44 to 29	0.03 to 2.00	0.15 to 8.7	0.01 to 0.60
OS/80X-MPA-D	1450	100	7.3 to 72.5	0.50 to 5.00	3.6 to 58	0.25 to 4.00
OS/80X-APA-D			29 to 145	2.0 to 10.00	4.4 to 102	0.30 to 7.00
OS/84X			72.5 to 595	5.0 to 41.0	58 to 232	4.0 to 16.0
OS/88X			261 to 1160	18.0 to 80.0	116 to 1015	8.0 to 70.0
OS/80X-PN			7.3 to 580	0.50 to 40.0	7.3 to 580	0.50 to 40.0
OS/84X-PN			435 to 1160	30.0 to 80.0	435 to 1160	30.0 to 80.0

Type OS/80X-PN: Pressure range 0.5 to 40 bar
Appliance made of Type OS/80X-APA-D set at about 0.4 bar and a variable number of Type PRX/182 pilots for overpressure and Type PRX/181 for underpressure, as many as necessary to control different points of the installation.
Type OS/84X-PN: Pressure range 30 to 80 bar
Appliance made of Type OS/84X set at about 20 bar and a variable number of Type PRX-AP/182 pilots for overpressure and Type PRX-AP/181 for underpressure, as many as necessary to control different points of the installation.

Table 5. OS/80X Series Pilot Material		
SERVOMOTOR BODY	Type OS/80X-BP	Aluminum
	Type OS/80X-BPA-D	Aluminum
	Type OS/80X-MPA-D	Steel
	Type OS/80X-APA-D	Steel
DIAPHRAGM	----	Fabric-finished Nitrile (NBR)
O-RING	----	Nitrile (NBR)

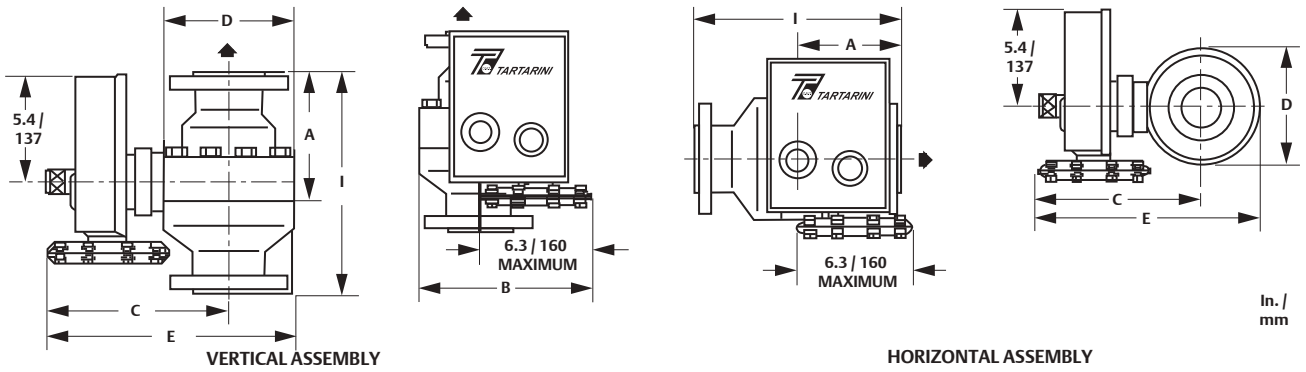


Figure 5. *Dimensions*

Table 6. Types OS/84X and OS/88X Pilot Material	
SERVOMOTOR BODY	Brass
LIP SEAL	Polytetrafluoroethylene (PTFE)
O-RING	Nitrile (NBR)

Table 7. PRX Series Pilot Material	
BODY	Steel
DIAPHRAGM	Fabric-finished Nitrile (NBR)
O-RING	Nitrile (NBR)

Table 8. Dimension

DIMENSION DESIGNATION		BODY SIZE													
		NPS 1 / DN 25		NPS 1-1/2 / DN 40		NPS 2 / DN 50		NPS 2-1/2 / DN 65		NPS 3 / DN 80		NPS 4 / DN 100		NPS 6 / DN 150	
		In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
A		3.93	100	4.92	125	5.71	145	6.10	155	6.50	165	7.68	195	9.84	250
B		8.66	220	9.25	235	9.65	245	10.04	255	10.83	275	11.61	295	14.37	365
C		7.87	200	8.07	205	8.47	215	8.86	225	9.65	245	10.63	270	14.96	380
D		4.92	125	6.10	155	6.50	165	7.48	190	9.06	230	10.83	275	16.14	410
E		10.24	260	11.02	280	11.81	300	12.60	320	14.17	360	16.14	410	23.03	585
I	PN 16	7.24	184	8.74	222	10	254	10.87	276	11.75	298	13.88	352	17.76	451
I	PN 25	7.24	184	----	----	10	254	----	----	11.75	298	13.88	352	17.76	451
I	CL150 RF	7.24	184	8.74	222	10	254	10.87	276	11.75	298	13.88	352	17.76	451
I	CL300 RF	7.76	197	9.25	235	10.49	266	11.50	292	12.50	317	14.51	368	18.62	473
I	CL600 RF	8.27	210	9.88	251	11.26	286	12.24	311	13.25	336	15.51	394	20	508

Note: Dimensions C are indicative and refer to models with the greatest overall dimensions. The threaded hole for the control piping connection is 1/4 NPT (internal).

Table 9. Shipping Weight

END CONNECTION STYLE	APPROXIMATE SHIPPING WEIGHT													
	Body Size													
	NPS 1 / DN 25		NPS 1-1/2 / DN 40		NPS 2 / DN 50		NPS 2-1/2 / DN 65		NPS 3 / DN 80		NPS 4 / DN 100		NPS 6 / DN 150	
	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
PN 16/25 - CL150 RF	33.07	15	46.30	21	57.32	26	83.77	38	119	54	183	83	375	170
CL300 RF/CL600 RF	37.48	17	55.12	25	66.14	30	90.39	41	137	62	231	105	617	280

Note: Weight of the valve complete with pilot.

Ordering Guide

Size (Select One)

- ☐ NPS 1 / DN 25***
- ☐ NPS 1-1/2 / DN 40***
- ☐ NPS 2 / DN 50***
- ☐ NPS 2-1/2 / DN 65***
- ☐ NPS 3 / DN 80***
- ☐ NPS 4 / DN 100***
- ☐ NPS 6 / DN 150***

End Connection Style (Select One)

- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ CL600 RF***
- ☐ PN 16***
- ☐ PN 25***

Elastomer Part (Select One)

- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)**

Orientation - Indicates Flow Direction (Select One)

- ☐ SD, Left-Hand - Right-Hand
- ☐ DS, Right-Hand - Left-Hand
- ☐ AB, Up-Down
- ☐ BA, Down-Up

Pilot Type (Select One)

- ☐ OS/80X-BP***
- ☐ OS/80X-BPA-D***
- ☐ OS/80X-MPA-D***
- ☐ OS/80X-APA-D***
- ☐ OS/84X***
- ☐ OS/88X***
- ☐ OS/80X-PN***
- ☐ OS/84X-PN***

Required Overpressure Setpoint (Specify)

Required Underpressure Setpoint (Specify)

Temperature Construction (Select One)

- ☐ Standard***
- ☐ Low Temperature**

Accessories (Select All that Apply)

- ☐ Proximity Switch
- ☐ Electrovalve for Remote Controlled Closure
- ☐ IT/3V Three-Way Valve for Setting Control (P_u max 50 bar)

Special Requirements

Ordering Guide (continued)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Looking for a specific product? When you know the application and Type or Series of the product you need, you can use the Quick Product Index in the Table of Contents, the Section Outline in the Application Map of each section, or the Product Index at the back of this Application Guide to direct you to the page on which the product is described.

Introduction

The BM6X Series axial flow slam-shut valves are an automatic shutoff appliance suitable for installation as a safety device in regulating stations and on gas transfer and distribution lines.

The reduced face-to-face dimension, which is typical of wafer valves, facilitates installation even in existing regulating stations that are not equipped with shutoff devices. The slam-shut valve rapidly interrupts the gas flow in cases in which the pressure at the control point or points reaches the set level.

The BM6X Series slam-shut valves are of the "wafer" type with an off-center butterfly disk that is mounted eccentrically. The gas flow favors closure of the valve. The valve can only be re-opened manually.

The BM6X Series slam-shut valves use gas from the gas line for operation and therefore it does not require outside sources to operate.

Body Sizes

NPS 3, 4, 6, 8, 10 and 12 /
DN 80, 100, 150, 200, 250 and 300

End Connection Style

CL150 RF, CL300 RF or CL600 RF

Flow Coefficients

See Table 4

Pressure Ratings

See Table 2

Accuracy Class

Up to ± 1%

Response Time

≤ 1 second

Type IT/2V By-Pass Valve Features

Material: Brass

Allowable Pressure:
1450 psig / 100 bar

Maximum Operating Pressure:
1450 psig / 100 bar

Threaded Pipe Fitting: 1/4 FNPT

Maximum Capacity

63,433,000 SCFH / 1,700,000 Nm³/h

Temperature Capabilities

Standard Version:
14 to 140°F / -10 to 60°C

Low Temperature Version:
-4 to 140°F / -20 to 60°C

Approximate Shipping Weight

See Table 9

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Axial Flow**
- **"Wafer" Type Valve**
- **Off-Center Butterfly Disk**
- **Pressure Control at One or More Points in the System**
- **Activation Due to Pressure Increase or Decrease**
- **Emergency Slam-Shut Push- Button**
- **Button By-Pass with Automatic Return**
- **Manual Reset by the Sole Rotation of the Reset Shaft**
- **Easy Maintenance**



Figure 1. *BM6X Series Slam-Shut Valve*



Figure 2. *BM6X Series Axial Flow Slam-Shut Valve*



Figure 3. *Type IT/2V By-Pass Valve*

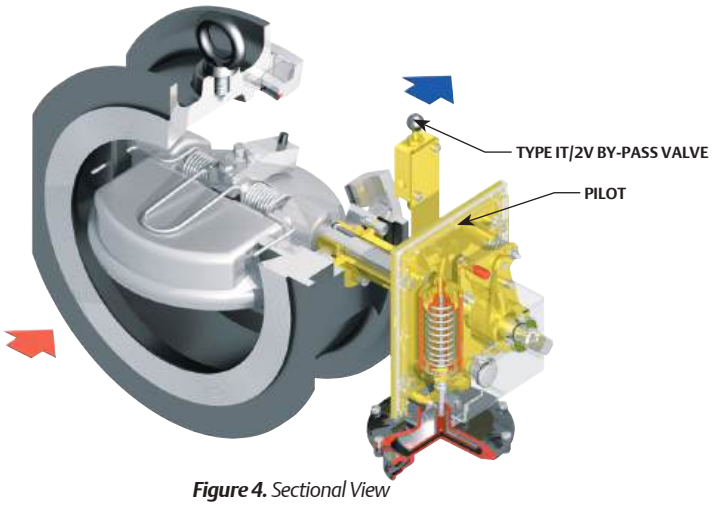
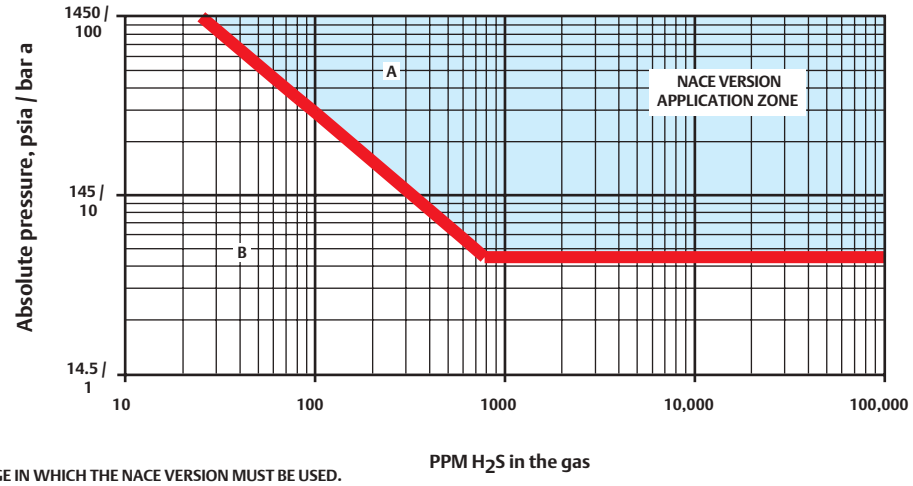


Figure 4. *Sectional View*



"A" ZONE INDICATES THE RANGE IN WHICH THE NACE VERSION MUST BE USED.
"B" ZONE INDICATES THE RANGE IN WHICH THAT VERSION IS NOT REQUIRED.

Figure 5. *Application Graph Based on the Amount of hydrogen sulfide (H_2S) Present in the Gas*

Table 1. Construction Material

Body	Steel
Butterfly Disk	Cast iron or Steel
Shaft	Steel
Spring	Stainless steel
Lip Seal	Fluorocarbon (FKM)
O-ring	Nitrile (NBR) or Fluorocarbon (FKM)

Table 2. Additional Specification

SPECIFICATION	PRESSURE RATING					
	End Connection					
	CL150 RF		CL300 RF		CL600 RF	
	psig	bar	psig	bar	psig	bar
Allowable Pressure	290	20.0	725	50.0	1450	100
Inlet Pressure Range	0 to 290	0 to 20.0	0 to 725	0 to 50.0	0 to 1450	0 to 100
Overpressure Set Range	0.44 to 290	0.03 to 20.0	0.44 to 725	0.03 to 50.0	0.44 to 1160	0.03 to 80.0
Underpressure Set Range	0.15 to 290	0.01 to 20.0	0.15 to 725	0.01 to 50.0	0.15 to 1160	0.01 to 80.0

Table 3. Construction and Functional Specifications of OS/80X-R and OS/80X-R-PN Series Pilots

VALVE FLOW FROM RIGHT TO LEFT	VALVE FLOW FROM LEFT TO RIGHT	BODY RESISTANCE		OVERPRESSURE SET RANGE		UNDERPRESSURE SET RANGE	
		psig	bar	psig	bar	psig	bar
Type OS/80X-BP-R	Type OS/80X-BP-S-R	72.5	5.0	0.44 to 29	0.03 to 2.0	0.15 to 8.7	0.01 to 0.60
Type OS/80X-BPA-D-R	Type OS/80X-BPA-D-S-R	290	20.0				
Type OS/80X-MPA-D-R	Type OS/80X-MPA-D-S-R	1450	100	7.25 to 72.5	0.50 to 5.0	3.63 to 58	0.25 to 4.0
Type OS/80X-APA-D-R	Type OS/80X-APA-D-S-R			29 to 145	2.0 to 10.0	4.35 to 102	0.30 to 7.0
Type OS/84X-R	Type OS/84X-S-R			72.5 to 595	5.0 to 41.0	58 to 232	4.0 to 16.0
Type OS/88X-R	Type OS/88X-S-R			261 to 1160	18.0 to 80.0	116 to 1015	8.0 to 70.0
Type OS/80X-R-PN	Type OS/80X-S-R-PN			7.25 to 580	0.50 to 40.0	7.25 to 580	0.50 to 40.0
Type OS/84X-R-PN	Type OS/84X-S-R-PN			435 to 1160	30.0 to 80.0	435 to 1160	30.0 to 80.0

Table 4. Flow Coefficient for BM6X Series

COEFFICIENT	NPS 3 / DN 80	NPS 4 / DN 100	NPS 6 / DN 150	NPS 8 / DN 200	NPS 10 / DN 250	NPS 12 / DN 300
C_g	4500	9000	20,250	36,000	55,800	81,000
C_1	18					

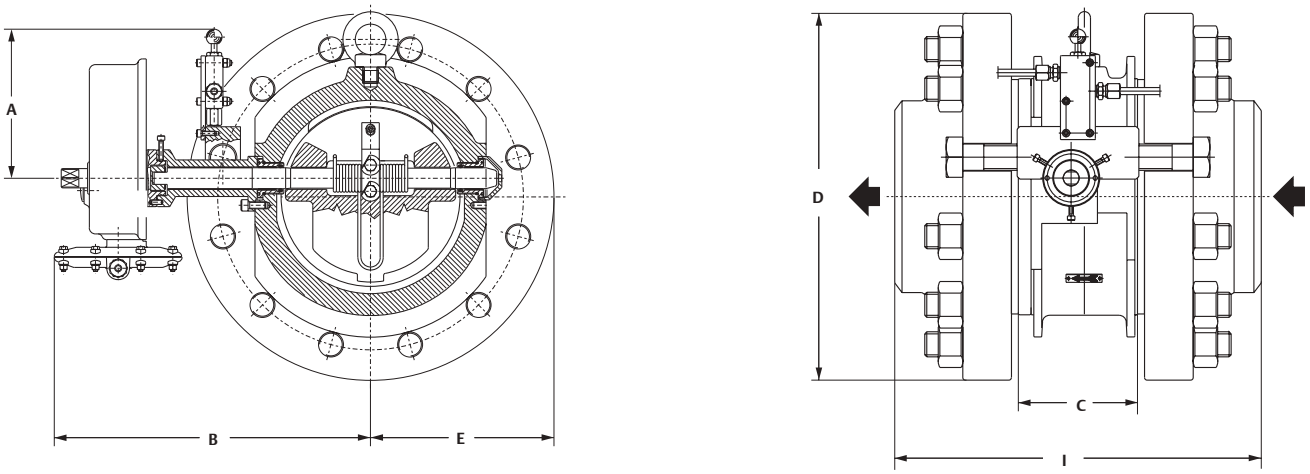


Figure 6. *Dimensions*

Table 5. OS/80X-R Series Pilot Material	
Servomotor Body	Types OS/80X-BP-R and OS/80X-BPA-D-R: Aluminum Types OS/80X-MPA-D-R and OS/80X-APA-D-R: Steel
Diaphragm	Fabric-finished Nitrile (NBR)
O-ring	Nitrile (NBR)

Table 6. Types OS/84X-R and OS/88X-R Material	
Servomotor Body	Brass
Lip Seal	Polytetrafluoroethylene (PTFE)
O-ring	Nitrile (NBR)

Table 7. PRX Series Pilot Material	
Body	Steel
Diaphragm	Fabric-finished Nitrile (NBR)
O-ring	Nitrile (NBR)

Table 8. Dimension

DESIGNATION		DIMENSION											
		Body Size											
		NPS 3 / DN 80		NPS 4 / DN 100		NPS 6 / DN 150		NPS 8 / DN 200		NPS 10 / DN 250		NPS 12 / DN 300	
		In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
A		6.10	155	6.69	170	8.66	220	8.66	220	8.66	220	8.66	220
B		9.84	250	11.4	290	16.3	415	17.5	445	18.9	480	20.1	510
C		2.13	54	2.76	70	4.02	102	5.32	135	6.61	168	8	203
CL150 RF	D	7.48	190	9.06	230	11	279	13.5	343	16	406	19	482
	E	3.74	95	4.53	115	5.51	140	6.77	172	8	203	9.5	241
	I	7.76	197	8.94	227	11.2	284	13.5	342	14.8	375	17.2	436
CL300 RF	D	8.27	210	10.0	254	12.5	318	15	381	17.5	445	20.5	521
	E	4.13	105	5.0	127	6.26	159	7.52	191	8.78	223	10.3	261
	I	8.54	217	9.65	245	11.9	303	14.2	361	16	407	18.4	468
CL600 RF	D	8.27	210	10.8	274	14.1	357	16.5	419	20	508	22	559
	E	4.13	105	5.39	137	7.05	179	8.66	220	10.0	254	11	280
	I	9.25	235	10.4	264	13.9	354	16.5	419	19.3	490	20.9	531

Note: Dimensions B are indicative and refer to the models with larger dimensions. The threaded opening for the connection of the control line is 1/4 NPT.

Table 9. Shipping Weight

END CONNECTION STYLE	APPROXIMATE SHIPPING WEIGHT											
	Body Size											
	NPS 3 / DN 80		NPS 4 / DN 100		NPS 6 / DN 150		NPS 8 / DN 200		NPS 10 / DN 250		NPS 12 / DN 300	
	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
CL150 RF	22.0	10	28.7	13	48.5	22	72.8	33	104	47	179	81
CL300 RF	22.0	10	28.7	13	57.3	26	92.6	42	123	56	198	90
CL600 RF	22.0	10	33.1	15	72.8	33	112	51	187	85	276	125

Ordering Guide

Body Size (Select One)

- ☐ NPS 3 / DN 80***
- ☐ NPS 4 / DN 100***
- ☐ NPS 6 / DN 150***
- ☐ NPS 8 / DN 200***
- ☐ NPS 10 / DN 250***
- ☐ NPS 12 / DN 300***

End Connection Style (Select One)

- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ CL600 RF***

Elastomer Part (Select One)

- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)**

Pilot (Select One)

- ☐ Type OS/80X-BP-R***
- ☐ Type OS/80X-BPA-D-R***
- ☐ Type OS/80X-MPA-D-R***
- ☐ Type OS/80X-APA-D-R***
- ☐ Type OS/84X-R***
- ☐ Type OS/88X-R***
- ☐ Type OS/80X-R-PN***
- ☐ Type OS/84X-R-PN***

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Orientation - Indicates Flow Direction (Select One)

- ☐ Flow from Left to Right (Clockwise Resetting)
- ☐ Flow from Right to Left (Counterclockwise Resetting)

Required Overpressure Setpoint (Specify)

Required Underpressure Setpoint (Specify)

Sour Gas Construction (Optional)

- ☐ Yes**
- ☐ No***

Accessories (Select All That Apply)

- ☐ Proximity Switch
- ☐ Electrovalve
- ☐ Type IT/3V 3-way valve

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Four easy ways to find the products you need . . .
1. Section headers at the top of each page are grouped by application of product (i.e., Natural Gas).
2. The Product Index at the back of this Application Guide contains a detailed list of products arranged by type and application.
3. If you know the application and product number, turn to the Application Map of that section and locate the Section Outline which indexes all of the products found in that section.
4. Look for the product type number in the Quick Reference Chart in the Table of Contents.

Introduction

The BM7 Series slam-shut valves are automatic isolating elements suitable for installation as safety devices in regulating stations. They assure easy installation and maintenance together with high accuracy.

Body Sizes and End Connection Styles

See Table 1

Flow Coefficients

See Table 4

Allowable Inlet Pressure

Up to 203 psig / 14.0 bar

Inlet Pressure Range

0 to 203 psig / 0 to 14.0 bar

Slam-Shut Pressure Ranges

Versions with Type OS/66:

Minimum Pressure Set Range:
0.10 to 6.5 psig / 0.007 to 0.45 bar

Maximum Pressure Set Range:
0.36 to 8.7 psig / 0.022 to 0.60 bar

Versions with Type OS/66-AP:

Minimum Pressure Set Range:
1.45 to 36.3 psig / 0.10 to 2.5 bar

Maximum Pressure Set Range:
2.90 to 72.5 psig / 0.20 to 5.0 bar

Maximum Capacity

36,194 SCFH / 970 Nm^3/h

Accuracy Class

Up to ±1%

Response Time

≤ 1 second

Temperature Capabilities

Standard Version:
Working: 14 to 140°F / -10 to 60°C

Low-Temperature Version:
Working: -4 to 140°F / -20 to 60°C

Approximate Weights

See Table 5

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Ease of Installation**
- **Ease of Maintenance**
- **High Operation Accuracy**



Figure 1. *BM7 Series with Threaded Connection*



Figure 2. *BM7 Series with Flanged Connection*

Table 1. Body Size and End Connection Style

TYPE	BODY SIZE		END CONNECTION STYLE
	NPS	DN	
BM7/1-1/2 in.	1-1/2		GAS
BM7/40-FS	1-1/2	40	PN 16 (with sliding flanges)
BM7/2 in.	2		GAS
BM7/50-F	2	50	PN 16

Table 2. Main Valve Construction Material

BODY	Type BM7/1-1/2-inch	Cast Iron
	Type BM7/40-FS	Cast Iron
	Type BM7/2-inch	Cast Iron
	Type BM7/50-F	Cast Iron or Steel
SEAT		Brass

Table 3. Slam-Shut Device Construction Material

TYPE	DIAPHRAGM	COVER	BODY
OS/66 and OS/66-AP	Nitrile (NBR)	Steel	Aluminum

Table 4. Flow Coefficient

TYPE	C_g	C_v	C_1
BM7/1-1/2-inch	170	5.86	29
BM7/40-FS	170	5.86	29
BM7/2-inch	500	17.2	29
BM7/50-F	650	22.4	29

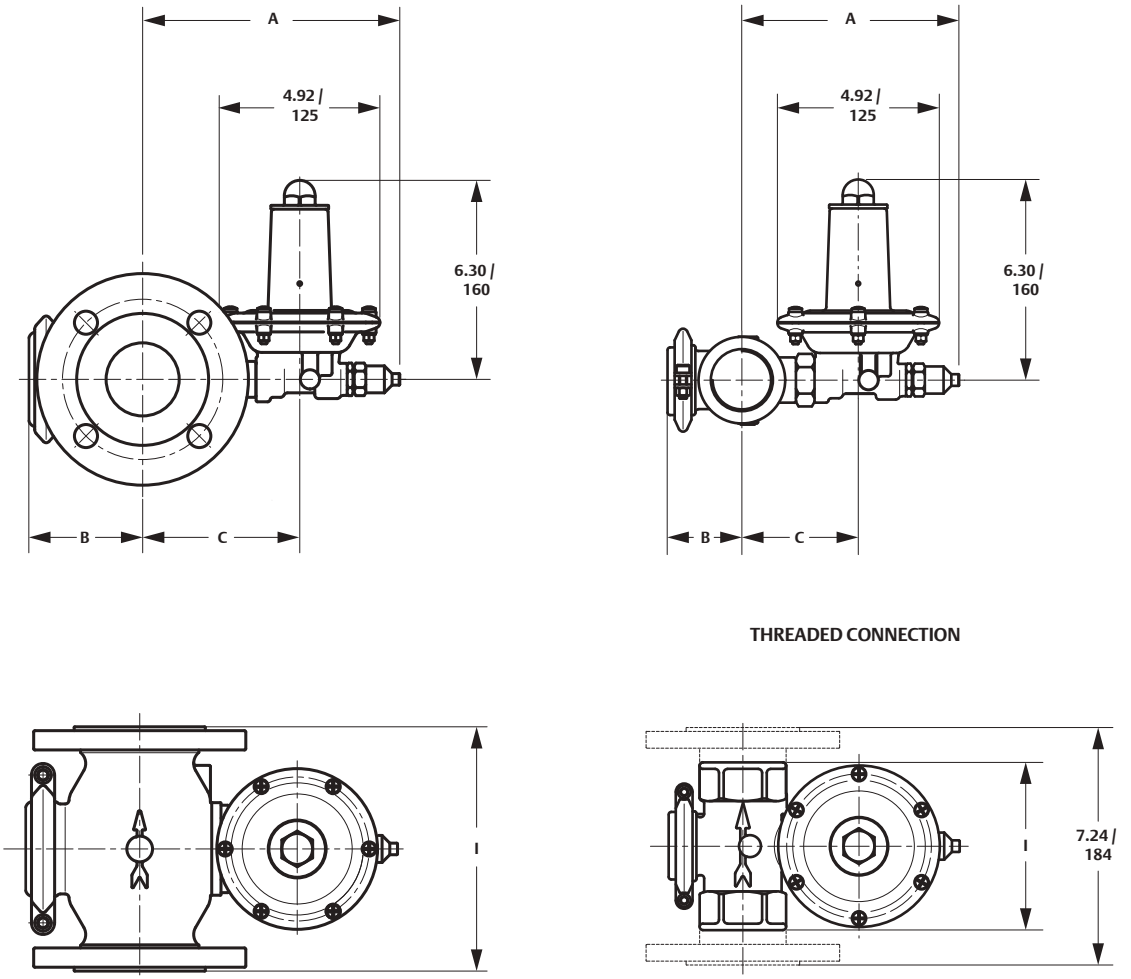


Figure 3. *Dimensions*

Table 5. Dimension and Approximate Weight

TYPE	DIMENSION								APPROXIMATE WEIGHT	
	A		B		C		I			
	In.	mm	In.	mm	In.	mm	In.	mm	LBB	kg
Threaded Connection										
BM7/1-1/2 in.	6.50 / 165		2.24 / 57		3.54 / 90		5.12 / 130		6.6	3
BM7/2 in.	7.48 / 190		3.35 / 85		4.72 / 120		6.30 / 160		15.4	7
Flanged Connection										
BM7/40-FS	6.50 / 165		2.24 / 57		3.54 / 90		7.24 / 184		11	5
BM7/50-F	7.68 / 195		3.54 / 90		4.92 / 125		7.48 / 190		28.7	13

Ordering Guide

Type (Select One)

- ☐ BM7/1-1/2 in.***
- ☐ BM7/40-FS***
- ☐ BM7/2 in.***
- ☐ BM7/50-F***

Elastomer Part (Select One)

- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)**

Required Overpressure Setpoint

_____ please specify

Required Underpressure Setpoint

_____ please specify

Temperature Construction (Select One)

- ☐ Standard***
- ☐ Low Temperature**

Sour Gas Construction (Optional)

- ☐ Yes**
- ☐ No***

Accessory (Optional)

- ☐ Proximity Switch

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

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To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

All regulators should be installed and used in accordance with federal, state and local codes and regulations.

CNF, CN, CF and SV Series

Tube Bundle Heat Exchangers

TARTARINI

Introduction

In the gas pressure reduction process by the "Joule-Thomson" effect, temperature drops considerably about 33°F / 0.5°C per reduction bar are estimated.

This fall in gas temperature can damage equipment due to formation of dangerous ice crystals produced by water vapor in the gas.

In first stage stations in particular, gas must be heated before pressure is reduced, since high pressure changes are usually involved.

It is recommended that, after reduction, gas temperature should not be below 41°F / 5°C.

One of the best established methods of heating gas in reduction stations is to use heat exchangers employing hot water or steam as their thermal carrier fluid.

The heat exchangers we produce are sized and designed to meet a very wide range of system requirements, and include all connections for accessories.

Available Configurations

Water as Thermal Carrier Fluid:
CNF, CN and CF Series

Steam as Thermal Carrier Fluid:
SV Series

Applications

- For pre-heating natural gas in first reception and reduction stations and for all gas heating requirements
- Non-Corrosive Gases
- Maximum Water Temperature: 194°F / 90°C (CNF, CN and CF Series)
- Maximum Steam Temperature: 248°F / 120°C (SV Series)

Installation and Assembly

- Heat Exchangers designed for installation with vertical tube bundle
- Can be supplied with different tube bundle configurations upon request

End Connections

See Table 1

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Tube Bundle Heat Exchangers Using U-tubes (BEU)**
- **Tube Bundle with Inspection Facility**
- **Gas in Tubes Section, Thermal Carrier Fluid in Shell Section**
- **Axial Connections in Gas Section**
- **Designed for Installation of Automatic Air Escape**
- **Designed for Installation of Relief Valve**



Figure 1. *Tube Bundle Heat Exchangers*

Table 1. CNF, CN, CF and SV Series End Connections and Thermal Characteristics

RATING	DESIGN PRESSURE		HYDROSTATIC TEST		PNEUMATIC TEST	
	psig	bar	psig	bar	psig	bar
Gas Side						
CL300 RF	653	45.0	827	57.0	102	7.0
CL600 RF	1305	90.0	1639	113	102	7.0
Water or Steam Side						
UNI/DIN PN 6	73	5.0	----	----	109	7.5

Table 2. CNF, CN, CF and SV Series Construction Materials

SHELL ON GAS SECTION	FLANGE	BUILT-IN FLANGE	TUBE PLATE	STUD BOLT	NUT	CONNECTION	SEAL
Steel	Steel	Steel	Steel	Steel	Steel	Steel	Nitrile (NBR)

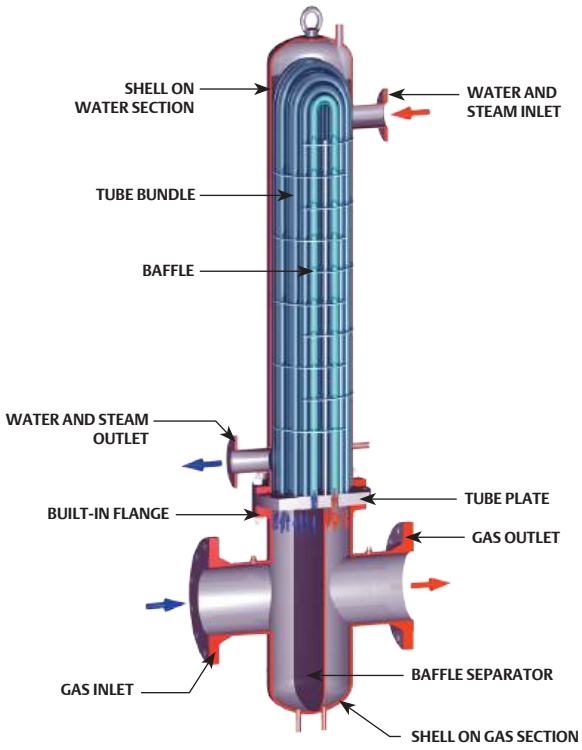


Figure 2. *Tube Bundle Heat Exchangers Operational Schematic*

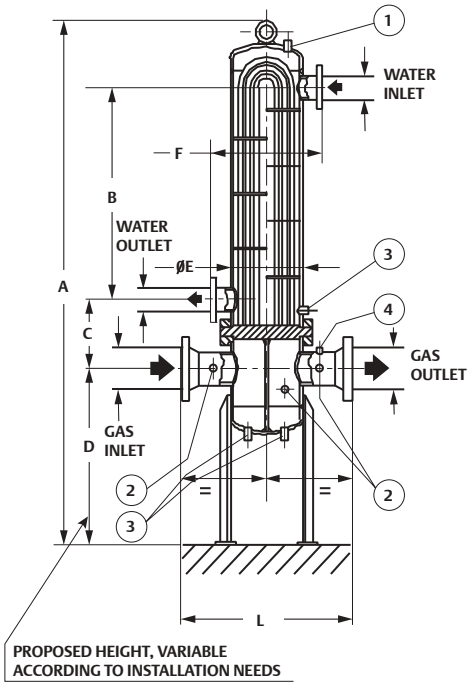


Figure 3. *CNF, CN and CF Series Dimensions*

Table 3. Types of Thermal Carrier Fluid

HOT WATER NATURAL CONVECTION[1]	HOT WATER FORCED CONVECTION[2]	STEAM[3]
Type CNF-05-AP Type CNF-1-AP Type CN2-AP	Type CNF-05-AP Type CNF-1-AP Type CF2 -AP Type CF3 -AP Type CF1-AP/5000 Type CF1-AP/8000 Type CF1-AP/12500 Type CF1-AP/17500	Type SV3-AP Type SV-AP/5000 Type SV-AP/8000 Type SV-AP/12500

1. Recommended for medium capacities up to a maximum of 45,000 Kcal/h.
2. Recommended for medium and large capacities up to a maximum of 75,000 Kcal/h.
3. Make sure steam pressure and temperature does not exceed 29 psia / 2.0 bar a and 248°F / 120°C respectively. If these values are exceeded, reduce them adequately before use. For these exchangers, it is normal practice to assume the same capacity as for those using forced circulation water.

Table 4. CNF, CN and CF Series Optional Connections

POSITION	QUANTITY	DESCRIPTION
1	1	Coupling 3/8-in. GAS-F
2	3	Thredolet 1/2-in. NTP
3	3	Coupling 1/2-in. GAS-M
4	2	Thredolet 1/4-in. NTP

Table 5. CNF, CN and CF Series Dimensions and Shipping Weights

TYPE	DIMENSION, In. / mm											APPROXIMATE SHIPPING WEIGHT, Lb / kg
	Gas Side		Water Side		A	B	C	D[1]	Ø E	F	L	
	Inlet (Maximum)	Outlet (Maximum)	Inlet (Maximum)	Outlet (Maximum)								
CNF-05-AP	1.97 / 50	1.97 / 50	1.97 / 50	1.97 / 50	74.0 / 1880	27.6 / 700	8.66 / 220	31.5 / 800	5.55 / 141	13.8 / 350	19.7 / 500	198 / 90
CNF-1-AP	3.94 / 100	3.94 / 100	2.56 / 65	2.56 / 65	76.0 / 1930	27.9 / 710	9.72 / 247	31.5 / 800	7.64 / 194	15.75 / 400	21.65 / 550	441 / 200
CN2-AP	4.92 / 125	4.92 / 125	3.15 / 80	3.15 / 80	97.2 / 2470	45.3 / 1150	12.6 / 320	31.5 / 800	8.62 / 219	16.54 / 420	25.6 / 650	562 / 255
CF2-AP	4.92 / 125	4.92 / 125	3.15 / 80	3.15 / 80	97.2 / 2470	45.3 / 1150	12.6 / 320	31.5 / 800	8.62 / 219	16.54 / 420	25.6 / 650	562 / 255
CF3-AP	5.91 / 150	5.91 / 150	3.15 / 80	3.15 / 80	102.2 / 2595	43.3 / 1100	16.9 / 430	31.5 / 800	10.75 / 273	23.6 / 600	31.5 / 800	683 / 310
CF1-AP/5000	7.87 / 200	7.87 / 200	3.15 / 80	3.15 / 80	100 / 2540	39.4 / 1000	16.7 / 425	31.5 / 800	12.75 / 324	23.6 / 600	31.5 / 800	1323 / 600
CF1-AP/8000	9.84 / 250	9.84 / 250	3.15 / 80	3.15 / 80	117.9 / 2995	41.3 / 1050	22.8 / 580	39.4 / 1000	18.0 / 457	31.5 / 800	43.3 / 1100	1984 / 900
CF1-AP/12500	11.8 / 300	11.8 / 300	5.91 / 150	5.91 / 150	120.1 / 3050	37.4 / 950	26.0 / 660	39.4 / 1000	20.0 / 508	31.5 / 800	47.2 / 1200	2866 / 1300
CF1-AP/17500	13.8 / 350	13.8 / 350	7.87 / 200	7.87 / 200	130.5 / 3315	37.4 / 950	32.3 / 820	39.4 / 1000	22.04 / 560	31.5 / 800	49.2 / 1250	2976 / 1350

1. Proposed height, variable according to installation needs.

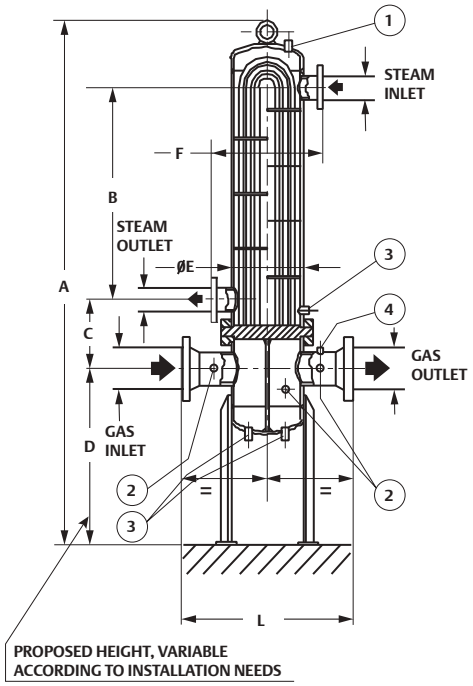


Figure 4. *SV Series Dimensions*

Table 6. CNF, CN and CF Series Thermal Features

TYPE	EXCHANGE SURFACE		WATER SIDE VOLUME		GAS SIDE VOLUME		REFERENCE THERMAL CAPACITY
	ft²	m²	Gallon	liter	Gallon	liter	Kcal/h
CNF-05-AP	7.0	0.6	2.91	11.0	1.0	3.8	14,500
CNF-1-AP	14.7	1.4	6.08	23.0	3.17	12.0	29,000
CN2-AP	21.2	2.0	7.93	30.0	6.21	23.5	48,500
CF2-AP	21.2	2.0	7.93	30.0	6.21	23.5	64,500
CF3-AP	36.6	3.5	14.5	55.0	11.1	42.0	100,000
CF1-AP/5000	54	5.0	18.0	68.0	19.8	75.0	161,000
CF1-AP/8000	124	11.5	31.7	120	42.3	160	340,000
CF1-AP/12500	161	15.0	52.8	200	66.0	250	485,000
CF1-AP/17500	194	180	74.2	281	88.8	336	750,000

Notes: Thermal capacities are calculated with the following conditions:
- Gas inlet pressure: 73 to 1088 psig / 5.0 to 75.0 bar
- Gas reduced pressure: 58 psig / 4.0 bar
- Inlet gas temperature: 41°F / 5°C
- After reduction gas temperature: 41°F / 5°C

For different conditions contact your local Sales Office.

Table 7. SV Series Optional Connections

POSITION	QUANTITY	DESCRIPTION
1	1	Coupling 3/8-in. GAS-F
2	3	Thredolet 1/2-in. NTP
3	3	Coupling 1/2-in. GAS-M
4	2	Thredolet 1/4-in. NTP

Table 8. SV Series Dimensions and Shipping Weights (See Figure 4)

TYPE	DIMENSION, In. / mm											APPROXIMATE SHIPPING WEIGHT, Lb / kg
	Gas Side		Steam Side		A	B	C	D[1]	Ø E	F	L	
	Inlet (Maximum)	Outlet (Maximum)	Inlet (Maximum)	Outlet (Maximum)								
SV3-AP	4.92 / 125	4.92 / 125	3.15 / 80.0	3.15 / 80.0	98.34 / 2498	43.3 / 1100	16.9 / 430	31.5 / 800	10.75 / 273	23.6 / 600	31.5 / 800	683 / 310
SV-AP/5000	5.91 / 150	5.91 / 150	3.15 / 80.0	3.15 / 80.0	97.84 / 2485	39.4 / 1000	15.7 / 400	31.5 / 800	12.75 / 324	23.6 / 600	31.5 / 800	1323 / 600
SV-AP/8000	7.87 / 200	7.87 / 200	3.15 / 80.0	3.15 / 80.0	118 / 3000	41.3 / 1050	22.8 / 580	39.4 / 1000	18.0 / 457	31.5 / 800	43.3 / 1100	2425 / 1100
SV-AP/12500	9.84 / 250	9.84 / 250	4.92 / 125	4.92 / 125	118.9 / 3019	37.4 / 950	26.0 / 660	39.4 / 1000	20.0 / 508	31.5 / 800	47.2 / 1200	2535 / 1150

1. Proposed height, variable according to installation needs.

Table 9. SV Series Thermal Features							
TYPE	EXCHANGE SURFACE		WATER SIDE VOLUME		GAS SIDE VOLUME		REFERENCE THERMAL CAPACITY
	ft²	m²	Gallon	liter	Gallon	liter	Kcal/h
SV3-AP	37.6	3.5	6.60	25.0	10.6	40.0	100,000
SV-AP/5000	53.8	5.0	18.0	68.0	19.8	75.0	161,000
SV-AP/8000	124	11.5	31.7	120	42.3	160	340,000
SV-AP/12500	161	15.0	52.8	200	66.0	250	485,000

Notes: Thermal capacities are calculated with the following conditions:
- Gas inlet pressure: 73 to 1088 psig / 5.0 to 75.0 bar
- Gas reduced pressure: 58 psig / 4.0 bar
- Inlet gas temperature: 41°F / 5°C
- After reduction gas temperature: 41°F / 5°C

For different conditions contact your local Sales Office.

Ordering Guide

Type (Select One)

- ☐ CNF***
- ☐ CN***
- ☐ CF***
- ☐ SV***

Elastomer Part (Select One)

- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)**

Thermal Capacity

_____ please specify

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.

Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.

Regulator Tip:

For every 15 psid / 1.0 bar d pressure differential across the regulator, expect approximately a one degree drop in gas temperature due to the natural refrigeration effect. Freezing is often a problem when the ambient temperature is between 30° and 45°F / -1° and 7°C.

CP200 Series

Pressure Reducing Regulator

FISHER

Introduction

The CP200 Series pressure loaded regulators have been engineered to fit a multitude of pressure-reducing applications including commercial and industrial installations. This flexibility is provided by the various body end connection sizes, outlet pressure settings and orifice sizes. The CP200 Series provides accurate control for use in pressure-factor measurement (fixed factor billing) applications.

Available Configurations

See Table 1

Body Size and End Connection Style

See Table 2

Inlet Pressure Ratings

See Table 5

Maximum Outlet Pressure

Emergency Casing: 25 psig / 1.7 bar
Operating: 20 psig / 1.4 bar

Outlet Pressure Range

1 to 20 psig / 69 mbar to 1.4 bar
See Table 6

Flow and Sizing Coefficients

See Table 7

Pressure Loading Regulator (Type 67CP) Spring Case Connection

1/4 NPT

Temperature Capabilities

-20 to 150°F / -29 to 66°C

Pressure Registration

Internal

Approximate Shipping Weight

10 lbs / 5 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Fixed Factor / Pressure Factor Measurement (PFM) Accuracy Capabilities**
- **Easy to Install and Maintain**
- **Only Standard Tools Required for Pressure Adjustment and Orifice Removal**
- **Wide Range of NPT Body Sizes**
- **Highly Configurable**
- **Secondary Seat™ Protection**



Figure 1. *Type CP200 Pressure Loaded Regulator*

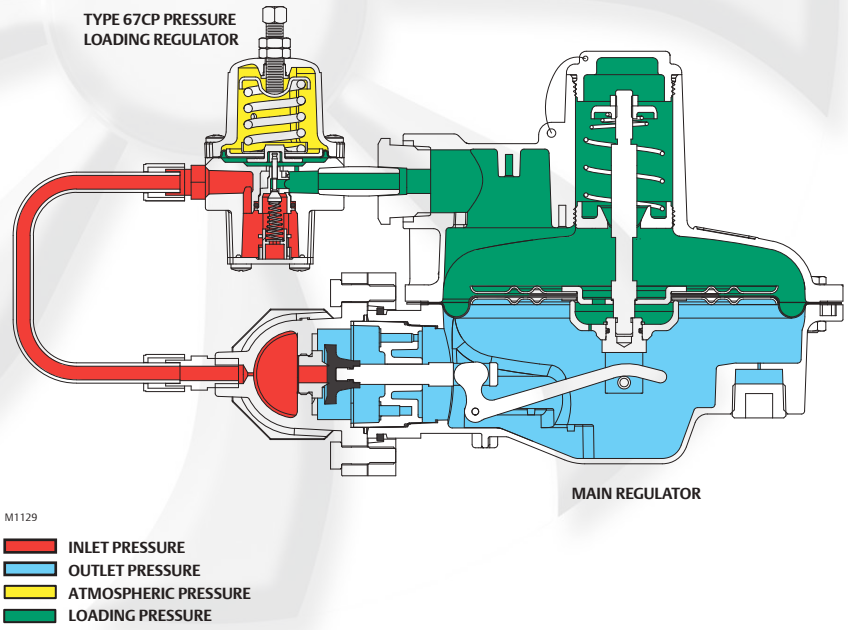


Figure 2. *Type CP200IN Pressure Loaded Pressure Reducing Regulator Operational Schematic*

EMERSON. Process Management

Table 1. Available Configuration

TYPE NUMBER							OPTION
C	P	2	0				**OVERPRESSURE PROTECTION MODULE**
				0			Without Overpressure Protection Module
				5			With Secondary Seat™ Protection
				6			With Secondary Seat Protection with bleed to indicate Secondary Seat is functioning
							PRESSURE REGISTRATION
					I		Internal Registration
							RELIEF
						N	Non-Relief
						T	Token Internal Relief

Table 2. Body Size, Material, End Connection Style and Pressure Rating

SERIES	BODY SIZE	END CONNECTION STYLE	BODY MATERIAL	FACE-TO-FACE DIMENSION		PRESSURE RATING	
				In.	mm	psig	bar
CP200	3/4	NPT	Gray Cast Iron	4	102	175	12,1
	3/4 x 1						
	3/4 x 1-1/4						
	1						
	1 x 1-1/4						
	1-1/4						

Table 3. Main Valve and Actuator Construction Material

BODY	BODY O-RING, DIAPHRAGM AND DISK	CLOSING CAP, ADJUSTING SCREW, DIAPHRAGM CASE, SPRING CASE AND ORIFICE	DIAPHRAGM PLATE	LEVER	PUSHER POST	LEVER PIN
Gray Cast Iron	Nitrile (NBR)	Aluminum	Steel	Zinc-plated Steel	Aluminum	18-8 Stainless steel

Table 4. Type 67CP Pressure Loading Regulator Construction Material

BODY	SPRING	VALVE STEM	O-RING, SOFT SEAT	ADJUSTING SCREW AND SPRING SEAT
Aluminum	302 Stainless steel	316 Stainless steel	Nitrile (NBR)	Steel

Table 5. Orifice Size and Inlet Pressure Rating

SERIES	ORIFICE SIZE		MAXIMUM OPERATING INLET PRESSURE	
	In.	mm	psig	bar
CP200	1/8	3.2	125	8.6
	3/16	4.8	125	8.6
	1/4	6.4	125	8.6
	3/8	9.5	60	4.1
	1/2	13	40	2.8

Table 6. Outlet Pressure Range

SPRING RANGE[1]		PART NUMBER	COLOR CODE	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
psig	bar			In.	mm	In.	mm
1 to 2	69 mbar to 0.14 bar	GE30199X012	Yellow Stripe	0.078	2.0	1.35	34.3
2 to 5	0.14 to 0.34	GE27213X012	Orange Stripe	0.100	2.5	1.47	37.3
5 to 10	0.34 to 0.69	GE39890X012	Black Stripe	0.114	2.9	1.47	37.3
10 to 20	0.69 to 1.4	GE30200X012	Purple Stripe	0.137	3.5	1.42	36.1

1. Spring range is controlled by Type 67CP pressure loading regulator.

Table 7. Flow and Sizing Coefficient

SERIES	ORIFICE SIZE		FLOW COEFFICIENT (WIDE-OPEN)			IEC SIZING COEFFICIENT		
	In.	mm	C_g	C_v	C_1	X_T	F_D	F_L
CP200	1/8	3,2	12	0.40	30	0.53	0.87	0.89
	3/16	4,8	24	0.80	30	0.58	0.82	
	1/4	6,4	44	1.52	29	0.53	0.85	
	3/8	9,5	102	3.30	31	0.60	0.83	
	1/2	13	172	4.40	39	0.97	0.72	

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
1 psig	-0.16 psi	0.16 psi	1 to 2 psig	GE30199X012 / Yellow Stripe
69 mbar	-11 mbar	11 mbar	69 mbar to 0.14 bar	

Table 8. CP200 Series Flow Capacities for 1 psig / 69 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 3/4 and 1 NPT									
3	0.21	160	4.2	310	8.3	460	12.3	850	22.8	1300	34.8
5	0.34	210	5.6	440	11.8	760	20.4	1200	32.2	1500	40.2
10	0.69	320	8.5	730	19.5	1100	29.5	2100	56.3	2100	56.3
15	1.0	410	11.0	890	23.8	1500	40.2	2500	67.1	2500	67.1
20	1.4	490	13.1	1000	26.8	1800	48.3	2800	75.1	2700	72.4
30	2.1	630	16.9	1400	37.5	2400	64.4	3000	80.5	2800	75.1
40	2.8	740	19.8	1700	45.6	2800	75.1	3000	80.5		
50	3.4	920	24.6	2000	53.6	3100	83.2	3100	83.2		
60	4.1	1000	26.8	2300	61.7	3300	88.5	3100	83.2		
80	5.5	1300	34.8	3000	80.5	3300	88.5				
100	6.9	1600	42.9	3100	83.2	3300	88.5				
125	8.6	2000	53.6	3100	83.2	1300	34.8				
psig	bar	Body Size: 1-1/4 NPT									
3	0.21	160	4.2	310	8.3	460	12.3	850	22.8	1400	37.5
5	0.34	210	5.6	440	11.8	800	21.4	1600	42.9	2100	56.3
10	0.69	320	8.5	730	19.5	1300	34.8	2500	67.1	2800	75.1
15	1.0	410	11.0	890	23.8	1600	42.9	3000	80.5	3000	80.5
20	1.4	490	13.1	1000	26.8	1900	51.0	3000	80.5	3000	80.5
30	2.1	630	16.9	1400	37.5	2500	67.1	3000	80.5	3000	80.5
40	2.8	740	19.8	1700	45.6	3000	80.5	3000	80.5		
50	3.4	920	24.6	2000	53.6	3200	85.9	3200	85.9		
60	4.1	1000	26.8	2300	61.7	3200	85.9	3200	85.9		
80	5.5	1300	34.8	3000	80.5	4200	113				
100	6.9	1600	42.9	3300	88.5	4200	113				
125	8.6	2000	53.6	3300	88.5	4200	113				

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Shaded areas indicate values that are limited due to boost effects.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
2 psig	-0.17 psi	0.17 psi	1 to 2 psig	GE30199X012 / Yellow Stripe
0.14 bar	-12 mbar	12 mbar	69 mbar to 0.14 bar	

Table 9. CP200IN Series Flow Capacities for 2 psig / 0.14 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 3/4 and 1 NPT									
5	0.34	190	5.1	410	11.0	780	20.9	1400	37.5	1900	51.0
10	0.69	330	8.8	580	15.5	1200	32.2	2600	69.7	2900	77.8
15	1.0	420	11.2	770	20.6	1600	42.9	3200	85.9	3200	85.9
20	1.4	500	13.4	1000	26.8	1900	51.0	3200	85.9	3200	85.9
30	2.1	630	16.9	1300	34.8	2500	67.1	3200	85.9	3200	85.9
40	2.8	790	21.2	1600	42.9	3100	83.2	4200	113		
50	3.4	930	24.9	1800	48.3	3700	99.3	4200	113		
60	4.1	1000	26.8	1800	48.3	4200	113	4200	113		
80	5.5	1300	34.8	1800	48.3	4200	113				
100	6.9	1600	42.9	1800	48.3	4200	113				
125	8.6	1800	48.3	1800	48.3						
psig	bar	Body Size: 1-1/4 NPT									
5	0.34	190	5.1	420	11.2	780	20.9	1400	37.5	1900	51.0
10	0.69	330	8.8	580	15.5	1200	32.2	2600	69.7	2900	77.8
15	1.0	420	11.2	770	20.6	1600	42.9	3200	85.9	3200	85.9
20	1.4	500	13.4	1000	26.8	1900	51.0	3200	85.9	3200	85.9
30	2.1	630	16.9	1300	34.8	2500	67.1	3200	85.9	3200	85.9
40	2.8	790	21.2	1600	42.9	3100	83.2	4200	113		
50	3.4	930	24.9	1800	48.3	3700	99.3	4200	113		
60	4.1	1000	26.8	1800	48.3	4200	113	4200	113		
80	5.5	1300	34.8	1800	48.3	4200	113				
100	6.9	1600	42.9	1800	48.3	4200	113				
125	8.6	1800	48.3	1800	48.3						

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
5 psig	-0.2 psi	0.2 psi	2 to 5 psig	GE27213X012 / Orange Stripe
0.34 bar	-14 mbar	14 mbar	0.14 to 0.34 bar	

Table 10. CP200 Series Flow Capacities for 5 psig / 0.34 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 3/4 and 1 NPT									
10	0.69	270	7.2	560	15.0	960	25.7	2000	53.6	2900	77.8
15	1.0	370	9.9	870	23.3	1500	40.2	3100	83.2	3800	102
20	1.4	470	12.6	1000	26.8	1900	51.0	3900	105	3900	105
30	2.1	620	16.6	1400	37.5	2400	64.4	4300	115	4300	115
40	2.8	770	20.6	1700	45.6	3000	80.5	4300	115		
50	3.4	940	25.2	1900	51.0	3600	96.6	4300	115		
60	4.1	1000	26.8	2000	53.6	4300	115	4300	115		
80	5.5	1300	34.8	2000	53.6	4300	115				
100	6.9	1600	42.9	2000	53.6	4300	115				
125	8.6	2000	53.6	2000	53.6						
psig	bar	Body Size: 1-1/4 NPT									
10	0.69	270	7.2	560	15.0	1000	26.8	2000	53.6	3000	80.5
15	1.0	370	9.9	870	23.3	1500	40.2	3200	85.9	3800	102
20	1.4	470	12.6	1000	26.8	1900	51.0	4000	107	3900	105
30	2.1	620	16.6	1400	37.5	2600	69.7	4300	115	4300	115
40	2.8	770	20.6	1700	45.6	3000	80.5	5300	142		
50	3.4	940	25.2	1900	51.0	3700	99.3	5300	142		
60	4.1	1000	26.8	2000	53.6	4300	115	5300	142		
80	5.5	1300	34.8	2000	53.6	4300	115				
100	6.9	1600	42.9	2000	53.6	4300	115				
125	8.6	2000	53.6	2000	53.6						

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
10 psig	-0.25 psi	0.25 psi	5 to 10 psig	GE39890X012 / Black Stripe
0.69 bar	-17 mbar	17 mbar	0.34 to 0.69 bar	

Table 11. CP200 Series Flow Capacities for 10 psig / 0.69 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 3/4 and 1 NPT									
15	1.0	260	6.9	580	15.5	1000	26.8	1600	42.9	2500	67.1
20	1.4	410	11.0	880	23.6	1500	40.2	2900	77.8	3100	83.2
30	2.1	590	15.8	1200	32.2	2200	59.0	3800	102	4100	110
40	2.8	760	20.4	1500	40.2	2900	77.8	4200	113		
50	3.4	900	24.1	1900	51.0	3600	96.6	4700	126		
60	4.1	990	26.5	2300	61.7	4000	107	4700	126		
80	5.5	1300	34.8	2900	77.8	5200	139				
100	6.9	1600	42.9	3500	93.9	5200	139				
125	8.6	1900	51.0	4500	121	5200	139				
psig	bar	Body Size: 1-1/4 NPT									
15	1.0	260	6.9	580	15.5	1000	26.8	2500	67.1	3400	91.2
20	1.4	410	11.0	880	23.6	1700	45.6	3200	85.9	4400	118
30	2.1	590	15.8	1200	32.2	2200	59.0	5000	134	5000	134
40	2.8	760	20.4	1500	40.2	3100	83.2	6100	164		
50	3.4	900	24.1	1900	51.0	3700	99.3	6900	185		
60	4.1	990	26.5	2300	61.7	4300	115	8000	215		
80	5.5	1300	34.8	2900	77.8	5200	139				
100	6.9	1600	42.9	3500	93.9	5200	139				
125	8.6	1900	51.0	4500	121	5200	139				

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
15 psig	-0.3 psi	0.3 psi	10 to 20 psig	GE30200X012 / Purple Stripe
1.0 bar	-20 mbar	20 mbar	0.69 to 1.4 bar	

Table 12. CP200 Series Flow Capacities for 15 psig / 1.0 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 3/4 and 1 NPT									
20	1.4	360	9.6	460	12.3	1200	32.2	2300	61.7	2800	75.1
30	2.1	580	15.5	1200	32.2	2200	59.0	4000	107	4200	113
40	2.8	690	18.5	1600	42.9	2900	77.8	4900	131		
50	3.4	890	23.8	2000	53.6	3500	93.9	5100	137		
60	4.1	1000	26.8	2300	61.7	4000	107	5900	158		
80	5.5	1300	34.8	2900	77.8	5100	137				
100	6.9	1500	40.2	3600	96.6	6200	166				
125	8.6	1800	48.3	4400	118	7500	201				
psig	bar	Body Size: 1-1/4 NPT									
20	1.4	360	9.6	460	12.3	1200	32.2	2700	72.4	4100	110
30	2.1	580	15.5	1200	32.2	2200	59.0	4900	131	6000	161
40	2.8	690	18.5	1600	42.9	2900	77.8	6300	169		
50	3.4	890	23.8	2000	53.6	3500	93.9	7500	201		
60	4.1	1000	26.8	2300	61.7	4000	107	8200	220		
80	5.5	1300	34.8	2900	77.8	5100	137				
100	6.9	1500	40.2	3600	96.6	6200	166				
125	8.6	1800	48.3	4400	118	7500	201				

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
20 psig	-0.35 psi	0.35 psi	10 to 20 psig	GE30200X012 / Purple Stripe
1.4 bar	-24 mbar	24 mbar	0.69 to 1.4 bar	

Table 13. CP200 Series Flow Capacities for 20 psig / 1.4 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 3/4 and 1 NPT									
30	2.1	560	15.0	1100	29.5	1900	51.0	3800	102	4100	110
40	2.8	740	19.8	1600	42.9	2700	72.4	4800	129		
50	3.4	840	22.5	1900	51.0	3300	88.5	5900	158		
60	4.1	1000	26.8	2300	61.7	4000	107	6700	180		
80	5.5	1300	34.8	2900	77.8	5200	139				
100	6.9	1600	42.9	3600	96.6	6300	169				
125	8.6	2000	53.6	4400	118	7700	207				
psig	bar	Body Size: 1-1/4 NPT									
30	2.1	560	15.0	1100	29.5	1900	51.0	4100	110	5600	150
40	2.8	740	19.8	1600	42.9	2700	72.4	6400	172		
50	3.4	840	22.5	1900	51.0	3300	88.5	7300	196		
60	4.1	1000	26.8	2300	61.7	4000	107	8800	236		
80	5.5	1300	34.8	2900	77.8	5200	139				
100	6.9	1600	42.9	3600	96.6	6300	169				
125	8.6	2000	53.6	4400	118	7700	207				

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

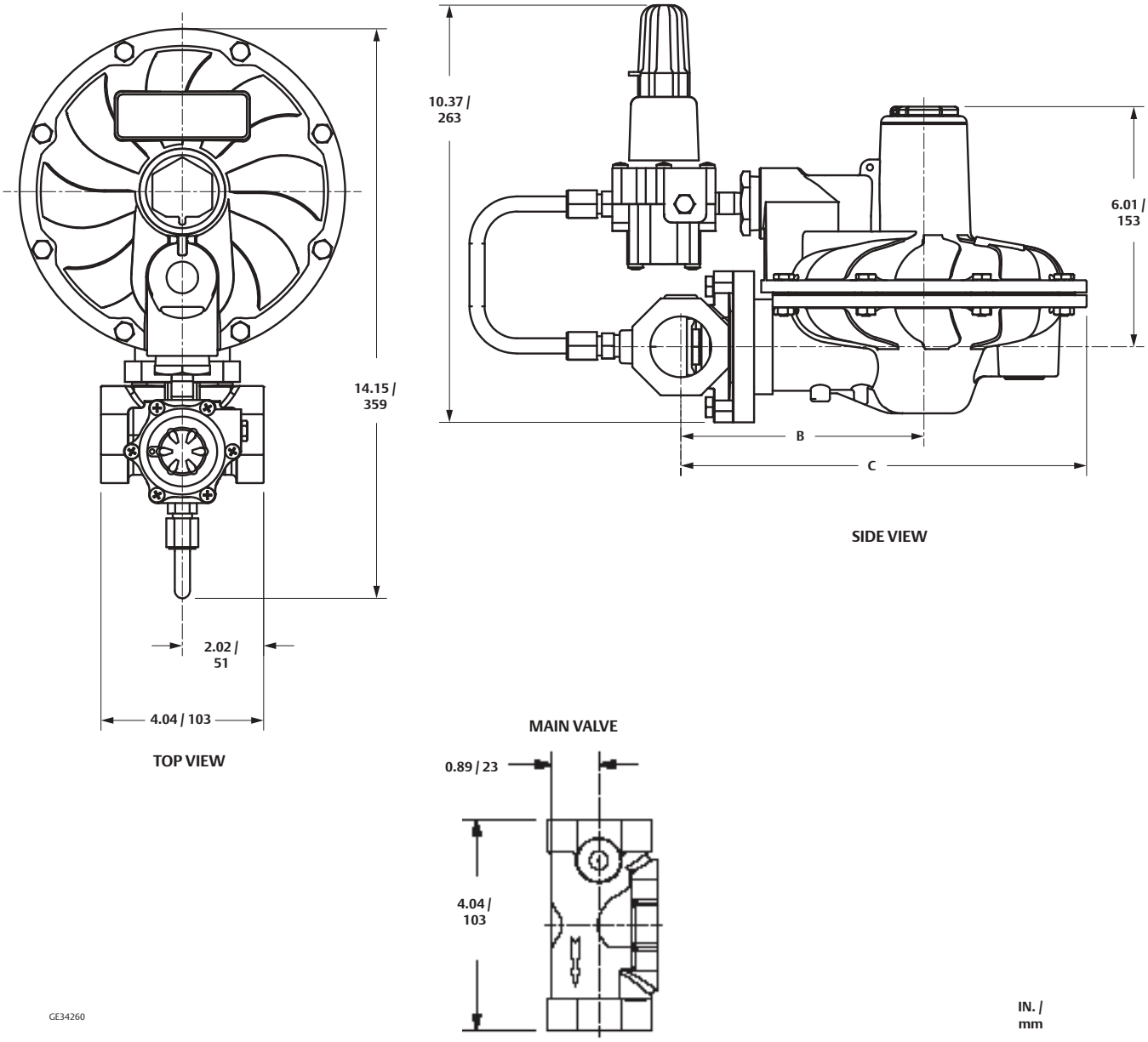


Figure 3. *Dimensions*

Table 14. Dimension

BODY SIZE, NPT		DIMENSION			
		B		C	
Inlet	Outlet	In.	mm	In.	mm
3/4	3/4	5.84	148	9.89	251
3/4	1				
1					
3/4	1-1/4	6.02	153	10.1	257
1					
1-1/4					

Ordering Guide

Type (Select One)

- ☐ CP200IN (without token relief)***
- ☐ CP200IT (with token relief)
- ☐ CP205IN (without token relief and with Secondary Seat™ Protection)
- ☐ CP205IT (with token relief and Secondary Seat Protection)
- ☐ CP206IT (with token relief and Secondary Seat Protection with bleed to indicate Secondary Seat is functioning)

Body Size and End Connection Style (Select One)

- ☐ 3/4 NPT***
- ☐ 3/4 x 1 NPT***
- ☐ 3/4 x 1-1/4 NPT***
- ☐ 1 NPT***
- ☐ 1 x 1-1/4 NPT***
- ☐ 1-1/4 NPT***

Outlet Pressure Range (Select One)

Type 67CP (without token relief)

- ☐ 1 to 2 psig / 69 mbar to 0.14 bar, Yellow Stripe***
- ☐ 2 to 5 psig / 0.14 bar to 0.34 bar, Orange Stripe***
- ☐ 5 to 10 psig / 0.34 to 0.69 bar, Black Stripe***
- ☐ 10 to 20 psig / 0.69 to 1.4 bar, Purple Stripe***

Orifice Size (Select One)

- ☐ 1/8 in. / 3.2 mm***
- ☐ 3/16 in. / 4.8 mm***
- ☐ 1/4 in. / 6.4 mm***
- ☐ 3/8 in. / 9.5 mm***
- ☐ 1/2 in. / 13 mm***

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.

Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired?	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Fixed factor measurement (or PFM) requires the regulator to maintain outlet pressure within ±1% of absolute pressure. For example: Setpoint of 2 psig + 14.7 psia = 16.7 psia x 0.01 = ±0.167 psi. (Setpoint of 0.14 bar + 1.01 bar = 1.15 bar x 0.01 = ±0.0115 bar.) Regulating C_g (coefficient of flow) can only be used for calculating flow capacities on pilot-operated regulators. Use capacity tables or flow charts for determining a directo-perated regulator's capacity.

Introduction

The CP400 Series pressure loaded regulators have been engineered to fit a multitude of pressure-reducing applications including commercial and light industrial installations. This flexibility is provided by the numerous body end connection sizes, body materials, outlet pressure settings and orifice sizes. The CP400 Series provides accurate control for use in pressure-factor measurement (fixed factor billing) applications.

Body Size, End Connection Style and Pressure Rating

See Table 2

Flow Capacities

Type CP400
See Tables 12 through 17, 20 through 25

Types CP403 and CP404
See Tables 18, 19, 26 and 27

Flow and Sizing Coefficients

See Table 7

Inlet Pressure Ratings

See Table 5

Maximum Outlet Pressure

Emergency (Casing): 25 psig / 1.7 bar

Operating:

Types CP400 and CP404: 20 psig / 1.4 bar

Type CP403: 7.5 psig / 0.52 bar

To Avoid Internal Parts Damage:

Types CP400 and CP404: 25 psig / 1.7 bar

Type CP403: 5 psig / 0.34 bar over setpoint

Outlet Pressure Range

1 to 20 psig / 0.07 to 1.4 bar
See Table 6

Pressure Loading Regulator (Type 67CP) Spring Case Connection

1/4 NPT

Pressure Registrations

Types CP400IN and CP400IT: Internal

Types CP400EN and CP400ET: External

Temperature Capabilities

-20 to 150°F / -29 to 66°C

Approximate Shipping Weight

With Threaded Body

Type CP400: 11 lbs / 5 kg
Type CP403: 20.5 lbs / 9 kg
Type CP404: 13.2 lbs / 6 kg

With Flanged Body

Add 8.6 lbs / 3.9 kg to above listed weights

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Fixed Factor / Pressure Factor Measurement (PFM) Accuracy Capabilities**
- **Easy to Install and Maintain**
- **Only Standard Tools Required for Pressure Adjustment and Orifice Removal**
- **Wide Variety of Body Sizes and End Connections**



Figure 1. *Typical Type CP400 Pressure Loaded Pressure Reducing Regulator*

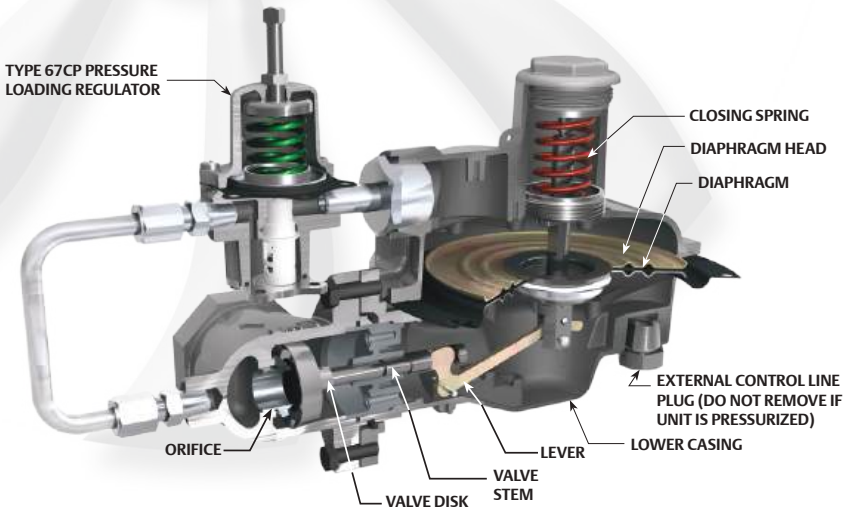


Figure 2. *Typical Type CP400 Regulator Cut-Away View*

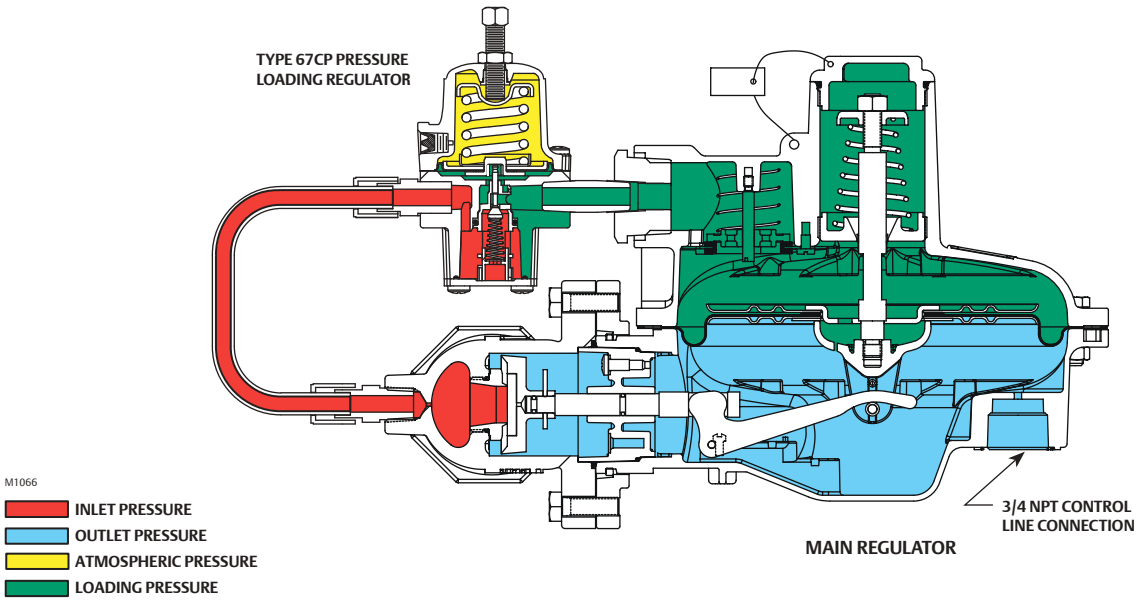


Figure 3. *Type CP400EN External Registration for Downstream Control Line*

Table 1. Available Configurations

TYPE NUMBER							OPTION
C	P	4	0				
							OVERPRESSURE PROTECTION MODULE
				0			Without Overpressure Protection Module
				3			With Integral Monitor Module(1)
				4			With Slam-Shut Module(2)
							PRESSURE REGISTRATION
					E		External Registration
					I		Internal Registration
							RELIEF
						N	Non-Relief
						T	Token Internal Relief
Example: Type number **CP404IT**: CP400 regulator constructed with Type VSX4 Slam-Shut module, with Internal pressure registration and with Token relief.							
1. Reference Instruction Manual D103126X012 for information regarding the Integral Monitor module. 2. Reference Instruction Manual D103127X012 for information regarding the Type VSX4 safety shutoff module.							

Table 2. Body Sizes, Materials, End Connections and Pressure Ratings

TYPE	BODY MATERIAL	BODY SIZE, IN.	END CONNECTION STYLE	FACE-TO-FACE DIMENSION		PRESSURE RATING	
				In.	mm	psig	bar
CP400	Gray Cast Iron	1-1/4	NPT	4.5	114	175	12.1
		1-1/2					
		2	NPT	5	127		
		NPS 2 / DN 50	CL125 FF	10	254		
CP400, CP403 and CP404	Ductile Iron	1-1/4	NPT	4.5	114	290	20.0
		1-1/2					
		2	NPT	5	127		
		1-1/4	Rp	4.5	114		
		1-1/2					
		2	Rp	5	127		
		NPS 2 / DN 50	CL125 FF / CL150 FF	10	254	290	20.0
		NPS 2 / DN 50	PN 10/16	10	254	232	16.0
	Steel	1-1/4	NPT	4.5	114	290	20.0
		1-1/2					
		1-1/4	Rp	7.5	191		
		1-1/2		10	254		

Table 3. Main Valve and Actuator Construction Material	
BODY	Gray Cast Iron, Ductile Iron and Steel
BODY O-RING	Nitrile (NBR)
CLOSING CAP	Aluminum
ADJUSTING SCREW	Aluminum
DIAPHRAGM CASE, SPRING CASE, DIAPHRAGM PLATE AND VALVE STEM	Aluminum
ORIFICE	Aluminum
PUSHER POST	Aluminum
DIAPHRAGM AND DISK	Nitrile (NBR)
CONTROL SPRING	Stainless Steel
LEVER	Steel

Table 4. 67CP Series Construction Material	
BODY	Aluminum
SPRING	Music Wire or Stainless Steel
VALVE STEM	Aluminum
O-RING, SOFT SEAT AND DIAPHRAGM	Nitrile (NBR)

Table 5. Orifice Size and Inlet Pressure Rating

ORIFICE SIZE		MAXIMUM OPERATING INLET PRESSURE(1)	
In.	**mm**	**psig**	**bar**
3/16	4.8	125	8.6
1/4	6.4	125	8.6
3/8	9.5	80	5.5
1/2	13	60	4.1
5/8	16	50	3.4
3/4	19	40	2.8

1. The pressure/temperature limits in this Application Guide or any applicable standard limitation should not be exceeded.

Table 6. Outlet Pressure Range

TYPE	OUTLET PRESSURE RANGE(1)		PART NUMBER	SPRING COLOR	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
	psig	bar			In.	mm	In.	mm
CP400, CP403(2) and CP404	1 to 2	0.07 to 0.14	GE30199X012	Yellow Stripe	0.085	2.16	1.47	37.3
	2 to 5	0.14 to 0.34	GE27213X012	Orange Stripe	0.096	2.44	1.47	37.3
CP400 and CP404	5 to 10	0.34 to 0.69	GE39890X012	Black Stripe	0.114	2.90	1.47	37.3
	10 to 20	0.69 to 1.4	GE30200X012	Purple Stripe	0.137	3.48	1.43	36.3

1. Outlet pressure range is controlled by Type 67CP loading pressure regulator spring.
2. Maximum operating outlet pressure for the integral True-Monitor™ installed on the Type CP403 is 7.5 psig / 0.52 bar.

Table 7. Flow and Sizing Coefficients

ORIFICE SIZE		WIDE-OPEN FLOW COEFFICIENT			IEC SIZING COEFFICIENT		
In.	**mm**	**C_g**	**C_v**	**C_1**	**X_T**	**F_L**	**F_D**
3/16	4.8	27	0.97	27.7	0.50	0.89	0.91
1/4	6.4	50	1.77	28.2	0.50		0.92
3/8	9.5	113	3.72	30.4	0.58		0.89
1/2	13	182	5.61	32.4	0.66		0.82
5/8	16	284	7.26	39.1	0.97		0.74
3/4	19	356	9.83	36.2	0.83		0.72

Table 8. CP404 Series Regulator and Slam-Shut Spring Ranges Overpressure Shutoff (OPSO) Only

TYPE	REGULATOR				SLAM-SHUT				
	Typical Setpoint		Spring Range[1]		Overpressure Shutoff (OPSO)				
					Typical Setpoint		Spring Range		Spring Part Number
	psig	bar	psig	bar	psig	bar	psig	bar	
CP404IN, CP404IT, CP404EN and CP404ET	1	0.07	1 to 2	0.07 to 0.14	5	0.34	2 to 7.3	0.14 to 0.50	GF02172X012
	2	0.14			5.5	0.38			
	3	0.21	2 to 5	0.14 to 0.34	8.5	0.59	3.2 to 11	0.22 to 0.76	GF02173X012
	4	0.28			9.5	0.66			
	5	0.34			10.5	0.72	5.8 to 21	0.40 to 1.4	GF04353X012
	6	0.41	5 to 10	0.34 to 0.69	11.5	0.79			
	7	0.48			14	0.97			
	10	0.69			17	1.2			
CP404IN and CP404EN	12	0.83	10 to 20	0.69 to 1.4	18	1.2			
	15	1.0			20	1.4			
	20	1.4			25	1.7	13.1 to 43.5	0.90 to 3.0	GF02173X012

1. Token Relief is not available with the 10 to 20 psig / 0.69 to 1.4 bar spring range.

Table 9. CP404 Series Regulator and Slam-Shut Spring Ranges Overpressure and Underpressure Shutoff (OPSO and UPSO)

TYPE	REGULATOR				SLAM-SHUT									
	Typical Setpoint		Spring Range[1]		Overpressure Shutoff (OPSO)					Underpressure Shutoff (UPSO)				
					Typical Setpoint		Spring Range		Spring Part Number	Typical Setpoint		Spring Range		Spring Part Number
	psig	bar	psig	bar	psig	bar	psig	bar		psig	bar	psig	bar	
CP404IN, CP404IT, CP404EN and CP404ET	1	0.07	1 to 2	0.07 to 0.14	5	0.34	2.2 to 5.5	0.15 to 0.38	GF02170X012	0.5	0.03	0.36 to 2.3	0.03 to 0.16	T14170T0012
	2	0.14			5.5	0.38				1	0.07			
	3	0.21	2 to 5	0.14 to 0.34	8.5	0.59				2	0.14	1.5 to 7.3	0.10 to 0.50	FA142869X12
	4	0.28			9.5	0.66	5.8 to 16	0.40 to 1.1	GF02172X012	3	0.21			
	5	0.34			10.5	0.72				4	0.28			
	6	0.41	5 to 10	0.34 to 0.69	11.5	0.79				4.5	0.31			
	7	0.48			14	0.97				5.5	0.38			
	10	0.69			17	1.2				8	0.55			
CP404IN and CP404EN	12	0.83	10 to 20	0.69 to 1.4	18	1.2	11.6 to 3.2	0.80 to 1.6	GF02173X012	9	0.62	1.5 to 10.9	0.10 to 0.75	T14171T0012
	15	1.0			20	1.4				10	0.69			
	20	1.4			25	1.7	16 to 29	1.1 to 2.0	GF02171X012	14	0.96	7.3 to 29	0.50 to 2.0	FA142869X12

1. Token Relief is not available with the 10 to 20 psig / 0.69 to 1.4 bar spring range.

Table 10. CP403 Series Spring Ranges (Without Token Relief)

TYPE	PRIMARY REGULATOR					INTEGRAL MONITOR				
	Typical Setpoint		Spring Range		Spring Color	Minimum Setpoint		Spring Range		Spring Color
	psig	bar	psig	bar		psig	bar	psig	bar	
CP403IN and CP403EN	1	0.07	1 to 2	0.07 to 0.14	Yellow Stripe	2	0.14	1.4 to 2.9	0.10 to 0.20	Black
	2	0.14				3	0.21	2.6 to 3.7	0.18 to 0.26	Purple
	3	0.21	2 to 5	0.14 to 0.34	Orange Stripe	5	0.34	3.6 to 6	0.25 to 0.40	Dark Blue
	4	0.28				6	0.41	5.1 to 7.5	0.35 to 0.52	Red
	5	0.34				7	0.48			

Table 11. CP403 Series Spring Ranges (With Token Relief)

TYPE	PRIMARY REGULATOR					INTEGRAL MONITOR				
	Typical Setpoint		Spring Range		Spring Color	Minimum Setpoint		Spring Range		Spring Color
	psig	bar	psig	bar		psig	bar	psig	bar	
CP403IT and CP403ET	1	0.07	1 to 2	0.07 to 0.14	Yellow Stripe	5	0.34	3.6 to 6	0.25 to 0.40	Dark Blue
	2	0.14				5.5	0.38	5.1 to 7.5	0.35 to 0.52	Red

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
1 psig	-0.16 psi	0.16 psi	1 to 2 psig	GE30199X012 / Yellow Stripe
0.07 bar	-11 mbar	11 mbar	0.07 to 0.14 bar	

Table 12. CP400 Series Internal Registration Flow Capacities for 1 psig / 0.07 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4 / DN 32											
3	0.21	310	8.31	500	13.4	940	25.2	1400	37.5	2300	61.6	2400	64.3
5	0.34	520	13.9	970	26.0	1900	50.9	2200	59.0	3500	93.8	3800	102
10	0.69	850	22.8	1500	40.2	2800	75.0	4100	110	5800	155	6000	161
15	1.0	1000	26.8	1800	48.2	3900	105	5700	153	6000	161	6000	161
20	1.3	1200	32.2	2000	53.6	4700	126	6000	161	6000	161	6000	161
30	2.0	1500	40.2	2800	75.0	6000	161	6000	161	5100	137	5500	147
40	2.7	1900	50.9	3300	88.4	6000	161	5200	139	5100	137	5500	147
50	3.4	2200	59.0	3900	105	6000	161	3200	85.8	5100	137		
60	4.1	2400	64.3	4500	121	3200	85.8	3200	85.8				
80	5.5	3300	88.4	5500	147	3200	85.8						
100	6.8	4000	107	7300	196								
125	8.6	4800	129	8400	225								
psig	bar	Body Size: NPS 1-1/2 / DN 40											
3	0.21	390	10.5	590	15.8	1300	34.8	1600	42.9	1600	42.9	2100	56.3
5	0.34	520	13.9	930	24.9	1900	50.9	2900	77.7	3300	88.4	3300	88.4
10	0.69	840	22.5	1300	34.8	2900	77.7	4900	131	5200	139	5200	139
15	1.0	1000	26.8	1600	42.9	3600	96.5	4600	123	6400	172	6400	172
20	1.3	1200	32.2	1900	50.9	4600	123	4600	123	7600	204	8200	220
30	2.0	1600	42.9	2700	72.4	4600	123	4600	123	3700	99.2	10,100	271
40	2.7	1800	48.2	3400	91.1	4600	123	3100	83.1	3500	93.8	12,000	322
50	3.4	2200	59.0	4000	107	4000	107	3100	83.1	3500	93.8		
60	4.1	2500	67.0	4300	115	3800	102	3000	80.4				
80	5.5	3300	88.4	5400	145	3800	102						
100	6.8	4000	107	5600	150								
125	8.6	4900	131	7900	212								
psig	bar	Body Size: NPS 2 / DN 50											
3	0.21	410	11.0	570	15.3	1100	29.5	1700	45.6	1700	45.6	2400	64.3
5	0.34	550	14.7	890	23.9	1900	50.9	2900	77.7	3100	83.1	4200	113
10	0.69	820	22.0	1400	37.5	3100	83.1	4700	126	6300	169	4200	113
15	1.0	1000	26.8	1800	48.2	4000	107	5600	150	10,700	287	5600	150
20	1.3	1200	32.2	2100	56.3	4800	129	5600	150	10,700	287	9700	260
30	2.0	1500	40.2	2800	75.0	5600	150	5600	150	10,700	287	7300	196
40	2.7	1900	50.9	3400	91.1	5600	150	5600	150	8500	228	5400	145
50	3.4	2300	61.6	4000	107	5600	150	5600	150	5700	153		
60	4.1	2600	69.7	4600	123	5600	150	5600	150				
80	5.5	3300	88.4	5600	150	5600	150						
100	6.8	4100	110	6500	174								
125	8.6	5000	134	7000	188								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Shaded areas indicate limited capacities due to boost effects.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
2 psig	-0.17 psi	0.17 psi	1 to 2 psig	GE30199X012 / Yellow Stripe
0.14 bar	-12 mbar	12 mbar	0.07 to 0.14 bar	

Table 13. CP400 Series Internal Registration Flow Capacities for 2 psig / 0.14 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4 / DN 32											
5	0.34	470	12.6	970	26.0	1400	37.5	1900	50.9	2700	72.4	3800	102
10	0.69	800	21.4	1300	34.8	2800	75.0	4100	110	5200	139	7100	190
15	1.0	1000	26.8	1800	48.2	3800	102	5000	134	5700	153	7200	193
20	1.3	1200	32.2	2100	56.3	4700	126	5000	134	5700	153	7200	193
30	2.0	1500	40.2	2700	72.4	6000	161	3200	85.8	5700	153	7200	193
40	2.7	1900	50.9	3300	88.4	6000	161	3200	85.8	5700	153	7200	193
50	3.4	2200	59.0	3900	105	6000	161	3200	85.8	5700	153		
60	4.1	2500	67.0	4200	113	4500	121	3200	85.8				
80	5.5	3300	88.4	4200	113	2900	77.7						
100	6.8	3300	88.4	4200	113								
125	8.6	3300	88.4	4200	113								
psig	bar	Body Size: NPS 1-1/2 / DN 40											
5	0.34	420	11.3	820	22.0	1900	50.9	350	9.38	2700	72.4	2800	75.0
10	0.69	810	21.7	1400	37.5	3200	85.8	3900	105	5300	142	6400	172
15	1.0	1000	26.8	1500	40.2	4000	107	5600	150	7000	188	9000	241
20	1.3	1100	29.5	2100	56.3	4700	126	7100	190	8400	225	9700	260
30	2.0	1500	40.2	2600	69.7	6000	161	7400	198	8400	225	10,200	273
40	2.7	1900	50.9	3200	85.8	7400	198	3700	99.2	8400	225	12,100	324
50	3.4	2100	56.3	3900	105	7400	198	3200	85.8	4200	113		
60	4.1	2400	64.3	4700	126	7400	198	3200	85.8				
80	5.5	3300	88.4	6000	161	7400	198						
100	6.8	4100	110	6500	174								
125	8.6	4900	131	6500	174								
psig	bar	Body Size: NPS 2 / DN 50											
5	0.34	530	14.2	850	22.8	1400	37.5	2100	56.3	3000	80.4	3400	91.1
10	0.69	820	22.0	1500	40.2	3100	83.1	4400	118	5700	153	9500	255
15	1.0	1000	26.8	1800	48.2	4000	107	6100	163	10,100	271	10,100	271
20	1.3	1200	32.2	2100	56.3	4600	123	7100	190	10,100	271	10,100	271
30	2.0	1500	40.2	2700	72.4	6000	161	7100	190	10,100	271	8600	230
40	2.7	1900	50.9	3300	88.4	6000	161	7100	190	6200	166	6700	180
50	3.4	2200	59.0	4000	107	6000	161	7100	190	4900	131		
60	4.1	2600	69.7	4700	126	6000	161	7100	190				
80	5.5	3400	91.1	6000	161	6000	161						
100	6.8	4100	110	6000	161								
125	8.6	5000	134	6000	161								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Shaded areas indicate limited capacities due to boost effects.

	ACCURACY			
SETPOINT	+ / - 1% ABS		SET RANGE	PART NUMBER / COLOR
5 psig	-0.2 psi	0.2 psi	2 to 5 psig	GE27213X012 / Orange Stripe
0.34 bar	-14 mbar	14 mbar	0.14 to 0.34 bar	

Table 14. CP400 Series Internal Registration Flow Capacities for 5 psig / 0.34 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4 / DN 32											
10	0.69	650	17.4	1200	32.2	2500	67.0	3100	83.1	3400	91.1	6000	161
15	1.0	1000	26.8	1700	45.6	3200	85.8	4300	115	6000	161	6000	161
20	1.3	1200	32.2	2100	56.3	4100	110	6000	161	6000	161	6000	161
30	2.0	1500	40.2	2600	69.7	6000	161	6000	161	6000	161	6000	161
40	2.7	1900	50.9	3000	80.4	6000	161	6000	161	5700	153	5200	139
50	3.4	2200	59.0	4100	110	6000	161	4300	115	3500	93.8		
60	4.1	2600	69.7	4700	126	6000	161	4300	115				
80	5.5	3300	88.4	5000	134	5500	147						
100	6.8	3900	105	5000	134								
125	8.6	5000	134	5000	134								
psig	bar	Body Size: NPS 1-1/2 / DN 40											
10	0.69	740	19.8	1000	26.8	2500	67.0	3800	102	5900	158	6500	174
15	1.0	980	26.3	1500	40.2	3500	93.8	5900	158	8700	233	8700	233
20	1.3	1200	32.2	2000	53.6	4300	115	6600	177	8700	233	8700	233
30	2.0	1500	40.2	2700	72.4	5500	147	6600	177	5700	153	5200	139
40	2.7	1800	48.2	3200	85.8	6600	177	6600	177	5700	153	5200	139
50	3.4	2400	64.3	3700	99.2	8800	236	5000	134	5300	142		
60	4.1	2600	69.7	4700	126	10,400	279	4700	126				
80	5.5	3200	85.8	5700	153	12,000	322						
100	6.8	4000	107	6300	169								
125	8.6	4700	126	6300	169								
psig	bar	Body Size: NPS 2 / DN 50											
10	0.69	680	18.2	1100	29.5	2600	69.7	3300	88.4	3800	102	5400	145
15	1.0	1000	26.8	1700	45.6	3800	102	5000	134	5900	158	11,000	295
20	1.3	1200	32.2	2100	56.3	4600	123	6400	172	12,400	332	12,900	346
30	2.0	1500	40.2	2700	72.4	6400	172	8700	233	12,900	346	12,900	346
40	2.7	1900	50.9	3400	91.1	7700	206	8700	233	6100	163	5400	145
50	3.4	2200	59.0	3900	105	7800	209	8700	233	5900	158		
60	4.1	2600	69.7	4500	121	7800	209	8800	236				
80	5.5	3300	88.4	5700	153	6700	180						
100	6.8	4000	107	6900	185								
125	8.6	4800	129	8900	239								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Shaded areas indicate limited capacities due to boost effects.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
10 psig	-0.25 psi	0.25 psi	5 to 10 psig	GE39890X012 / Black Stripe
0.69 bar	-17 mbar	17 mbar	0.34 to 0.69 bar	

Table 15. CP400 Series Internal Registration Flow Capacities for 10 psig / 0.69 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4 / DN 32											
15	1.0	820	22.0	1300	34.8	2700	72.4	3900	105	5200	139	5200	139
20	1.3	1100	29.5	1900	50.9	3200	85.8	5500	147	5800	155	7400	198
30	2.0	1300	34.8	2700	72.4	5700	153	7100	190	7100	190	7400	198
40	2.7	1700	45.6	3100	83.1	7100	190	7100	190	7100	190	7400	198
50	3.4	2300	61.6	3900	105	7100	190	7100	190	7100	190		
60	4.1	2500	67.0	4500	121	7500	201	7500	201				
80	5.5	3200	85.8	5200	139	7500	201						
100	6.8	4100	110	5200	139								
125	8.6	4600	123	5200	139								
psig	bar	Body Size: NPS 1-1/2 / DN 40											
15	1.0	770	20.6	1300	34.8	2500	67.0	3900	105	5900	158	7800	209
20	1.3	1100	29.5	1500	40.2	4100	110	4200	113	7700	206	9700	260
30	2.0	1500	40.2	2700	72.4	6100	163	6700	180	9700	260	9700	260
40	2.7	1900	50.9	3400	91.1	6700	180	6700	180	6700	180	9700	260
50	3.4	2200	59.0	4000	107	6800	182	6800	182	5200	139		
60	4.1	2600	69.7	4700	126	7200	193	5100	137				
80	5.5	3300	88.4	5400	145	5400	145						
100	6.8	4000	107	5600	150								
125	8.6	5000	134	5600	150								
psig	bar	Body Size: NPS 2 / DN 50											
15	1.0	590	15.8	1200	32.2	3000	80.4	3600	96.5	4800	129	4800	129
20	1.3	1100	29.5	1600	42.9	3100	83.1	5100	137	7800	209	9500	255
30	2.0	1500	40.2	2800	75.0	5900	158	8800	236	7800	209	11,900	319
40	2.7	1800	48.2	2800	75.0	7600	204	9900	265	7800	209	11,900	319
50	3.4	2200	59.0	4000	107	9200	247	9900	265	7800	209		
60	4.1	2600	69.7	4700	126	9200	247	9900	265				
80	5.5	3300	88.4	5600	150	9200	247						
100	6.8	4100	110	7100	190								
125	8.6	5000	134	8600	230								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Shaded areas indicate limited capacities due to boost effects.

	ACCURACY			
SETPOINT	+ / - 1% ABS		SET RANGE	PART NUMBER / COLOR
15 psig	-0.30 psi	0.30 psi	10 to 20 psig	GE30200X012 / Purple Stripe
1.0 bar	-20 mbar	-20 mbar	0.69 to 1.4 bar	

Table 16. CP400 Series Internal Registration Flow Capacities for 15 psig / 1.0 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4 / DN 32											
20	1.3	460	12.3	1500	40.2	2800	75.0	4200	113	4700	126	5400	145
30	2.0	1500	40.2	2600	69.7	5100	137	7200	193	10,400	279	15,400	413
40	2.7	1900	50.9	3300	88.4	7300	196	9400	252	11,100	297	15,400	413
50	3.4	2200	59.0	4000	107	7500	201	11,000	295	11,100	297		
60	4.1	2600	69.7	4600	123	9800	263	11,000	295				
80	5.5	3300	88.4	5900	158	11,000	295						
100	6.8	4000	107	7200	193								
125	8.6	4900	131	7500	201								
psig	bar	Body Size: NPS 1-1/2 / DN 40											
20	1.3	700	18.8	1400	37.5	2800	75.0	4200	113	6400	172	7100	190
30	2.0	1500	40.2	2500	67.0	5800	155	8600	230	11,800	316	12,200	327
40	2.7	1900	50.9	3400	91.1	7300	196	10,000	268	11,800	316	12,200	327
50	3.4	2300	61.6	4000	107	7500	201	10,300	276	7600	204		
60	4.1	2600	69.7	4600	123	7500	201	6700	180				
80	5.5	3300	88.4	5900	158	7500	201						
100	6.8	4100	110	6500	174								
125	8.6	5000	134	6500	174								
psig	bar	Body Size: NPS 2 / DN 50											
20	1.3	670	18.0	1500	40.2	2700	72.4	3500	93.8	6600	177	7700	206
30	2.0	1400	37.5	2500	67.0	5600	150	8300	222	13,900	373	17,100	458
40	2.7	1800	48.2	3400	91.1	7600	204	12,300	330	15,600	418	17,200	461
50	3.4	2200	59.0	4000	107	9100	244	14,700	394	15,600	418		
60	4.1	2600	69.7	4600	123	10,500	281	15,600	418				
80	5.5	3300	88.4	5900	158	13,600	364						
100	6.8	3900	105	7100	190								
125	8.6	4800	129	8900	239								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Shaded areas indicate limited capacities due to boost effects.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
20 psig	-0.35 psi	0.35 psi	10 to 20 psig	GE30200X012 / Purple Stripe
1.4 bar	-24 mbar	24 mbar	0.69 bar to 1.4 bar	

Table 17. CP400 Series Internal Registration Flow Capacities for 20 psig / 1.4 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4 / DN 32											
30	2.0	1300	34.8	2300	61.6	4100	110	7100	190	8800	236	8800	236
40	2.7	1800	48.2	3400	91.1	6800	182	10,900	292	11,200	300	15,800	423
50	3.4	2200	59.0	4000	107	7300	196	13,000	348	15,800	423		
60	4.1	2600	69.7	4700	126	10,300	276	15,800	423				
80	5.5	3300	88.4	5900	158	11,100	297						
100	6.8	4100	110	7200	193								
125	8.6	4500	121	8800	236								
psig	bar	Body Size: NPS 1-1/2 / DN 40											
30	2.0	1300	34.8	2000	53.6	4800	129	6100	163	11,600	311	13,700	367
40	2.7	1700	45.6	3300	88.4	7000	188	10,200	273	15,600	418	15,600	418
50	3.4	2300	61.6	3900	105	8400	225	11,000	295	15,800	423		
60	4.1	2500	67.0	4700	126	9800	263	14,600	391				
80	5.5	3300	88.4	6100	163	12,200	327						
100	6.8	4100	110	7200	193								
125	8.6	5000	134	8100	217								
psig	bar	Body Size: NPS 2 / DN 50											
30	2.0	1300	34.8	2500	67.0	5100	137	6700	180	8400	225	13,300	356
40	2.7	1900	50.9	3300	88.4	7500	201	10,600	284	11,400	306	15,600	418
50	3.4	2200	59.0	4000	107	9200	247	13,900	373	14,300	383		
60	4.1	2600	69.7	4600	123	10,300	276	15,800	423				
80	5.5	3400	91.1	5900	158	13,700	367						
100	6.8	4100	110	7300	196								
125	8.6	4900	131	8800	236								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
2 psig	-0.17 psi	0.17 psi	1 to 2 psig	GE30199X012 / Yellow Stripe
0.14 bar	-12 mbar	12 mbar	0.07 to 0.14 bar	

Table 18. Types CP403 and CP404 Internal Registration Flow Capacities for 2 psig / 0.14 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50											
3	0.21	240	6.43	450	12.1	840	22.5	880	23.6	1400	37.5	1300	34.8
5	0.34	450	12.1	740	19.8	1400	37.5	2500	67.0	2500	67.0	3200	85.8
10	0.69	810	21.7	1300	34.8	3000	80.4	4400	118	5600	150	6500	174
15	1.0	980	26.3	1800	48.2	4000	107	6000	161	8200	220	9800	263
20	1.4	1200	32.2	2100	56.3	4700	126	7500	201	8200	220	9800	263
30	2.1	1500	40.2	2700	72.4	6300	169	7500	201	5100	137	5600	150
40	2.8	1900	50.9	3400	91.1	7900	212	4900	131	4400	118	4700	126
50	3.4	2200	59.0	4200	113	7900	212	4400	118	4000	107		
60	4.1	2600	69.7	4700	126	4700	126	4400	118				
80	5.5	3300	88.4	4700	126	4700	126						
100	6.9	4000	107	5100	137								
125	8.6	4900	131	5100	137								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Shaded areas indicate limited capacities due to boost effects.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
5 psig	-0.2 psi	0.2 psi	2 to 5 psig	GE27213X012 / Orange Stripe
0.34 bar	-14 mbar	14 mbar	0.14 to 0.34 bar	

Table 19. Types CP403 and CP404 Internal Registration Flow Capacities for 5 psig / 0.34 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50											
10	0.69	630	16.9	1000	26.8	1600	42.9	2700	72.4	3500	93.8	3700	99.2
15	1.0	910	24.4	1400	37.5	3000	80.4	4400	118	5400	145	7400	198
20	1.4	1100	29.5	2000	53.6	4000	107	6000	161	6800	182	7400	198
30	2.1	1500	40.2	2700	72.4	6000	161	6000	161	6800	182	7400	198
40	2.8	1900	50.9	3300	88.4	6000	161	5200	139	6800	182	6300	169
50	3.4	2200	59.0	4000	107	6000	161	4400	118	7200	193		
60	4.1	2600	69.7	4700	126	5100	137	4400	118				
80	5.5	3300	88.4	6000	161	3700	99.2						
100	6.9	4000	107	6700	180								
125	8.6	4500	121	8400	225								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Shaded areas indicate limited capacities due to boost effects.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
1 psig	-0.16 psi	0.16 psi	1 to 2 psig	GE30199X012 / Yellow Stripe
0.07 bar	-11 mbar	11 mbar	0.07 to 0.14 bar	

Table 20. CP400 Series External Registration Flow Capacities for 1 psig / 0.07 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50											
3	0.21	330	8.84	330	8.84	890	23.9	1700	45.6	1700	45.6	1700	45.6
5	0.34	400	10.7	690	18.5	1800	48.2	2500	67.0	2500	67.0	2900	77.7
10	0.69	820	22.0	1400	37.5	2500	67.0	3600	96.5	3600	96.5	5700	153
15	1.0	1000	26.8	1800	48.2	3300	88.4	5100	137	5100	137	8700	233
20	1.3	1200	32.2	2200	59.0	4100	110	6300	169	6400	172	8700	233
30	2.0	1500	40.2	2700	72.4	5800	155	8500	228	11,200	300	8700	233
40	2.7	1900	50.9	3200	85.8	6900	185	11,100	297	14,300	383	8700	233
50	3.4	2300	61.6	3900	105	6900	185	13,800	370	15,200	407		
60	4.1	2700	72.4	4600	123	6900	185	15,200	407				
80	5.5	3300	88.4	5800	155	6900	185						
100	6.8	4100	110	7000	188								
125	8.6	5000	134	7000	188								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
2 psig	-0.17 psi	0.17 psi	1 to 2 psig	GE30199X012 / Yellow Stripe
0.14 bar	-12 mbar	12 mbar	0.07 to 0.14 bar	

Table 21. CP400 Series External Registration Flow Capacities for 2 psig / 0.14 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50											
5	0.34	500	13.4	800	21.4	1300	34.8	1600	42.9	1600	42.9	2200	59.0
10	0.69	800	21.4	1000	26.8	2400	64.3	3700	99.2	3700	99.2	5300	142
15	1.0	1000	26.8	1600	42.9	3100	83.1	5600	150	6300	169	7300	196
20	1.3	1200	32.2	2100	56.3	4100	110	6100	163	8500	228	13,800	370
30	2.0	1600	42.9	2400	64.3	5600	150	6300	169	13,000	348	15,200	407
40	2.7	1900	50.9	3200	85.8	6500	174	9300	249	13,000	348	15,200	407
50	3.4	2300	61.6	3500	93.8	6500	174	12,300	330	13,000	348		
60	4.1	2600	69.7	4500	121	6500	174	13,000	348				
80	5.5	3400	91.1	5800	155	6500	174						
100	6.8	3800	102	7100	190								
125	8.6	4900	131	8700	233								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
5 psig	-0.2 psi	0.2 psi	2 to 5 psig	GE27213X012 / Orange Stripe
0.34 bar	-14 mbar	14 mbar	0.14 to 0.34 bar	

Table 22. CP400 Series External Registration Flow Capacities for 5 psig / 0.34 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50											
10	0.69	520	13.9	980	26.3	1300	34.8	2200	59.0	3300	88.4	3300	88.4
15	1.0	770	20.6	1500	40.2	2900	77.7	4400	118	6600	177	6800	182
20	1.3	1100	29.5	2000	53.6	3800	102	6000	161	11,700	314	12,800	343
30	2.0	1300	34.8	2400	64.3	5300	142	8400	225	12,800	343	13,900	373
40	2.7	1700	45.6	3200	85.8	6500	174	10,800	289	17,200	461	17,200	461
50	3.4	1900	50.9	3800	102	9000	241	13,100	351	17,200	461		
60	4.1	2200	59.0	4400	118	9500	255	14,500	389				
80	5.5	3100	83.1	5900	158	13,300	356						
100	6.8	3900	105	7000	188								
125	8.6	4800	129	8700	233								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
10 psig	-0.25 psi	0.25 psi	5 to 10 psig	GE39890X012 / Black Stripe
0.69 bar	-17 mbar	17 mbar	0.34 to 0.69 bar	

Table 23. CP400 Series External Registration Flow Capacities for 10 psig / 0.69 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50											
15	1.0	650	17.4	1300	34.8	2000	53.6	3100	83.1	3800	102	6300	169
20	1.3	990	26.5	1700	45.6	2700	72.4	6200	166	9800	263	10,300	276
30	2.0	1400	37.5	2400	64.3	5800	155	9500	255	14,500	389	15,800	423
40	2.7	1700	45.6	3100	83.1	6400	172	10,000	268	15,800	423	17,200	461
50	3.4	2000	53.6	3900	105	8700	233	12,300	330	16,700	448		
60	4.1	2500	67.0	4500	121	9200	247	13,300	356				
80	5.5	3100	83.1	5800	155	10,300	276						
100	6.8	3500	93.8	7000	188								
125	8.6	4400	118	8500	228								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
15 psig	-0.30 psi	0.30 psi	10 to 20 psig	GE30200X012 / Purple Stripe
1.0 bar	-20 mbar	20 mbar	0.69 to 1.4 bar	

Table 24. CP400 Series External Registration Flow Capacities for 15 psig / 1.0 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50											
20	1.3	680	18.2	1300	34.8	2500	67.0	2800	75.0	4000	107	8500	228
30	2.0	1300	34.8	2200	59.0	5300	142	6300	169	8500	228	15,000	402
40	2.7	1500	40.2	3300	88.4	6100	163	11,800	316	14,300	383	17,600	472
50	3.4	2200	59.0	3600	96.5	7600	204	12,800	343	16,700	448		
60	4.1	2400	64.3	4500	121	10,500	281	14,400	386				
80	5.5	3000	80.4	5800	155	11,700	314						
100	6.8	3600	96.5	6700	180								
125	8.6	4300	115	8500	228								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
20 psig	-0.35 psi	0.35 psi	10 to 20 psig	GE30200X012 / Purple Stripe
1.4 bar	-24 mbar	24 mbar	0.69 to 1.4 bar	

Table 25. CP400 Series External Registration Flow Capacities for 20 psig / 1.4 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50											
30	2.0	960	25.7	2500	67.0	3400	91.1	6600	177	11,800	316	14,200	381
40	2.7	1400	37.5	2900	77.7	5500	147	9500	255	12,800	343	17,600	472
50	3.4	1900	50.9	3700	99.2	7500	201	13,600	364	14,400	386		
60	4.1	2600	69.7	4000	107	8600	230	13,600	364				
80	5.5	3000	80.4	5800	155	11,700	314						
100	6.8	3900	105	6500	174								
125	8.6	4900	131	8200	220								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
2 psig	-0.17 psi	0.17 psi	1 to 2 psig	GE30199X012 / Yellow Stripe
0.14 bar	-12 mbar	12 mbar	0.07 to 0.14 bar	

Table 26. Types CP403 and CP404 External Registration Flow Capacities for 2 psig / 0.14 bar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50											
3	0.20	280	7.50	380	10.2	740	19.8	1200	32.2	1400	37.5	1400	37.5
5	0.34	450	12.1	770	20.6	1400	37.5	1800	48.2	2200	59.0	2800	75.0
10	0.69	740	19.8	1300	34.8	2400	64.3	3300	88.4	3700	99.2	5400	145
15	1.0	1000	26.8	1600	42.9	3000	80.4	4700	126	6800	182	7900	212
20	1.4	1100	29.5	2100	56.3	4200	113	6100	163	9300	249	11,400	306
30	2.1	1500	40.2	2600	69.7	6000	161	9300	249	13,700	367	16,900	453
40	2.8	1900	50.9	3400	91.1	7400	198	11,800	316	18,700	501	21,000	563
50	3.4	2200	59.0	4000	107	9000	241	15,500	415	23,300	624		
60	4.1	2600	69.7	4700	126	10,700	287	17,300	464				
80	5.5	3300	88.4	6000	161	13,700	367						
100	6.9	4000	107	7400	198								
125	8.6	4900	131	9000	241								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

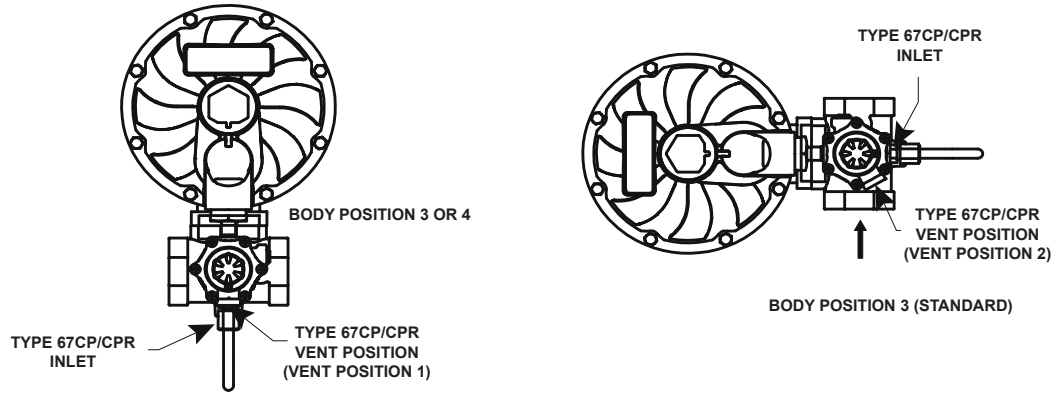
SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	PART NUMBER / COLOR
5 psig	-0.2 psi	0.2 psi	2 to 5 psig	GE27213X012 / Orange Stripe
0.34 bar	-14 mbar	14 mbar	0.14 to 0.34 bar	

Table 27. Types CP403 and CP404 External Registration Flow Capacities for 5 psig / 0.34 bar Setpoint

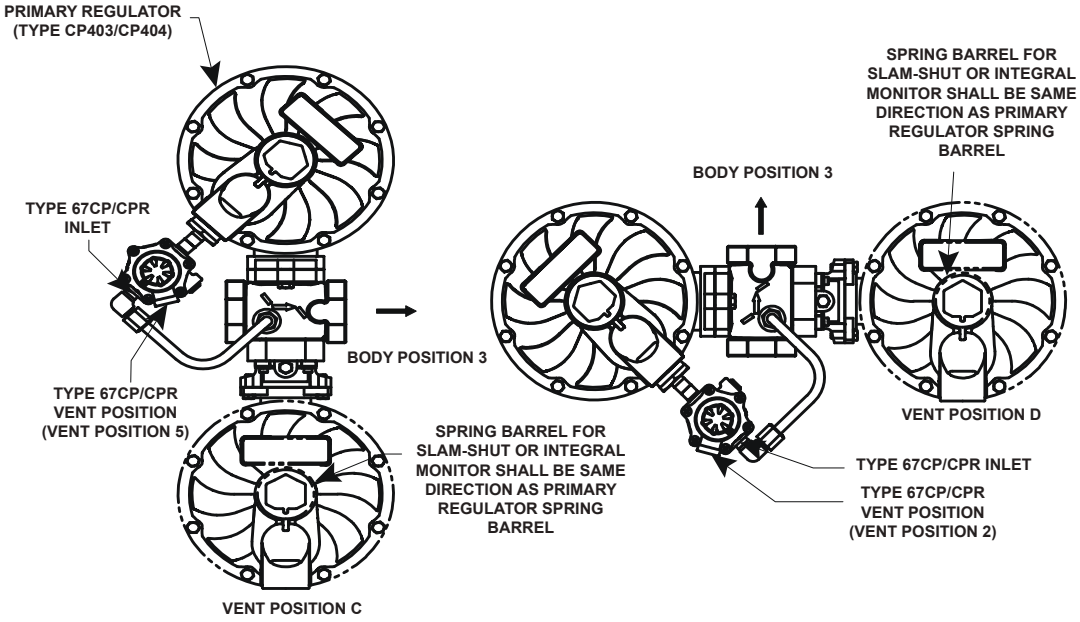
CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size											
		3/16 In. / 4.8 mm		1/4 In. / 6.4 mm		3/8 In. / 9.5 mm		1/2 In. / 13 mm		5/8 In. / 16 mm		3/4 In. / 19 mm	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: NPS 1-1/4, 1-1/2 and 2 / DN 32, 40 and 50											
10	0.69	520	13.9	1000	26.8	1500	40.2	2400	64.3	2800	75.0	3100	83.1
15	1.0	810	21.7	1300	34.8	2700	72.4	3700	99.2	4500	121	5600	150
20	1.4	1000	26.8	1800	48.2	3200	85.8	5200	139	6300	169	8100	217
30	2.1	1400	37.5	2700	72.4	4900	131	7700	206	10,500	281	13,200	354
40	2.8	1800	48.2	3200	85.8	6800	182	10,200	273	15,300	410	18,500	496
50	3.4	2100	56.3	4000	107	9100	244	13,000	348	19,900	533		
60	4.1	2500	67.0	4500	121	10,000	268	16,700	448				
80	5.5	3200	85.8	5800	155	13,000	348						
100	6.9	4000	107	7000	188								
125	8.6	4700	126	8200	220								

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.



TYPE CP400 GRAY CAST IRON BODY PIPING POSITIONS

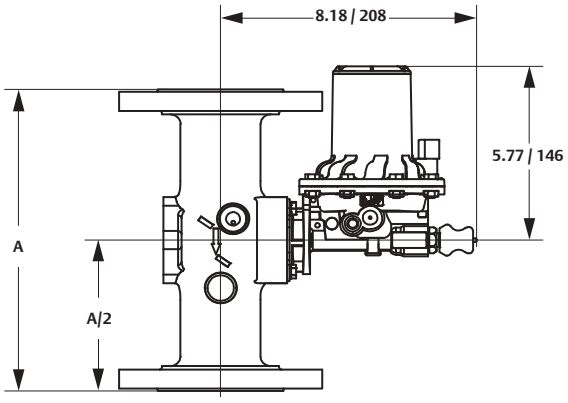


TYPES CP403 AND CP404 DUCTILE IRON/STEEL BODY PIPING POSITIONS

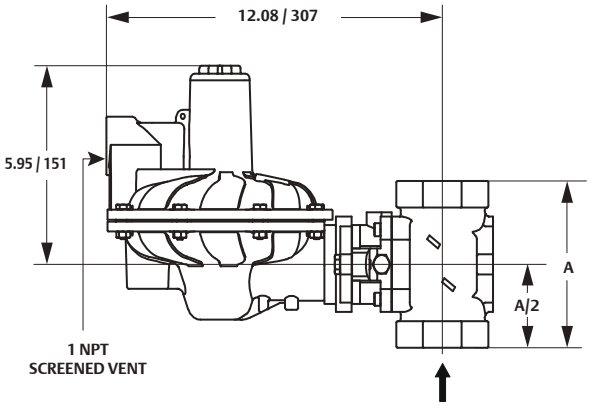
Figure 4. *CP400 Series Vent and Body Orientation*

Table 28. Type CP400 Inlet Set Pressure for Pressure Factor Measurement (PFM) Service

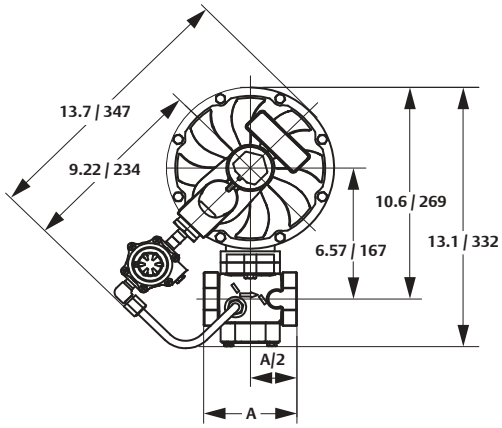
BODY SIZE, NPS / DN	SETPOINT		ORIFICE SIZE, In. / mm									
			3/16 / 4.8 Inlet Set Pressure		1/4 / 6.4 Inlet Set Pressure		3/8 / 9.5 Inlet Set Pressure		1/2 / 13 Inlet Set Pressure		3/4 / 19 Inlet Set Pressure	
	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
1-1/4 / 32	2	0.14	60	4.1	60	4.1	40	2.8	25	1.7	10	0.69
	5	0.34	40	2.8	60	4.1	25	1.7	25	1.7	15	1.0
	7	0.48	80	5.5	40	2.8	50	3.4	25	1.7	25	1.7
	10	0.69	80	5.5	80	5.5	25	1.7	25	1.7	20	1.4
	15	1.0	60	4.1	40	2.8	25	1.7	25	1.7	25	1.7
	20	1.4	60	4.1	40	2.8	40	2.8	30	2.1	25	1.7
1-1/2 / 40	2	0.14	80	5.5	60	4.1	25	1.7	25	1.7	10	0.69
	5	0.34	60	4.1	60	4.1	25	1.7	25	1.7	15	1.0
	7	0.48	60	4.1	60	4.1	25	1.7	25	1.7	25	1.7
	10	0.69	80	5.5	60	4.1	60	4.1	25	1.7	20	1.4
	15	1.0	60	4.1	40	2.8	25	1.7	25	1.7	25	1.7
	20	1.4	60	4.1	40	2.8	40	2.8	30	2.1	30	2.1
2 / 50	2	0.14	60	4.1	60	4.1	30	2.1	25	1.7	20	1.4
	5	0.34	60	4.1	50	3.4	25	1.7	25	1.7	20	1.4
	7	0.48	80	5.5	60	4.1	25	1.7	25	1.7	25	1.7
	10	0.69	60	4.1	40	2.8	25	1.7	25	1.7	20	1.4
	15	1.0	60	4.1	60	4.1	25	1.7	25	1.7	30	2.1
	20	1.4	60	4.1	40	2.8	30	2.1	30	2.1	25	1.7



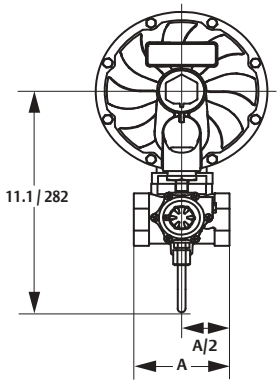
SLAM-SHUT MODULE



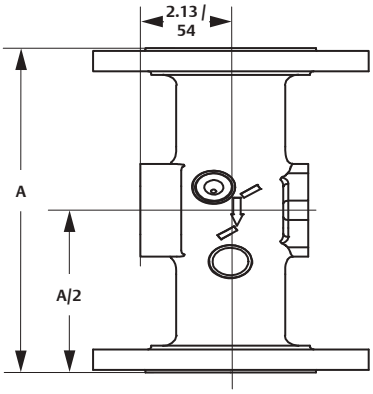
TRUE-MONITOR™ MODULE



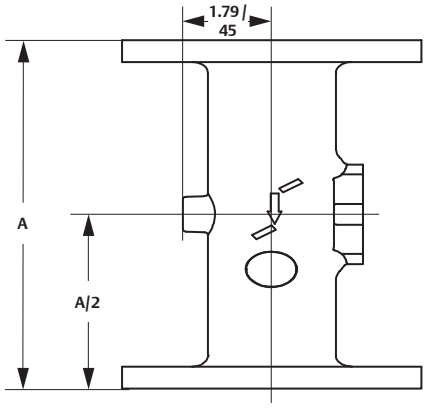
DUCTILE IRON OR STEEL THREADED BODY



GRAY CAST IRON THREADED BODY



DUCTILE IRON OR STEEL FLANGED BODY



GRAY CAST IRON FLANGED BODY

IN. / mm

Figure 5. *Dimensions*

Table 29. Dimensions

BODY SIZE, IN.	END CONNECTION STYLE			
	A			
	NPT / Rp		CL125 FF / CL150 FF / PN 16	
	In.	mm	In.	mm
1-1/4	4.49	114	----	
1-1/2			----	
1	3.94	100	----	
NPS 2 / DN 50	5	127	10	254

Ordering Guide

Type (Select One)

Regulator with Internal Registration
- ☐ CP400IN***
- ☐ CP400IT (with token relief)***

Regulator with External Registration
- ☐ CP400EN***
- ☐ CP400ET (with token relief)***

Regulator with Internal Registration and Integral True-Monitor™ Protection
- ☐ CP403IN***
- ☐ CP403IT (with token relief)***

Regulator with External Registration and Integral True-Monitor™ Protection
- ☐ CP403EN***
- ☐ CP403ET (with token relief)***

Regulator with Internal Registration and Integral Type VSX4 Slam-Shut module
- ☐ CP404IN***
- ☐ CP404IT (with token relief)***

Regulator with External Registration and Integral Type VSX4 Slam-Shut module
- ☐ CP404EN***
- ☐ CP404ET (with token relief)***

Body Size, Material and End Connection (Select One)

Gray Cast Iron (Type CP400 only)
- ☐ 1-1/4 NPT***
- ☐ 1-1/2 NPT***
- ☐ 2 NPT***
- ☐ NPS 2 / DN 50, CL125 FF (10 in. / 254 mm Face-to-Face)***

Ductile Iron (All Types)
- ☐ 1-1/4 NPT***
- ☐ 1-1/2 NPT***
- ☐ 2 NPT***
- ☐ Rp 1-1/4***
- ☐ Rp 1-1/2***
- ☐ Rp 2***
- ☐ NPS 2 / DN 50, CL125 FF (10 in. / 254 mm Face-to-Face)***
- ☐ NPS 2 / DN 50, CL150 FF (10 in. / 254 mm Face-to-Face)***
- ☐ NPS 2 / DN 50, PN 10/16 (10 in. / 254 mm Face-to-Face)***

Steel (All Types)
- ☐ 1-1/4 NPT***
- ☐ 1-1/2 NPT***
- ☐ Rp 1-1/4***
- ☐ Rp 1-1/2***

Outlet Pressure Range (Select One)

- ☐ 1 to 2 psig / 0.07 to 0.14 bar***
- ☐ 2 to 5 psig / 0.14 to 0.34 bar***
- ☐ 5 to 10 psig / 0.34 to 0.69 bar***
- ☐ 10 to 20 psig / 0.69 to 1.4 bar***

Orifice Size (Select One)

- ☐ 3/16 in. / 4.8 mm***
- ☐ 1/4 in. / 6.4 mm***
- ☐ 3/8 in. / 9.5 mm***
- ☐ 1/2 in. / 13 mm***
- ☐ 5/8 in. / 16 mm***
- ☐ 3/4 in. / 19 mm***

Body Orientation (Select One)

Type CP400
- ☐ Position 3 **(standard)***
- ☐ Position 4 (only available on Type CP400 with Gray Cast Iron Body)***

Vent Orientation of Types 67CP/67CPR and CP400 with Gray Cast Iron Body (Select One)

- ☐ Position 1 **(standard)***
- ☐ Position 2***

Vent Orientation of Types CP403/CP404 and CP400 with Ductile or Steel Body (Select One)

- ☐ Position 2***
- ☐ Position 5 **(standard)***

Certification (Available only on CP400 Series Construction)

- ☐ Pressure Factor Measurement (PFM)

True-Monitor™ Control Pressure Range (Select One)

CP403 Series
- ☐ 1.4 to 2.9 psig / 97 to 200 mbar, Black(1)
- ☐ 2.6 to 3.7 psig / 179 to 255 mbar, Purple(1)
- ☐ 3.6 to 6 psig / 248 to 414 mbar, Dark Blue
- ☐ 5.1 to 7.5 psig / 352 to 517 mbar, Red

Slam-Shut Trip Pressure Setting Types VSX4L and VSX4H

- ☐ Overpressure (OPSO) trip only (supply high-pressure trip pressure) Indicate trip pressure **See Table 8**
- ☐ Over and Underpressure (OPSO / UPSO) trip (supply high and low pressure trip pressure) Indicate trip points **See Table 9**
  Over _____ Under_____

1. Available with CP403 Series without Token relief only.

Ordering Guide (continued)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Do not use needle valves in control lines; use full-open valves. Needle valves can cause instability.

Cronos Series

Pressure Reducing Regulator

TARTARINI

Introduction

The Cronos Series regulators are accurate pilot-operated, pressure balanced, soft seated regulators designed for high pressure transmission/city gate, large capacity distribution systems and power plant feeds. They provide smooth, quiet operation, tight shutoff and long life. The regulator utilizes a main valve actuator, Type PRX pressure reducing pilot, and Type SA/2 pilot supply regulator or Type PS compact pressure reducing pilot.

The superior performance of this regulator is due to the amplifying effect of the pilot and the two-path control system. Changes in outlet pressure act quickly on the actuator diaphragm to provide fast response to system change. Then the pilot amplifies any small system changes to position the main valve for precise pressure control.

Available Configurations

See Table 1

Flange Rating PN 16 - CL150 RF

Allowable Pressure:
Up to 290 psig / 20.0 bar
Inlet Pressure Range:
2.9 to 290 psig / 0.20 to 20.0 bar
Set Range: 0.15 to 116 psig / 0.01 to 8.0 bar
Minimum Operating Differential Pressure: 2.9 psi / 0.20 bar

Flange Rating PN 25/40 - CL300 RF, CL600 RF

Allowable Pressure:
Up to 1450 psig / 100 bar
Inlet Pressure Range:
14.5 to 1450 psig / 1.00 to 100 bar
Set Range: 7.25 to 1160 psig / 0.50 to 80.0 bar
Minimum Operating Differential Pressure: 7.25 psi / 0.50 bar

Accuracy Class

Up to ±1%

Lockup Pressure Class

Up to 5%

Class of Lockup Pressure Zone

Up to 5%

Outlet Pressure Ranges

See Tables 3 and 4

Flow Coefficients

See Table 5

Shutoff Device

Accuracy Class: Up to ±1%
Response Time: ≤ 1 second

Flanged Connections

Same Inlet and Outlet:
1, 2 or 3-inch / DN 25, 50 or 80
Different Inlet and Outlet:
1 x 4, 2 x 6 or 3 x 10-inch / DN 25 x 100, 50 x 150 or 80 x 250

Operating Temperature

Standard Version:
Working: 14 to 140°F / -10 to 60°C
Low Temperature Version:
Working: -4 to 140°F / -20 to 60°C

Approximate Weights (Including Pilot)

See Tables 7 and 9

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Control Accuracy**
- **Versatility**
- **Tight Shutoff**
- **No Atmospheric Bleed**
- **High Capacity**
- **Quiet Operation**
- **In-Service Travel Indicator**
- **Silencer Options**



Figure 1. *Type Cronos C Pressure Reducing Regulator*



Figure 2. *Type Cronos CCB - SRS Pressure Reducing Regulator with Slam-Shut and Type SRS Silencer*



Figure 3. *Type Cronos CCBS Pressure Reducing Regulator and Monitor with Slam-Shut*

EMERSON
Process Management

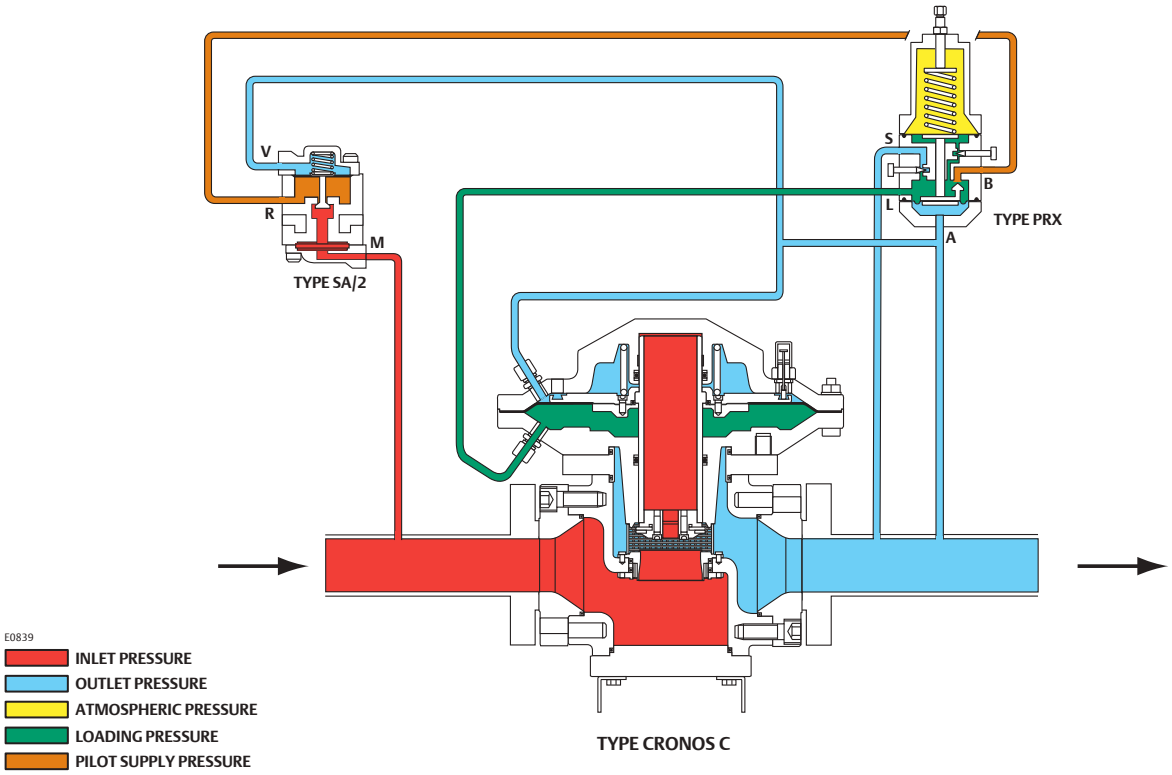


Figure 4. *Type Cronos with Type PRX Pilot Operational Schematic*

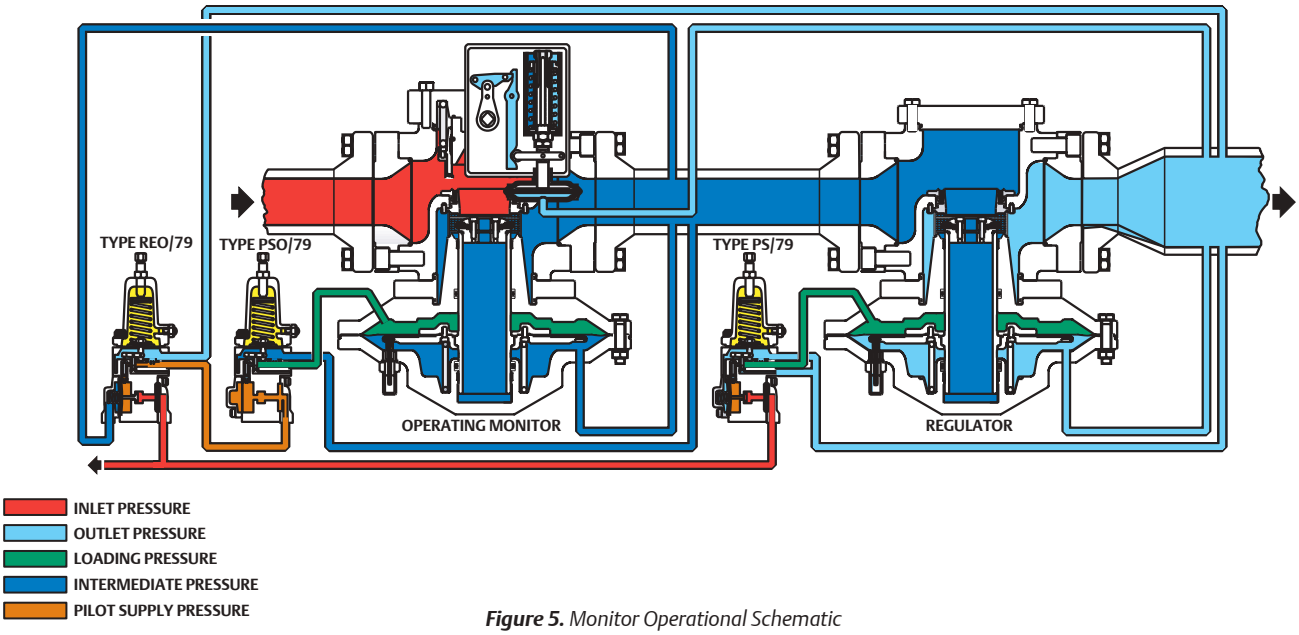


Figure 5. *Monitor Operational Schematic*

Table 1. Available Configurations

CONFIGURATION	TYPE					
	Horizontal Flow			90° Flow		
	Standard	Silenced		Standard	Silenced	
		with SR	with SRS		with SR	with SRS
Pressure Reducing Regulator	C	C-SR	C-SRS	----	----	----
Pressure Reducing Regulator with Slam-Shut	CB	CB-SR	CB-SRS	CBS	CBS-SR	CBS-SRS
Pressure Reducing Regulator and Monitor	CC	CC-SR	CC-SRS	CCS	CCS-SR	CCS-SRS
Pressure Reducing Regulator and Monitor with Slam-Shut	CCB	CCB-SR	CCB-SRS	CCBS	CCBS-SR	CCBS-SRS

Table 2. Construction Material

MAIN BODY, FLANGE, DIAPHRAGM CASING, AND DIAPHRAGM PLATE	SEAT	DIAPHRAGM	O-RING AND SEAT
Steel	Stainless steel	Nitrile (NBR) with PVC Coating	Nitrile (NBR) or Fluorocarbon (FKM)

Table 3. Outlet Pressure Ranges of Service Regulator or Monitor Pilot

PILOT TYPE	USE	OUTLET PRESSURE RANGE		ALLOWABLE PRESSURE		BODY AND COVER MATERIAL
		psig	bar	psig	bar	
PS/79-1(1)	Regulator or Monitor	0.15 to 7.3	0.01 to 0.50	363	25.0	Aluminum
PS/79-2(1)		7.3 to 43.5	0.50 to 3.0			
PS/79(1)	Regulator or Monitor	7.3 to 580	0.50 to 40.0	1450	100	Steel
PSO/79(1)	Operating Monitor - Regulator					
REO/79(1)	Operating Monitor - Monitor					
PS/80(1)	Regulator or Monitor	22 to 580	1.5 to 40.0	1450	100	Steel
PSO/80(1)	Operating Monitor - Regulator					
REO/80(1)	Operating Monitor - Monitor					
PRX/120(2)	Regulator or Monitor	14.5 to 26 23 to 44 41 to 80 73 to 123	1.00 to 1.8 1.6 to 3.0 2.8 to 5.5 5.0 to 8.5	1450	100	Steel
PRX/125(2)	Monitor	116 to 210 203 to 334 319 to 435	8.0 to 14.5 14.0 to 23.0 22.0 to 30.0			
PRX/120-AP(2)	Regulator or Monitor	435 to 1160	30.0 to 80.0	1450	100	Steel
PRX/125-AP(2)	Monitor					

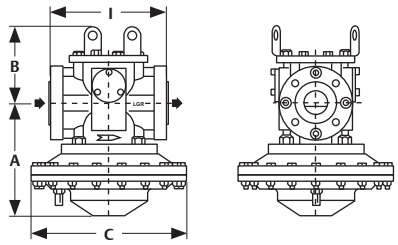
1. All PS/ Series pilots are supplied with a filter (5 micron filtering degree) and built-in pressure stabilizer, with the exception of Types PSO/79 and PSO/80.
2. The Type SA/2 pressure pre-reducer must be used with PRX Series pilots.

Table 4. Outlet Pressure Ranges of Shutoff Device Pilots

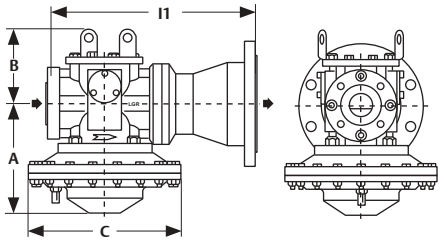
TYPE	SERVOMOTOR BODY RESISTANCE		OVERPRESSURE SET RANGE				UNDERPRESSURE SET RANGE			
			Minimum		Maximum		Minimum		Maximum	
	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
OS/80X-BP	73	5.0	0.4	0.03	29	2.0	0.15	0.01	8.7	0.60
OS/80X-BPA-D	290	20.0	0.4	0.03	29	2.0	0.15	0.01	8.7	0.60
OS/80X-MPA-D	1450	100	7.25	0.50	73	5.0	3.6	0.25	58	4.0
OS/80X-APA-D	1450	100	29	2.0	145	10.0	4.4	0.30	102	7.0
OS/84X	1450	100	73	5.0	595	41.0	58	4.0	232	16.0
OS/88X	1450	100	261	18.0	1160	80.0	116	8.0	1015	70.0

Table 5. Flow Coefficients

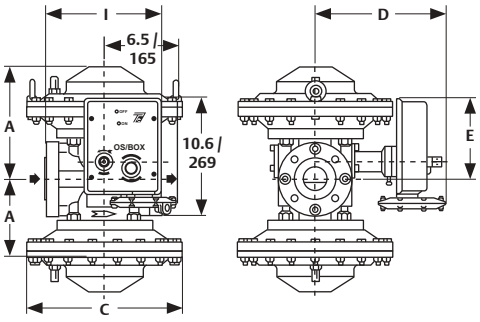
BODY SIZE		FLOW COEFFICIENT	TYPE															
			Regulating and Wide-Open for Relief Sizing															
			Standard				With SR				With SRS				With Wide Outlet			
In.	DN		C	CB	CC	CCB	C	CB	CC	CCB	C	CB	CC	CCB	C	CB	CC	CCB
Horizontal Flow																		
1	25	C_g	550	510	510	500	540	500	500	490	500	460	460	450	580	550	550	540
		C_v	18.3	16.7	16.7	16.1	18	16.4	16.4	15.8	15.2	13.7	13.7	13.2	19.3	17.7	17.7	17.4
		C_1	30	30.5	30.5	31	30	30.5	30.5	31	33	33.5	33.5	34	30	31	31	31
2	50	C_g	2250	2080	2080	2050	2200	2030	2030	2000	1900	1780	1780	1750	2300	2100	2100	2050
		C_v	77.6	69.3	69.3	67.2	75.9	67.7	67.7	64.5	59.4	53.9	53.9	52.2	79.3	70	70	67.2
		C_1	29	30	30	30.5	29	30	30	31	32	33	33	33.5	29	30	30	30.5
3	80	C_g	5100	4800	4800	4700	5000	4700	4700	4600	4200	4000	4000	3900	5200	4850	4850	4800
		C_v	176	160	160	152	172	157	157	148	131	121	121	114	179	162	162	155
		C_1	29	30	30	31	29	30	30	31	32	33	33	34	29	30	30	31
90° Flow																		
1	25	C_g	----	450	450	440	----	440	440	430	----	400	400	390	----	475	475	470
		C_v		15	15	14.2		14.7	14.7	13.9		12.1	12.1	11.5		15.8	15.8	15.2
		C_1		30	30	31		30	30	31		33	33	34		30	30	31
2	50	C_g	----	1850	1850	1800	----	1800	1800	1750	----	1650	1650	1600	----	1900	1900	1850
		C_v		61.7	61.7	58.1		60	60	56.5		51.6	51.6	48.5		63.3	63.3	59.7
		C_1		30	30	31		30	30	31		32	32	33		30	30	31
3	80	C_g	----	4300	4300	4200	----	4200	4200	4100	----	3500	3500	3400	----	4400	4400	4300
		C_v		143	143	135		140	140	132		106	106	100		147	147	139
		C_1		30	30	31		30	30	31		33	33	34		30	30	31



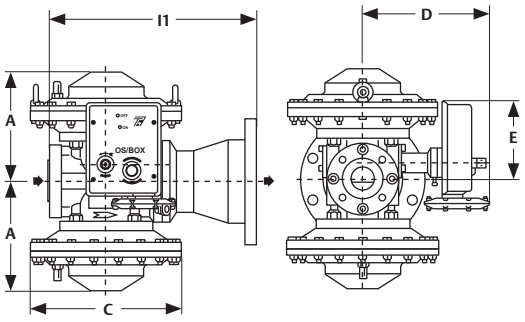
TYPE CRONOS C WITH TYPE SR SILENCER



TYPE CRONOS C WITH TYPE SRS SILENCER



TYPE CRONOS CCB WITH TYPE SR SILENCER



TYPE CRONOS CCB WITH TYPE SRS SILENCER

IN. / mm

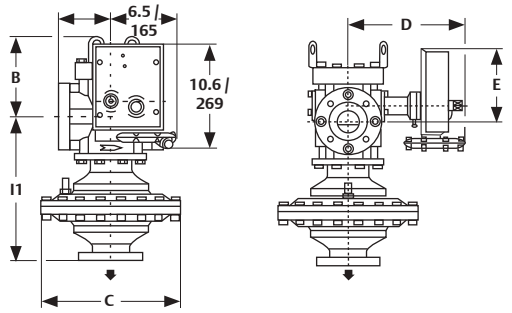
Figure 6. *Horizontal Flow Dimensions*

Table 6. Horizontal Flow Dimensions

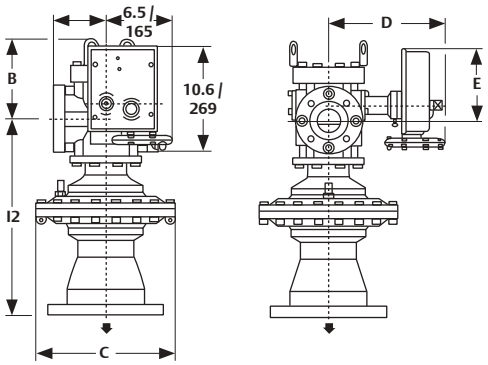
BODY SIZE		OVERALL DIMENSIONS, IN. / mm										FACE-TO-FACE DIMENSIONS, IN. / mm					
		CL150 RF Flanged PN 16					CL300 RF or CL600 RF Flanged PN 25 or 40					CL150 RF Flanged PN 16		CL300 RF Flanged PN 25		CL600 RF Flanged PN 40	
NPS	DN	A	B	C	D	E	A	B	C	D	E	I	I1	I	I1	I	I1
1	25	8.5 / 216	7.1 / 180	11.2 / 284	10.2 / 259	6.7 / 170	8.7 / 221	7.1 / 180	8.9 / 226	10.2 / 259	6.7 / 170	13.8 / 351	13.8 / 351	7.8 / 198	13.9 / 353	8.3 / 211	14.2 / 361
2	50	9.6 / 244	7.7 / 196	13.2 / 335	11.2 / 284	6.9 / 175	10.2 / 259	7.7 / 196	11.3 / 287	11.2 / 284	6.9 / 175	18.3 / 465	18.3 / 465	10.5 / 267	18.6 / 472	11.3 / 287	18.9 / 480
3	80	13.0 / 330	10.2 / 259	15.7 / 399	12.8 / 325	7.3 / 185	13.8 / 351	10.2 / 259	15.7 / 399	12.8 / 325	7.3 / 185	22.4 / 569	22.4 / 569	12.5 / 317	23.2 / 589	13.3 / 338	836 / 379

Table 7. Horizontal Flow Weights

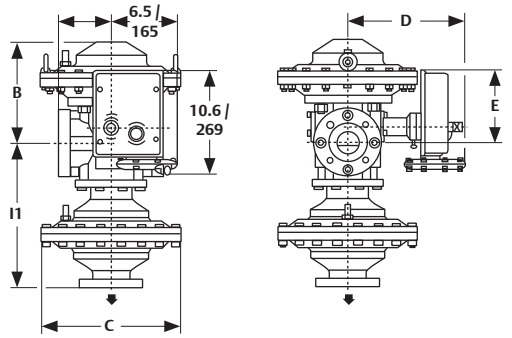
BODY SIZE		TYPE															
		Standard and SR, LBS / kg								Widened Outlet and SRS, LBS / kg							
		CL150 RF Flanged PN 16				CL300 RF or CL600 RF Flanged PN 25 or 40				CL150 RF Flanged PN 16				CL300 RF or CL600 RF Flanged PN 25 or 40			
In.	DN	C	CB	CC	CCB	C	CB	CC	CCB	C	CB	CC	CCB	C	CB	CC	CCB
1	25	79 / 36	84 / 38	123 / 56	128 / 58	82 / 37	86 / 39	134 / 61	139 / 63	108 / 49	112 / 51	152 / 69	157 / 71	123 / 56	128 / 58	172 / 78	176 / 80
2	50	137 / 62	146 / 66	212 / 96	220 / 100	163 / 74	172 / 78	260 / 118	269 / 122	192 / 87	201 / 91	267 / 121	276 / 125	240 / 109	249 / 113	337 / 153	346 / 157
3	80	282 / 128	313 / 142	421 / 191	434 / 197	377 / 171	408 / 185	597 / 271	611 / 277	419 / 190	450 / 204	558 / 253	571 / 259	602 / 273	615 / 279	822 / 373	836 / 379



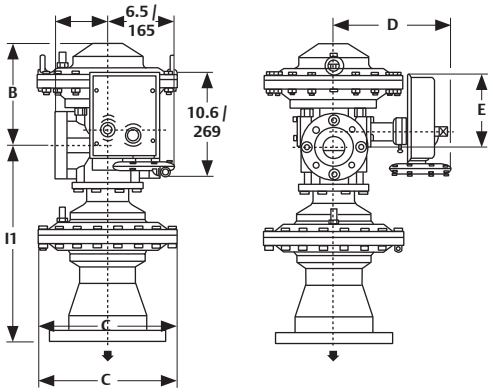
TYPE CRONOS CBS WITH TYPE SR SILENCER



TYPE CRONOS CBS WITH TYPE SRS SILENCER



TYPE CRONOS CCBS WITH TYPE SR SILENCER



TYPE CRONOS CCBS WITH TYPE SRS SILENCER

IN. / mm

Figure 7. *90° Flow Dimensions*

Table 8. 90° Flow Dimensions

BODY SIZE		OVERALL DIMENSIONS, IN. / mm										FACE-TO-FACE DIMENSIONS, IN. / mm					
		CL150 RF Flanged PN 16					CL300 RF or CL600 RF Flanged PN 25 or 40					CL150 RF Flanged PN 16		CL300 RF Flanged PN 25		CL600 RF Flanged PN 40	
NPS	DN	A	B	C	D	E	A	B	C	D	E	I	I1	I	I1	I	I1
1	25	8.5 / 216	7.1 / 180	11.2 / 284	10.2 / 259	6.7 / 170	8.7 / 221	7.1 / 180	8.9 / 226	10.2 / 259	6.7 / 170	7.2 / 183	13.8 / 351	7.8 / 198	13.9 / 353	8.3 / 211	14.2 / 361
2	50	9.6 / 244	7.7 / 196	13.2 / 335	11.2 / 284	6.9 / 175	10.2 / 259	7.7 / 196	11.3 / 287	11.2 / 284	6.9 / 175	10.0 / 254	18.3 / 465	10.5 / 267	18.6 / 472	11.3 / 287	18.9 / 480
3	80	13.0 / 330	10.2 / 259	15.7 / 399	12.8 / 325	7.3 / 185	13.8 / 351	10.2 / 259	15.7 / 399	12.8 / 325	7.3 / 185	11.7 / 297	22.4 / 569	12.5 / 317	23.2 / 589	13.3 / 338	23.6 / 599

Table 9. 90° Flow Weights

BODY SIZE		TYPE															
		Standard and SR, LBS / kg								Widened Outlet and SRS, LBS / kg							
		CL150 RF Flanged PN 16				CL300 RF or CL600 RF Flanged PN 25 or 40				CL150 RF Flanged PN 16				CL300 RF or CL600 RF Flanged PN 25 or 40			
In.	DN	C	CB	CC	CCB	C	CB	CC	CCB	C	CB	CC	CCB	C	CB	CC	CCB
1	25	79 / 36	84 / 38	123 / 56	128 / 58	82 / 37	86 / 39	134 / 61	139 / 63	108 / 49	112 / 51	152 / 69	157 / 71	123 / 56	128 / 58	172 / 78	176 / 80
2	50	137 / 62	146 / 66	212 / 96	220 / 100	163 / 74	172 / 78	260 / 118	269 / 122	192 / 87	201 / 91	267 / 121	276 / 125	240 / 109	249 / 113	337 / 153	346 / 157
3	80	282 / 128	313 / 142	421 / 191	434 / 197	377 / 171	408 / 185	597 / 271	611 / 277	419 / 190	450 / 204	558 / 253	571 / 259	602 / 273	615 / 279	822 / 373	836 / 379

Ordering Guide

Configuration (Fill in - see Table 1)

_____

Body Size (Select One)

- ☐ NPS 1 / DN 25**
- ☐ NPS 2 / DN 50**
- ☐ NPS 3 / DN 80**

Built-In Silencer - For Clean Gas Only

- ☐ Type SR**
- ☐ Type SRS**
- ☐ None

End Connection Style (Select One)

- ☐ PN 16**
- ☐ PN 25**
- ☐ PN 40**
- ☐ CL150**
- ☐ CL300**
- ☐ CL600**

Elastomer Part (Select One)

- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)**

Working Temperature Range (Select One)

- ☐ Standard Version: 14 to 140°F / -10 to 60°C**
- ☐ Low Temperature Version: -4 to 140°F / -20° to 60°C**

Pilot Type (Fill in - see Table 3)

- ☐ PS/79-1**
- ☐ PS/79-2**
- ☐ PS/79**
- ☐ PS/80**
- ☐ PSO/79
- ☐ PSO/80
- ☐ REO/79
- ☐ REO/80
- ☐ PRX/120 and SA/2**
- ☐ PRX/120-AP and SA/2**
- ☐ PRX/125 and SA/2**
- ☐ PRX/125-AP and SA/2**

Setpoint (Fill in - see Tables 3 and 4)

Regulator Outlet Pressure: _____
Built-in Monitor Outlet Pressure: _____
Built-in Safety Shutoff Device Minimum Pressure: _____
Built-in Safety Shutoff Device Maximum Pressure: _____

Monitor Booster Valve

- ☐ Type V/31-1**
- ☐ Type PRX/131**
- ☐ Type PRX-AP/131**

PED Certificate (Optional)

- ☐ Yes**

Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

Installation (Select One)

Horizontal Flow

- ☐ Left to Right
- ☐ Right to Left

Vertical Flow

- ☐ Downward
- ☐ Upward

90° Flow

- ☐ Left Downward
- ☐ Right Downward
- ☐ Left Upward
- ☐ Right Upward

- continued -

Ordering Guide (continued)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Do not make the setpoints of the regulator/monitor too close together. The monitor can try to take over if the setpoints are too close, causing instability and reduction of capacity. Set them at least one proportional band apart.

Introduction

The CS200 Series direct-operated, spring-loaded regulators have been engineered to fit a multitude of pressure-reducing applications including commercial and industrial installations. This flexibility is provided by the numerous body sizes, outlet pressure settings and orifice sizes. Ease of maintenance and installation are also strengths of the CS200 Series, which offers a full 360° of rotation of the actuator via the union ring connection between the body and casing. The combination of 360° rotatable union ring along with a rotatable upper casing provide simplified vent position, especially in tight spaces or awkward installations.

The CS200 Series also offers Overpressure Protection in the form of Internal Relief and Secondary Seat™ Protection.

Body Sizes, End Connection Style and Pressure Rating

See Table 2

Inlet Pressure Ratings

See Table 4

Maximum Outlet Pressures

Casing: 25 psig / 1.7 bar

To Avoid Internal Parts Damage:
5 psi / 0.34 bar differential above outlet pressure setting

Operating: 2 psig / 138 mbar

Outlet Pressure Range

3.5 in. w.c. to 2 psig / 9 mbar to 138 mbar

See Table 5

Spring Case Vent Connection

1 NPT

Temperature Capabilities

-20 to 150°F / -29 to 66°C

Pressure Registration

Internal

Approximate Shipping Weight

8 lbs / 4 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Wide Range of NPT Body Sizes**
- **Easy to Install and Maintain**
- **Only Standard Tools Required for Pressure Adjustment and Orifice Removal**
- **Fixed Factor Accuracy (PFM Approved)**
- **Application Flexibility**
- **Secondary Seat Protection**



Figure 1. *Typical CS200 Pressure Reducing Regulator*

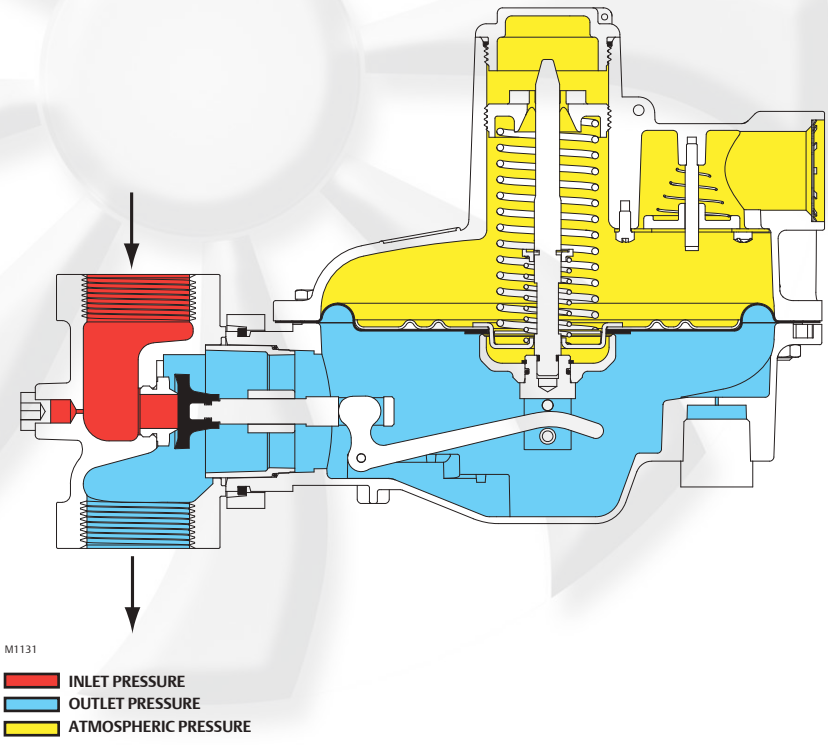


Figure 2. *Type CS200IR Pressure Reducing Regulator Operational Schematic*

Table 1. Available Configuration

TYPE NUMBER							OPTION
C	S	2	0				
							OVERPRESSURE PROTECTION MODULE
				0			Without Overpressure Protection Module
				5			With Secondary Seat™ Protection
				6			With Secondary Seat Protection with bleed to indicate Secondary Seat is functioning
							PRESSURE REGISTRATION
					I		Internal Registration
							RELIEF
						N	Non-Relief
						R	Internal Relief

Table 2. Body Size, Material, End Connection Style and Pressure Rating

SERIES	BODY SIZE	END CONNECTION STYLE	BODY MATERIAL	PRESSURE RATING	
				psig	bar
CS200	3/4 3/4 x 1 3/4 x 1-1/4 1 1 x 1-1/4 1-1/4	NPT	Gray Cast Iron	175	12,1

Table 3. Construction Material

BODY	BODY O-RING	CLOSING CAP	ADJUSTING SCREW	DIAPHRAGM CASE, SPRING CASE AND VALVE STEM	DIAPHRAGM HEAD	ORIFICE	PUSHER POST	DIAPHRAGM AND DISK	LEVER PIN
Gray Cast Iron	Nitrile (NBR)	Aluminum	Aluminum	Aluminum	Steel	Aluminum	Aluminum	Nitrile (NBR)	18-8 Stainless steel

Table 4. Orifice Size and Inlet Pressure Rating

SERIES	ORIFICE SIZE		MAXIMUM OPERATING INLET PRESSURE(1)(2)		MAXIMUM EMERGENCY INLET PRESSURE	
	In.	mm	psig	bar	psig	bar
CS200	1/8	3.2	125	8.6	175	12.1
	3/16	4.8	125	8.6		
	1/4	6.4	125	8.6		
	3/8	9.5	60	4.1		
	1/2	13	40	2.8		

1. Inlet pressures based on lockup performance. For maximum inlet pressure values with optimum regulating performance refer to the applicable Flow Capacity table.
2. To comply with ANSI B109.4 relief requirements the maximum inlet pressure may need to be reduced. Reference the Relief Performance Tables 8 and 11.

Table 5. Outlet Pressure Range

SERIES	OUTLET PRESSURE RANGE		PART NUMBER	SPRING COLOR	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
	In. w.c.	mbar			In.	mm	In.	mm
CS200	3.5 to 5	9 to 12	GE30198X012	Red	0.102	2.59	3.95	100
	4.5 to 6.5	11 to 16	GE30195X012	Purple	0.090	2.28	4.32	110
	6 to 8	15 to 20	GE30188X012	Gold	0.111	2.82	4.48	114
	7.5 to 11	19 to 27	GE30189X012	Blue	0.112	2.84	4.40	112
	10 to 14	25 to 35	GE30224X012	Unpainted	0.102	2.59	4.78	121
	12 to 19	30 to 47	GE30196X012	Green	0.112	2.84	4.70	119
	18 to 1 psig	45 to 0.07 bar	GE30225X012	Orange	0.120	3.04	4.94	125
	1 to 2 psig	0.07 to 0.14 bar	GE30190X012	Black	0.145	3.68	4.66	118

Table 6. Flow and Sizing Coefficient

SERIES	ORIFICE SIZE		FLOW COEFFICIENT (WIDE-OPEN)			IEC SIZING COEFFICIENT		
	In.	mm	C_g	C_v	C_1	X_T	F_D	F_L
CS200	1/8	3.2	12	0.40	30	0.53	0.87	0.89
	3/16	4.8	24	0.80	30	0.58	0.82	
	1/4	6.4	44	1.52	29	0.53	0.85	
	3/8	9.5	102	3.30	31	0.60	0.83	
	1/2	13	172	4.40	39	0.97	0.72	

SETPOINT	ACCURACY		SET RANGE	SPRING PART NUMBER / COLOR
	Droop	Boost		
7 in. w.c.	-1 in. w.c.	2 in. w.c.	6 to 8 in. w.c.	GE30188X012 / Gold
17 mbar	-2 mbar	5 mbar	15 to 20 mbar	

Table 7. Types CS200IN and CS200IR Series Flow Capacities for 7 in. w.c. / 17 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 3/4									
0.5	34 mbar	60	1.6	120	3.2	170	4.6	225	6.0	300	8.1
1	69 mbar	100	2.7	175	4.7	300	8.1	350	9.4	425	11.4
2	138 mbar	130	3.5	250	6.7	325	8.7	525	14.1	625	16.8
3	0.21	160	4.3	325	8.7	400	10.7	600	16.1	825	22.1
5	0.34	220	5.9	425	11.4	675	18.1	925	24.8	1050	28.2
10	0.69	300	8.1	700	18.8	1025	27.5	1400	37.6	1400	37.6
15	1.0	375	10.1	900	24.2	1400	37.6	1675	45.0	1550	41.6
20	1.4	475	12.8	1050	28.2	1625	43.6	1825	49.0	1725	46.3
30	2.1	600	16.1	1375	36.9	1975	53.0	2000	53.7		
40	2.8	750	20.1	1700	45.6	2075	55.7	2000	53.7		
50	3.4	900	24.2	2025	54.4	2150	57.7	2000	53.7		
60	4.1	1050	28.2	2350	63.1	2200	59.1				
80	5.5	1350	36.2	2350	63.1	2250	60.4				
100	6.9	1650	44.3	2350	63.1						
125	8.6	2000	53.7								
psig	bar	Body Size: NPS 1									
0.5	34 mbar	60	1.6	120	3.2	170	4.6	240	6.4	300	8.1
1	69 mbar	100	2.7	175	4.7	300	8.1	400	10.7	425	11.4
2	138 mbar	130	3.5	250	6.7	400	10.7	575	15.4	775	20.8
3	0.21	160	4.3	325	8.7	475	12.8	750	20.1	1025	27.5
5	0.34	220	5.9	425	11.4	700	18.8	1100	29.5	1375	36.9
10	0.69	300	8.1	700	18.8	1150	30.9	1775	47.7	2075	55.7
15	1.0	375	10.1	900	24.2	1600	43.0	2300	61.7	2525	67.8
20	1.4	475	12.8	1050	28.2	1950	52.3	2650	71.1	2675	71.8
30	2.1	600	16.1	1375	36.9	2550	68.5	3325	89.3	3250	87.2
40	2.8	750	20.1	1375	36.9	3100	83.2	3775	101	3400	91.3
50	3.4	900	24.2	1375	36.9	1350	36.2	3775	101		
60	4.1	1050	28.2	1375	36.9	1250	33.6	3775	101		
80	5.5	1350	36.2	1375	36.9	1250	33.6				
100	6.9	1350	36.2	1375	36.9	1250	33.6				
125	8.6	1350	36.2	1250	33.6	1250	33.6				
psig	bar	Body Size: NPS 1-1/4									
0.5	34 mbar	60	1.6	100	2.6	160	4.2	240	6.4	300	8.1
1	69 mbar	100	2.7	170	4.5	250	6.7	400	10.7	425	11.4
2	138 mbar	130	3.5	250	6.7	400	10.7	575	15.4	775	20.8
3	0.21	160	4.3	270	7.2	475	12.8	775	20.8	1050	28.2
5	0.34	220	5.9	425	11.4	700	18.8	1175	31.5	1475	39.6
10	0.69	300	8.1	700	18.8	1150	30.9	2150	57.7	2450	65.8
15	1.0	375	10.1	870	23.4	1600	43.0	3000	80.5	3300	88.6
20	1.4	500	13.4	1050	28.2	1900	51.0	3200	85.9	2750	73.8
30	2.1	625	16.8	1320	35.4	2550	68.5	2200	59.1	2000	53.7
40	2.8	775	20.8	1725	46.3	2800	75.2	1825	49.0	1700	45.6
50	3.4	950	25.5	2025	54.4	2350	63.1	1600	42.9		
60	4.1	1075	28.9	2375	63.8	1900	51.0	1600	42.9		
80	5.5	1375	36.9	2875	77.2	1900	51.0				
100	6.9	1700	45.6	3150	84.6	1900	51.0				
125	8.6	1700	53.0	3175	85.2	1900	51.0				

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Gray areas indicate limited capacities due to boost effects.

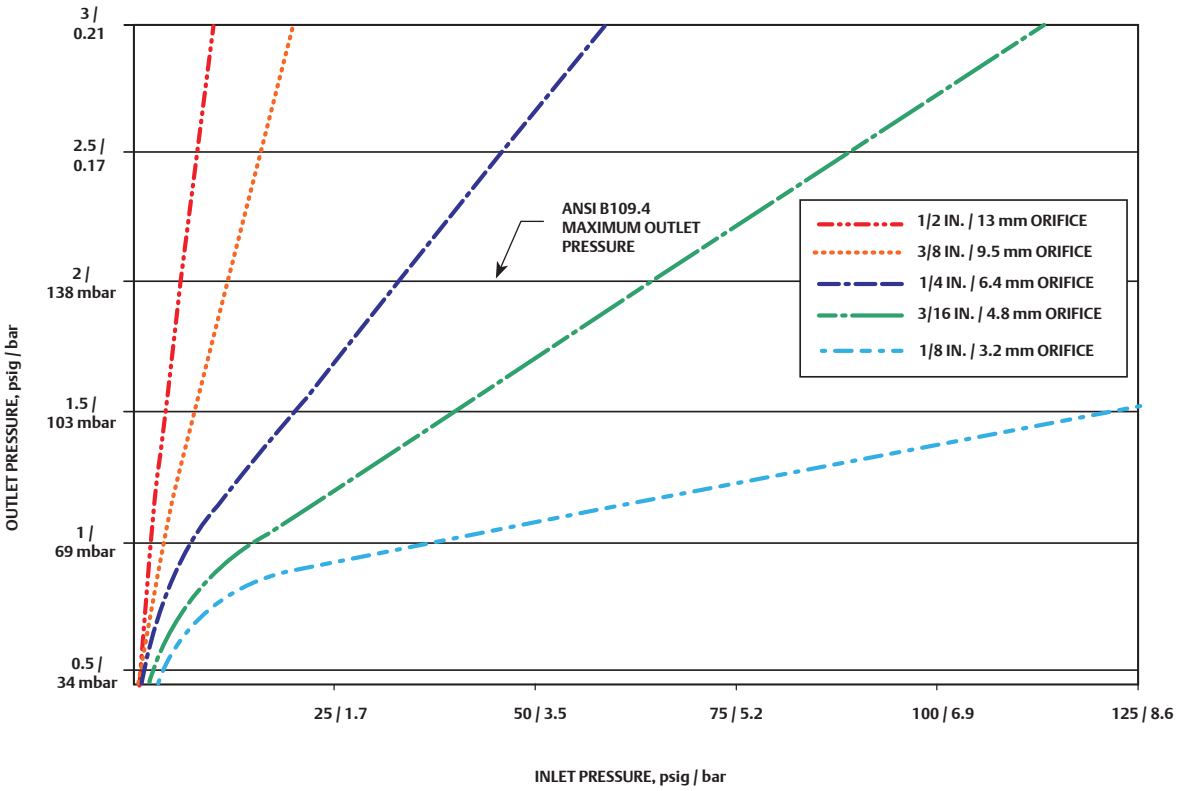


Figure 3. *Type CS200IR Relief Curves (Linkage Disconnect) at 7 in. w.c. / 17 mbar Set Pressure*

Table 8. Type CS200IR Internal Relief Performance Table for 7 in. w.c. / 17 mbar Setpoint

ORIFICE SIZE		REGULATOR SET PRESSURE		MAXIMUM INLET PRESSURE TO KEEP OUTLET PRESSURE AT OR BELOW[1][2]			
				1 psig / 0.07 bar		2 psig / 0.14 bar	
In.	mm	In. w.c.	mbar	psig	bar	psig	bar
1/8	3.2	7	17	36	2.5	>125	>8.6
3/16	4.8			15	1.0	74	5.1
1/4	6.4			6	0.41	36	2.5
3/8	9.5			3	0.21	12	0.83

1. Relief value obtained by disconnecting the lever.
2. 2 psig / 138 mbar is the maximum outlet pressure allowed per ANSI B109.4.

	ACCURACY			
SETPOINT	Droop	Boost	SET RANGE	SPRING PART NUMBER / COLOR
11 in. w.c.	-2 in. w.c.	2 in. w.c.	7.5 to 11 in. w.c.	GE30189X012 / Blue
27 mbar	-5 mbar	5 mbar	19 to 27 mbar	

Table 9. Types CS200IN and CS200IR Series Flow Capacities for 11 in. w.c. / 27 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 3/4									
1	69 mbar	85	2.3	185	5.0	300	8.1	425	11.4	575	15.4
2	138 mbar	130	3.5	285	7.7	425	11.4	600	16.1	825	22.1
3	0.21	170	4.6	350	9.4	525	14.1	775	20.8	1050	28.2
5	0.34	225	6.0	480	12.9	775	20.8	1150	30.9	1300	34.9
10	0.69	325	8.7	700	18.8	1200	32.2	1550	41.6	1625	43.6
15	1.0	400	10.7	900	24.2	1500	40.3	1850	49.7	1775	47.7
20	1.4	480	12.9	1075	28.9	1750	47.0	2025	54.4	2200	59.1
30	2.1	625	16.8	1400	37.6	2125	57.0	2200	59.1	2200	59.1
40	2.8	775	20.8	1700	45.6	2300	61.7	2200	59.1	2200	59.1
50	3.4	925	24.8	2025	54.4	2375	63.8	2200	59.1		
60	4.1	1050	28.2	2350	63.1	2450	65.8	2200	59.1		
80	5.5	1350	36.2	2500	67.1	2500	67.1				
100	6.9	1650	44.3	2500	67.1	2500	67.1				
125	8.6	1950	52.3	2500	67.1	2500	67.1				
psig	bar	Body Size: NPS 1									
1	69 mbar	85	2.3	185	5.0	300	8.1	500	13.4	650	17.4
2	138 mbar	130	3.5	285	7.7	425	11.4	725	19.5	975	26.2
3	0.21	170	4.6	350	9.4	525	14.1	925	24.8	1250	33.6
5	0.34	225	6.0	480	12.9	775	20.8	1325	35.6	1750	47.0
10	0.69	325	8.7	700	18.8	1250	33.6	1950	52.3	2400	64.4
15	1.0	400	10.7	900	24.2	1625	43.6	2500	67.1	2850	76.5
20	1.4	480	12.9	1075	28.9	1950	52.3	2925	78.5	2900	77.9
30	2.1	625	16.8	1400	37.6	2550	68.5	3550	95.3		
40	2.8	775	20.8	1725	46.3	3125	83.9	3900	105		
50	3.4	925	24.8	2050	55.0	1475	39.6	3900	105		
60	4.1	1050	28.2	1350	36.2	1475	39.6				
80	5.5	1350	36.2	1350	36.2	1475	39.6				
100	6.9	1475	39.6	1350	36.2						
125	8.6	1600	43.0								
psig	bar	Body Size: NPS 1-1/4									
1	69 mbar	85	2.3	170	4.6	300	8.1	500	13.4	650	17.4
2	138 mbar	130	3.5	270	7.2	425	11.4	725	19.5	1100	29.5
3	0.21	170	4.6	350	9.4	525	14.1	1000	26.8	1475	39.6
5	0.34	225	6.0	480	12.9	775	20.8	1375	36.9	2000	53.7
10	0.69	325	8.7	700	18.8	1250	33.6	2225	59.7	2450	65.8
15	1.0	400	10.7	900	24.2	1625	43.6	2850	76.5	2875	77.2
20	1.4	480	12.9	1075	28.9	1950	52.3	3400	91.3	3525	94.5
30	2.1	625	16.8	1400	37.6	2500	67.1	3400	91.3	1800	48.3
40	2.8	775	20.8	1725	46.3	2500	67.1	2400	64.4	1800	48.3
50	3.4	925	24.8	2050	55.0	2500	67.1	1700	45.6		
60	4.1	1050	28.2	2350	63.1	2500	67.1	1700	45.6		
80	5.5	1350	36.2	2975	79.9	2000	53.6				
100	6.9	1650	44.3	1700	45.6	1900	51.0				
125	8.6	2000	53.7	1700	45.6	1900	51.0				

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Gray areas indicate limited capacities due to boost effects.

SETPOINT	ACCURACY		SET RANGE	SPRING PART NUMBER / COLOR
	Droop	Boost		
14 in. w.c.	-2 in. w.c.	2 in. w.c.	10 to 14 in. w.c.	GE30224X012 / Unpainted
35 mbar	-5 mbar	5 mbar	25 to 35 mbar	

Table 10. Types CS200IN and CS200IR Series Flow Capacities for 14 in. w.c. / 35 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 3/4									
1	69 mbar	85	2.3	185	5.0	300	8.1	425	11.4	575	15.4
2	138 mbar	130	3.5	285	7.7	425	11.4	600	16.1	825	22.1
3	0.21	170	4.6	350	9.4	525	14.1	775	20.8	1050	28.2
5	0.34	225	6.0	480	12.9	775	20.8	1150	30.9	1300	34.9
10	0.69	325	8.7	700	18.8	1200	32.2	1550	41.6	1625	43.6
15	1.0	400	10.7	900	24.2	1500	40.3	1850	49.7	1775	47.7
20	1.4	480	12.9	1075	28.9	1750	47.0	2025	54.4	2200	59.1
30	2.1	625	16.8	1400	37.6	2125	57.0	2200	59.1		
40	2.8	775	20.8	1700	45.6	2300	61.7	2200	59.1		
50	3.4	925	24.8	2025	54.4	2375	63.8	2200	59.1		
60	4.1	1050	28.2	2350	63.1	2450	65.8				
80	5.5	1350	36.2	2500	67.1	2500	67.1				
100	6.9	1650	44.3	2500	67.1						
125	8.6	1950	52.3								
psig	bar	Body Size: NPS 1									
1	69 mbar	85	2.3	185	5.0	300	8.1	500	13.4	650	17.4
2	138 mbar	130	3.5	285	7.7	425	11.4	725	19.5	975	26.2
3	0.21	170	4.6	350	9.4	525	14.1	925	24.8	1250	33.6
5	0.34	225	6.0	480	12.9	775	20.8	1325	35.6	1750	47.0
10	0.69	325	8.7	700	18.8	1250	33.6	1950	52.3	2400	64.4
15	1.0	400	10.7	900	24.2	1625	43.6	2500	67.1	2850	76.5
20	1.4	480	12.9	1075	28.9	1950	52.3	2925	78.5	2900	77.9
30	2.1	625	16.8	1400	37.6	2550	68.5	3550	95.3	3400	91.3
40	2.8	775	20.8	1725	46.3	3125	83.9	3900	105		
50	3.4	925	24.8	2050	55.0	1475	39.6	3900	105		
60	4.1	1050	28.2	1350	36.2	1475	39.6				
80	5.5	1350	36.2	1350	36.2	1475	39.6				
100	6.9	1475	39.6	1350	36.2						
125	8.6	1600	43.0								
psig	bar	Body Size: NPS 1-1/4									
1	69 mbar	85	2.3	185	5.0	280	7.5	500	13.4	650	17.4
2	138 mbar	130	3.5	245	6.6	425	11.4	725	19.5	1100	29.5
3	0.21	170	4.6	350	9.4	525	14.1	1000	26.8	1475	39.6
5	0.34	225	6.0	480	12.9	775	20.8	1375	36.9	2000	53.7
10	0.69	325	8.7	700	18.8	1250	33.6	2225	59.7	2450	65.8
15	1.0	400	10.7	900	24.2	1625	43.6	2850	76.5	2875	77.2
20	1.4	480	12.9	1075	28.9	1950	52.3	3400	91.1	3525	94.6
30	2.1	625	16.8	1400	37.6	2300	61.7	3400	91.1	1850	49.7
40	2.8	775	20.8	1725	46.3	2300	61.7	2300	61.7	1850	49.7
50	3.4	925	24.8	2050	55.0	2300	61.7	2150	57.7		
60	4.1	1050	28.2	2350	63.1	2300	61.7	2150	57.7		
80	5.5	1350	36.2	2975	79.9	2000	53.6				
100	6.9	1650	44.3	2975	79.9	1900	51.0				
125	8.6	2000	53.7	2975	79.9	1900	51.0				

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Gray areas indicate limited capacities due to boost effects.

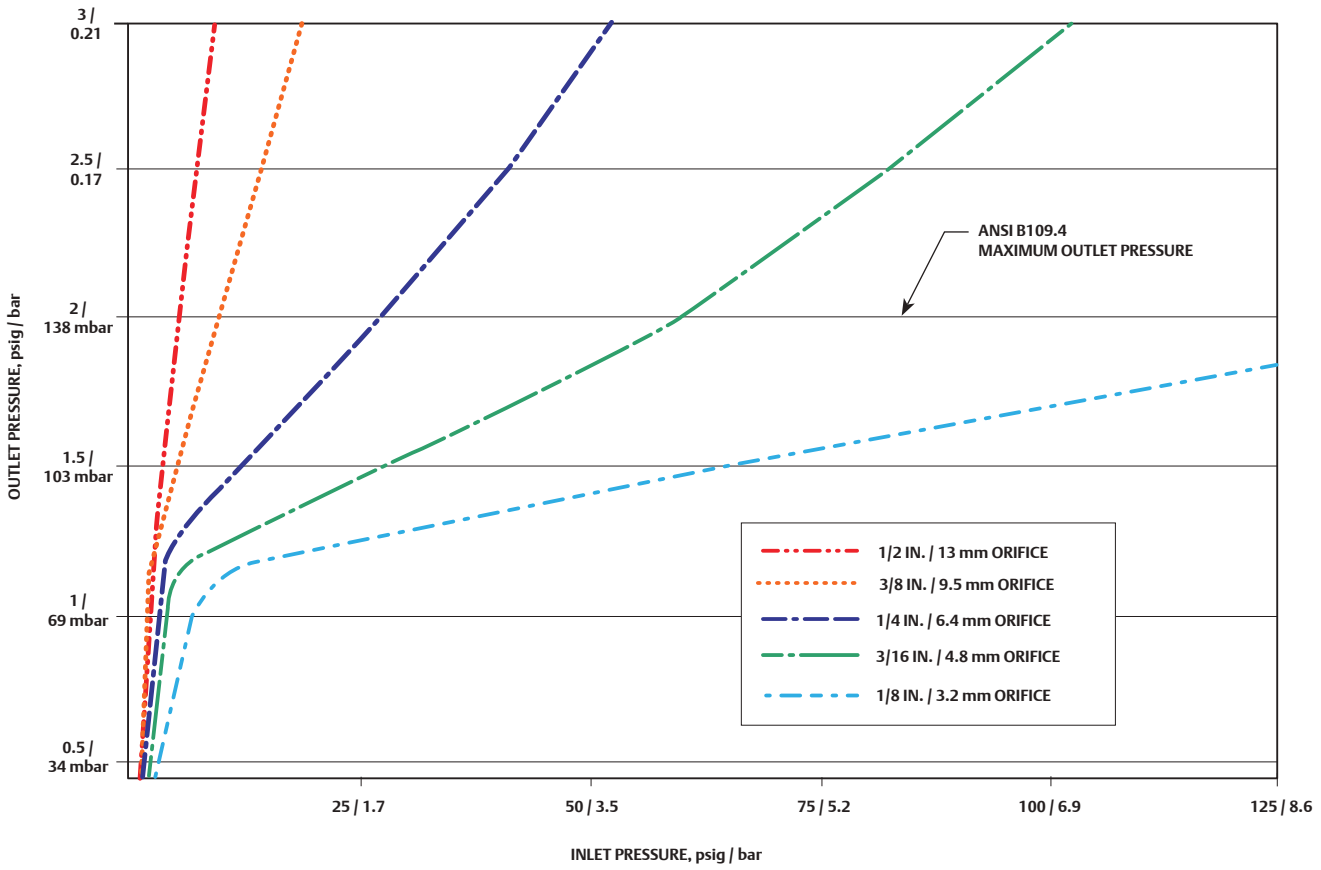


Figure 4. *Type CS200IR Relief Curves (Linkage Disconnect) at 14 in. w.c. / 35 mbar Set Pressure*

Table 11. Type CS200IR Internal Relief Performance Table for 14 in. w.c. / 35 mbar Setpoint

ORIFICE SIZE		REGULATOR SET PRESSURE		MAXIMUM INLET PRESSURE TO KEEP OUTLET PRESSURE AT OR BELOW[1][2]			
				2 psig / 0.14 bar		2.5 psig / 0.17 bar	
In.	mm	In. w.c.	mbar	psig	bar	psig	bar
1/8	3.2	14	35	>125	>8.6	>125	>8.6
3/16	4.8			59	4.1	82	5.7
1/4	6.4			28	1.9	40	2.8
3/8	9.5			10	0.69	14	0.97

1. Relief value obtained by disconnecting the lever.
2. 2 psig /138 mbar is the maximum outlet pressure allowed per ANSI B109.4.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	SPRING PART NUMBER / COLOR
1 psig	-0.16 psi	0.16 psi	18 in. w.c. to 1 psig	GE30225X012 / Orange
69 mbar	-11 mbar	11 mbar	45 to 69 mbar	

Table 12. Types CS200IN and CS200IR Series Flow Capacities for 1 psig / 69 mbar Setpoint at 1% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 3/4									
2	138 mbar	115	3.1	240	6.4	375	10.1	625	16.8	875	23.5
3	0.21	150	4.0	325	8.7	500	13.4	800	21.5	1175	31.5
5	0.34	225	6.0	450	12.1	725	19.5	1200	32.2	1475	39.6
10	0.69	325	8.7	725	19.5	1150	30.9	1750	47.0	1950	52.3
15	1.0	400	10.7	850	22.8	1500	40.3	2100	56.4	2225	59.7
20	1.4	475	12.8	1025	27.5	1725	46.3	2300	61.7	2350	63.1
30	2.1	625	16.8	1400	37.6	2175	58.4	2675	71.8	2700	72.5
40	2.8	750	20.1	1700	45.6	2550	68.5	2675	71.8	2700	72.5
50	3.4	900	24.2	2000	53.7	2650	71.1	2675	71.8		
60	4.1	1050	28.2	2350	63.1	2750	73.8	2675	71.8		
80	5.5	1350	36.2	2850	76.5	2850	76.5				
100	6.9	1600	43.0	2850	76.5	2850	76.5				
125	8.6	1975	53.0	2850	76.5						
psig	bar	Body Size: NPS 1									
2	138 mbar	115	3.1	240	6.4	400	10.7	675	18.1	950	25.5
3	0.21	150	4.0	325	8.7	550	14.8	975	26.2	1325	35.6
5	0.34	225	6.0	450	12.1	775	20.8	1400	37.6	1850	49.7
10	0.69	325	8.7	725	19.5	1200	32.2	2100	56.4	2600	69.8
15	1.0	400	10.7	850	22.8	1600	43.0	2750	73.8	3100	83.2
20	1.4	475	12.8	1025	27.5	1900	51.0	3200	85.9	3450	92.6
30	2.1	625	16.8	1400	37.6	2425	65.1	3750	101	4000	107
40	2.8	750	20.1	1700	45.6	3150	84.6	4375	117	4000	107
50	3.4	900	24.2	2000	53.7	3700	99.3	4550	122		
60	4.1	1050	28.2	2350	63.1	4150	111	4550	122		
80	5.5	1350	36.2	2975	79.9	4150	111				
100	6.9	1600	43.0	3650	98.0	4150	111				
125	8.6	1975	53.0	4400	118	4150	111				
psig	bar	Body Size: NPS 1-1/4									
2	138 mbar	115	3.1	240	6.4	425	11.4	750	20.1	1000	26.8
3	0.21	150	4.0	325	8.7	575	15.4	1050	28.2	1450	38.9
5	0.34	225	6.0	450	12.1	825	22.1	1500	40.2	2100	56.4
10	0.69	325	8.7	725	19.5	1300	34.9	2475	66.4	3250	87.2
15	1.0	400	10.7	850	22.8	1600	42.9	3325	89.3	4100	110
20	1.4	475	12.8	1025	27.5	1925	51.7	4095	110	4900	131
30	2.1	625	16.8	1400	37.6	2500	67.1	4400	118	4900	131
40	2.8	750	20.1	1700	45.6	3025	81.2	4400	118	4900	131
50	3.4	900	24.2	2000	53.7	3175	85.2	4400	118		
60	4.1	1050	28.2	2350	63.1	4275	115	4400	118		
80	5.5	1350	36.2	2975	79.9	4600	123				
100	6.9	1600	43.0	3650	98.0	4600	123				
125	8.6	1975	53.0	4400	118	4600	123				

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 2% ABS		SET RANGE	SPRING PART NUMBER / COLOR
1 psig	-0.31 psi	0.31 psi	18 in. w.c. to 1 psig	GE30225X012 / Orange
69 mbar	-21 mbar	21 mbar	45 to 69 mbar	

Table 13. Types CS200IN and CS200IR Series Flow Capacities for 1 psig / 69 mbar Setpoint at 2% Accuracy

CAPACITIES IN SCFH / Nm^3/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm^3/h	SCFH	Nm^3/h	SCFH	Nm^3/h	SCFH	Nm^3/h	SCFH	Nm^3/h
psig	bar	Body Size: NPS 3/4									
2	138 mbar	115	3.1	275	7.4	450	12.1	875	23.5	1300	34.9
3	0.21	150	4.0	350	9.4	600	16.1	1150	30.9	1675	45.0
5	0.34	225	6.0	500	13.4	850	22.8	1625	43.6	2150	57.7
10	0.69	325	8.7	775	20.8	1300	34.9	2425	65.1	2550	68.5
15	1.0	400	10.7	925	24.8	1650	44.3	2775	74.5	2875	77.2
20	1.4	475	12.8	1050	28.2	1925	51.7	3000	80.5	2975	79.9
30	2.1	625	16.8	1425	38.3	2500	67.1	3325	89.3	3400	91.3
40	2.8	750	20.1	1725	46.3	3025	81.2	3500	94.0	3500	94.0
50	3.4	900	24.2	2050	55.0	3425	91.9	3500	94.0		
60	4.1	1050	28.2	2375	63.8	3500	94.0	3500	94.0		
80	5.5	1350	36.2	3000	80.5	3500	94.0				
100	6.9	1600	43.0	3600	96.6	3500	94.0				
125	8.6	1975	53.0	3700	99.3						
psig	bar	Body Size: NPS 1									
2	138 mbar	115	3.1	275	7.4	450	12.1	950	25.5	1450	38.9
3	0.21	150	4.0	350	9.4	600	16.1	1275	34.2	1850	49.7
5	0.34	225	6.0	500	13.4	850	22.8	1775	47.7	2525	67.8
10	0.69	325	8.7	775	20.8	1300	34.9	2700	72.5	3400	91.3
15	1.0	400	10.7	925	24.8	1650	44.3	3425	91.9	4025	108
20	1.4	475	12.8	1050	28.2	1925	51.7	4000	107	4450	120
30	2.1	625	16.8	1425	38.3	2500	67.1	4800	129	4875	131
40	2.8	750	20.1	1725	46.3	3100	83.2	5450	146	5425	146
50	3.4	900	24.2	2050	55.0	3675	98.7	5950	160		
60	4.1	1050	28.2	2375	63.8	4275	115	6000	161		
80	5.5	1350	36.2	3000	80.5	5425	146				
100	6.9	1600	43.0	3600	96.6	5825	156				
125	8.6	1975	53.0	4400	118	5825	156				
psig	bar	Body Size: NPS 1-1/4									
2	138 mbar	115	3.1	275	7.4	450	12.1	1000	26.8	1450	38.9
3	0.21	150	4.0	350	9.4	600	16.1	1325	35.6	1950	52.3
5	0.34	225	6.0	500	13.4	850	22.8	1875	50.3	2800	75.2
10	0.69	325	8.7	775	20.8	1300	34.9	2825	75.8	4250	114
15	1.0	400	10.7	925	24.8	1650	44.3	3600	96.6	5250	141
20	1.4	475	12.8	1050	28.2	1925	51.7	4200	113	6200	166
30	2.1	625	16.8	1425	38.3	2500	67.1	5625	151	7400	199
40	2.8	750	20.1	1725	46.3	3100	83.2	6825	183	7600	204
50	3.4	900	24.2	2050	55.0	3675	98.7	7000	188		
60	4.1	1050	28.2	2375	63.8	4275	115	7000	188		
80	5.5	1350	36.2	3000	80.5	5425	146				
100	6.9	1600	43.0	3600	96.6	5825	156				
125	8.6	1975	53.0	4400	118	5825	156				

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

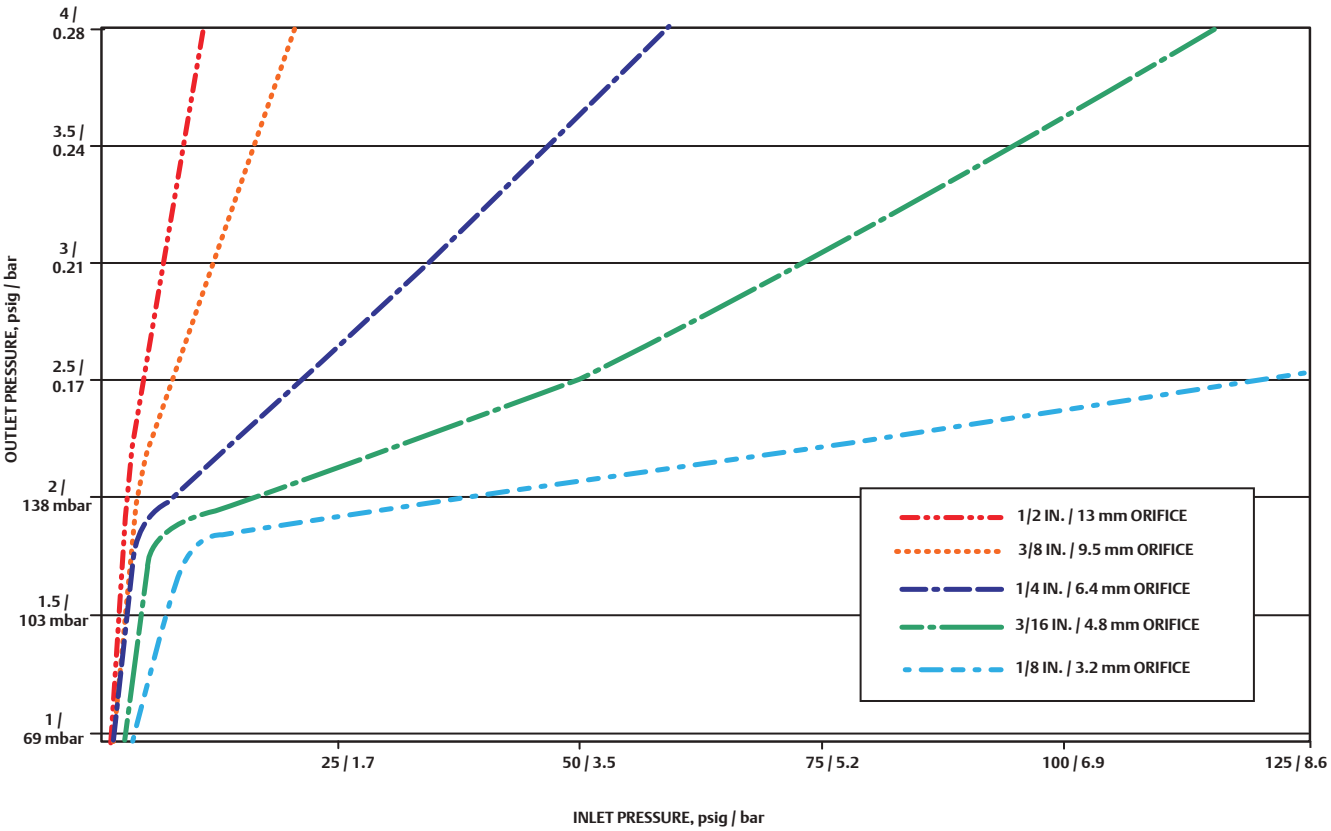


Figure 5. *Type CS200IR Relief Curves (Linkage Disconnect) at 1 psig / 69 mbar Set Pressure*

Table 14. Type CS200IR Internal Relief Performance Table for 1 psig / 69 mbar Setpoint

ORIFICE SIZE		REGULATOR SET PRESSURE		MAXIMUM INLET PRESSURE TO KEEP OUTLET PRESSURE AT OR BELOW(1)			
				2.5 psig / 0.17 bar		3 psig / 0.21 bar	
In.	mm	psig	mbar	psig	bar	psig	bar
1/8	3.2	1	69	121	8.3	>125	>8.6
3/16	4.8			49	3.4	74	5.1
1/4	6.4			24	1.7	38	2.6
3/8	9.5			8	0.55	12	0.83

1. Relief value obtained by disconnecting the lever.

SETPOINT	ACCURACY + / - 1% ABS		SET RANGE	SPRING PART NUMBER / COLOR
2 psig	-0.17 psi	0.17 psi	1 to 2 psig	GE30190X012 / Black
138 mbar	-12 mbar	12 mbar	69 to 138 mbar	

Table 15. Types CS200IN and CS200IR Series Flow Capacities for 2 psig / 138 mbar Setpoint at 1% Accuracy

CAPACITIES IN SCFH / Nm^3/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm^3/h	SCFH	Nm^3/h	SCFH	Nm^3/h	SCFH	Nm^3/h	SCFH	Nm^3/h
psig	bar	Body Size: NPS 3/4									
3	0.21	120	3.2	250	6.7	250	6.7	425	11.4	550	14.8
5	0.34	150	4.0	350	9.4	445	11.9	700	18.8	1000	26.8
10	0.69	250	6.7	550	14.8	720	19.3	1125	30.2	1550	41.6
15	1.0	330	8.9	750	20.1	1100	29.5	1575	42.3	1900	51.0
20	1.4	425	11.4	950	25.5	1375	36.9	1800	48.3	2125	57.0
30	2.1	550	14.8	1300	34.9	1850	49.7	2150	57.7	2475	66.4
40	2.8	750	20.1	1425	38.3	2175	58.4	2450	65.8	2575	69.1
50	3.4	875	23.5	1900	51.0	2475	66.4	2575	69.1		
60	4.1	1025	27.5	2100	56.4	2600	69.8	2675	71.8		
80	5.5	1300	34.9	2475	66.4	2850	76.5				
100	6.9	1600	43.0	2725	73.2	2850	76.5				
125	8.6	1975	53.0	2850	76.5						
psig	bar	Body Size: NPS 1									
3	0.21	120	3.2	250	6.7	300	8.1	475	12.8	675	18.1
5	0.34	150	4.0	350	9.4	445	11.9	800	21.5	1000	26.8
10	0.69	250	6.7	550	14.8	720	19.3	1400	37.6	1850	49.7
15	1.0	330	8.9	800	21.5	1120	30.1	1900	51.0	2500	67.1
20	1.4	425	11.4	1000	26.8	1445	38.8	2325	62.4	2800	75.2
30	2.1	550	14.8	1350	36.2	2045	54.9	3000	80.5	3300	88.6
40	2.8	750	20.1	1600	43.0	2750	73.8	3500	94.0	4100	110
50	3.4	875	23.5	1950	52.3	3300	88.6	3900	105		
60	4.1	1025	27.5	2300	61.7	3825	103	4100	110		
80	5.5	1300	34.9	3000	80.5	4200	113				
100	6.9	1600	43.0	3550	95.3	4200	113				
125	8.6	1975	53.0	4200	113	4200	113				
psig	bar	Body Size: NPS 1-1/4									
3	0.21	120	3.2	250	6.7	290	7.7	475	12.8	675	18.1
5	0.34	150	4.0	350	9.4	445	11.9	825	22.1	1000	26.8
10	0.69	250	6.7	550	14.8	720	19.3	1500	40.3	1850	49.7
15	1.0	330	8.9	800	21.5	1120	30.1	2175	58.4	2800	75.2
20	1.4	425	11.4	1000	26.8	1495	40.1	2675	71.8	3675	98.7
30	2.1	550	14.8	1350	36.2	2220	59.6	3950	106	5400	145
40	2.8	750	20.1	1600	43.0	3000	80.5	5400	145	5400	145
50	3.4	875	23.5	1950	52.3	3475	93.3	5400	145		
60	4.1	1025	27.5	2300	61.7	4075	109	5400	145		
80	5.5	1300	34.9	3000	80.5	4400	118				
100	6.9	1600	43.0	3550	95.3	4400	118				
125	8.6	1975	53.0	4200	113	4400	118				

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 2% ABS		SET RANGE	SPRING PART NUMBER / COLOR
2 psig	-0.33 psi	0.33 psi	1 to 2 psig	GE30190X012 / Black
138 mbar	-23 mbar	23 mbar	69 to 138 mbar	

Table 16. Types CS200IN and CS200IR Series Flow Capacities for 2 psig / 138 mbar Setpoint at 2% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 3/4									
3	0.21	120	3.2	275	7.4	450	12.1	700	18.8	1100	29.5
5	0.34	150	4.0	425	11.4	675	18.1	1050	28.2	1550	41.6
10	0.69	250	6.7	675	18.1	1150	30.9	1850	49.7	2225	59.7
15	1.0	330	8.9	875	23.5	1450	38.9	2175	58.4	2650	71.1
20	1.4	425	11.4	1050	28.2	1725	46.3	2500	67.1	2825	75.8
30	2.1	550	14.8	1400	37.6	2150	57.7	2975	79.9	3300	88.6
40	2.8	750	20.1	1650	44.3	2800	75.2	3275	87.9	3300	88.6
50	3.4	875	23.5	2050	55.0	3000	80.5	3400	91.3		
60	4.1	1025	27.5	2275	61.1	3300	88.6	3400	91.3		
80	5.5	1300	34.9	3000	80.5	3500	94.0				
100	6.9	1600	43.0	3400	91.3	3500	94.0				
125	8.6	1975	53.0	3400	91.3						
psig	bar	Body Size: NPS 1									
3	0.21	120	3.2	275	7.4	450	12.1	700	18.8	1100	29.5
5	0.34	150	4.0	425	11.4	675	18.1	1250	33.6	1725	46.3
10	0.69	250	6.7	675	18.1	1175	31.5	2075	55.7	2750	73.8
15	1.0	330	8.9	875	23.5	1550	41.6	2675	71.8	3425	91.9
20	1.4	425	11.4	1050	28.2	1900	51.0	3250	87.2	3900	105
30	2.1	550	14.8	1400	37.6	2500	67.1	4025	108	4475	120
40	2.8	750	20.1	1650	44.3	3050	81.9	4550	122	5100	137
50	3.4	875	23.5	2050	55.0	3650	98.0	5000	134		
60	4.1	1025	27.5	2275	61.1	4250	114	5200	140		
80	5.5	1300	34.9	3000	80.5	5450	146				
100	6.9	1600	43.0	3600	96.6	5700	153				
125	8.6	1975	53.0	4450	120	5700	153				
psig	bar	Body Size: NPS 1-1/4									
3	0.21	120	3.2	275	7.4	430	11.5	750	20.1	1150	30.9
5	0.34	150	4.0	425	11.4	675	18.1	1300	34.9	1700	45.6
10	0.69	250	6.7	675	18.1	1175	31.5	2225	59.7	3090	83.0
15	1.0	330	8.9	875	23.5	1550	41.6	2975	79.9	4090	110
20	1.4	425	11.4	1050	28.2	1900	51.0	3800	102	5025	135
30	2.1	550	14.8	1400	37.6	2500	67.1	5250	141	5900	158
40	2.8	750	20.1	1650	44.3	3050	81.9	5800	155	5900	158
50	3.4	875	23.5	2050	55.0	3650	98.0	5800	155		
60	4.1	1025	27.5	2275	61.1	4250	114	5800	155		
80	5.5	1300	34.9	3000	80.5	4900	131				
100	6.9	1600	43.0	3600	96.6	4900	131				
125	8.6	1975	53.0	4450	120	4900	131				

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

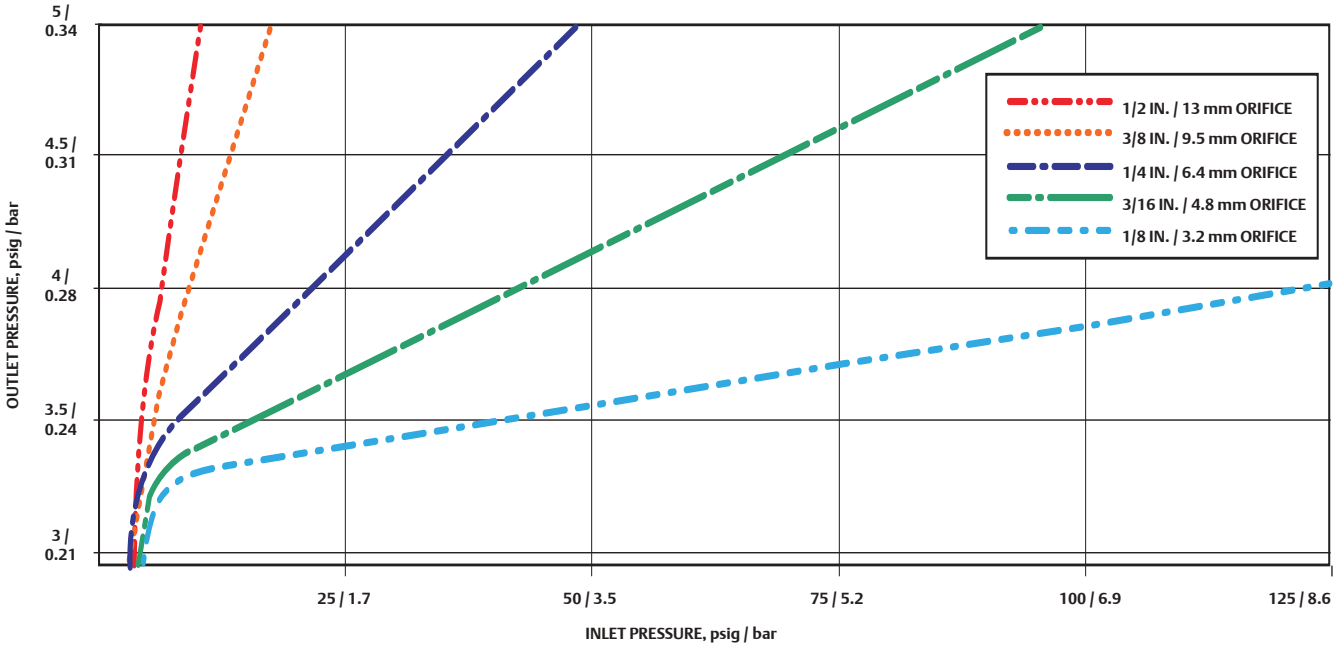


Figure 6. *Type CS200IR Relief Curves (Linkage Disconnect) at 2 psig / 0.14 bar Set Pressure*

Table 17. Type CS200IR Internal Relief Performance Table for 2 psig / 138 mbar Setpoint

ORIFICE SIZE		REGULATOR SET PRESSURE		MAXIMUM INLET PRESSURE TO KEEP OUTLET PRESSURE AT OR BELOW(1)			
				4 psig / 0.28 bar		5 psig / 0.34 bar	
In.	mm	psig	mbar	psig	bar	psig	bar
1/8	3.2	2	138	122	8.4	>125	>8.6
3/16	4.8			47	3.2	96	6.6
1/4	6.4			23	1.6	49	3.4
3/8	9.5			9	0.62	17	1.17

1. Relief value obtained by disconnecting the lever.

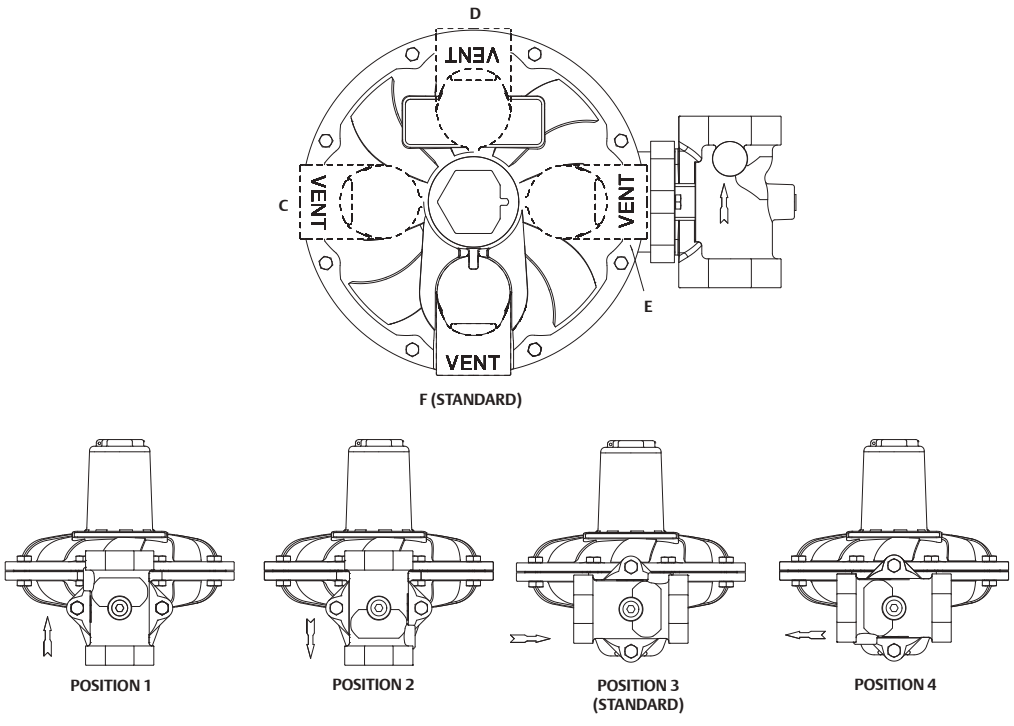


Figure 7. *Body Positions and Spring Case Vent Locations*

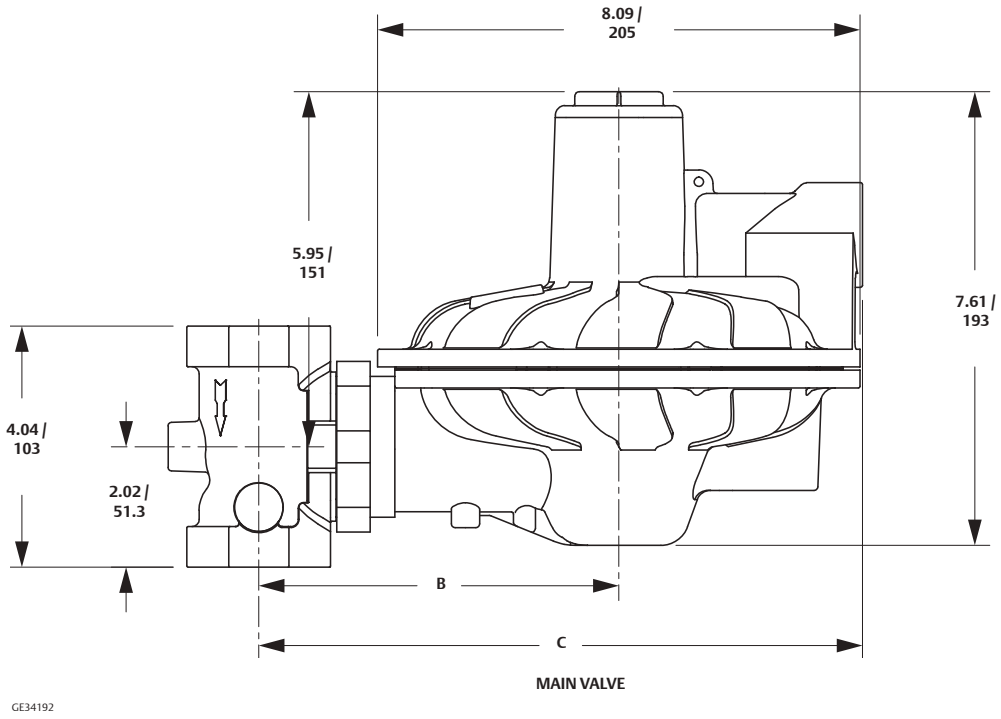


Figure 8. *Dimension*

Table 18. Dimension

BODY SIZE, NPT		DIMENSION			
		B		C	
Inlet	Outlet	In.	mm	In.	mm
3/4	3/4	5.84	148	9.93	252
3/4	1				
1					
3/4	1-1/4	6.02	153	10.1	257
1					
1-1/4					

Ordering Guide

Type (Select One)

- ☐ CS200IN***
- ☐ CS200IR***
- ☐ CS205IN***
- ☐ CS205IR***
- ☐ CS206IR***

Body Size, Material and End Connection (Select One)

Gray Cast Iron

- ☐ 3/4 NPT***
- ☐ 3/4 x 1 NPT***
- ☐ 3/4 x 1-1/4 NPT***
- ☐ 1 NPT***
- ☐ 1 x 1-1/4 NPT***
- ☐ 1-1/4 NPT***

Outlet Pressure Range (Select One)

- ☐ 3.5 to 5 in. w.c. / 9 to 12 mbar, Red***
- ☐ 4.5 to 6.5 in. w.c. / 11 to 16 mbar, Purple***
- ☐ 6 to 8 in. w.c. / 15 to 20 mbar, Gold***
- ☐ 7.5 to 11 in. w.c. / 19 to 27 mbar, Blue***
- ☐ 10 to 14 in. w.c. / 25 to 35 mbar, Unpainted***
- ☐ 12 to 19 in. w.c. / 30 to 47 mbar, Green***
- ☐ 18 in. w.c. to 1 psig / 45 to 69 mbar, Orange***
- ☐ 1 to 2 psig / 69 to 138 mbar, Black***

Orifice Size (Select One)

- ☐ 1/8 in. / 3.2 mm***
- ☐ 3/16 in. / 4.8 mm***
- ☐ 1/4 in. / 6.4 mm***
- ☐ 3/8 in. / 9.5 mm***
- ☐ 1/2 in. / 13 mm***

Body Orientation (Select One)

- ☐ Position 1***
- ☐ Position 2***
- ☐ Position 3 **(standard)*****
- ☐ Position 4***

Vent Orientation (Select One)

- ☐ Position C***
- ☐ Position D***
- ☐ Position E***
- ☐ Position F **(standard)*****

Certification
(available only on CS200 Series constructions)

- ☐ Pressure Factor Measurement (PFM)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Does the application require overpressure protection?
☐ Yes, which is preferred? ☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device
Is overpressure protection equipment selection assistance desired?
Pressure
Maximum Inlet Pressure (P_{1max}):
Minimum Inlet Pressure (P_{1min}):
Downstream Pressure Setting(s) (P_2):
Maximum Flow (Q_{max}):
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Do not oversize regulators. Pick the smallest orifice size or regulator that will work. Keep in mind when sizing a station that most restricted trims that do not reduce the main port size do not help with improved low flow control.

CS400 Series

Commercial / Industrial – Pressure Reducing Regulator

FISHER™

Introduction

The CS400 Series direct-operated, spring-loaded regulators have been engineered to fit a multitude of pressure-reducing applications including commercial and industrial installations. This flexibility is provided by the numerous body sizes and end connections, outlet pressure settings orifice sizes, as well as the option for internal or external pressure registration.

In addition to application flexibility, the CS400 Series offers multiple overpressure protection options to meet demands on application requirements.

Body Sizes, Materials, End Connections and Pressure Rating

See Table 2

Flow Capacities

See Tables 10, 12, 13, 15, 17, 19 and 21 through 28

Flow and Sizing Coefficients

See Table 9

Maximum Inlet Pressure

Emergency: 175 psig / 12.1 bar
Operating: See Table 9

Maximum Outlet Pressure

Casing: 25 psig / 1.7 bar
To Avoid Internal Parts Damage: 5 psig / 0.34 bar over set pressure
Operating: 5.5 psig / 0.38 bar

Outlet Pressure Ranges

3.5 in. w.c. to 5.5 psig / 9 mbar to 0.38 bar
See Table 4

Spring Case Vent Connection

1 NPT

Pressure Registration

Internal or External

Operating Temperature (TS)(1)

According to PED Standards
All Types: -4 to 150°F / -20 to 66°C

Non-PED
All Types: -20 to 150°F / -29 to 66°C

Approximate Shipping Weight

With Threaded Body
Type CS400: 9 lb / 4.1 kg
Type CS403: 18.5 lb / 8.4 kg
Type CS404: 11.2 lb / 5.1 kg

With Flanged Body
Add 8.6 lbs / 4.0 kg to weights listed in the previous section.

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Wide Variety of Body Sizes and End Connections**
- **Fixed Factor/ PFM Accuracy Capabilities**
- **Only Standard Tools Required for Pressure Adjustment and Orifice Removal**
- **Easy to Maintain**



P1190

Figure 1. *Typical Type CS400 Pressure Reducing Regulator*



P1003

Figure 2. *Typical Type CS400 Pressure Reducing Regulator Internal View*

1. Product has passed Fisher™ testing for lockup, relief start-to-discharge and reseal down to -40°.

EMERSON
Process Management

Table 1. Available Configurations

TYPE NUMBER							OPTION
C	S	4	0				
							OVERPRESSURE PROTECTION MODULE
				0			Without Overpressure Protection Module
				3			With Integral Monitor Module[1][3]
				4			With Slam-Shut Module[2]
							PRESSURE REGISTRATION
					E		External Registration[3]
					I		Internal Registration
							RELIEF
						N	Non-Relief
						T	Token Internal Relief
						R	Internal Relief

Example: Type number **CS404IT**: A Type CS400 regulator constructed with Type VSX4 Slam-Shut module, with Internal pressure registration and with Token relief.

1. Reference Instruction Manual D103126X012 for information regarding the Integral Monitor module.
2. Reference Instruction Manual D103127X012 for information regarding the Type VSX4 safety shut-off module.
3. Available only with Non-Relieving or Token Relief options, not Internal Relief.

Table 2. Body Size, Material, End Connection and Pressure Rating

BODY MATERIAL	BODY SIZE, In.		END CONNECTION	FACE-TO-FACE DIMENSION		BODY PRESSURE RATING	
	INLET	OUTLET		in.	mm	psig	bar
Gray Cast iron	1-1/4	1-1/4	NPT	4.5	114	175	12.1
	1-1/4	1-1/2					
	1-1/2	1-1/2					
	2	2	NPT	5	127		
	NPS 2 / DN 50	NPS 2 / DN 50	CL125 FF	10	254		
Ductile Cast iron	1-1/4	1-1/4	NPT	4.5	114	290	20.0
	1-1/2	1-1/2		4.5	114		
	2	2		5	127		
	1-1/4	1-1/4	Rp	4.5	114		
	1-1/2	1-1/2		4.5	114		
	2	2		5	127		
	NPS 2 / DN 50	NPS 2 / DN 50	CL125 FF / CL150 FF	10	254	290	20.0
			PN 10/16	10	254	232	16.0
Steel	1-1/4	1-1/4	NPT	4.5	114	290	20.0
	1-1/2	1-1/2		4.5	114		
	1-1/4	1-1/4	Rp	4.5	114		
	1-1/2	1-1/2		4.5	114		

Table 3. CS400 Series Main Valve and Actuator Construction Material

BODY	CONTROL SPRING	RELIEF VALVE SPRING	LEVER PIN	DIAPHRAGM PLATE	O-RING, DIAPHRAGM AND DISK	CLOSING CAP, ADJUSTING SCREW, VALVE STEM, ORIFICE AND RELIEF VALVE SPRING RETAINER
Gray Cast iron, Ductile iron and Steel	Stainless steel or Music Wire	Stainless steel	Stainless steel	Zinc-plated steel	Nitrile (NBR)	Aluminum

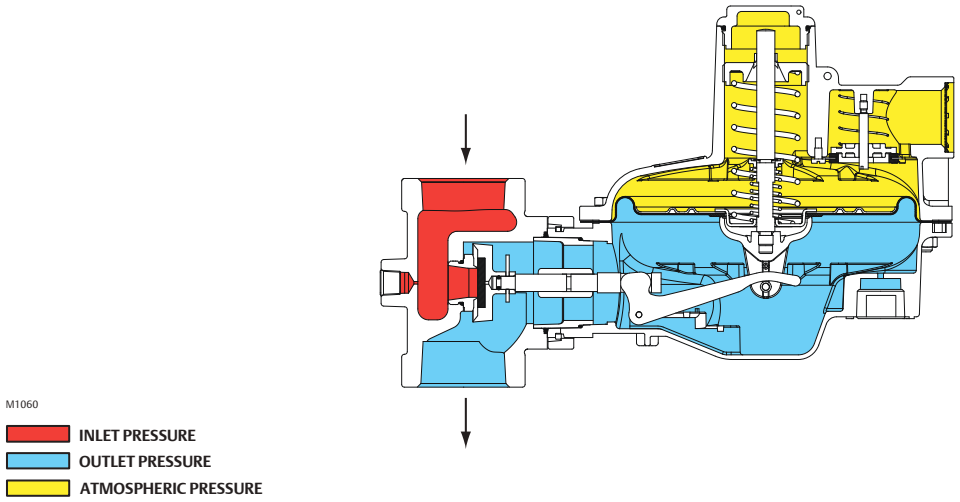


Figure 3. *Type CS400IR Internally Registered Regulator with Internal Relief Operational Schematic*

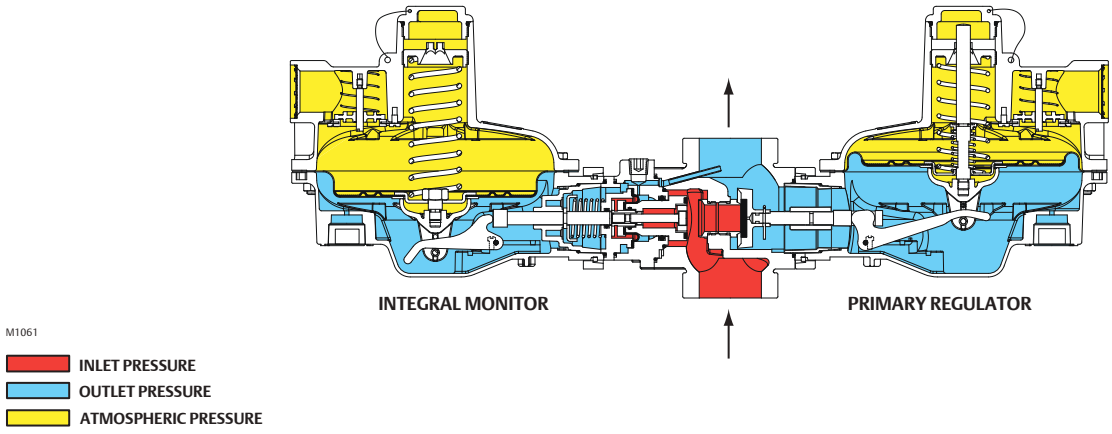


Figure 4. *Type CS403, Internally Registered Primary Regulator with Internally Registered Integral Monitor Operational Schematic*

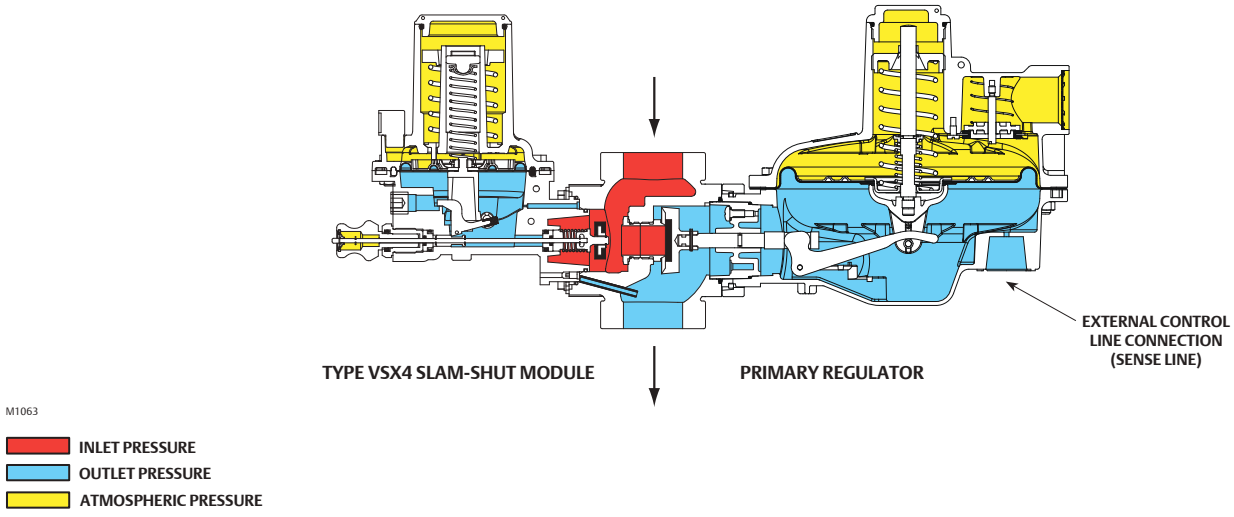


Figure 5. *Type CS404ET with Slam-Shut Module, External Pressure Registration and Token Relief Operational Schematic*

Table 4. Outlet Pressure Range

TYPE	OUTLET PRESSURE RANGE		PART NUMBER	COLOR CODE	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
	In. w.c.	mbar			In.	mm	In.	mm
CS400, CS403 and CS404	3.5 to 5	9 to 12	GE30198X012	Red	0.098	2.49	4.18	106
	4.5 to 6.5	11 to 16	GE30195X012	Purple	0.080	2.03	4.32	110
	6 to 8	15 to 20	GE30188X012	Gold	0.108	2.74	4.18	106
	7.5 to 11	19 to 27	GE30189X012	Blue	0.110	2.80	4.40	112
	10 to 14	25 to 35	GE30224X012	Unpainted	0.110	2.80	4.40	112
	12 to 19	30 to 47	GE30196X012	Green	0.112	2.85	4.70	119
	18 in. w.c. to 1 psig	45 mbar to 0.07 bar	GE30225X012	Orange	0.120	3.05	4.94	125
	1 to 2 psig	0.07 to 0.14 bar	GE30190X012	Black	0.140	3.56	4.66	118
	2 to 5.5 psig	0.14 to 0.38 bar	GE30197X012	Yellow	0.172	4.37	4.42	112

Table 5. Approximate Internal Relief Valve Start-to-Discharge Pressure Above Setpoint

SETPOINT	SPRING COLOR	SPRING PART NUMBER	START-TO-DISCHARGE PRESSURE RANGE ABOVE SETPOINT	
			Internal Relief	Token Relief
7 -in. w.c. / 17 mbar	Gold	GE30188X012	6 to 12-in. w.c. / 15 to 30 mbar	6 to 12-in. w.c. / 15 to 30 mbar
11-in. w.c. / 27 mbar	Blue	GE30189X012	6 to 12-in. w.c. / 15 to 30 mbar	6 to 12-in. w.c. / 15 to 30 mbar
14-in. w.c. / 35 mbar	Unpainted	GE30224X012	6 to 12-in. w.c. / 15 to 30 mbar	6 to 12-in. w.c. / 15 to 30 mbar
1 psig / 0.07 bar	Orange	GE30225X012	0.5 to 1.5 psi / 35 to 103 mbar	0.5 to 1 psi / 35 mbar to 0.07 bar
2 psig / 0.14 bar	Black	GE30190X012	0.5 to 1.5 psi / 35 to 103 mbar	0.5 to 1 psi / 35 mbar to 0.07 bar
5 psig / 0.34 bar	Yellow	GE30197X012	0.5 to 3.3 psi / 35 to 228 mbar	0.5 to 2 psi / 35 mbar to 0.14 bar

Table 6. Type CS403 Regulator and Integral Monitor Outlet Pressure Range

PRIMARY REGULATOR					INTEGRAL MONITOR					
Type	Setpoint		Spring Part Number	Spring Color	Setpoint[1]		Spring Part Number	Spring Range		Spring Color
	in. w.c.	mbar			in. w.c.	mbar		in. w.c.	mbar	
CS403	4	10	GE30198X012	Red	14	35	GE30189X012	12 to 21	30 to 52	Blue
	5	12	GE30195X012	Purple						
	7	17	GE30188X012	Gold						
	11	27	GE30189X012	Blue	21	52	GE30196X012	18 to 30	45 to 75	Green
	14	35	GE30224X012	Unpainted						
	18	45	GE30196X012	Green	1 psig	0.07 bar	GE30225X012	26 to 40	65 to 99	Orange
	1 psig	0.07 bar	GE30225X012	Orange	1.5 psig	0.10 bar	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
	2 psig	0.14 bar	GE30190X012	Black	2.5 psig	0.17 bar	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
	3 psig	0.21 bar	GE30197X012	Yellow	3.5 psig	0.24 bar	GE35081X012	2.6 to 3.7 psig	179 to 255	Purple
	4 psig	0.28 bar			5 psig	0.34 bar	GE30192X012	3.6 to 6 psig	248 to 414	Dark Blue
	5 psig	0.34 bar			6 psig	0.41 bar	GE33121X012	5.1 to 7.5 psig	352 to 517	Red

1. Integral Monitor setpoints shown represent the minimum setpoint difference between the Integral Monitor and the Primary regulator. Higher monitor setpoints can be chosen, e.g., for a Primary regulator setpoint of 7 in. w.c. / 17 mbar, the Integral Monitor can also be set at 14 and 21 in. w.c. / 35 and 52 mbar; 1 psig / 0.07 bar or higher.

Table 7. Type CS404 Regulator and Slam-Shut OPSO Pressure Range

REGULATOR			SLAM-SHUT DEVICE Overpressure Shutoff (OPSO)		
type	Setpoint, In. w.c. / mbar	Spring Range, In. w.c. / mbar	Factory Setpoint, In. w.c. / mbar[1]	Spring Range, In. w.c. / mbar	Spring Part Number
CS404	4 / 10	3.5 to 5 / 9 to 12	18 / 45	12 to 25 / 30 to 60	GF02168X012
	5 / 12	4.5 to 6.5 / 11 to 16	19 / 47		
	7 / 17	6 to 8 / 15 to 20	21 / 52		
	11 / 27	7.5 to 11 / 19 to 27	0.9 psig / 62	0.58 to 1.6 psig / 40 to 110	GF02169X012
	14 / 35	10 to 14 / 25 to 35	1.1 psig / 75		
	0.65 psig / 45	0.45 to 0.7 psig / 30 to 47	1.4 psig / 96	0.87 to 2.8 psig / 60 to 190	GF02170X012
	0.72 psig / 50	0.65 to 1 psig / 45 to 69	1.6 psig / 112		
	1 psig / 69		2.5 psig / 172	1.4 to 4.1 psig / 95 to 280	GF02171X012
	1.5 psig / 103	1 to 2 psig / 69 to 138	3.0 psig / 207		
	2 psig / 138		3.5 psig / 241		
	3 psig / 207	2 to 5.5 psig / 138 to 380	6.3 psig / 434	3.2 to 11 psig / 220 to 760	GF02173X012
	4 psig / 276		7.3 psig / 503		
	5 psig / 345		8.3 psig / 572		
	5.5 psig / 380		8.8 psig / 606		

1. For Types CS404IT and CS404ET equipped with Token Relief, if Non-Factory slam-shut OPSO setpoints are specified, they must not encroach on the Token Relief Start-to-Discharge values provided in Table 5.

Table 8. Type CS404 Regulator and Slam-shut OPSO and UPSO Pressure Range

REGULATOR			SLAM-SHUT DEVICE					
			Overpressure Shutoff (OPSO)			Underpressure Shutoff (UPSO)		
Type	Setpoint, psig / mbar	Spring Range, psig / mbar	Typical Setpoint, psig / mbar[1]	Range, psig / mbar	Spring Part Number	Typical Setpoint, psig / mbar[1]	Range, psig / mbar	Spring Part Number
CS404	0.51 / 35	0.36 to 0.51 / 25 to 35	1.1 / 75	0.73 to 1.9 / 50 to 130	GF02168X012	0.32 / 22	0.14 to 1.1 / 10 to 75	T14169T0012
	0.65 / 45	0.45 to 0.7 / 30 to 48	1.4 / 95			0.4 / 30		
	0.72 / 50	0.65 to 1 / 45 to 69	1.6 / 110	1.4 to 3.9 / 95 to 270	GF02169X012	0.4 / 30		
	1 / 69		2.5 / 172	2.2 to 5.5 / 150 to 380	GF02170X012	0.58 / 40	0.36 to 2.3 / 25 to 160	T14170T0012
	1.5 / 103	1 to 2 psig / 69 to 138	3.0 / 207			0.73 / 50		
	2 / 138		3.5 / 241			1 / 69		
	3 / 207	2 to 5.5 psig / 138 to 380	6.3 / 434	3.8 to 8.7 / 260 to 600	GF02171X012	1.75 / 121	1.5 to 7.3 / 100 to 500	FA142869X12
	4 / 276		7.3 / 503			2 / 140		
	5 / 345		8.3 / 572	5.8 to 16 / 400 to 1100	GF02172X012	2.9 / 200		
	5.5 / 380		8.8 / 606			3.6 / 250		

1. For Types CS404IT and CS404ET equipped with Token Relief, if Non-Factory slam-shut OPSO setpoints are specified, they must not encroach on the Token Relief Start-to-Discharge values provided in Table 5.

Table 9. Inlet Pressure Rating and Flow and Sizing Coefficient

TYPE	ORIFICE SIZE		MAXIMUM OPERATING INLET PRESSURE TO OBTAIN OPTIMUM PERFORMANCE		FLOW COEFFICIENT (WIDE-OPEN)		C_1	IEC SIZING COEFFICIENT		
	In.	mm	psig	bar	C_g	C_v		X_T	F_D	F_L
CS400, CS403 and CS404	3/16	4.8	125	8.6	27	0.97	27.7	0.50	0.89	0.91
	1/4	6.4	125	8.6	50	1.77	28.2	0.50		0.92
	5/16	7.9	100	6.9	82	2.90	28.3	0.50		0.94
	3/8[1]	9.5[1]	60	4.1	113	3.72	30.4	0.58		0.89
	1/2	12	40	2.8	182	5.61	32.4	0.66		0.82
	5/8	16	30	2.1	284	7.26	39.1	0.97		0.74
	3/4	19	20	1.4	356	9.83	36.2	0.83		0.72

1. 80 psig / 5.5 bar maximum operating inlet pressure available at special request for setpoints 1 psig / 0.07 bar or greater.

	ACCURACY			
SETPOINT	Droop	Boost	SET RANGE	PART NUMBER / COLOR
7 in. w.c.	-1 in. w.c.	2 in. w.c.	6 to 8 in. w.c.	GE30188X012 / Gold
17 mbar	-2 mbar	5 mbar	15 to 20 mbar	

Table 10. Type CS400 Internal Registration Flow Capacities for 7 in. w.c. / 17 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4													
0.5	0.03	100	2.6	160	4.2	200	5.3	290	7.7	370	9.9	630	16.9	560	15.0
1	0.07	170	4.5	250	6.7	330	8.8	630	16.9	650	17.4	660	17.7	730	19.5
2	0.14	260	6.9	510	13.6	770	20.6	660	17.7	880	23.6	1100	29.5	1200	32.2
3	0.21	390	10.4	690	18.5	710	19.0	860	23.0	1100	29.5	1700	45.6	1800	48.3
5	0.34	500	13.4	800	21.4	970	26.0	1300	34.8	1600	42.9	2700	72.4	3200	85.9
10	0.69	750	20.1	1200	32.2	1900	51.0	2500	67.1	3300	88.5	3300	88.5	3900	105
15	1.0	1000	26.8	1700	45.6	2800	75.1	3200	85.9	3300	88.5	3300	88.5	3900	105
20	1.4	1100	29.5	1900	51.0	3200	85.9	3200	85.9	3300	88.5	3300	88.5	3900	105
30	2.1	1500	40.2	2700	72.4	3300	88.5	2400	64.4	2700	72.4	3300	88.5		
40	2.8	1900	51.0	2800	75.1	2000	53.6	2100	56.3	1700	45.6				
50	3.4	2200	59.0	2800	75.1	2000	53.6	1600	42.9						
60	4.1	2600	69.7	1900	51.0	1500	40.2	1600	42.9						
80	5.5	3100	83.2	1900	51.0	1500	40.2								
100	6.9	1700	45.6	1900	51.0	1500	40.2								
125	8.6	1700	45.6	1900	51.0										
psig	bar	Body Size: NPS 1-1/2													
0.5	0.03	120	3.2	210	5.6	220	5.9	280	7.5	340	9.1	470	12.6	720	19.3
1	0.07	170	4.5	260	6.9	330	8.8	620	16.6	840	22.5	620	16.6	740	19.8
2	0.14	260	6.9	500	13.4	770	20.6	730	19.5	850	22.8	1100	29.5	1300	34.8
3	0.21	310	8.3	680	18.2	780	20.9	980	26.3	1200	32.2	1400	37.5	1800	48.3
5	0.34	540	14.4	940	25.2	950	25.5	1300	34.8	2300	61.7	3300	88.5	4400	118
10	0.69	770	20.6	1200	32.2	2000	53.6	3000	80.5	3300	88.5	4300	115	4400	118
15	1.0	990	26.5	1800	48.3	2900	77.8	3300	88.5	3300	88.5	4300	115	4400	118
20	1.4	1100	29.5	2100	56.3	3300	88.5	3300	88.5	3300	88.5	4300	115	4400	118
30	2.1	1500	40.2	2300	61.7	3300	88.5	3300	88.5	2500	67.1	2800	75.1		
40	2.8	1900	51.0	2500	67.1	3300	88.5	2500	67.1	2500	67.1				
50	3.4	2200	59.0	1900	51.0	2900	77.8	2200	59.0						
60	4.1	2200	59.0	1800	48.3	2500	67.1	2000	53.6						
80	5.5	2200	59.0	1800	48.3	2200	59.0								
100	6.9	1800	48.3	1800	48.3	2200	59.0								
125	8.6	1600	42.9	1800	48.3										
psig	bar	Body Size: NPS 2													
0.5	0.03	130	3.4	200	5.3	260	6.9	260	6.9	420	11.2	380	10.2	750	20.1
1	0.07	160	4.2	280	7.5	330	8.8	590	15.8	610	16.3	660	17.7	760	20.4
2	0.14	240	6.4	400	10.7	700	18.7	700	18.7	840	22.5	1100	29.5	1100	29.5
3	0.21	320	8.5	660	17.7	610	16.3	850	22.8	1100	29.5	1500	40.2	1700	45.6
5	0.34	540	14.4	730	19.5	790	21.2	1100	29.5	1900	51.0	2400	64.4	2700	72.4
10	0.69	700	18.7	1200	32.2	1500	40.2	2400	64.4	4000	107	4400	118	4400	118
15	1.0	980	26.3	1700	45.6	2500	67.1	3500	93.9	4200	113	4400	118	4400	118
20	1.4	1100	29.5	2100	56.3	3300	88.5	3500	93.9	4400	118	4400	118	4400	118
30	2.1	1500	40.2	2600	69.7	3300	88.5	3500	93.9	4400	118	3200	85.9		
40	2.8	1900	51.0	3200	85.9	3300	88.5	3100	83.2	3200	85.9				
50	3.4	2200	59.0	3200	85.9	3200	85.9	2800	75.1						
60	4.1	2600	69.7	3200	85.9	3000	80.5	2500	67.1						
80	5.5	3100	83.2	3000	80.5	2900	77.8								
100	6.9	3100	83.2	3000	80.5	2900	77.8								
125	8.6	3100	83.2	2800	75.1										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Gray areas indicate limited capacities due to boost effects.

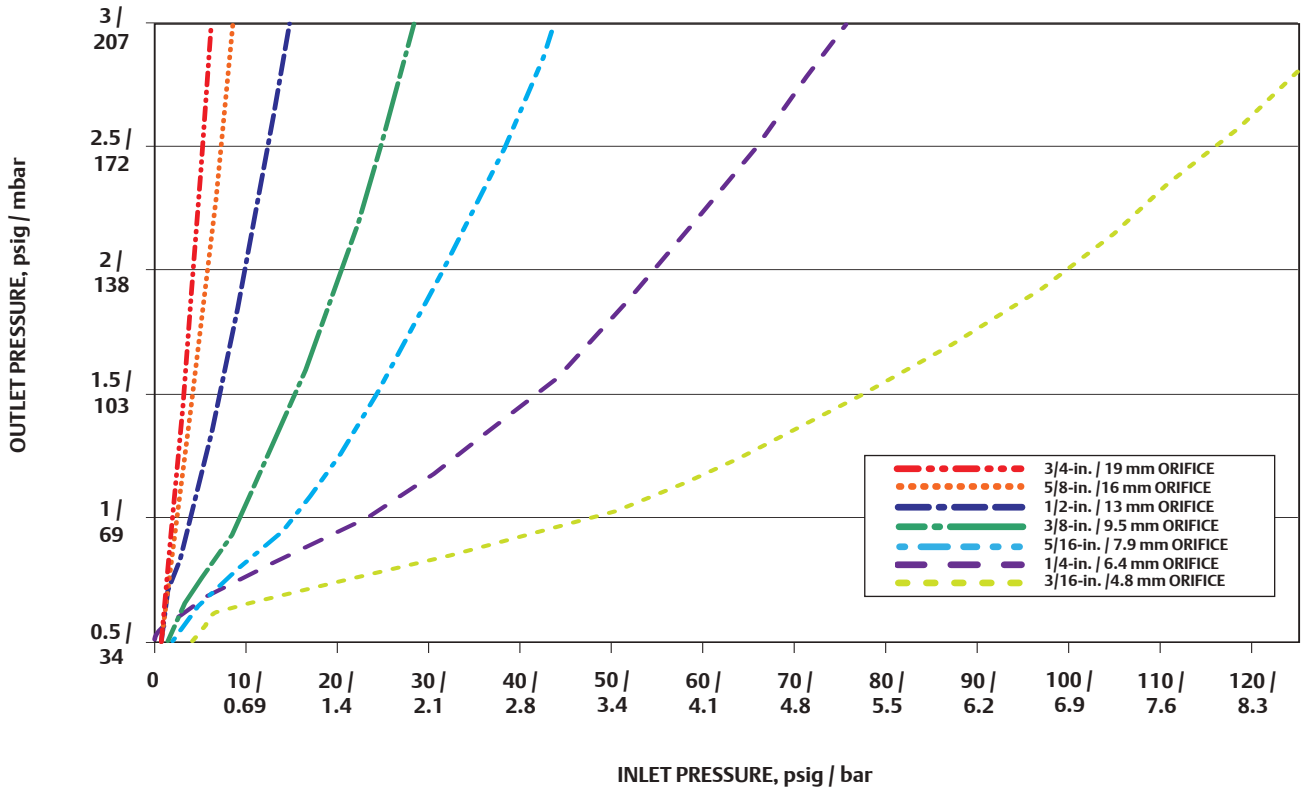


Figure 6. *Type CS400IR Relief Curves (Blocked per Orifice Size) at 7 in. w.c. / 17 mbar Set Pressure*

Table 11. Type CS400 Relief Table, 7 in. w.c. / 17 mbar Setpoint, Internal Registration

ORIFICE SIZE		REGULATOR SET PRESSURE		MAXIMUM INLET PRESSURE TO KEEP OUTLET PRESSURE AT/OR BELOW(1)			
				1 psig / 69 mbar		2 psig / 138 mbar	
In.	mm	In. w.c.	mbar	psig	bar	psig	bar
3/16	4.8	7	17	46	3.2	100	6.9
1/4	6.4			23	1.6	54	3.7
5/16	7.9			15	1.0	31	2.1
3/8	9.5			9	0.62	20	1.4

1. Relief values obtained by blocking regulator open per orifice.

	ACCURACY			
SETPOINT	Droop	Boost	SET RANGE	PART NUMBER / COLOR
11 in. w.c.	-2 in. w.c.	2 in. w.c.	7.5 to 11 in. w.c.	GE30189X012 / Blue
27 mbar	-5 mbar	5 mbar	19 to 27 mbar	

Table 12. Type CS400 Internal Registration Flow Capacities for 11 in. w.c. / 27 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4													
0.5	0.03	150	4.0	220	5.9	300	8.0	320	8.5	530	14.2	710	19.0	550	14.7
1	0.07	210	5.6	320	8.5	680	18.2	700	18.7	840	22.5	810	21.7	1000	26.8
2	0.14	320	8.5	600	16.1	940	25.2	920	24.6	1100	29.5	1500	40.2	1600	42.9
3	0.21	450	12.0	700	18.7	1100	29.5	1100	29.5	1500	40.2	2000	53.6	2300	61.7
5	0.34	540	14.4	920	24.6	1200	32.2	1500	40.2	2100	56.3	2900	77.8	3200	85.9
10	0.69	780	20.9	1300	34.8	2100	56.3	2600	69.7	3500	93.9	3900	105	4300	115
15	1.0	980	26.3	1700	45.6	2800	75.1	3400	91.2	3500	93.9	3900	105	4300	115
20	1.4	1100	29.5	2000	53.6	3400	91.2	3400	91.2	3500	93.9	2200	59.0	4300	115
30	2.1	1500	40.2	2800	75.1	3400	91.2	3400	91.2	3500	93.9	2200	59.0		
40	2.8	1800	48.3	2800	75.1	2700	72.4	2400	64.4	1800	48.3				
50	3.4	2200	59.0	2800	75.1	2500	67.1	1700	45.6						
60	4.1	2500	67.1	2600	69.7	2400	64.4	1700	45.6						
80	5.5	2500	67.1	2000	53.6	2400	64.4								
100	6.9	1700	45.6	1900	51.0	1600	42.9								
125	8.6	1700	45.6	1900	51.0										
psig	bar	Body Size: NPS 1-1/2													
0.5	0.03	100	2.6	160	4.2	240	6.4	340	9.1	410	11.0	530	14.2	690	18.5
1	0.07	170	4.5	320	8.5	440	11.8	700	18.7	970	26.0	880	23.6	970	26.0
2	0.14	280	7.5	550	14.7	840	22.5	970	26.0	1200	32.2	1500	40.2	2000	53.6
3	0.21	410	11.0	710	19.0	930	24.9	1100	29.5	1600	42.9	2200	59.0	2600	69.7
5	0.34	560	15.0	970	26.0	1200	32.2	1700	45.6	2700	72.4	3500	93.9	3500	93.9
10	0.69	800	21.4	1400	37.5	2100	56.3	3000	80.5	3500	93.9	3500	93.9	4800	129
15	1.0	990	26.5	1800	48.3	2900	77.8	3300	88.5	3500	93.9	3500	93.9	4800	129
20	1.4	1100	29.5	2100	56.3	3300	88.5	3300	88.5	3500	93.9	3500	93.9	4900	134
30	2.1	1500	40.2	2800	75.1	3300	88.5	3300	88.5	2500	67.1	1900	51.0		
40	2.8	1800	48.3	3200	85.9	3300	88.5	3000	80.5	2500	67.1				
50	3.4	2200	59.0	3200	85.9	3300	88.5	1800	48.3						
60	4.1	2600	69.7	2000	53.6	3200	85.9	1700	45.6						
80	5.5	2800	75.1	2000	53.6	1900	51.0								
100	6.9	2800	75.1	2000	53.6	1900	51.0								
125	8.6	2800	75.1	2000	53.6										
psig	bar	Body Size: NPS 2													
0.5	0.03	110	2.9	200	5.3	270	7.2	340	9.1	420	11.2	620	16.6	870	23.3
1	0.07	190	5.1	270	7.2	430	11.5	690	18.5	990	26.5	820	22.0	1000	26.8
2	0.14	290	7.7	530	14.2	800	21.4	940	25.2	1100	29.5	1400	37.5	1700	45.6
3	0.21	410	11.0	730	19.5	870	23.3	1200	32.2	1400	37.5	1900	51.0	2400	64.4
5	0.34	550	14.7	920	24.6	1100	29.5	1500	40.2	2200	59.0	3100	83.2	3500	93.9
10	0.69	790	21.2	1300	34.8	1900	51.0	2800	75.1	4000	107	4200	113	4800	129
15	1.0	1000	26.8	1800	48.3	2800	75.1	3700	99.3	4000	107	4200	113	4800	129
20	1.4	1100	29.5	2000	53.6	3400	91.2	3700	99.3	4100	110	4200	113	4800	129
30	2.1	1500	40.2	2700	72.4	3400	91.2	3700	99.3	4100	110	2600	69.7		
40	2.8	1900	51.0	3200	85.9	3400	91.2	3200	85.9	3000	80.5				
50	3.4	2200	59.0	3200	85.9	3400	91.2	3200	85.9						
60	4.1	2500	67.1	3200	85.9	3400	91.2	3200	85.9						
80	5.5	3200	85.9	3200	85.9	3400	91.2								
100	6.9	3300	88.5	3200	85.9	3000	80.5								
125	8.6	3300	88.5	3200	85.9										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Gray areas indicate limited capacities due to boost effects.

	ACCURACY			
SETPOINT	Droop	Boost	SET RANGE	PART NUMBER / COLOR
14 in. w.c.	-2 in. w.c.	2 in. w.c.	10 to 14 in. w.c.	GE30224X012 / Unpainted
35 mbar	-5 mbar	5 mbar	25 to 35 mbar	

Table 13. Type CS400 Internal Registration Flow Capacities for 14 in. w.c. / 35 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4													
1	0.07	190	5.1	280	7.5	380	10.2	680	18.2	860	23.0	890	23.8	1000	26.8
2	0.14	320	8.5	540	14.4	770	20.6	910	24.4	1100	29.5	1300	34.8	1700	45.6
3	0.21	390	10.4	700	18.7	840	22.5	1100	29.5	1500	40.2	2000	53.6	2200	59.0
5	0.34	530	14.2	880	23.6	1100	29.5	1500	40.2	2100	56.3	2700	72.4	3100	83.2
10	0.69	770	20.6	1300	34.8	2000	53.6	2600	69.7	3300	88.5	3600	96.6	4100	110
15	1.0	970	26.0	1700	45.6	2600	69.7	3400	91.2	3600	96.6	3600	96.6	4300	115
20	1.4	1100	29.5	2000	53.6	3200	85.9	3400	91.2	3600	96.6	3600	96.6	4300	115
30	2.1	1500	40.2	2300	61.7	3200	85.9	3400	91.2	3600	96.6	3300	88.5		
40	2.8	1800	48.3	2300	61.7	1900	51.0	2300	61.7	2000	53.6				
50	3.4	2200	59.0	2300	61.7	1900	51.0	2300	61.7						
60	4.1	2500	67.1	2300	61.7	1900	51.0	2300	61.7						
80	5.5	2500	67.1	2000	53.6	1900	51.0								
100	6.9	2500	67.1	1900	51.0	1900	51.0								
125	8.6	1600	42.9	1900	51.0										
psig	bar	Body Size: NPS 1-1/2													
1	0.07	180	4.8	260	6.9	420	11.2	680	18.2	870	23.3	840	22.5	840	22.5
2	0.14	280	7.5	530	14.2	760	20.4	860	23.0	1000	26.8	1300	34.8	1600	42.9
3	0.21	370	9.9	740	19.8	870	23.3	980	26.3	1500	40.2	2100	56.3	2200	59.0
5	0.34	560	15.0	930	24.9	1100	29.5	1500	40.2	2300	61.7	3500	93.9	3500	93.9
10	0.69	760	20.4	1300	34.8	1900	51.0	2700	72.4	3500	93.9	3800	102	4500	121
15	1.0	980	26.3	1800	48.3	2600	69.7	3400	91.2	3500	93.9	3800	102	4500	121
20	1.4	1100	29.5	2100	56.3	3200	85.9	3400	91.2	3500	93.9	3800	102	4500	121
30	2.1	1500	40.2	2800	75.1	3400	91.2	3400	91.2	3300	88.5	3000	80.5		
40	2.8	1900	51.0	2900	77.8	3400	91.2	3100	83.2	2800	75.1				
50	3.4	2200	59.0	2900	77.8	3400	91.2	2900	77.8						
60	4.1	2600	69.7	2900	77.8	3400	91.2	2800	75.1						
80	5.5	3300	88.5	2900	77.8	3400	91.2								
100	6.9	3500	93.9	2900	77.8	3400	91.2								
125	8.6	3600	96.6	2900	77.8										
psig	bar	Body Size: NPS 2													
1	0.07	170	4.5	230	6.1	350	9.3	530	14.2	890	23.8	790	21.2	960	25.7
2	0.14	310	8.3	450	12.0	760	20.4	940	25.2	1000	26.8	1400	37.5	1600	42.9
3	0.21	360	9.6	700	18.7	860	23.0	1100	29.5	1400	37.5	1700	45.6	2200	59.0
5	0.34	560	15.0	890	23.8	1100	29.5	1600	42.9	2200	59.0	2800	75.1	3500	93.9
10	0.69	760	20.4	1300	34.8	1900	51.0	2600	69.7	3300	88.5	3400	91.2	4500	121
15	1.0	980	26.3	1800	48.3	2600	69.7	3400	91.2	3500	93.9	3500	93.9	4800	129
20	1.4	1100	29.5	2100	56.3	3200	85.9	3500	93.9	3600	96.6	3600	96.6	4800	129
30	2.1	1500	40.2	2700	72.4	3400	91.2	3600	96.6	4000	107	2400	64.4		
40	2.8	1900	51.0	3200	85.9	3500	93.9	3600	96.6	2700	72.4				
50	3.4	2200	59.0	3200	85.9	3700	99.3	2900	77.8						
60	4.1	2600	69.7	3200	85.9	3700	99.3	2800	75.1						
80	5.5	3100	83.2	2800	75.1	3700	99.3								
100	6.9	3100	83.2	2600	69.7	3700	99.3								
125	8.6	3100	83.2	2600	69.7										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
Gray areas indicate limited capacities due to boost effects.

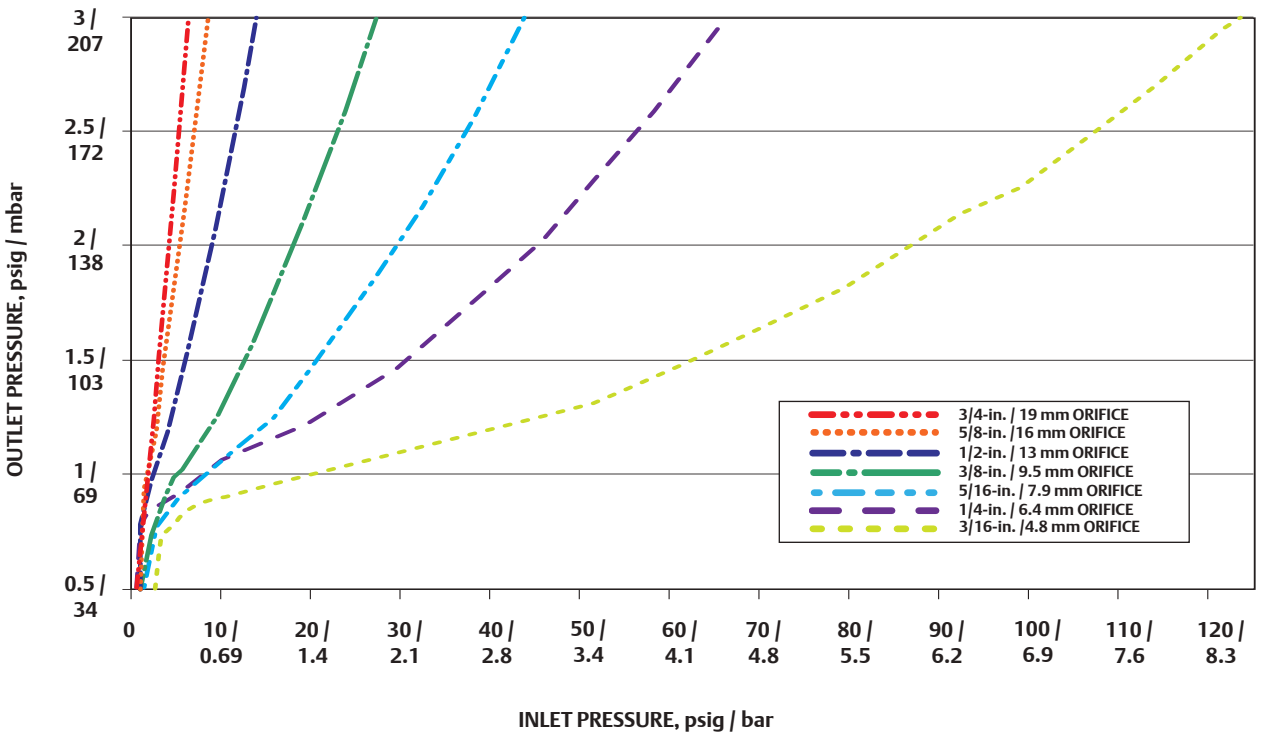


Figure 7. *Type CS400IR Relief Curves (Blocked per Orifice Size) at 14 in. w.c. / 35 mbar Set Pressure*

Table 14. Type CS400 Relief Table, 14 in. w.c. / 35 mbar Setpoint, Internal Registration

ORIFICE SIZE		REGULATOR SET PRESSURE		MAXIMUM INLET PRESSURE TO KEEP OUTLET PRESSURE AT/OR BELOW(1)			
				2 psig / 138 mbar		2.5 psig / 172 mbar	
In.	mm	In. w.c.	mbar	psig	bar	psig	bar
3/16	4.8	14	35	87	6.0	107	7.4
1/4	6.4			45	3.1	56	3.9
5/16	7.9			30	2.1	37	2.6
3/8	9.5			18	1.2	23	1.6

1. Relief values obtained by blocking regulator open per orifice.

	ACCURACY			
SETPOINT	+ / - 20%		SET RANGE	PART NUMBER / COLOR
1 psig	-0.2 psi	0.2 psi	18 in. w.c. to 1 psig	GE30225X012 / Orange
69 mbar	-14 mbar	14 mbar	45 to 69 mbar	

Table 15. Type CS400 Internal Registration Flow Capacities for 1 psig / 69 mbar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4													
2	0.14	270	7.2	510	13.6	840	22.5	1000	26.8	1200	32.2	1700	45.6	2000	53.6
3	0.21	370	9.9	700	18.7	1000	26.8	1200	32.2	1700	45.6	2200	59.0	2700	72.4
5	0.34	530	14.2	940	25.2	1300	34.8	1700	45.6	2400	64.4	3400	91.2	4100	110
10	0.69	790	21.2	1400	37.5	2200	59.0	2800	75.1	3900	105	5600	150	6700	180
15	1.0	1000	26.8	1700	45.6	2900	77.8	3800	102	5300	142	7000	188	7800	209
20	1.4	1100	29.5	2100	56.3	3500	93.9	4200	113	6800	183	7600	204	7800	209
30	2.1	1500	40.2	2700	72.4	4700	126	6200	166	7600	204	7600	204		
40	2.8	1800	48.3	3400	91.2	5800	156	7600	204	7600	204				
50	3.4	2200	59.0	4000	107	6200	166	7600	204						
60	4.1	2500	67.1	4700	126	7600	204	7600	204						
80	5.5	3200	85.9	5800	156	7600	204								
100	6.9	3800	102	6500	174	7600	204								
125	8.6	4700	126	6500	174										
psig	bar	Body Size: NPS 1-1/2													
2	0.14	290	7.7	530	14.2	810	21.7	1000	26.8	1300	34.8	1500	40.2	1900	51.0
3	0.21	390	10.4	700	18.7	1000	26.8	1200	32.2	1700	45.6	2400	64.4	2700	72.4
5	0.34	550	14.7	960	25.7	1300	34.8	1800	48.3	2700	72.4	3800	102	4900	132
10	0.69	840	22.5	1400	37.5	2100	56.3	2800	75.1	4600	123	5600	150	6000	161
15	1.0	1000	26.8	1800	48.3	2700	72.4	3900	105	5600	150	5600	150	6000	161
20	1.4	1200	32.2	2100	56.3	3400	91.2	4700	126	5600	150	5600	150	6000	161
30	2.1	1500	40.2	2800	75.1	4700	126	6300	169	5600	150	5600	150		
40	2.8	1900	51.0	3300	88.5	5500	148	5600	150	5600	150				
50	3.4	2300	61.7	3900	105	5500	148	5600	150						
60	4.1	2600	69.7	4500	121	5500	148	5600	150						
80	5.5	3300	88.5	5400	145	5500	148								
100	6.9	4000	107	5500	148	5500	148								
125	8.6	4000	107	5500	148										
psig	bar	Body Size: NPS 2													
2	0.14	290	7.7	450	12.0	750	20.1	1000	26.8	1300	34.8	1700	45.6	1800	48.3
3	0.21	380	10.2	670	17.9	1000	26.8	1100	29.5	1700	45.6	2100	56.3	2600	69.7
5	0.34	540	14.4	950	25.5	1200	32.2	1700	45.6	2400	64.4	3100	83.2	4300	115
10	0.69	820	22.0	1400	37.5	2100	56.3	2800	75.1	4500	121	6000	161	8200	220
15	1.0	1000	26.8	1800	48.3	2700	72.4	3900	105	5700	153	6600	177	8200	220
20	1.4	1100	29.5	2100	56.3	3400	91.2	4800	129	6000	161	6600	177	8200	220
30	2.1	1500	40.2	2600	69.7	4200	113	6300	169	6000	161	6600	177		
40	2.8	1900	51.0	3300	88.5	5700	153	6300	169	6000	161				
50	3.4	2200	59.0	4000	107	5700	153	6300	169						
60	4.1	2600	69.7	4500	121	5700	153	6300	169						
80	5.5	3300	88.5	5500	148	5700	153								
100	6.9	4000	107	5500	148	5700	153								
125	8.6	4000	107	5500	148										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

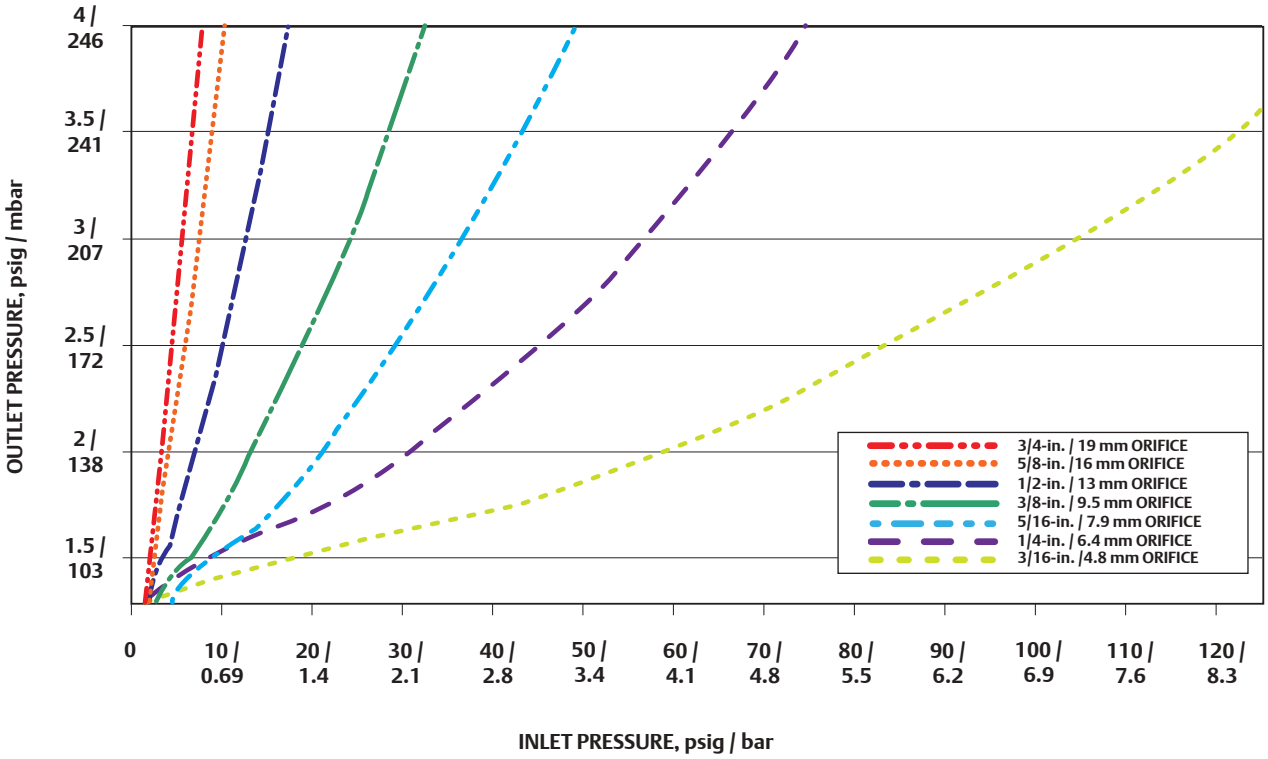


Figure 8. *Type CS400IR Relief Curves (Blocked per Orifice Size) at 1 psig / 69 mbar Set Pressure*

Table 16. Type CS400 Relief Table, 1 psig / 69 mbar Setpoint, Internal Registration

ORIFICE SIZE		REGULATOR SET PRESSURE		MAXIMUM INLET PRESSURE TO KEEP OUTLET PRESSURE AT/OR BELOW[1]			
				2.5 psig / 172 mbar		3 psig / 207 mbar	
In.	mm	psig	mbar	psig	bar	psig	bar
3/16	4.8	1	69	84	5.8	105	7.2
1/4	6.4			46	3.2	56	3.9
5/16	7.9			29	2.0	37	2.6
3/8	9.5			19	1.3	24	1.7

1. Relief values obtained by blocking regulator open per orifice.

	ACCURACY			
SETPOINT	+ / - 20%		SET RANGE	PART NUMBER / COLOR
2 psig	-0.4 psi	0.4 psi	1 to 2 psig	GE30190X012 / Black
138 mbar	-28 mbar	28 mbar	69 to 138 mbar	

Table 17. Type CS400 Internal Registration Flow Capacities for 2 psig / 138 mbar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4													
3	0.21	350	9.3	460	12.3	820	22.0	1100	29.5	1300	34.8	1600	42.9	1900	51.0
5	0.34	550	14.7	850	22.8	1100	29.5	1500	40.2	1900	51.0	2600	69.7	3400	91.2
10	0.69	850	22.8	1300	34.8	1900	51.0	2600	69.7	3400	91.2	4700	126	6200	166
15	1.0	1000	26.8	1700	45.6	2500	67.1	3600	96.6	4400	118	6200	166	6200	166
20	1.4	1200	32.2	2100	56.3	3100	83.2	4100	110	6200	166	6200	166	6200	166
30	2.1	1500	40.2	2700	72.4	4400	118	6000	161	6200	166	6200	166		
40	2.8	1800	48.3	3400	91.2	5400	145	6000	161	6200	166				
50	3.4	2200	59.0	4000	107	6000	161	6000	161						
60	4.1	2600	69.7	4600	123	6000	161	6000	161						
80	5.5	3300	88.5	5800	156	6000	161								
100	6.9	3900	105	5800	156	6000	161								
125	8.6	3900	105	5800	156										
psig	bar	Body Size: NPS 1-1/2													
3	0.21	310	8.3	570	15.3	900	24.1	1100	29.5	1300	34.8	1700	45.6	1900	51.0
5	0.34	520	13.9	880	23.6	1100	29.5	1500	40.2	2000	53.6	2600	69.7	3300	88.5
10	0.69	800	21.4	1300	34.8	1900	51.0	2500	67.1	3400	91.2	5300	142	6700	180
15	1.0	1000	26.8	1800	48.3	2500	67.1	3600	96.6	5400	145	6400	172	6700	180
20	1.4	1100	29.5	2100	56.3	3100	83.2	4500	121	6200	166	6400	172	6700	180
30	2.1	1600	42.9	2800	75.1	4600	123	6200	166	6200	166	6400	172		
40	2.8	1900	51.0	3300	88.5	5700	153	6200	166	6200	166				
50	3.4	2200	59.0	3900	105	6000	161	6200	166						
60	4.1	2500	67.1	4500	121	6000	161	6200	166						
80	5.5	3300	88.5	5800	156	6000	161								
100	6.9	3900	105	5800	156	6000	161								
125	8.6	3900	105	5800	156										
psig	bar	Body Size: NPS 2													
3	0.21	300	8.0	560	15.0	850	22.8	1100	29.5	1300	34.8	1700	45.6	1900	51.0
5	0.34	500	13.4	890	23.8	1000	26.8	1500	40.2	2100	56.3	2700	72.4	3200	85.9
10	0.69	780	20.9	1300	34.8	1800	48.3	2600	69.7	3600	96.6	4900	131	5600	150
15	1.0	1000	26.8	1700	45.6	2400	64.4	3300	88.5	5100	137	6000	161	6000	161
20	1.4	1100	29.5	2000	53.6	3000	80.5	4200	113	6000	161	6000	161	6000	161
30	2.1	1500	40.2	2700	72.4	3900	105	6000	161	6000	161	6000	161		
40	2.8	1900	51.0	3300	88.5	5400	145	6000	161	6000	161				
50	3.4	2200	59.0	4000	107	5800	156	6000	161						
60	4.1	2600	69.7	4600	123	5800	156	6000	161						
80	5.5	3300	88.5	5800	156	5800	156								
100	6.9	4100	110	5800	156	5800	156								
125	8.6	4100	110	5800	156										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

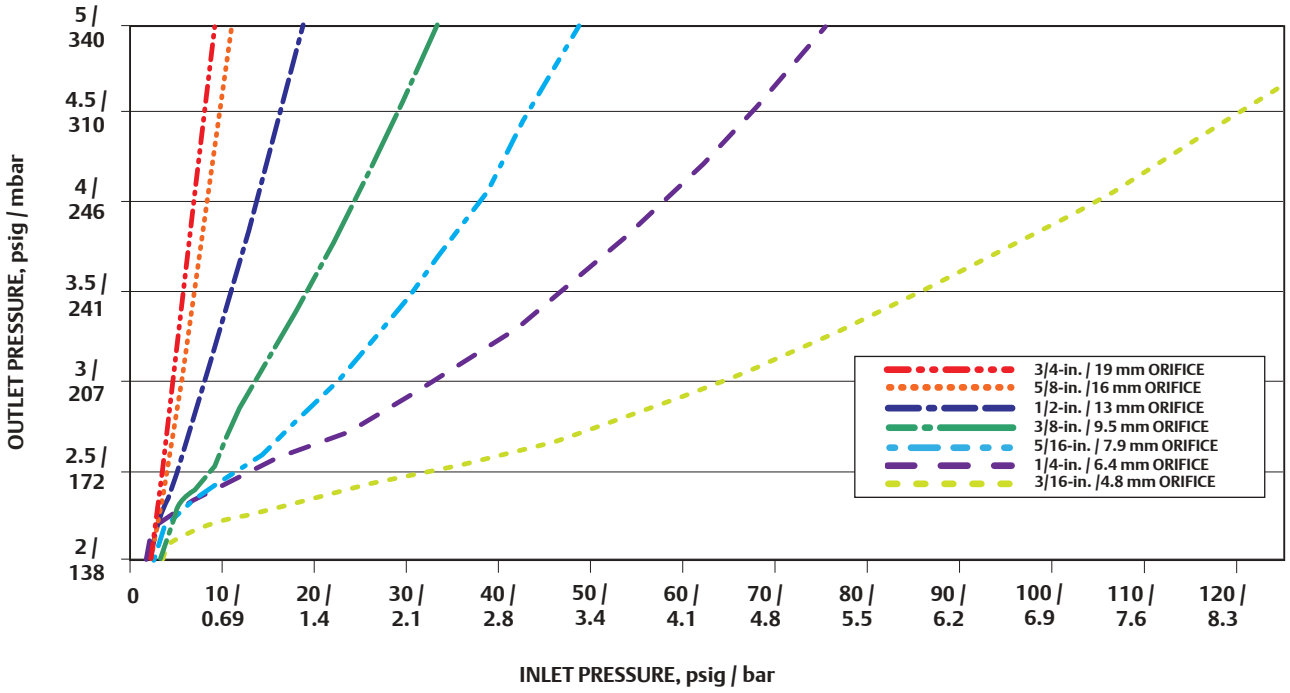


Figure 9. *Type CS400IR Relief Curves (Blocked per Orifice Size) at 2 psig / 138 mbar Set Pressure*

Table 18. Type CS400 Relief Table, 2 psig / 138 mbar Setpoint, Internal Registration

ORIFICE SIZE		REGULATOR SET PRESSURE		MAXIMUM INLET PRESSURE TO KEEP OUTLET PRESSURE AT/OR BELOW(1)			
				3 psig / 207 mbar		4 psig / 276 mbar	
In.	mm	psig	mbar	psig	bar	psig	bar
3/16	4.8	2	138	64	4.4	105	7.2
1/4	6.4			32	2.2	58	4.0
5/16	7.9			23	1.6	37	2.6
3/8	9.5			14	0.97	24	1.7

1. Relief values obtained by blocking regulator open per orifice.

	ACCURACY			
SETPOINT	+ / - 20%		SET RANGE	PART NUMBER / COLOR
5 psig	-1 psig	1 psig	2 to 5.5 psig	GE30197X012 / Yellow
345 mbar	-69 mbar	69 mbar	138 to 380 mbar	

Table 19. Type CS400 Internal Registration Flow Capacities for 5 psig / 345 mbar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4													
10	0.69	720	19.3	1200	32.2	1700	45.6	2200	59.0	3000	80.5	3900	105	4700	126
15	1.0	960	25.7	1700	45.6	2400	64.4	3100	83.2	4700	126	6200	166	7000	188
20	1.4	1100	29.5	2000	53.6	3000	80.5	4000	107	6000	161	6500	174	7000	188
30	2.1	1400	37.5	2700	72.4	4500	121	5800	156	6500	174	6500	174		
40	2.8	1900	51.0	3400	91.2	5500	148	6500	174	6500	174				
50	3.4	2200	59.0	4100	110	6500	174	6500	174						
60	4.1	2600	69.7	4600	123	6500	174	6500	174						
80	5.5	3200	85.9	5700	153	6500	174								
100	6.9	4000	107	5700	153	6500	174								
125	8.6	4200	113	5700	153										
psig	bar	Body Size: NPS 1-1/2													
10	0.69	750	20.1	1200	32.2	1600	42.9	2300	61.7	2900	77.8	3900	105	4400	118
15	1.0	990	26.5	1500	40.2	2300	61.7	3200	85.9	4200	113	6100	164	7200	193
20	1.4	1100	29.5	2000	53.6	2800	75.1	4000	107	5900	158	6600	177	7200	193
30	2.1	1600	42.9	2600	69.7	4200	113	5900	158	6500	174	6600	177		
40	2.8	1900	51.0	3300	88.5	5200	140	6500	174	6500	174				
50	3.4	2200	59.0	3800	102	6200	166	6500	174						
60	4.1	2600	69.7	4500	121	6200	166	6500	174						
80	5.5	3300	88.5	5700	153	6200	166								
100	6.9	4100	110	5700	153	6200	166								
125	8.6	4500	121	5700	153										
psig	bar	Body Size: NPS 2													
10	0.69	720	19.3	1200	32.2	1500	40.2	2200	59.0	3000	80.5	3800	102	4700	126
15	1.0	970	26.0	1600	42.9	2200	59.0	3200	85.9	4400	118	5700	153	6600	177
20	1.4	1100	29.5	2000	53.6	2900	77.8	3900	105	5200	140	6800	183	7200	193
30	2.1	1500	40.2	2700	72.4	4000	107	5400	145	6500	174	6800	183		
40	2.8	1900	51.0	3200	85.9	5000	134	6500	174	6500	174				
50	3.4	2200	59.0	3800	102	5900	158	6500	174						
60	4.1	2600	69.7	4300	115	6200	166	6500	174						
80	5.5	3300	88.5	5900	158	6200	166								
100	6.9	4000	107	5900	158	6200	166								
125	8.6	4900	132	5900	158										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

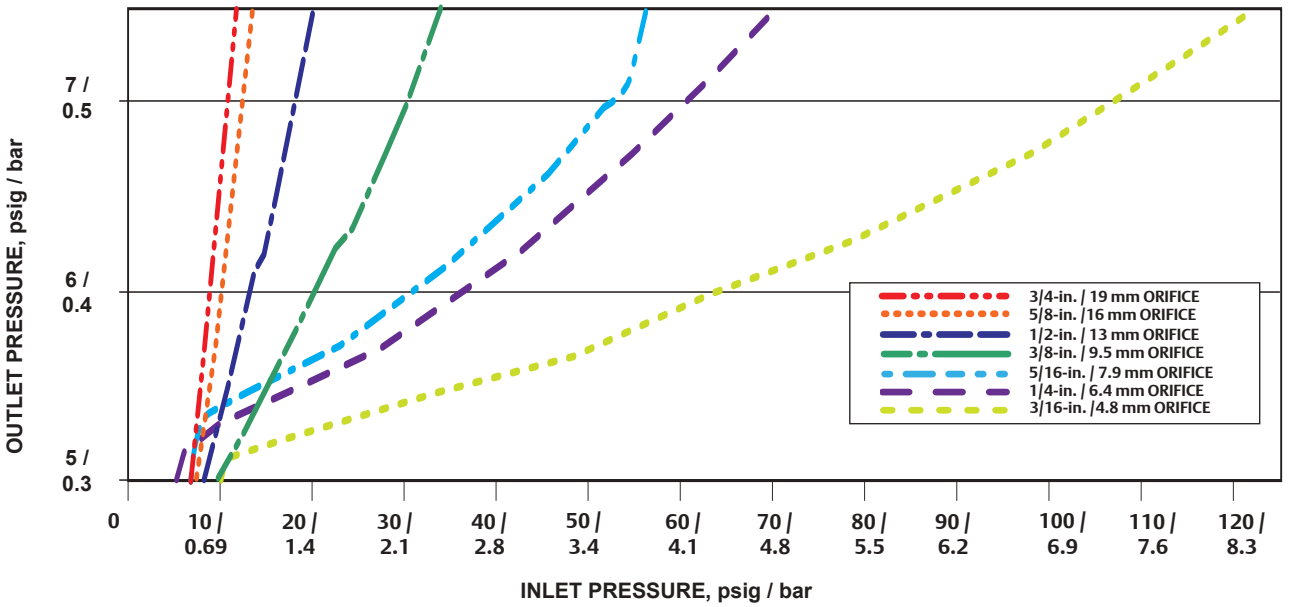


Figure 10. *Type CS400IR Relief Curves (Blocked per Orifice Size) at 5 psig / 345 mbar Set Pressure*

Table 20. Type CS400 Relief Table, 5 psig / 345 mbar Setpoint, Internal Registration

ORIFICE SIZE		REGULATOR SET PRESSURE		MAXIMUM INLET PRESSURE TO KEEP OUTLET PRESSURE AT/OR BELOW[1]			
				6 psig / 414 mbar		7 psig / 483 mbar	
In.	mm	psig	mbar	psig	bar	psig	bar
3/16	4.8	5	345	63	4.3	106	7.3
1/4	6.4			36	2.5	61	4.2
5/16	7.9			31	2.1	53	3.7
3/8	9.5			20	1.4	29	2.0

1. Relief values obtained by blocking regulator open per orifice.

	ACCURACY			
SETPOINT	Droop	Boost	SET RANGE	PART NUMBER / COLOR
7 in. w.c.	-1 in. w.c.	2 in. w.c.	6 to 8 in. w.c.	GE30188X012 / Gold
17 mbar	-2 mbar	5 mbar	15 to 20 mbar	

Table 21. Type CS400 External Registration Flow Capacities for 7 in. w.c. / 17 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4, 1-1/2 and 2													
0.5	0.03	140	3.7	200	5.3	230	6.1	280	7.5	360	9.6	410	11.0	430	11.5
1	0.07	180	4.8	260	6.9	300	8.0	360	9.6	360	9.6	610	16.3	760	20.4
2	0.14	210	5.6	350	9.3	360	9.6	360	9.6	360	9.6	910	24.4	980	26.3
3	0.21	210	5.6	450	12.0	510	13.6	510	13.6	510	13.6	990	26.5	1060	28.4
5	0.34	210	5.6	590	15.8	610	16.3	870	23.3	1120	30.0	1360	36.5	1920	51.5
10	0.69	210	5.6	680	18.2	970	26.0	1180	31.6	1430	38.3	2000	53.6	2500	67.1
15	1.0	210	5.6	1060	28.4	1150	30.8	1440	38.6	1720	46.1	2100	56.3	2700	72.4
20	1.4	980	26.3	1220	32.7	1390	37.3	1550	41.6	1550	41.6	2500	67.1	3300	88.5
30	2.1	1230	33.0	1450	38.9	1700	45.6	1800	48.3	1880	50.4	2600	69.7		
40	2.8	1400	37.5	1450	38.9	1730	46.4	1880	50.4	2300	61.7				
50	3.4	1450	38.9	1450	38.9	1860	49.9	2000	53.6						
60	4.1	1450	38.9	1450	38.9	2000	53.6	2300	61.7						
80	5.5	1450	38.9	1450	38.9	2500	67.1								
100	6.9	1450	38.9	1450	38.9	2900	77.8								
125	8.6	1450	38.9	1450	38.9										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

	ACCURACY			
SETPOINT	Droop	Boost	SET RANGE	PART NUMBER / COLOR
11 in. w.c.	-2 in. w.c.	2 in. w.c.	7.5 to 11 in. w.c.	GE30189X012 / Blue
27 mbar	-5 mbar	5 mbar	19 to 27 mbar	

Table 22. Type CS400 External Registration Flow Capacities for 11 in. w.c. / 27 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4, 1-1/2 and 2													
0.5	0.03	130	3.4	170	4.5	240	6.4	290	7.7	350	9.3	350	9.3	350	9.3
1	0.07	160	4.2	350	9.3	380	10.2	520	13.9	690	18.5	890	23.8	1040	27.9
2	0.14	280	7.5	470	12.6	600	16.1	840	22.5	1050	28.1	1330	35.7	1530	41.0
3	0.21	370	9.9	600	16.1	760	20.4	1060	28.4	1380	37.0	1390	37.3	1950	52.3
5	0.34	500	13.4	810	21.7	1380	37.0	1900	51.0	1950	52.3	2000	53.6	2400	64.4
10	0.69	760	20.4	1330	35.7	1480	39.7	2100	56.3	2700	72.4	3600	96.6	3800	102
15	1.0	840	22.5	1790	48.0	1960	52.6	2700	72.4	3500	93.9	4900	132	6600	177
20	1.4	1180	31.6	1990	53.4	2500	67.1	3800	102	4900	132	7100	191	7300	196
30	2.1	1500	40.2	2400	64.4	3300	88.5	5100	137	7900	212	10,700	287		
40	2.8	1880	50.4	3100	83.2	4700	126	6200	166	9700	260				
50	3.4	2200	59.0	3900	105	5700	153	8200	220						
60	4.1	2500	67.1	4600	123	6500	174	9900	266						
80	5.5	3300	88.5	6000	161	7000	188								
100	6.9	4000	107	7000	188	7000	188								
125	8.6	4700	126	8600	231										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

	ACCURACY			
SETPOINT	Droop	Boost	SET RANGE	PART NUMBER / COLOR
14 in. w.c.	-2 in. w.c.	2 in. w.c.	10 to 14 in. w.c.	GE30224X012 / Unpainted
35 mbar	-5 mbar	5 mbar	25 to 35 mbar	

Table 23. Type CS400 External Registration Flow Capacities for 14 in. w.c. / 35 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4, 1-1/2 and 2													
1	0.07	170	4.5	260	6.9	370	9.9	490	13.1	610	16.3	820	22.0	840	22.5
2	0.14	270	7.2	450	12.0	600	16.1	810	21.7	1040	27.9	1180	31.6	1520	40.8
3	0.21	350	9.3	570	15.3	750	20.1	970	26.0	1610	43.2	1650	44.2	1730	46.4
5	0.34	480	12.8	760	20.4	1310	35.1	1330	35.7	1630	43.7	2300	61.7	2300	61.7
10	0.69	760	20.4	1380	37.0	1670	44.8	2100	56.3	2600	69.7	3500	93.9	3900	105
15	1.0	970	26.0	1650	44.2	1940	52.0	2500	67.1	3900	105	5000	134	5100	137
20	1.4	1170	31.4	1760	47.2	2300	61.7	3200	85.9	4200	113	6100	164	6500	174
30	2.1	1500	40.2	2400	64.4	3300	88.5	4200	113	6400	172	10,300	277		
40	2.8	1830	49.1	3200	85.9	4000	107	5900	158	10,900	293				
50	3.4	2200	59.0	3700	99.3	5200	140	8200	220						
60	4.1	2500	67.1	4500	121	6200	166	8700	234						
80	5.5	3300	88.5	5400	145	9100	244								
100	6.9	4000	107	6700	180	11,200	301								
125	8.6	4600	123	8100	217										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

	ACCURACY			
SETPOINT	+ / - 20%		SET RANGE	PART NUMBER / COLOR
1 psig	-0.2 psi	0.2 psi	18 in. w.c. to 1 psig	GE30225X012 / Orange
69 mbar	-14 mbar	14 mbar	45 to 69 mbar	

Table 24. Type CS400 External Registration Flow Capacities for 1 psig / 69 mbar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4, 1-1/2 and 2													
2	0.14	270	7.2	360	9.6	430	11.5	430	11.5	430	11.5	430	11.5	430	11.5
3	0.21	350	9.3	410	11.0	470	12.6	470	12.6	470	12.6	1200	32.2	1350	36.2
5	0.34	410	11.0	410	11.0	840	22.5	1070	28.7	1330	35.7	1780	47.7	1790	48.0
10	0.69	410	11.0	410	11.0	1310	35.1	1650	44.2	2200	59.0	2600	69.7	2900	77.8
15	1.0	490	13.1	1250	33.5	1670	44.8	2100	56.3	2800	75.1	3500	93.9	3700	99.3
20	1.4	1090	29.2	1480	39.7	2000	53.6	2500	67.1	3500	93.9	4000	107	4100	110
30	2.1	1490	40.0	1940	52.0	2600	69.7	3300	88.5	4400	118	5400	145		
40	2.8	1790	48.0	2500	67.1	3300	88.5	4300	115	5700	153				
50	3.4	2100	56.3	2300	61.7	3900	105	4900	132						
60	4.1	2400	64.4	3300	88.5	4500	121	5200	140						
80	5.5	3100	83.2	3300	88.5	5400	145								
100	6.9	3600	96.6	3700	99.3	6400	172								
125	8.6	4500	121	4500	121										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 20%		SET RANGE	PART NUMBER / COLOR
2 psig	-0.4 psi	0.4 psi	1 to 2 psig	GE30190X012 / Black
138 mbar	-28 mbar	28 mbar	69 to 138 mbar	

Table 25. Type CS400 External Registration Flow Capacities for 2 psig / 138 mbar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4, 1-1/2 and 2													
3	0.21	330	8.8	540	14.4	720	19.3	990	26.5	1360	36.5	2200	59.0	2600	69.7
5	0.34	500	13.4	800	21.4	1100	29.5	1500	40.2	2500	67.1	2500	67.1	3000	80.5
10	0.69	790	21.2	1270	34.0	1960	52.6	2500	67.1	3400	91.2	4200	113	5400	145
15	1.0	1020	27.3	1760	47.2	2300	61.7	3200	85.9	4500	121	6000	161	6800	183
20	1.4	1180	31.6	2100	56.3	2800	75.1	3900	105	5800	156	7000	188	8000	215
30	2.1	1550	41.6	2600	69.7	4000	107	5500	148	7900	212	9500	255		
40	2.8	1900	51.0	3300	88.5	5000	134	6900	185	9800	263				
50	3.4	2200	59.0	4100	110	5800	156	8200	220						
60	4.1	2600	69.7	4500	121	6800	183	9600	258						
80	5.5	3300	88.5	5800	156	8900	239								
100	6.9	3900	105	7000	188	10,500	282								
125	8.6	4900	132	8700	234										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY + / - 20%		SET RANGE	PART NUMBER / COLOR
5 psig	-1 psig	1 psig	2 to 5.5 psig	GE30190X012 / Black
345 mbar	-69 mbar	69 mbar	138 to 380 mbar	

Table 26. Type CS400 External Registration Flow Capacities for 5 psig / 345 mbar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4, 1-1/2 and 2													
10	0.69	670	17.9	1320	35.4	1600	42.9	1700	45.6	3000	80.5	3600	97	4200	113
15	1.0	950	25.5	1770	47.5	2700	72.4	3100	83.2	4400	118	5500	148	6300	169
20	1.4	1160	31.1	2000	53.6	2900	77.8	3700	99.3	5300	142	7000	188	8200	220
30	2.1	1570	42.1	2600	69.7	4100	110	5200	140	7700	207	9000	247		
40	2.8	1860	49.9	3300	88.5	4800	129	6700	180	9000	242				
50	3.4	2000	53.6	3900	105	5800	156	8100	217						
60	4.1	2500	67.1	4300	115	7000	188	9600	258						
80	5.5	3300	88.5	5600	150	8900	239								
100	6.9	3900	105	6600	177	10,200	274								
125	8.6	4900	132	8800	236										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY Droop	Boost	SET RANGE	PART NUMBER / COLOR
7 in. w.c.	-1 in. w.c.	2 in. w.c.	6 to 8 in. w.c.	GE30188X012 / Gold
17 mbar	-2 mbar	5 mbar	15 to 20 mbar	

Table 27. Types CS403 and CS404 Internal Registration Flow Capacities for 7 in. w.c. / 17 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4													
0.5	0.03	80	2.1	160	4.3	210	5.6	250	67	520	13.9	420	11.3	410	11.0
1	0.07	160	4.3	290	7.8	440	11.8	340	9.1	520	13.9	560	15.0	730	19.6
2	0.14	280	7.5	350	9.4	480	12.9	590	15.8	830	22.2	1050	28.1	1210	32.4
3	0.21	310	8.3	460	12.3	650	17.4	740	19.8	1270	34.0	1440	38.6	1790	48.0
5	0.34	420	11.3	660	17.7	960	25.7	1180	31.6	2070	55.5	2460	65.9	2730	73.2
10	0.69	720	19.3	1280	34.3	1840	49.3	2390	64.1	3640	97.6	4830	129	4850	130.0
15	1.0	970	26.0	1800	48.2	2700	72.4	3580	95.9	5130	138	3910	105	6700	180
20	1.4	1150	30.8	2170	58.2	3390	90.9	4530	121	3170	85.0	2540	68.1	3330	89.2
30	2.1	1530	41.0	2780	74.5	4450	119	2410	64.6	2260	60.6	2280	61.1		
40	2.8	1890	50.7	2800	75.0	2980	79.9	2120	56.8	2260	60.6				
50	3.4	2260	60.6	2800	75.0	2690	72.1	2080	55.7						
60	4.1	2400	64.3	2730	73.2	2590	69.4	2040	54.7						
80	5.5	2400	64.3	2590	69.4	2590	69.4								
100	6.9	2400	64.3	2590	69.4	2590	69.4								
125	8.6	2540	68.1	2590	69.4										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

Gray areas indicate limited capacities due to boost effects.

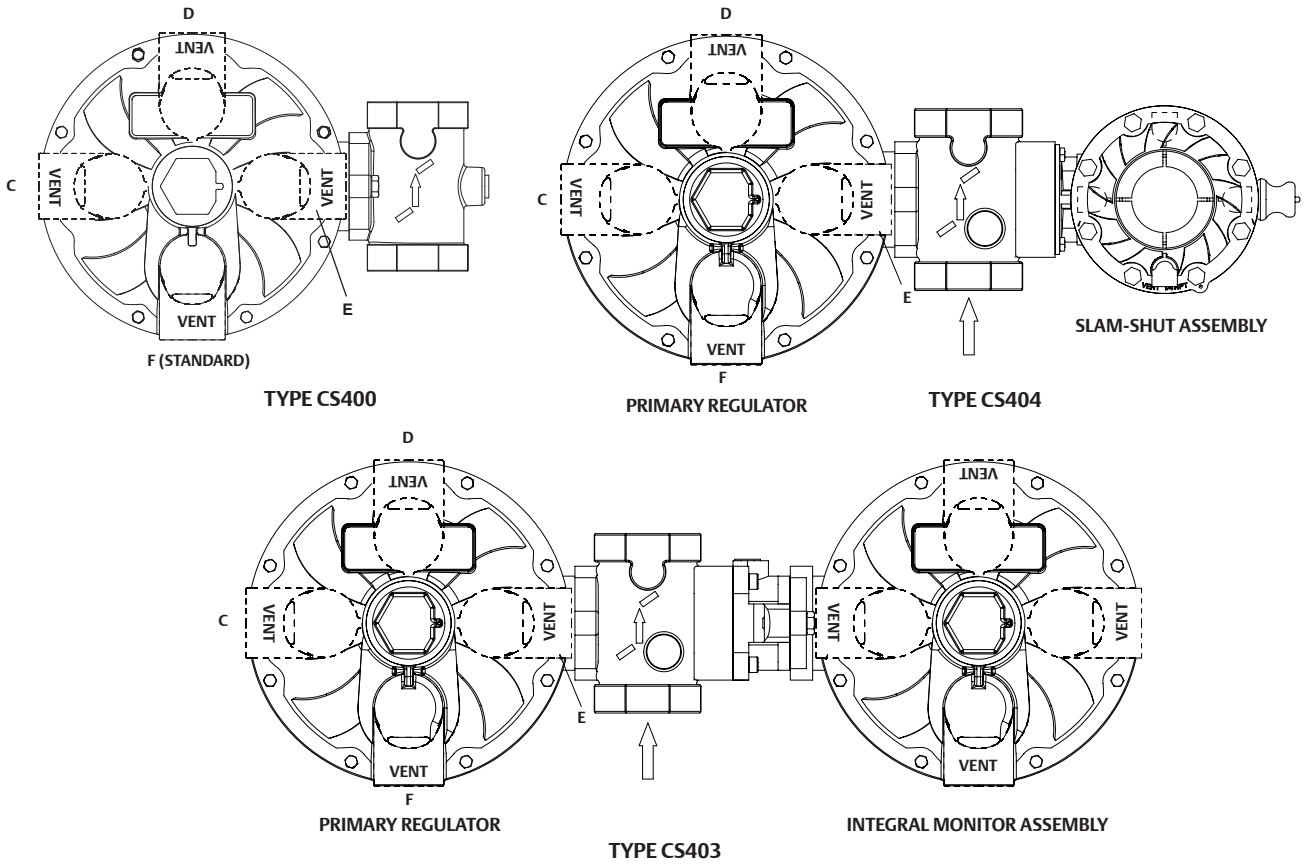


Figure 11. *Spring Case Vent Orientation*

CHOOSE VENT AND BODY POSITION FOR THE TYPES CS403 AND CS404 IN THE SAME MANNER AS FOR THE BASE TYPE CS400 REGULATOR. THE VENT OF THE INTEGRAL MONITOR OR SLAM-SHUT WILL BE ORIENTED IN THE SAME DIRECTION AS THE PRIMARY REGULATOR. BODY POSITION WILL ALSO BE BASED ON PRIMARY REGULATOR AS THE SPRING BARREL OF THE INTEGRAL MONITOR OR SLAM-SHUT WILL POINT THE SAME DIRECTION AS THE PRIMARY REGULATOR.

	ACCURACY			
SETPOINT	+ / - 20%		SET RANGE	PART NUMBER / COLOR
1 psig	-0.2 psig	0.2 psig	18 in. w.c. to 1 psig	GE30225X012 / Orange
69 mbar	-14 bar	14 mbar	45 to 69 mbar	

Table 28. Types CS403 and CS404 Internal Registration Flow Capacities for 1 psig / 69 mbar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm													
		3/16	4.8	1/4	6.4	5/16	7.9	3/8	9.5	1/2	13	5/8	16	3/4	19
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: NPS 1-1/4													
2	0.14	220	5.9	370	9.9	700	18.8	560	15.0	760	20.4	840	22.5	960	25.7
3	0.21	380	10.2	450	12.1	950	25.5	740	19.8	1000	26.8	1200	32.2	1390	37.3
5	0.34	450	12.1	640	17.2	1350	36.2	1080	28.9	1460	39.1	1860	49.8	2270	60.8
10	0.69	740	19.8	1050	28.1	2100	56.3	1890	50.7	2610	69.9	3230	86.6	3850	103
15	1.0	950	25.5	1460	39.1	2750	73.7	2530	67.8	3630	97.3	4980	134	5800	155
20	1.4	1180	31.6	1860	49.8	3390	90.9	3290	88.2	4890	131	6610	177	7370	198
30	2.1	1530	41.0	2680	71.8	4470	120	4710	126	7650	205	9180	246		
40	2.8	1900	50.9	3320	89.0	5620	151	6760	181	10,380	278				
50	3.4	2250	60.3	4000	107	6680	179	8530	229						
60	4.1	2650	71.0	4650	125	7770	208	10,030	269						
80	5.5	3360	90.0	5980	160	9900	265								
100	6.9	4090	110	7230	194	12,010	322								
125	8.6	3890	104	7840	210										

Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

Gray areas indicate limited capacities due to boost effects.

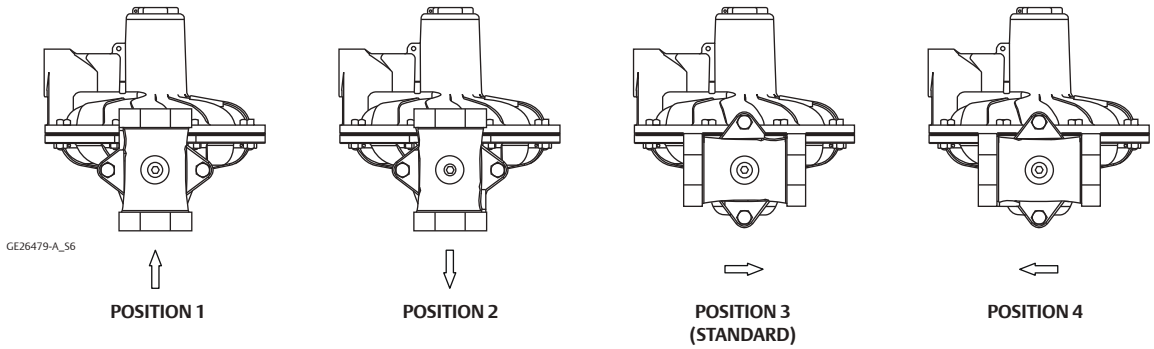


Figure 12. *Body Orientation*

CHOOSE VENT AND BODY POSITION FOR THE TYPES CS403 AND CS404 IN THE SAME MANNER AS FOR THE BASE TYPE CS400 REGULATOR. THE VENT OF THE INTEGRAL MONITOR OR SLAM-SHUT WILL BE ORIENTED IN THE SAME DIRECTION AS THE PRIMARY REGULATOR. BODY POSITION WILL ALSO BE BASED ON PRIMARY REGULATOR AS THE SPRING BARREL OF THE INTEGRAL MONITOR OR SLAM-SHUT WILL POINT THE SAME DIRECTION AS THE PRIMARY REGULATOR.

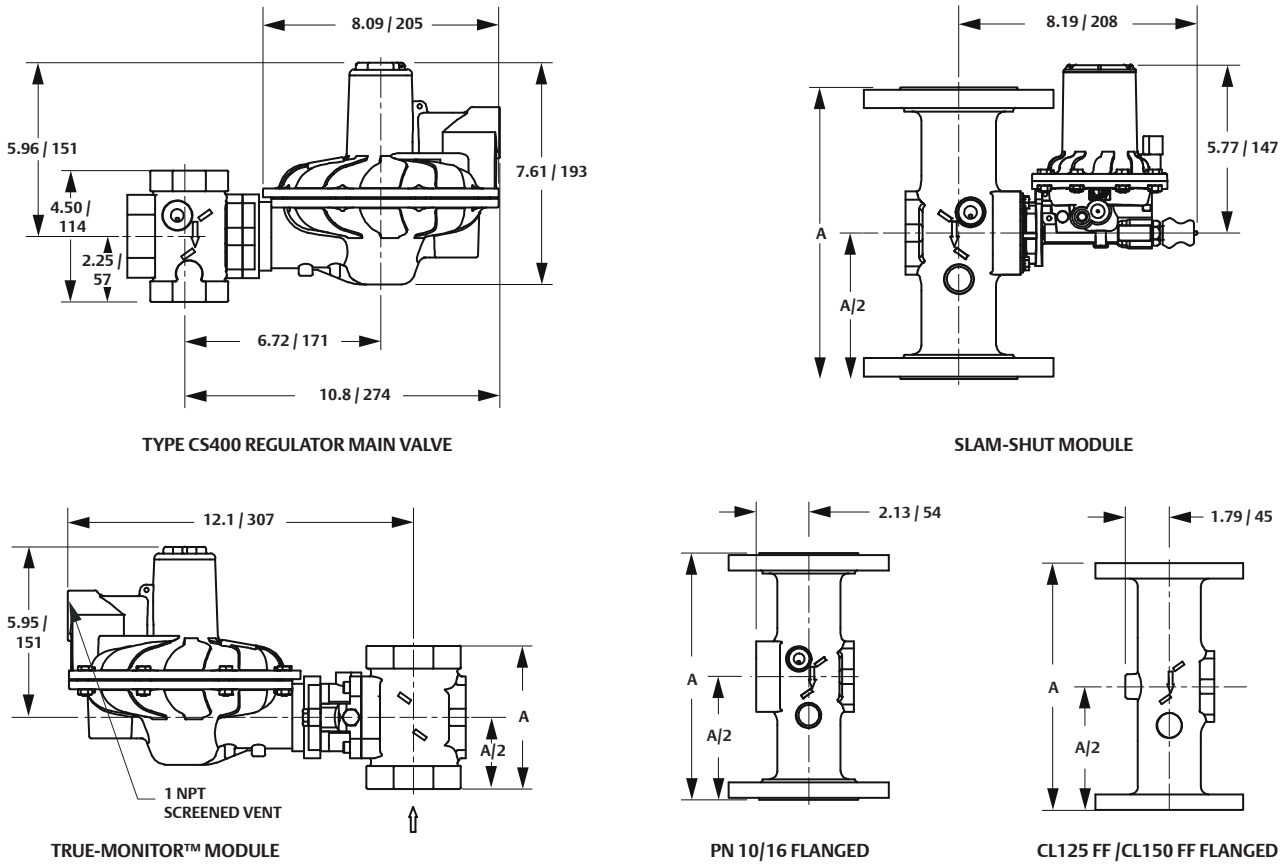


Figure 13. *Dimensions*

Table 29. Dimension

BODY SIZE	END CONNECTION STYLE					
	A					
	NPT / Rp		CL125 FF/CL150 FF		PN 16	
	In.	mm	In.	mm	In.	mm
1-1/4	4.49	114	----		----	
1-1/2						
1	3.94	100	----		----	
2	5	127	----		----	
NPS 2 / DN 50	----		10	254	10	254

Ordering Guide

Type (See Table 1 for Construction Features) (Select One)

Stand-Alone Regulator
- ☐ CS400IN
- ☐ CS400IR
- ☐ CS400IT
- ☐ CS400EN
- ☐ CS400ET

With Integral True-Monitor™ Module
- ☐ CS403IN
- ☐ CS403IT
- ☐ CS403EN
- ☐ CS403ET

With Type VSX4 Slam-Shut Module
- ☐ CS404IN
- ☐ CS404IR
- ☐ CS404IT
- ☐ CS404EN
- ☐ CS404ET

Body Sizes, Materials and End Connection (Select One)

Cast Iron (Type CS400 Only)
- ☐ 1-1/4 NPT***
- ☐ 1-1/4 x 1-1/2 NPT***
- ☐ 1-1/2 NPT***
- ☐ 2 NPT***
- ☐ NPS 2 / DN 50, CL125 FF***

Ductile Cast Iron (All Types)
- ☐ 1-1/4 NPT***
- ☐ 1-1/2 NPT***
- ☐ 2 NPT***
- ☐ Rp 1-1/4***
- ☐ Rp 1-1/2***
- ☐ Rp 2***
- ☐ NPS 2 / DN 50, CL125 FF / CL150 FF***
- ☐ NPS 2/ DN 50, PN 10/16

Steel (All Types)
- ☐ 1-1/4 NPT***
- ☐ 1-1/2 NPT***
- ☐ Rp 1-1/4***
- ☐ Rp 1-1/2***

Outlet Pressure Range (Select One)
- ☐ 3.5 to 5 in. w.c. / 9 to 12 mbar, Red***
- ☐ 4.5 to 6.5 in. w.c. / 11 to 16 mbar, Purple***
- ☐ 6 to 8 in. w.c. / 15 to 20 mbar, Gold***
- ☐ 7.5 to 11 in. w.c. / 19 to 27 mbar, Blue***
- ☐ 10 to 14 in. w.c. / 25 to 35 mbar, Unpainted***
- ☐ 12 to 19 in. w.c. / 30 to 47 mbar, Green***
- ☐ 18 to 28 in. w.c. / 45 to 69 mbar, Orange***
- ☐ 1 to 2 psig / 69 to 138 mbar, Black***
- ☐ 2 to 5.5 psig / 138 to 380 mbar, Yellow***

Orifice Size (Select One)
- ☐ 3/16 in. / 4.8 mm
- ☐ 1/4 in. / 6.4 mm
- ☐ 5/16 in. / 7.9 mm
- ☐ 3/8 in. / 9.5 mm
- ☐ 1/2 in. / 13 mm
- ☐ 5/8 in. / 16 mm
- ☐ 3/4 in. / 19 mm

Body Orientation (Select One)
- ☐ Position 1***
- ☐ Position 2***
- ☐ Position 3 **(standard)*****
- ☐ Position 4***

Vent Orientation (Select One)
- ☐ Position C***
- ☐ Position D***
- ☐ Position E***
- ☐ Position F **(standard)*****

Ordering Guide (continued)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Regulator Tip:

Droop is the reduction of outlet pressure experienced by pressure-reducing regulators as the flow rate increases. It is stated as a percent, in inches of water column (mbar) or in pounds per square inch (bar) and indicates the difference between the outlet pressure setting made at low flow rates and the actual outlet pressure at the published maximum flow rate. Droop is also called offset or proportional band.

CS800 Series

Commercial/Industrial - Pressure Reducing Regulators

FISHER

Introduction

The CS800 Series direct-operated, spring-loaded regulators have been engineered to fit a multitude of commercial and industrial pressure-reducing applications. This flexibility is provided by the numerous body sizes and end connections, outlet pressure settings orifice sizes, as well as the option for internal or external pressure registration.

Body Sizes, End Connection Styles and Pressure Rating

See Table 2

Flow Capacities

See Tables 12 to 42

Flow and Sizing Coefficients

See Table 8

Maximum Inlet Pressure

Emergency: 175 psig / 12.1 bar

Operating: See Table 8

Maximum Outlet Pressure

Emergency (Casing):
15 psig / 1.0 bar

To Avoid Internal Parts Damage:
3 psig / 0.21 bar differential above outlet pressure setting

Outlet Pressure Ranges

3.5 in. w.c. to 10 psig /
9 mbar to 0.69 bar
See Table 4

Spring Case Vent Connection

Internal Relief: 1 NPT

High Capacity Relief: 2-1/2 NPT

Pressure Registration

Internal or External

Temperature Capabilities

-20 to 150°F / -29 to 66°C

Approximate Weights

With Threaded Body
Type CS800/CS820: 25 lbs / 11 kg
Type CS803/CS823: 34 lbs / 16 kg
Type CS804/CS824: 31 lbs / 14 kg
Type CS805/CS825: 26 lbs / 12 kg
Type CS806/CS826: 26 lbs / 12 kg

High-Pressure Types
For CS85x add 2 lbs / 0.91 kg to types listed with threaded body

With Flanged Body
Add 11 lbs / 5.0 kg to weights listed above

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Flow Optimized Disks Provide the Maximum Flow for Your Application**
- **Wide Variety of Body Sizes and End Connections**
- **Fixed Factor / Pressure Factor Measurement (PFM) Accuracy Capabilities**
- **Only Standard Tools Required for Pressure Adjustment and Orifice Removal**
- **Simplified Maintenance**



P1235

Figure 1. *Type CS800 Regulator*



P1234

Figure 2. *Type CS800IQ with High Capacity Relief*



P1521

Figure 3. *Type CS803 Regulator with True-Monitor™ Protection*



P1692

Figure 4. *Type CS804IT Regulator with Integral Type VSX8 Slam-shut Module*

EMERSON
Process Management

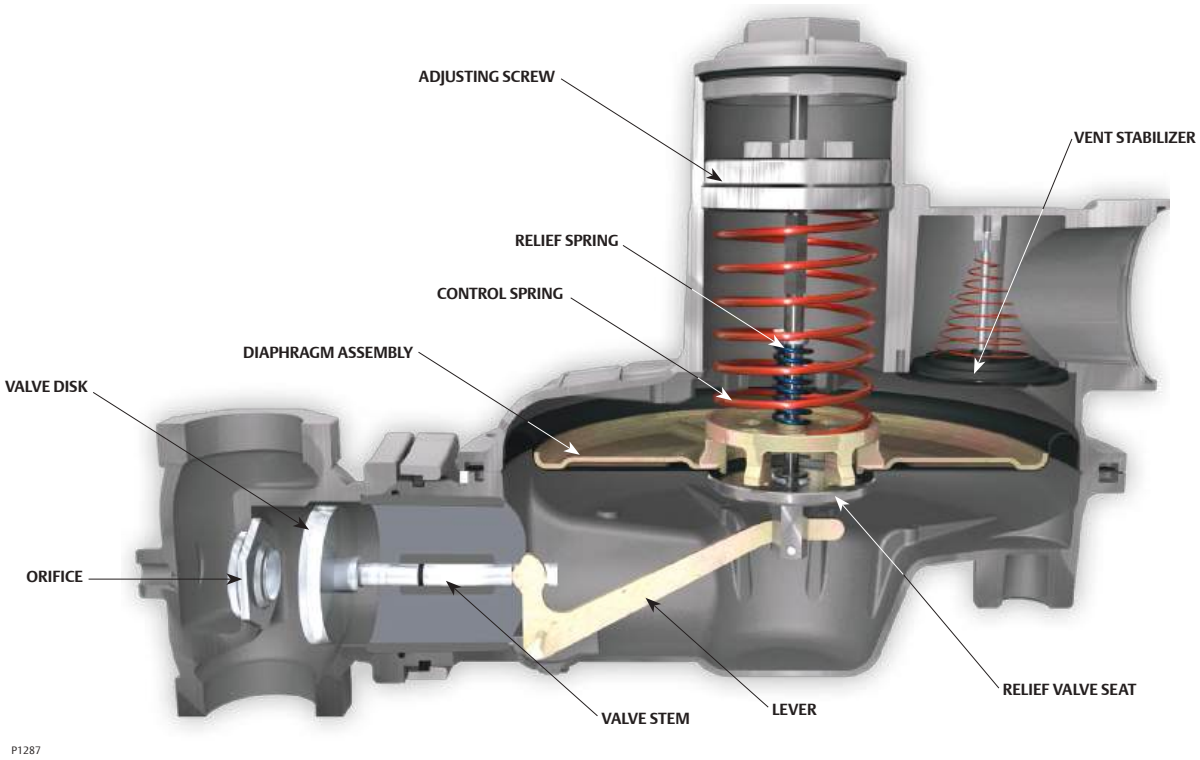


Figure 5. *Internal View of CS800 Series with High Capacity Relief*

Table 1. Available Configuration

TYPE NUMBER							OPTION
C	S	8					**OUTLET PRESSURE CONSTRUCTION**
			0				Low Pressure Applications *(Outlet Pressure: 3.5 to 30 in. w.c. / 9 to 75 mbar)*
			2				Medium Pressure Applications *(Outlet Pressure: 1 to 5.5 psig / 69 mbar to 0.38 bar)*
			5				High Pressure Applications *(Outlet Pressure: 5 to 10 psig / 0.34 to 0.69 bar)*[1]
							OVERPRESSURE PROTECTION MODULE
				0			Without Overpressure Protection Module
				3			With Integral True-Monitor Module[4]
				4			With Slam-shut Module[4]
				5			With Secondary Seat™ Protection
				6			With Secondary Seat Protection with controlled bleed to indicate Secondary Seat is functioning[2]
							PRESSURE REGISTRATION
					I		Internal Registration
					E		External Registration[3]
							RELIEF
						N	Non-Relieving
						R	Internal Relief
						Q	High-Capacity Relief
						T	Token Relief
						L	Low Flow Token Relief

Example: Type Number CS800IR: Type CS800 regulator without Overpressure Protection Module with Internal Pressure Registration and with Internal Relief.

1. High-pressure Construction is not available with True-Monitor Protection, Secondary Seat Protection or Relief.
2. Available only with Internal Relief or High-Capacity Relief Constructions.
3. Available only with Non-Relieving or Token Relief Constructions.
4. Reference Instruction Manual D103126X012 for information regarding the Type TM600 Integral True-Monitor or Instruction Manual D103127X012 for Type VSX8 safety Slam-shut module.

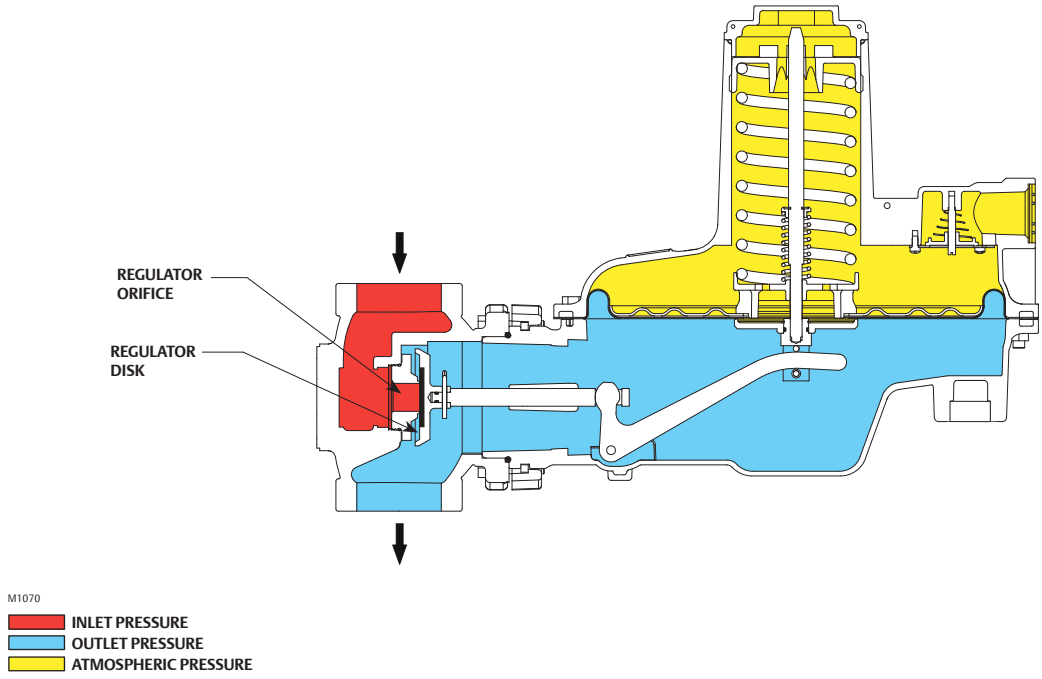


Figure 6. *Type CS800IR Internally Registered Regulator with Internal Relief Operational Schematic*

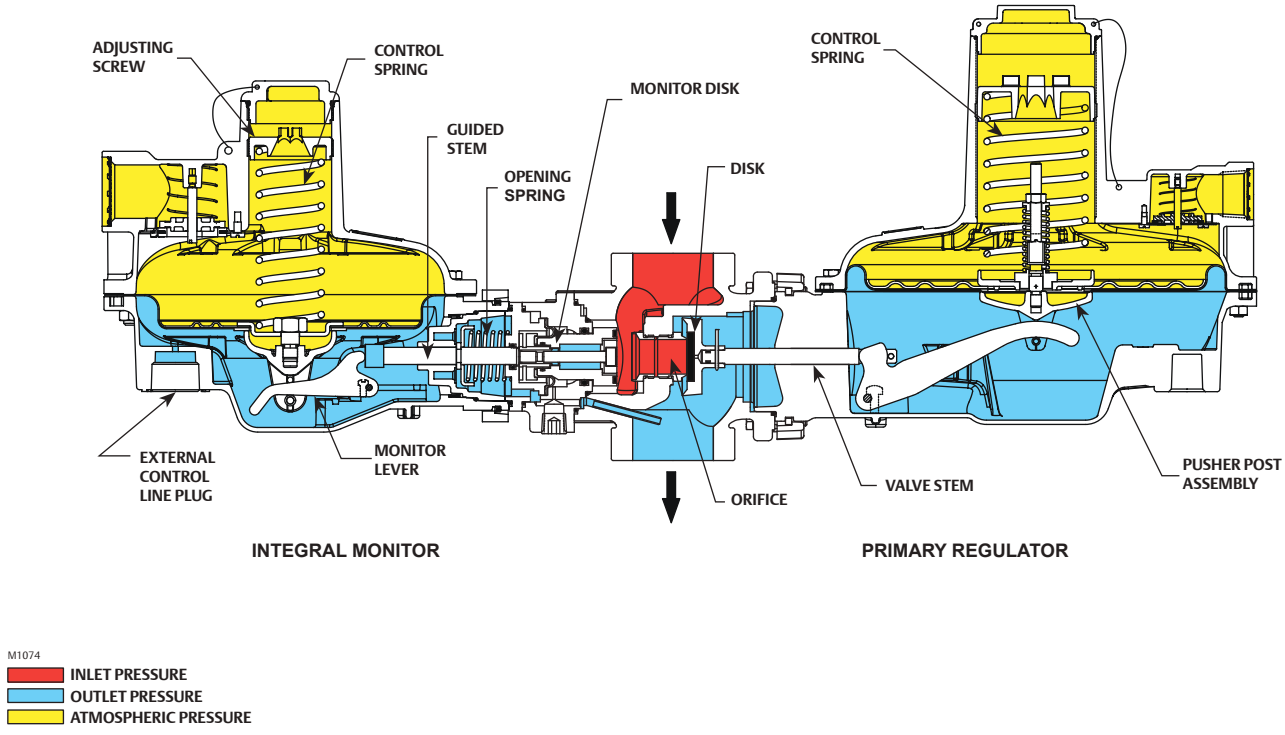


Figure 7. *Type CS803IT Internally Registered Primary Regulator with Internally Registered Integral Monitor Operational Schematic*

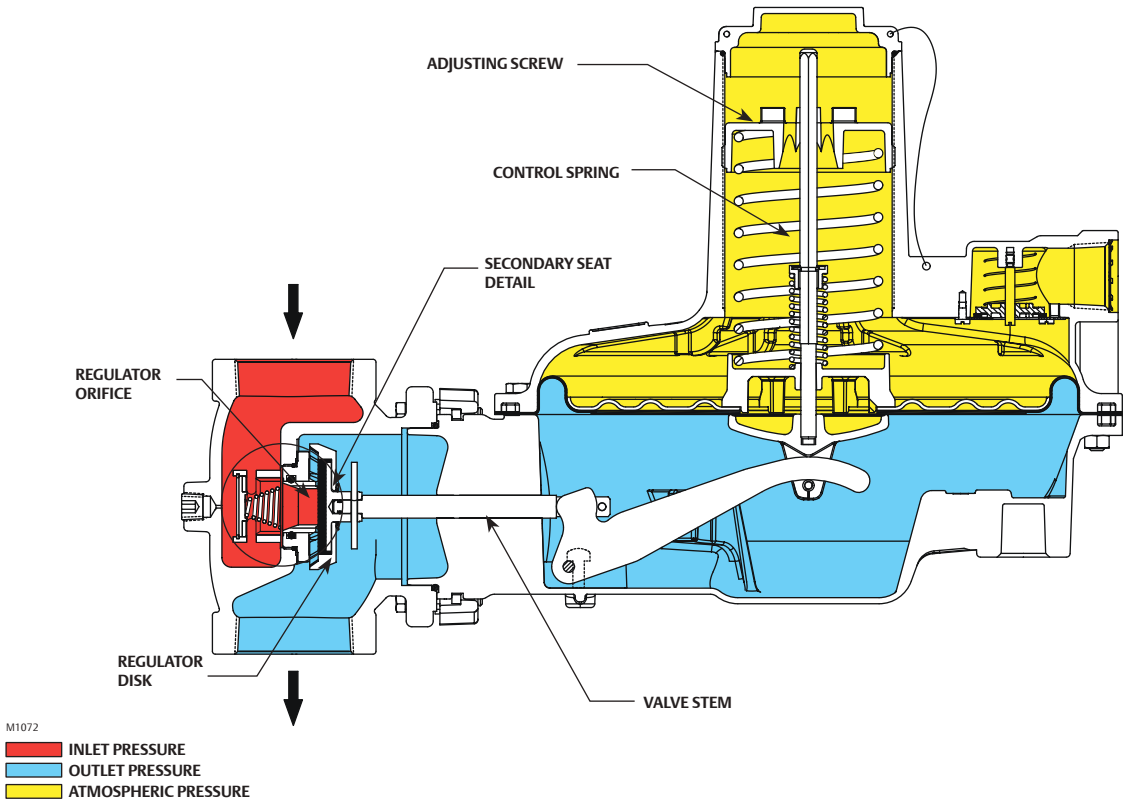


Figure 8. *CS800 Series with Secondary Seat Protection*

Table 2. Body Sizes, Materials, End Connections and Maximum Cold Working Pressure Ratings[5]

TYPE	BODY MATERIAL	END CONNECTION	BODY SIZE		FACE-TO-FACE DIMENSION		BODY INLET PRESSURE RATING	
			In.	DN	In.	mm	psig	bar
CS800, CS805, CS806, CS820, CS825, CS826 and CS850	Gray Cast Iron	NPT	1-1/4	----	6.12	155	175	12.1
			1-1/2	----	6.12	155		
			2[1]	----	6.12	155		
			2	----	6.12	155		
		CL125 FF	2	50	7.5	191	175	12.1
			2	50	10	254		
CS800[3], CS820[3], CS850[3], CS803, CS823, CS804, CS824 and CS854	Gray Cast Iron	NPT	2[2]	----	6.12	155	175	12.1
	Ductile Iron	NPT	1-1/4[4]	----	6.12	155	250	17.2
			1-1/2	----	6.12	155		
			2	----	6.12	155		
		Rp	2	----	6.12	155	250	17.2
		CL125 FF / CL150 FF	2	50	7.5[4]	191[4]	250	17.2
			2	50	10	254		
			2	50	10.5	267		
		PN 10/16	2	50	7.5[4]	191[4]	232	16
			2	50	10	254		
	WCC Steel	NPT	1-1/4[4]	----	6.12	155	290	20
			1-1/2	----	6.12	155		
			2	----	6.12	155		
		Rp	2	----	6.12	155	290	20
		CL150 RF	2	50	10	254	290	20
		PN 10/16	2	50	10	254	232	16

1. Standard on Types CS800, CS820 and CS850.
2. Standard on Types CS803, CS804, CS823, CS824 and CS854.
3. If a ductile iron or steel body material is selected without an Integral True-Monitor™ or Slam-shut Overpressure Protection (OPP) device, the port located at the bottom of the body will receive an aluminum plug.
4. Not available on Types CS804, CS824 and CS854.
5. The pressure/temperature limits in this Datasheet or any applicable standard or code limitation should not be exceeded.

Table 3. CS800 Series Main Valve and Actuator Construction Material

BODY	LEVER PIN AND RELIEF VALVE SPRING	DIAPHRAGM, DISK AND BODY O-RING	CLOSING CAP, ADJUSTING SCREW, PUSHER POST, UPPER AND LOWER CASE	LEVER
Gray Cast iron, Ductile iron or WCC steel	Stainless steel	Nitrile (NBR)	Aluminum	Plated steel

Table 4. Outlet Pressure Range

TYPE	OUTLET PRESSURE RANGE		COLOR CODE	PART NUMBER	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
	In. w.c.	mbar			In.	mm	In.	mm
CS800, CS803, CS804, CS805 AND CS806	3.5 to 6[1]	9 to 15[1]	Red	GE30337X012	0.15	3.8	6.8	173
	5.5 to 8.5	13 to 21	Black	GE30338X012	0.17	4.3	6.8	173
	5.5 to 8.5	13 to 21	Brown [Use with Low Inlet (LIN) Option]	GE49043X012	0.16	4.1	8.3	211
	8 to 12	20 to 30	Purple	GE30339X012	0.17	4.3	7.4	188
	10 to 16	25 to 40	White	GE30340X012	0.18	4.6	7.4	188
	14 to 30	35 to 75	Dark Green	GE30341X012	0.2	5.2	7.5	191
CS820, CS823, CS824, CS825 and CS826	1 to 2.5 psig	70 to 170	Dark Blue	GE30342X012	0.25	6.4	7.5	191
	1.5 to 3.5 psig	100 to 240	Orange	GE46922X012	0.26	6.6	7.1	180
	2.5 to 5.5 psig	170 to 380	Yellow	GE30343X012	0.29	7.5	6.7	170
CS850	5 to 10 psig	345 to 690	Green with White Stripe	GE30344X012	0.39	9.9	7.6	192

1. In order to achieve the complete spring range listed, in some applications it may be required to re-orient the actuator/spring case to point downward to utilize the weight of the internal components.

Table 5. Secondary Seat™ Outlet Pressure

CONTROL SPRING		SPRING RANGE		SETPOINT		TYPES CS805 AND CS825 Secondary Seat Shutoff Pressure[2]				TYPES CS806 AND CS826 Downstream Build-up Pressure[1][2][3]			
						Orifice Size							
						In.	mm	In.	mm	In.	mm	In.	mm
						Up to 1/2	Up to 13	Up to 7/8	Up to 22	Up to 1/2	Up to 13	Up to 7/8	Up to 22
Color	Spring Part Number	In. w.c.	mbar	In. w.c.	mbar	In. w.c.	mbar	In. w.c.	mbar	In. w.c.	mbar	In. w.c.	mbar
Black	GE30338X012	5.5 to 8.5	13 to 21	7	17	11	27	12	30	25	62	23	57
Brown (LIN)	GE49043X012	5.5 to 8.5	13 to 21	7	17	11	27	12	30	25	62	23	57
White	GE30340X012	10 to 16	25 to 40	14	35	19	47	20	50	36	89	33	81
Dark Green	GE30341X012	14 to 30	35 to 75	1 psig	69	1.2 psig	83	1.3 psig	90	2.1 psig	145	2 psig	138
Dark Blue	GE30342X012	1 to 2.5 psig	69 to 170	2 psig	140	2.6 psig	179	2.6 psig	179	3.8 psig	262	3.7 psig	255
Yellow	GE30343X012	2.5 to 5.5 psig	170 to 380	5 psig	345	6.3 psig	434	6.3 psig	434	7.4 psig	510	8.2 psig	565

1. Downstream pressure buildup with Secondary Seat fixed bleed in operation and regulator relief valve relieving to atmosphere.
2. Outlet pressure values listed are at maximum operating inlet pressure rating per orifice.
3. If the outlet pressure rises above setpoint exceeding the pressure rating of the regulator, the internal parts must be inspected and replaced if damaged.

Table 6. Types CS803 and CS823 Regulator and Integral True-Monitor™ Outlet Pressure Ranges without Token Relief

PRIMARY REGULATOR							INTEGRAL TRUE MONITOR					
Type	Setpoint		Spring Part Number	Spring Range		Spring Color	Setpoint		Spring Part Number	Spring Range		Spring Color
	In. w.c.	mbar		In. w.c.	mbar		In. w.c.	mbar		In. w.c.	mbar	
CS803IN and CS803EN	4	10	GE30337X012	3.5 to 6	9 to 15	Red	14	35	GE30189X012	12 to 21	30 to 52	Blue
							21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
	7	17	GE30338X012	5.5 to 8.5	13 to 21	Black	14	35	GE30189X012	12 to 21	30 to 52	Blue
							21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
	7	17	GE49043X012	5.5 to 8.5	13 to 21	Brown (LIN)	14	35	GE30189X012	12 to 21	30 to 52	Blue
							21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
	11	27	GE30339X012	8 to 12	20 to 30	Purple	21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
							1.5 psig	103	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
	14	35	GE30340X012	10 to 16	25 to 40	White	21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
							1.5 psig	103	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
	1 psig	69	GE30341X012	14 to 30	35 to 75	Dark Green	1.5 psig	103				
							2 psig	138	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
							3.5 psig	241	GE35081X012	2.6 to 3.7 psig	179 to 255	Purple
CS823IN and CS823EN	2 psig	138	GE30342X012	1 to 2.5 psig	70 to 170	Dark Blue	2.5 psig	172	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
							3 psig	207	GE35081X012	2.6 to 3.7 psig	179 to 255	Purple
							5 psig	345	GE30192X012	3.6 to 6 psig	248 to 414	Dark Blue
	3 psig	207	GE46922X012	1.5 to 3.5 psig	100 to 240	Orange	3.5 psig	241	GE35081X012	2.6 to 3.7 psig	179 to 255	Purple
							4 psig	276	GE30192X012	3.6 to 6 psig	248 to 414	Dark Blue
							6 psig	414	GE33121X012	5.1 to 7.5 psig	352 to 517	Red
	5 psig	345	GE30343X012	2.5 to 5.5 psig	170 to 380	Yellow	6 psig	414				
							7 psig	483				
							7.5 psig	517				

Table 7. Types CS803 and CS823 Regulator and Integral True-Monitor™ Outlet Pressure Range with Token Relief

PRIMARY REGULATOR							INTEGRAL TRUE MONITOR					
Type	Setpoint		Spring Part Number	Spring Range		Spring Color	Setpoint		Spring Part Number	Spring Range		Spring Color
	In. w.c.	mbar		In. w.c.	mbar		In. w.c.	mbar		In. w.c.	mbar	
CS803IT and CS803ET	4	10	GE30337X012	3.5 to 6	9 to 15	Red	21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
	7	17	GE30338X012	5.5 to 8.5	13 to 21	Black	21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
	7	17	GE30338X012	5.5 to 8.5	13 to 21	Brown (LIN)	21	52	GE30196X012	18 to 30	45 to 75	Green
							1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
	11	27	GE30339X012	8 to 12	20 to 30	Purple	1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
							1.5 psig	103	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
	14	35	GE30340X012	10 to 16	25 to 40	White	1 psig	69	GE30225X012	26 to 40	65 to 99	Orange
							1.5 psig	103	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
	1 psig	69	GE30341X012	14 to 30	35 to 75	Dark Green	2 psig	138	GE30190X012	1.4 to 2.9 psig	97 to 200	Black
							3 psig	207	GE35081X012	2.6 to 3.7 psig	179 to 255	Purple
CS823IT and CS823ET	2 psig	138	GE30342X012	1 to 2.5 psig	70 to 170	Dark Blue	3 psig	207	GE35081X012	2.6 to 3.7 psig	179 to 255	Purple
							4 psig	276	GE30192X012	3.6 to 6 psig	248 to 414	Dark Blue
	3 psig	207	GE46922X012	1.5 to 3.5 psig	100 to 240	Orange	5 psig	345	GE30192X012	3.6 to 6 psig	248 to 414	Dark Blue
							6 psig	414	GE33121X012	5.1 to 7.5 psig	352 to 517	Red
	5 psig	345	GE30343X012	2.5 to 5.5 psig	170 to 380	Yellow	7 psig	483	GE33121X012	5.1 to 7.5 psig	352 to 517	Red
							7.5 psig	517	GE33121X012	5.1 to 7.5 psig	352 to 517	Red

Table 8. Inlet Pressure Rating and Flow and Sizing Coefficient

ORIFICE SIZE		MAXIMUM OPERATING INLET PRESSURE TO OBTAIN OPTIMUM PERFORMANCE				MAXIMUM EMERGENCY INLET PRESSURE		WIDE-OPEN FLOW COEFFICIENT			IEC SIZING COEFFICIENT		
		psig Setpoint		In. w.c. Setpoint									
In.	mm	psig	bar	psig	bar	psig	bar	C_g	C_v	C_1	X_T	F_L	F_D
1/4[1]	6.4[1]	125	8.6	125	8.6	175	12.1	50	2.1	24.6	0.38	0.89	0.99
3/8	9.5	125	8.6	125	8.6	175	12.1	110	3.8	29.5	0.55	0.89	0.90
1/2	13	100	6.9	100	6.9	175	12.1	210	7.2	29.5	0.55	0.89	0.93
5/8	16	80	6.5	60	4.1	175	12.1	320	10.1	31.8	0.64	0.89	0.88
3/4	19	80	6.5	60	4.1	175	12.1	450	13.3	34	0.73	0.89	0.84
7/8	22	60	4.1	50	3.4	175	12.1	600	16.7	36	0.82	0.89	0.81
1[1]	25[1]	30	2.1	25	1.7	175	12.1	765	20.1	38.1	0.92	0.89	0.77
1-3/8[1][2]	35[1][2]	15	1.0	15	1.0	175	12.1	1125	29.8	37.7	0.90	0.89	0.76

1. Not available on the Types CS805, CS806, CS825 and CS826.
2. Not available on the Types CS803 and CS823.

Table 9. Approximate Internal Relief Valve Start-to-Discharge Pressure Above Setpoint

CONTROL SPRING	SETPOINT		SET RANGE		INTERNAL RELIEF AND HIGH CAPACITY RELIEF				TOKEN RELIEF	
					Start-to-Discharge Pressure Range above Setpoint		Low Start-to-Discharge Option[1] Start-to-Discharge Pressure Range above Setpoint		Start-to-Discharge Pressure Range above Setpoint	
	In. w.c.	mbar	In. w.c.	mbar	In. w.c.	mbar	In. w.c.	mbar	In. w.c.	mbar
GE30337X012	4	10	3.5 to 6	9 to 15	11 to 18	27 to 42	7 to 14	17 to 35	6 to 14	15 to 35
GE30338X012	7	17	5.5 to 8.5	13 to 21	11 to 18	27 to 42	7 to 14	17 to 35	6 to 14	15 to 35
GE49043X012 (LIN)	7	17	5.5 to 8.5	13 to 21	11 to 18	27 to 42	7 to 14	17 to 35	6 to 14	15 to 35
GE30339X012	11	27	8 to 12	20 to 30	11 to 18	27 to 42	7 to 14	17 to 35	6 to 14	15 to 35
GE30340X012	14	35	10 to 16	25 to 40	11 to 18	27 to 42	7 to 14	17 to 35	6 to 14	15 to 35
GE30341X012	1 psig	69	14 to 30	35 to 75	7 in. w.c. to 1 psig	17 to 69	----	----	8 to 16	20 to 40
GE30342X012	2 psig	138	1 to 2.5 psig	70 to 170	7 in. w.c. to 2 psig	17 to 138	----	----	7 in. w.c. to 1 psig	17 to 69
GE46922X012	3 psig	207	1.5 to 3.5 psig	100 to 240	7 in. w.c. to 2 psig	17 to 138	----	----	0.5 to 1.5 psig	35 to 100
GE30343X012	5 psig	345	2.5 to 5.5 psig	170 to 380	7 in. w.c. to 2.5 psig	17 to 170	----	----	1 to 2 psig	69 to 138

1. Low start-to-discharge option is only available on the main control spring ranges up to 10 to 16 in. w.c. / 25 to 40 mbar.

Table 10. Regulator and Slam-Shut Overpressure Shutoff (OPSO) Pressure Ranges

REGULATOR					SLAM-SHUT DEVICE				
					Over Pressure Shut-off (OPSO)				
Type	Factory Setpoint		Spring Range		Factory Setpoint[1]		Spring Range[2]		Spring Part Number and Color
	In. w.c.	mbar	In. w.c.	mbar	In. w.c.	mbar	In. w.c.	mbar	
CS804	4	10	3.5 to 6	9 to 15	19	47	12 to 25	30 to 60	GF02168X012 / Brown
	7	17	5.5 to 8.5	14 to 21	22	55			
	7 (optional)	17 (optional)	5.5 to 8.5	14 to 21	25	62	16 to 44	40 to 110	GF02169X012 / Red
	11	27	8 to 12	20 to 30					
	14	35	10 to 16	25 to 40	30	75	24 to 78	60 to 190	GF02170X012 / Orange
	14 (optional)	35 (optional)	10 to 16	25 to 40	2 psig	138	1.4 to 4.1 psig	97 to 283	GF02171X012 / Pink
	1 psig	69	14 to 30	35 to 75	2 psig	138			
CS824	2 psig	138	1 to 2.5 psig	69 to 170	3.5 psig	241	2 to 7.3 psig	138 to 503	GF02172X012 / Green
	3 psig	207	1.5 to 3.5 psig	100 to 241	5 psig	345			
	5 psig	345	2.5 to 5.5 psig	170 to 380	7 psig	483	3.2 to 8.5 psig	221 to 586	GF02173X012 / Silver
CS854	7 psig	483	5 to 10 psig	345 to 690	9 psig	621	5.8 to 13 psig	400 to 896	GF04353X012 / Yellow

1. For units equipped with Token Relief, if Non-Factory Slam-shut OPSO setpoints are specified, they must be higher than the Token Relief Start-to-Discharge values provided in Table 9.
2. If Non-Factory OPSO setpoints are specified, the allowable OPSO setpoint cannot exceed the maximum of 3 psig / 207 mbar above the regulator setpoint in order to ensure no internal parts damage from overpressure.

Table 11. Regulator and Slam-Shut Underpressure Shutoff (UPSO) Pressure and Overpressure Shutoff (OPSO) Ranges

REGULATOR					SLAM-SHUT DEVICE									
					Under Pressure Shut-off (UPSO)					Over Pressure Shut-off (OPSO)				
Type	Factory Setpoint		Spring Range		Factory Setpoint[1]		Spring Range		Spring Part Number and Color	Factory Setpoint[2]		Spring Range Over UPSO Setpoint[3]		Spring Part Number and Color
	In. w.c.	mbar	In. w.c.	mbar	In. w.c.	mbar	In. w.c.	mbar		In. w.c.	mbar	In. w.c.	mbar	
CS804	7	17	5.5 to 8.5	14 to 21	3	7	2 to 12	5 to 30	T14168T0012 / White	22	55	17 to 28	42 to 69	GF02168X012 / Brown
	11	27	8 to 12	20 to 30	6	15				25	62			
	14	35	10 to 16	25 to 40	9	22				30	75			
	1 psig	69	14 to 30	35 to 75	0.5 psig	35	0.36 to 2.3 psig	25 to 160	T14170T0012 / Silver	2 psig	138	1.3 to 3.1 psig	90 to 214	GF02170X012 / Orange
CS824	2 psig	138	1 to 2.5 psig	69 to 170	1 psig	69	0.36 to 2.3 psig	25 to 160	T14170T0012 / Silver	3.5 psig	241	1.3 to 3.1 psig	90 to 214	GF02170X012 / Orange
	3 psig	207	1.5 to 3.5 psig	100 to 241	1.75 psig	121	1.5 to 7.3 psig	100 to 500	FA142869X12 / Orange Stripe	5 psig	345	2.7 to 5.5 psig	186 to 379	GF02171X012 / Pink
	5 psig	345	2.5 to 5.5 psig	170 to 380	3 psig	207				7 psig	483			
CS854	7 psig	483	5 to 10 psig	345 to 690	3.5 psig	241	1.5 to 7.3 psig	100 to 500	FA142869X12 / Orange Stripe	9 psig	621	2.7 to 5.5 psig	186 to 379	GF02171X012 / Pink

1. If Non-Factory UPSO setpoints are specified, a minimum differential of 4 in. w.c. / 10 mbar between UPSO setpoint and regulator setpoint must be maintained in order to ensure a secure latch of the Slam-Shut.
2. For units equipped with Token Relief, if Non-Factory Slam-shut OPSO setpoints are specified, they must be higher than the Token Relief Start-to-Discharge values provided in Table 9.
3. If Non-Factory OPSO setpoints are specified, the allowable OPSO setpoint cannot exceed the maximum of 3 psig / 207 mbar above the regulator setpoint in order to ensure no internal parts damage from overpressure.

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
4 in. w.c.	-1 in. w.c.	2 in. w.c.	3.5 to 6 in. w.c.	GE30337X012 / Red
10 mbar	-2.5 mbar	5 mbar	9 to 15 mbar	

Table 12. Types CS800, CS803 and CS804 Internal Registration Flow Capacities for 4 in. w.c. / 10 mbar Setpoint for 1-1/2 in. / DN 40 Body Size

Capacities in SCFH / Nm³/h of 0.6 Specific Gravity Natural Gas

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40															
0.4	0.03			300	8.1	300	8.1	300	8.1	1000	26.8	1400	37.6	1400	37.6	1600	43.0
0.51	0.04			300	8.1	500	13.4	850	22.8	1400	37.6	1590	42.7	1600	43.0	1710	45.9
1	0.07	400	10.7	800	21.5	1200	32.2	1540	41.3	2100	56.4	2300	61.7	2500	67.1	2700	72.5
2	0.14	600	16.1	1300	34.9	2000	53.7	2400	64.4	2800	75.2	3100	83.2	3470	93.2	3470	93.2
3	0.21	780	20.9	1600	43.0	2470	66.3	2860	76.8	3360	90.2	3620	97.2	4100	110	4190	113
5	0.34	1150	30.9	2170	58.3	2940	78.9	3800	102	4500	121	4580	123	5190	139	5190	139
10	0.69	1370	36.8	2900	77.9	4750	128	5200	140	5650	152	5650	152	5650	152	5930	159
15	1.0	1600	43.0	3600	96.6	6200	166	6500	175	6500	175	6500	175	6000	161	6710	180
20	1.4	2070	55.6	4300	115	6620	178	7250	195	7250	195	7400	199	7500	201		
25	1.7	2550	68.5	5000	134	7050	189	7250	195	7250	195	7500	201	9000	242		
30	2.1	2860	76.8	5010	135	7050	189	7250	195	7250	195	7500	201				
40	2.8	3170	85.1	5020	135	7050	189	7250	195	7250	195	7500	201				
50	3.4	4120	111	5070	136	7050	189	7250	195	7250	195	7500	201				
60	4.1	4750	128	5100	137	7050	189	7250	195	7250	195						
80	5.5	5700	153	6200	166	7170	193										
100	6.9	6650	179	7300	196	7300	196										
125	8.6	6950	187	8300	223												

■ - Black areas show where indicated droop/boost would be exceeded regardless of capacity.
□ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on Type CS803.

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
4 in. w.c.	-1 in. w.c.	2 in. w.c.	3.5 to 6 in. w.c.	GE30337X012 / Red
10 mbar	-2.5 mbar	5 mbar	9 to 15 mbar	

Table 13. Types CS800, CS803 and CS804 Internal Registration Flow Capacities for 4 in. w.c. / 10 mbar Setpoint for 2 in / DN 50 Body Size

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 2 in. / DN 50															
0.4	0.03			300	8.1	300	8.1	300	8.1	1170	31.4	1400	37.6	1600	43.0	1800	48.3
0.51	0.04			300	8.1	500	13.4	1000	26.8	1550	41.6	1900	51.0	2070	55.6	2400	64.4
1	0.07	400	10.7	900	24.2	1300	34.9	1760	47.2	1950	52.3	3000	80.5	2710	72.8	3800	102
2	0.14	600	16.1	1240	33.3	2070	55.6	2620	70.3	3930	106	5000	134	3450	92.6	5620	151
3	0.21	730	19.6	1530	41.1	2580	69.3	3540	95.0	4980	134	6200	166	6830	183	8010	215
5	0.34	1000	26.8	2090	56.1	3700	99.3	5500	148	7800	209	8600	231	9500	255	10,620	285
10	0.69	1320	35.4	3000	80.5	5100	137	7450	200	10,400	279	10,900	293	11,750	315	12,580	338
15	1.0	1650	44.3	3700	99.3	6500	175	9400	252	13,000	349	13,200	354	14,000	376	13,150	353
20	1.4	2020	54.2	4450	120	7850	211	10,150	273	13,000	349	13,200	354	16,000	430		
25	1.7	2400	64.4	5200	140	9200	247	10,900	293	13,000	349	13,200	354	18,000	483		
30	2.1	2720	73.0	5560	149	9460	254	10,980	295	13,400	360	13,560	364				
40	2.8	3040	81.6	5920	159	9720	261	11,060	297	13,800	371	13,920	374				
50	3.4	4000	107	7000	188	10,500	282	11,300	303	15,000	403	12,510	336				
60	4.1	4450	120	9000	242	12,800	344	13,800	371	11,140	299						
80	5.5	4970	133	9250	248	12,850	345										
100	6.9	5500	148	9500	255	11,770	316										
125	8.6	7250	195	9500	255												

■ - Black areas show where indicated droop/boost would be exceeded regardless of capacity.
▒ - Gray areas indicate limited capacities due to boost effects.
□ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on the Type CS803.

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
7 in. w.c.	-1 in. w.c.	2 in. w.c.	5.5 to 8.5 in. w.c.	GE30338X012 / Black
17 mbar	-2.5 mbar	5 mbar	13 to 21 mbar	

Table 14. Types CS800, CS803 and CS804 Internal Registration Flow Capacities for 7 in. w.c. / 17 mbar Setpoint for 1-1/2 in. / DN 40 Body Size

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40															
0.4	0.03			430	11.5	740	19.9	550	14.8	800	21.5	800	21.5	1060	28.5	1420	38.1
0.51	0.04			520	14.0	800	21.5	890	23.9	1100	29.5	1150	30.9	1300	34.9	1630	43.8
1	0.07	570	15.3	770	20.7	1140	30.6	1360	36.5	1510	40.5	1830	49.1	1960	52.6	2640	70.9
2	0.14	780	20.9	980	26.3	1570	42.1	1790	48.1	2220	59.6	2510	67.4	2790	74.9	3550	95.3
3	0.21	990	26.6	1230	33.0	1960	52.6	2380	63.9	2810	75.4	3310	88.9	3680	98.8	4380	118
5	0.34	1220	32.8	1920	51.5	2940	78.9	3390	91.0	4130	111	4130	111	4850	130	5510	148
10	0.69	1600	43.0	3160	84.8	4900	132	5130	138	5950	160	6270	168	6650	179	7200	193
15	1.0	1980	53.2	4150	111	6310	169	6040	162	7110	191	7240	194	7520	202	7650	205
20	1.4	2330	62.6	4910	132	7300	196	7130	191	7770	209	7770	209	8010	215		
25	1.7	2620	70.3	5680	153	7550	203	7550	203	8220	221	8330	224	8330	224		
30	2.1	2990	80.3	6370	171	8310	223	8140	219	8560	230	8560	230				
40	2.8	3650	98.0	7830	210	8990	241	8690	233	8770	235	8770	235				
50	3.4	4320	116	9010	242	9010	242	8880	238	9000	242	9210	247				
60	4.1	5010	135	9040	243	9040	243	9040	243	9070	244						
80	5.5	6290	169	9620	258	9620	258										
100	6.9	7550	202	9510	255	9510	255										
125	8.6	7820	210	9600	258												

■ - Black areas show where indicated droop/boost would be exceeded regardless of capacity.
□ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on Type CS803.

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
7 in. w.c.	-1 in. w.c.	2 in. w.c.	5.5 to 8.5 in. w.c.	GE30338X012 / Black
17 mbar	-2.5 mbar	5 mbar	13 to 21 mbar	

Table 15. Types CS800[1], CS803[2] and CS804[2] Internal Registration Flow Capacities for 7 in. w.c. / 17 mbar Setpoint for 2 in. / DN 50 Body Size

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25[1][2]		1-3/8 / 35[3]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 2 in. / DN 50															
5	0.34	1120	30.1	1120	30.1	2600	69.8	3670	98.5	4630	124	8130	218	9590	257	5510	148
10	0.69	1480	39.7	2520	67.7	4840	130	9100	244	12,450	334	13,250	356	16,280	437	7200	193
15	1.0	1870	50.2	3130	84.0	7760	208	12,000	322	16,170	434	16,630	446	20,380	547	7650	205
20	1.4	2130	57.2	4230	114	9200	247	14,550	391	19,090	513	17,370	466	22,860	614		
25	1.7	2500	67.1	5530	149	10,510	282	15,920	427	20,180	542	17,370	466	22,860	614		
30	2.1	2850	76.5	6290	169	11,850	318	18,720	503	23,010	618	17,380	467				
40	2.8	3590	96.4	7850	211	14,100	379	22,910	615	25,910	696	16,180	434				
50	3.4	4200	113	9280	249	16,740	449	24,340	653	27,340	734	12,050	324				
60	4.1	4910	132	10,810	290	19,390	521	24,360	654	19,730	530						
80	5.5	6220	167	13,740	369	25,530	685										
100	6.9	7440	200	16,630	446	25,530	685										
125	8.6	8730	234	20,320	546												

□ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
▒ - Gray areas indicate limited capacities due to boost effects.
1. Type CS800 with Ductile iron or Steel Bodies exhibit a 20% reduction in capacity for indicated orifice size. Multiply listed values by a factor of 0.8.
2. Types CS803 and CS804 exhibit a 30% reduction in capacity for indicated orifice size. Multiply listed values by a factor of 0.7.
3. Not available on the Type CS803.

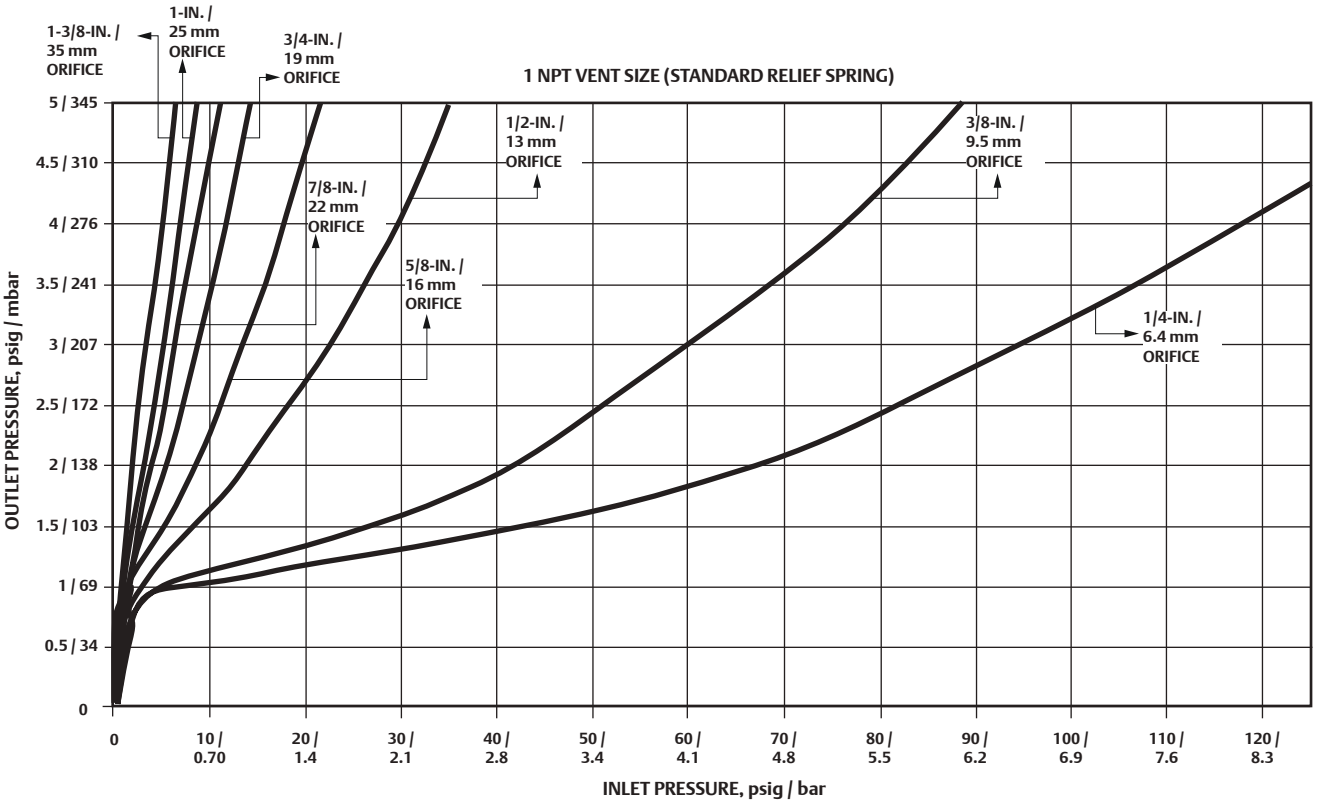


Figure 9. *Type CS800IR Relief Curves (Blocked Open per Orifice Size) at 7 in. w.c. / 17 mbar Set Pressure*

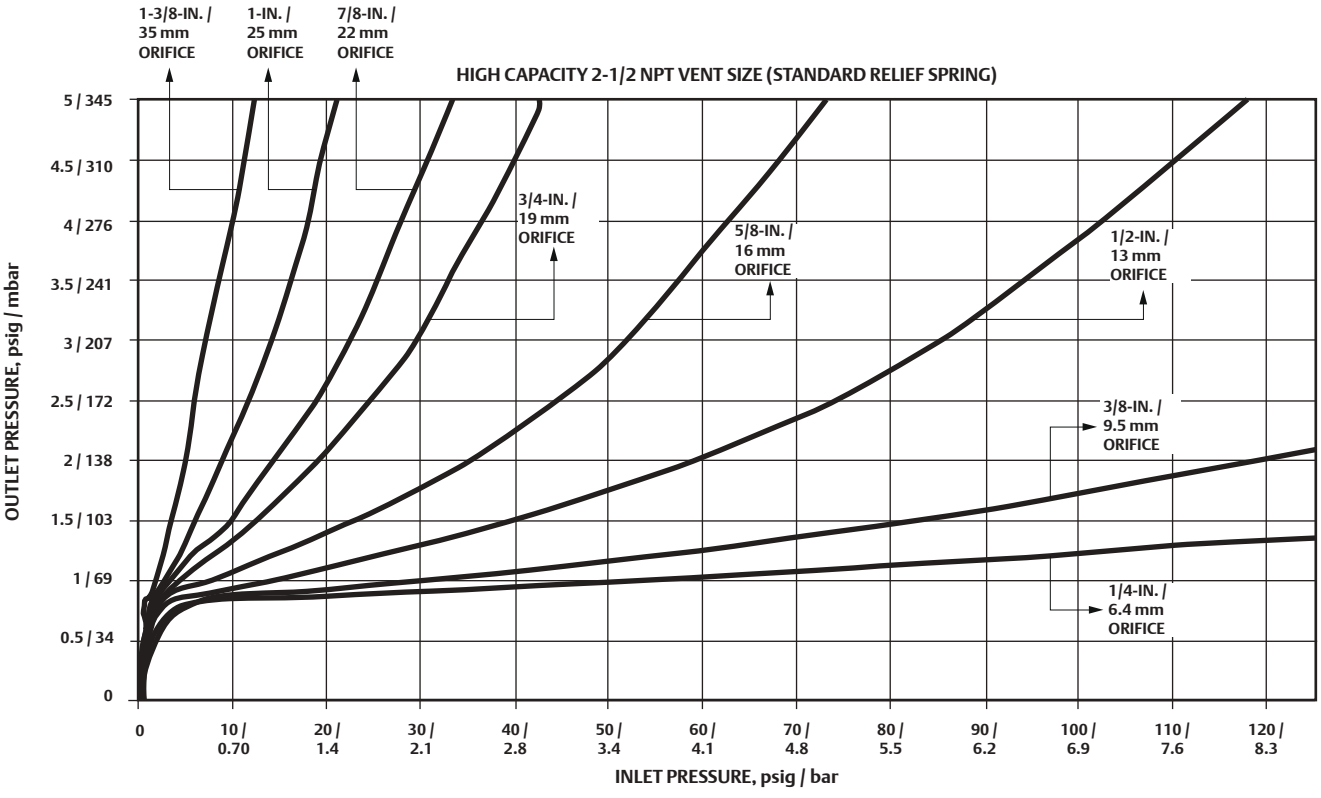


Figure 10. *Type CS800IQ High Capacity Relief Curves (Blocked Open per Orifice Size) at 7 in. w.c. / 17 mbar Set Pressure*

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
14 in. w.c.	-2 in. w.c.	2 in. w.c.	10 to 16 in. w.c.	GE30340X012 / White
35 mbar	-5 mbar	5 mbar	25 to 40 mbar	

Table 16. Types CS800, CS803 and CS804 Internal Registration Flow Capacities for 14 in. w.c. / 35 mbar Setpoint for 1-1/2 in. / DN 40 Body Size

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35(1)	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40															
1	0.07	450	12.1	670	18.0	1000	26.8	1100	29.5	1250	33.6	1400	37.6	1500	40.3	1950	52.3
2	0.14	550	14.8	1070	28.7	1400	37.6	1600	43.0	1750	47.0	2000	53.7	2300	61.7	2500	67.1
3	0.21	700	18.8	1160	31.1	1610	43.2	1900	51.0	2160	58.0	2500	67.1	2960	79.5	3250	87.2
5	0.34	1000	26.8	1200	32.2	2050	55.0	2500	67.1	3000	80.5	3600	96.6	4300	115	4750	128
10	0.69	1370	36.8	2120	56.9	3150	84.6	3800	102	4550	122	5100	137	5800	156	6300	169
15	1.0	1750	47.0	3050	81.9	4250	114	5100	137	6100	164	6700	180	7300	196	7850	211
20	1.4	2120	56.9	3900	105	4950	133	6000	161	7250	195	7600	204	8000	215		
25	1.7	2500	67.1	4750	128	5650	152	7000	188	8700	234	8700	234	8600	231		
30	2.1	2820	75.7	5420	146	6260	168	7500	201	8960	241	8960	241				
40	2.8	3140	84.3	6090	164	6870	184	7900	212	9220	248	9220	248				
50	3.4	4100	110	8100	217	8720	234	9300	250	9870	265	9870	265				
60	4.1	4750	128	9450	254	9730	261	9730	261	10,240	275						
80	5.5	6100	164	9920	266	10,270	276										
100	6.9	7450	200	10,400	279	10,430	280										
125	8.6	9050	243	10,400	279												

▭ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on Type CS803.

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
14 In. w.c.	-2 In. w.c.	2 In. w.c.	10 to 16 In. w.c.	GE30340X012 / White
35 mbar	-5 mbar	5 mbar	25 to 40 mbar	

Table 17. Types CS800, CS803 and CS804 Series Internal Registration Flow Capacities for 14 in. w.c. / 35 mbar Setpoint for 2 in. / DN 50 Body Size

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, in. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35(1)	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 2 in. / DN 50															
1	0.07	450	12.1	630	16.9	770	20.7	1300	34.9	1500	40.3	1600	43.0	1700	45.6	2700	72.5
2	0.14	600	16.1	1000	26.8	1800	48.3	2240	60.1	2800	75.2	3260	87.5	3800	102	3800	102
3	0.21	750	20.1	1210	32.5	2200	59.1	2700	72.5	3200	85.9	3700	99.3	4300	115	6060	163
5	0.34	1050	28.2	1750	47.0	2800	75.2	3300	88.6	4000	107	4600	124	5300	142	10,200	274
10	0.69	1400	37.6	2720	73.0	4250	114	6500	175	9200	247	10,300	277	11,650	313	14,550	391
15	1.0	1750	47.0	3700	99.3	5700	153	9600	258	14,400	387	16,100	431	17,910	481	17,110	459
20	1.4	2170	58.3	4700	126	7950	213	11,700	314	16,200	435	18,800	504	20,290	544		
25	1.7	2560	68.7	5700	153	10,200	274	12,400	333	18,000	483	21,400	574	22,000	590		
30	2.1	2910	78.1	6440	173	10,310	277	12,400	333	18,220	489	21,400	574				
40	2.8	3540	95.0	7770	209	10,540	283	13,020	350	18,680	501	21,400	574				
50	3.4	4170	112	9190	247	10,770	289	14,500	389	19,140	513	21,400	574				
60	4.1	4800	129	10,900	293	11,000	295	14,900	400	19,600	525						
80	5.5	6100	164	12,550	337	12,550	337										
100	6.9	7400	199	14,100	379	14,100	379										
125	8.6	9100	244	16,120	433												

▭ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on Type CS803.

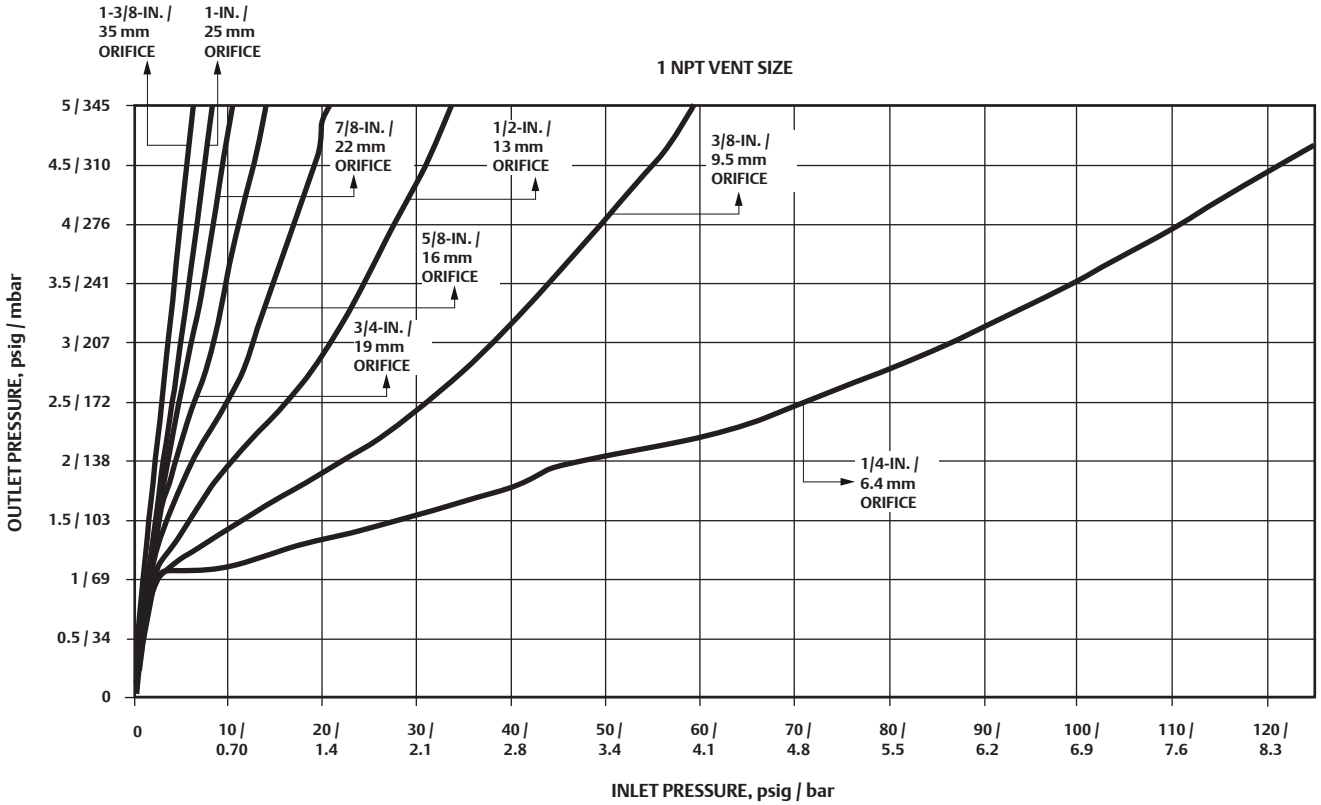


Figure 11. *Type CS800IR Relief Curves (Blocked Open per Orifice Size) at 14 In. w.c. / 35 mbar Set Pressure*

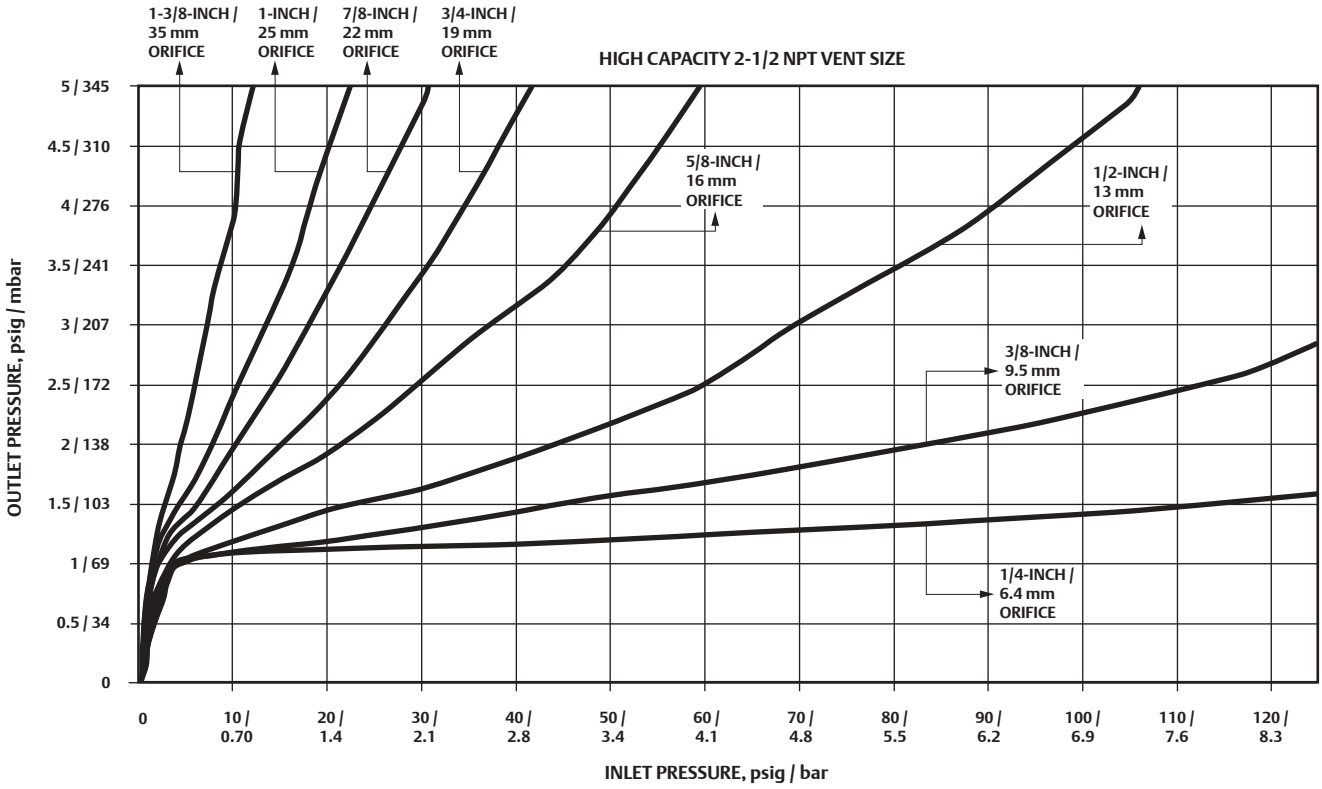


Figure 12. *Types CS800IQ High Capacity Relief Curves (Blocked Open per Orifice Size) at 14 In. w.c. / 35 mbar Set Pressure*

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
1 psig	-2.8 in. w.c.	2.8 in. w.c.	14 to 30 in. w.c.	GE30341X012 / Dark Green
0.07 bar	-7 mbar	7 mbar	35 to 75 mbar	

Table 18. Types CS800, CS803 and CS804 Internal Registration Flow Capacities for 1 psig / 0.07 bar Setpoint for 1-1/2 in. / DN 40 Body Size at 10% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1][2]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40															
2	0.14	530	14.2	710	19.1	940	25.2	1220	32.8	1430	38.4	1430	38.4	1330	35.7	1930	51.8
3	0.21	620	16.6	1070	28.7	1150	30.9	1490	40.0	1770	47.5	1700	45.6	1700	45.6	2530	67.9
5	0.34	810	21.7	1560	41.9	1650	44.3	2050	55.0	2530	67.9	2450	65.8	2450	65.8	3750	101
10	0.69	1360	36.5	2080	55.8	3100	83.2	3840	103	4680	126	4840	130	4950	133	5330	143
15	1.0	1650	44.3	2920	78.4	3860	104	4670	125	5570	150	6290	169	7000	188	7500	201
20	1.4	1960	52.6	3650	98.0	4560	122	5040	135	5570	150	6680	179	8120	218		
25	1.7	2400	64.4	4400	118	5550	149	6700	180	7900	212	7900	212	8650	232		
30	2.1	2570	69.0	5270	142	5650	152	7080	190	8220	221	9300	250	9990	268		
40	2.8	3360	90.2	3960	106	7300	196	7790	209	8470	227	8510	229				
50	3.4	3960	106	7920	213	7970	214	8590	231	8920	240	8920	240				
60	4.1	4660	125	7820	210	8020	215	8520	229	9020	242	9020	242				
80	5.5	5860	157	8740	235	9020	242	9020	242	9020	242						
100	6.9	7350	197	8960	241	10,150	273										
125	8.6	9050	243	10,020	269												

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on the Type CS803.
2. Type CS824 exhibits a 20% reduction in capacity for indicated orifice size. Multiply listed values by a factor of 0.8.

SETPOINT	ACCURACY: + / - 10% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
1 psig	-2.8 in. w.c.	2.8 in. w.c.	14 to 30 in. w.c.	GE30341X012 / Dark Green
0.07 bar	-7 mbar	7 mbar	35 to 75 mbar	

Table 19. Types CS800, CS803 and CS804 Internal Registration Flow Capacities for 1 psig / 0.07 bar Setpoint for 2 in. / DN 50 Body Size at 10% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 2 in. / DN 50															
2	0.14	500	13.4	860	23.1	1420	38.1	1450	38.9	1450	38.9	1450	38.9	1450	38.9	1450	38.9
3	0.21	610	16.4	1030	27.7	1420	38.1	1660	44.6	2000	53.7	2300	61.7	2700	72.5	3260	87.5
5	0.34	850	22.8	1640	44.0	1800	48.3	2130	57.2	2570	69.0	3320	89.1	4190	113	5140	138
10	0.69	1350	36.2	1750	47.0	2380	63.9	4000	107	5920	159	6540	176	7110	191	8470	227
15	1.0	1610	43.2	2690	72.2	3540	95.0	5290	142	7470	201	7680	206	8050	216	9580	257
20	1.4	2000	53.7	3760	101	5350	144	7430	200	9760	262	9760	262	9800	263		
25	1.7	2400	64.4	4340	117	7000	188	9770	262	13,100	352	13,410	360	13,890	373		
30	2.1	2470	66.3	5120	137	7500	201	11,420	307	16,250	436	17,320	465	18,520	497		
40	2.8	3490	93.7	7300	196	13,100	352	15,510	416	18,410	494	20,910	561				
50	3.4	3900	105	8020	215	16,110	433	17,090	459	18,410	494	22,290	598				
60	4.1	4600	124	10,700	287	18,800	505	19,700	529	20,700	556	22,410	602				
80	5.5	5700	153	13,000	349	18,800	505	19,700	529	20,700	556						
100	6.9	7190	193	15,720	422	19,070	512										
125	8.6	9190	247	19,600	526												

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on the Type CS803.

SETPOINT	ACCURACY: + / - 20% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
1 psig	-5.5 in. w.c.	5.5 in. w.c.	14 to 30 in. w.c.	GE30341X012 / Dark Green
0.07 bar	-14 mbar	14 mbar	35 to 75 mbar	

Table 20. Types CS800, CS803[1] and CS804[2] Internal Registration Flow Capacities for 1 psig / 0.07 bar Setpoint for 1-1/2 in. / DN 40 Body Size at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, Inch / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1][2]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40															
2	0.14	500	13.4	750	20.1	1750	47.0	2000	53.7	2250	60.4	2300	61.7	2400	64.4	2850	76.5
3	0.21	700	18.8	1100	29.5	1930	51.8	2200	59.1	2630	70.6	2900	77.9	3210	86.2	3680	98.8
5	0.34	1100	29.5	1800	48.3	2300	61.7	2800	75.2	3400	91.3	4100	110	4850	130	5350	144
10	0.69	1600	43.0	3200	85.9	4600	124	5800	156	7250	195	8000	215	8800	236	8800	236
15	1.0	1900	51.0	3970	107	5400	145	6600	177	8030	216	8700	234	9410	253	10,020	269
20	1.4	2200	59.1	4750	128	6200	166	7400	199	8820	237	9400	252	10,020	269		
25	1.7	2500	67.1	5520	148	7000	188	8200	220	9610	258	10,100	271	10,630	285		
30	2.1	2800	75.2	6300	169	7800	209	9000	242	10,400	279	10,800	290	11,250	302		
40	2.8	3500	94.0	7400	199	8410	226	9400	252	10,600	285	10,600	285				
50	3.4	4200	113	8500	228	9030	242	9800	263	10,800	290	10,800	290				
60	4.1	4900	132	9600	258	9650	259	10,300	277	11,000	295	11,000	295				
80	5.5	6100	164	10,070	270	10,800	290	10,900	293	11,000	295						
100	6.9	7300	196	10,550	283	11,950	321										
125	8.6	9100	244	10,550	283												

☐ Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on the Type CS803.
2. Type CS824 exhibits a 20% reduction in capacity for indicated orifice size. Multiply listed values by a factor of 0.8.

SETPOINT	ACCURACY: + / - 20% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
1 psig	-5.5 in. w.c.	5.5 in. w.c.	14 to 30 in. w.c.	GE30341X012 / Dark Green
0.07 bar	-14 mbar	14 mbar	35 to 75 mbar	

Table 21. Types CS800, CS803 and CS804 Internal Registration Flow Capacities for 1 psig / 0.07 bar Setpoint for 2 in. / DN 50 Body Size at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 2 in. / DN 50															
2	0.14	650	17.4	1040	27.9	2200	59.1	2570	69.0	3200	85.9	3400	91.3	3600	96.6	4500	121
3	0.21	800	21.5	1560	41.9	2530	67.9	3100	83.2	3730	100	4300	115	4960	133	6330	170
5	0.34	1100	29.5	2300	61.7	3200	85.9	3900	105	4800	129	6100	164	7700	207	10,000	269
10	0.69	1600	43.0	3000	80.5	4300	115	7500	201	11,400	306	13,200	354	15,200	408	16,300	438
15	1.0	1900	51.0	4000	107	6900	185	10,800	290	14,560	391	18,000	483	19,930	535	20,170	542
20	1.4	2300	61.7	4900	132	9100	244	13,600	365	18,520	497	21,300	572	22,680	609		
25	1.7	2600	69.8	5600	150	10,500	282	15,500	416	21,700	583	24,300	652	24,410	655		
30	2.1	2900	77.9	6500	175	11,800	317	17,900	481	24,020	645	25,320	680	25,580	687		
40	2.8	3700	99.3	8000	215	14,500	389	20,100	540	27,000	725	27,810	747				
50	3.4	4300	115	9300	250	16,600	446	21,700	583	27,810	747	27,810	747				
60	4.1	4900	132	10,940	294	19,500	524	24,900	669	29,050	780	29,050	780				
80	5.5	6300	169	13,830	371	24,000	644	27,400	736	29,070	780						
100	6.9	7700	207	16,680	448	29,500	792										
125	8.6	9600	258	20,200	542												

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on the Type CS803.

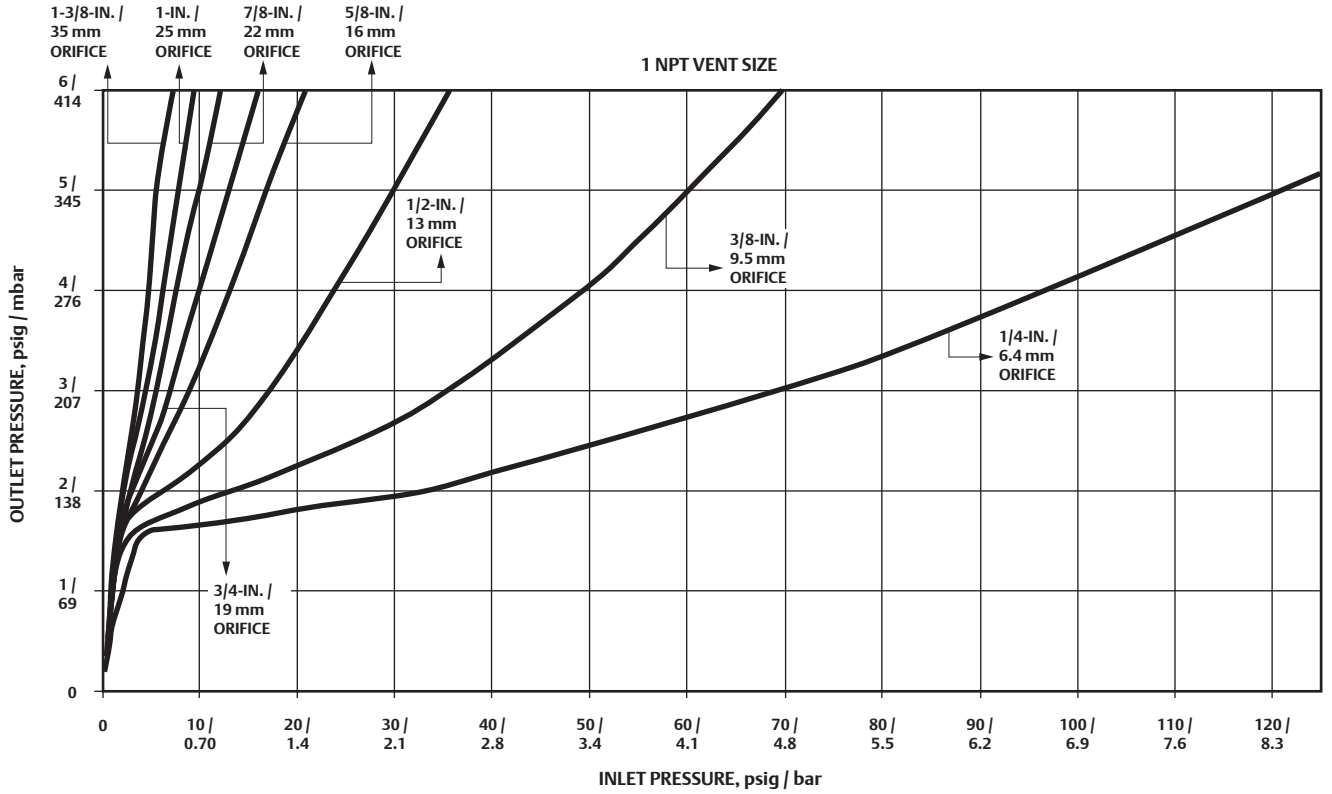


Figure 13. *Type CS800IR Relief Curves (Blocked Open per Orifice Size) at 1 psig / 0.07 bar Set Pressure*

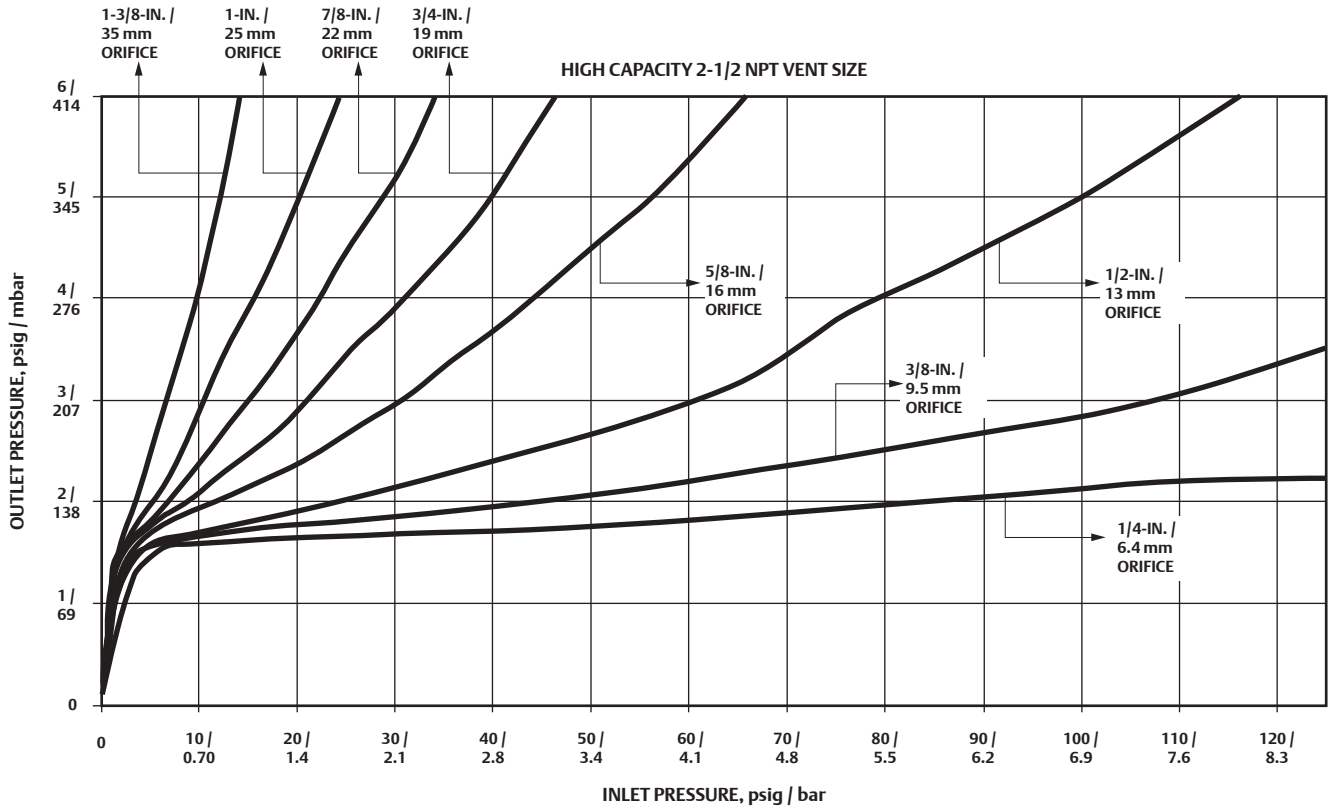


Figure 14. *Type CS800IQ High Capacity Relief Curves (Blocked Open per Orifice Size) at 1 psig / 0.07 bar Set Pressure*

SETPOINT	ACCURACY: + / - 10% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
2 psig	-0.20 psig	0.20 psig	1 to 2.5 psig	GE30342X012 / Dark Blue
0.14 bar	-14 mbar	14 mbar	0.07 to 0.17 bar	

Table 22. Types CS820, CS823 and CS824 Internal Registration Flow Capacities for 2 psig / 0.14 bar Setpoint for 1-1/2 in. / DN 40 Body Size at 10% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40															
3	0.21	740	19.9	1170	31.4	1170	31.4	1560	41.9	1730	46.4	2240	60.1	2240	60.1	3080	82.7
5	0.34	960	25.8	1410	37.9	1980	53.2	2510	67.4	2850	76.5	3640	97.7	3980	107	4830	130
10	0.69	1450	38.9	2260	60.7	3360	90.2	4320	116	5040	135	5510	148	6030	162	7410	199
15	1.0	1940	52.1	3080	82.7	4640	125	5830	157	6480	174	6980	187	7740	208	8440	227
20	1.4	2310	62.0	3880	104	5920	159	7090	190	7720	207	8020	215	8860	238		
25	1.7	2610	70.1	4660	125	6830	183	8210	220	8470	227	8600	231	9180	246		
30	2.1	2960	79.5	5430	146	7750	208	8810	237	9450	254	9120	245	9860	265		
40	2.8	3570	95.8	6830	183	9110	245	10,220	274	10,230	275	10,230	275				
50	3.4	4340	117	8310	223	10,060	270	10,520	282	10,800	290	10,800	290				
60	4.1	4970	133	9680	260	10,850	291	11,100	298	11,100	298	11,100	298				
80	5.5	6370	171	11,390	306	11,810	317	11,810	317	11,810	317						
100	6.9	7590	204	12,070	324	12,090	325										
125	8.6	9340	251	12,080	324												

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on the Type CS823.

SETPOINT	ACCURACY: + / - 10% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
2 psig	-0.20 psig	0.20 psig	1 to 2.5 psig	GE30342X012 / Dark Blue
0.14 bar	-14 mbar	14 mbar	0.07 to 0.17 bar	

Table 23. Types CS820, CS823[1] and CS824 Internal Registration Flow Capacities for 2 psig / 0.14 bar Setpoint for 2 in. / DN 50 Body Size at 10% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[2][3]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 2 in. / DN 50															
3	0.21	670	18.0	910	24.4	1280	34.4	1760	47.2	1920[1]	51.5[1]	2310	62.0	2770	74.4	3490	93.7
5	0.34	1080	29.0	1430	38.4	2230	59.9	3110	83.5	3440[1]	92.3[1]	4830	130	4970	133	6390	172
10	0.69	1510	40.5	2580[1]	69.3[1]	4040	109	5470	147	6680	179	8670	233	10,060	270	12,100	325
15	1.0	1900	51.0	3610	96.9	6220	167	8610	231	9800	263	12,320	331	13,570	364	17,260	463
20	1.4	2310	62.0	4520	121	7980	214	10,990	295	13,000	349	14,630	393	16,230	436		
25	1.7	2620	70.3	5380	144	9690	260	13,480	362	16,010	430	17,180	461	18,510	497		
30	2.1	2940	78.9	5910	159	11,080	297	15,240	409	18,190	488	19,450	522	19,930	535		
40	2.8	3530	94.8	7770	209	14,390	386	18,740	503	21,510	577	22,830	613				
50	3.4	4250	114	8860	238	17,160	461	22,320	599	23,060	619	23,060	619				
60	4.1	4980	134	10,710	288	20,160	541	23,740	637	23,740	637	23,740	637				
80	5.5	6310	169	13,640	366	25,290	679	26,330	707	26,330	707						
100	6.9	7640	205	16,380	440	29,370	789										
125	8.6	9370	252	19,980	536												

1. Due to droop, the Type CS823 exhibits a 10% reduction in capacity for indicated conditions. Multiply listed values by a factor of 0.9.
2. Not available on the Type CS823.
3. Type CS824 exhibits a 20% reduction in capacity for indicated orifice size. Multiply listed values by a factor of 0.8.

SETPOINT	ACCURACY: + / - 20% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
2 psig	-0.40 psig	0.40 psig	1 to 2.5 psig	GE30342X012 / Dark Blue
0.14 bar	-28 mbar	28 mbar	0.07 to 0.17 bar	

Table 24. Types CS820, CS823 and CS824 Internal Registration Flow Capacities for 2 psig / 0.14 bar Setpoint for 1-1/2 in. / DN 40 Body Size at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40															
3	0.21	820	22.0	1420	38.1	1960	52.6	2830	76.0	3200	85.9	3950	106	4160	112	4620	124
5	0.34	1060	28.5	1860	49.9	3220	86.4	4200	113	5020	135	5920	159	6570	176	8000	215
10	0.69	1590	42.7	3120	83.8	5230	140	6870	184	7600	204	8410	226	9580	257	11,220	301
15	1.0	1990	53.4	4090	110	6970	187	8880	238	9820	264	10,200	274	11,520	309	11,790	317
20	1.4	2310	62.0	4880	131	8440	227	10,380	279	11,160	300	11,490	309	12,630	339		
25	1.7	2680	71.9	5640	151	9630	259	11,480	308	12,480	335	12,130	326	13,570	364		
30	2.1	2980	80.0	6340	170	10,670	286	12,360	332	12,960	348	12,990	349	13,920	374		
40	2.8	3660	98.3	7850	211	12,140	326	14,150	380	14,240	382	13,470	362				
50	3.4	4360	117	9260	249	13,460	361	14,190	381	14,920	401	14,280	383				
60	4.1	5000	134	10,860	292	14,740	396	14,910	400	15,260	410	14,620	393				
80	5.5	6400	172	13,710	368	15,440	415	15,440	415	15,440	415						
100	6.9	7670	206	15,900	427	16,200	435										
125	8.6	9410	253	16,080	432												

▭ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on the Type CS823.

SETPOINT	ACCURACY: + / - 20% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
2 psig	-0.40 psig	0.40 psig	1 to 2.5 psig	GE30342X012 / Dark Blue
0.14 bar	-28 mbar	28 mbar	0.07 to 0.17 bar	

Table 25. Types CS820, CS823[1][2] and CS824 Internal Registration Flow Capacities for 2 psig / 0.14 bar Setpoint for 2 in. / DN 50 Body Size at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25[1]		1-3/8 / 35[3][4]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 2 in. / DN 50															
3	0.21	730	19.6	1280	34.4	2140	57.4	2890	77.6	3400[2]	91.3[2]	4190	113	4800	129	6490	174
5	0.34	1150	30.9	1960	52.6	3440	92.3	4380	118	5700[2]	153[2]	6770	182	7960	214	11,840	318
10	0.69	1610	43.2	3260	87.5	5790	155	7870	211	9930	267	11,840	318	13,680	367	18,160	488
15	1.0	1980	53.2	4200	113	7760	208	10,520	282	13,510	363	16,080	432	18,220	489	20,810	559
20	1.4	2330	62.6	4950	133	9250	248	12,990	349	16,570	445	19,760	531	20,610	553		
25	1.7	2660	71.4	5710	153	10,560	284	15,060	404	19,630	527	22,340	600	23,530	632		
30	2.1	2940	78.9	6300	169	11,890	319	17,290	464	21,870	587	24,500	658	25,180	676		
40	2.8	3600	96.6	7950	213	14,880	400	21,370	574	24,710	663	28,610	768				
50	3.4	4280	115	9200	247	17,600	473	24,860	667	27,290	733	29,870	802				
60	4.1	4980	134	10,890	292	20,430	549	29,670	797	29,670	797	30,930	830				
80	5.5	6310	169	13,710	368	25,880	695	32,240	866	32,240	866						
100	6.9	7650	205	16,620	446	31,200	838										
125	8.6	9360	251	20,220	543												

1. Type CS823 exhibits a 10% reduction in capacity for indicated orifice size. Multiply listed values by a factor of 0.9.
2. Due to droop, the Type CS823 exhibits a 15% reduction in capacity for indicated conditions. Multiply listed values by a factor of 0.85.
3. Not available on the Type CS823.
4. Type CS824 exhibits a 20% reduction in capacity for indicated orifice size. Multiply listed values by a factor of 0.8.

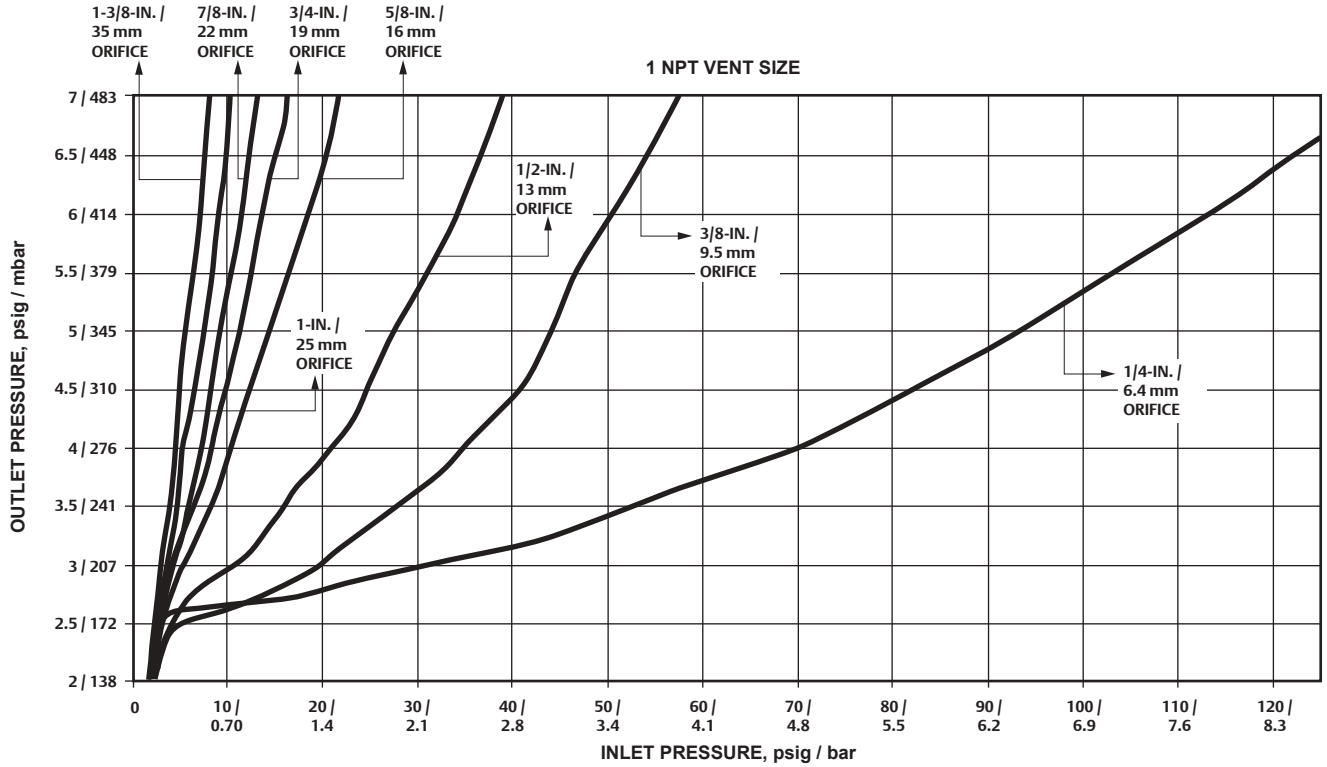


Figure 15. *Type CS820IR Relief Curves (Blocked Open per Orifice Size) at 2 psig / 0.14 bar Set Pressure*

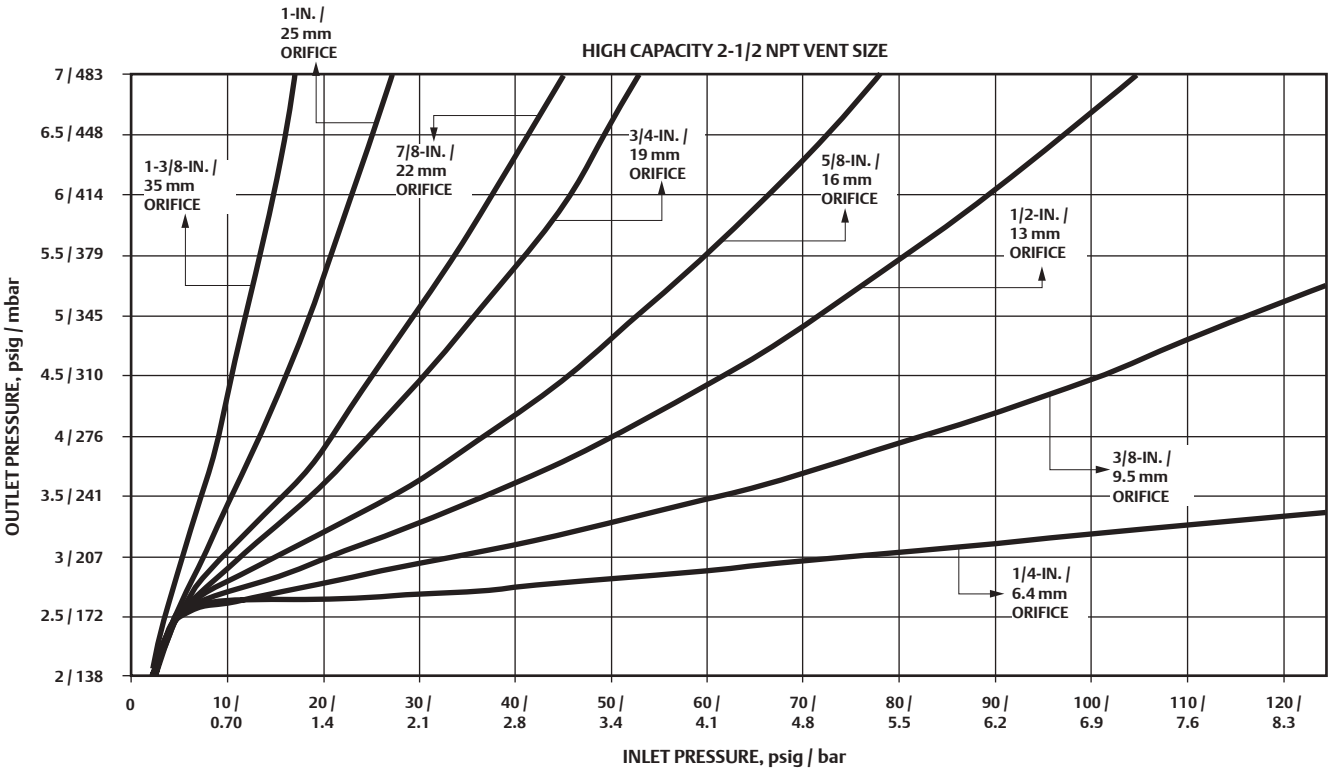


Figure 16. *Types CS820IQ High Capacity Relief Curves (Blocked Open per Orifice Size) at 2 psig / 0.14 bar Set Pressure*

SETPOINT	ACCURACY: + / - 10% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
5 psig	-0.50 psig	0.50 psig	2.5 to 5.5 psig	GE30343X012 / Yellow
0.34 bar	-34 mbar	34 mbar	0.17 to 0.38 bar	

Table 26. Types CS820, CS823 and CS824 Internal Registration Flow Capacities for 5 psig / 0.34 bar Setpoint at 10% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40															
10	0.69	1450	38.9	1870	50.2	2650	71.1	3640	97.7	4170	112	5190	139	5760	155	7240	194
15	1.0	1910	51.3	2640	70.9	3920	105	5070	136	6050	162	6970	187	7960	214	9410	253
20	1.4	2260	60.7	3440	92.3	4910	132	6530	175	7520	202	8800	236	9670	260		
25	1.7	2640	70.9	4060	109	5920	159	7510	202	8570	230	9620	258	11,320	304		
30	2.1	2710	72.8	4700	126	6690	180	8750	235	9900	266	10,670	286	12,160	326		
40	2.8	3410	91.5	6000	161	8000	215	10,100	271	11,330	304	13,220	355				
50	3.4	4100	110	7260	195	10,070	270	11,540	310	13,030	350	14,920	401				
60	4.1	4950	133	8610	231	11,250	302	12,880	346	14,220	382	15,630	420				
80	5.5	6260	168	10,690	287	13,890	373	15,400	413	16,290	437						
100	6.9	7660	206	12,590	338	15,980	429										
125	8.6	9300	250	14,860	399												
psig	bar	Body Size: 2 in. / DN 50															
10	0.69	1280	34.4	1880	50.5	2940	78.9	3530	94.8	4830	130	4970	133	6060	163	7680[2]	206[2]
15	1.0	1880	50.5	2410	64.7	4310	116	5160	139	7240	194	7610	204	9790	263	12,150[2]	326[2]
20	1.4	2300	61.7	3310	88.9	5610	151	6900	185	9230	248	10,390	279	12,770	343		
25	1.7	2660	71.4	4200	113	7040	189	8220	221	10,950	294	12,690	341	15,480	416		
30	2.1	2950	79.2	4990	134	8220	221	10,580	284	13,060	351	14,810	398	19,260	517		
40	2.8	3640	97.7	6360	171	11,080	297	14,630	393	17,710	475	20,120	540				
50	3.4	4280	115	8000	215	14,370	386	18,760	504	21,200	569	23,760	638				
60	4.1	4940	133	9900	266	17,590	472	21,760	584	23,760	638	27,480	738				
80	5.5	6290	169	13,260	356	22,900	615	27,200	730	27,200	730						
100	6.9	7650	205	16,380	440	28,030	753										
125	8.6	9390	252	20,030	538												

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on the Type CS823.
2. Type CS824 exhibits a 20% reduction in capacity for indicated orifice size. Multiply listed values by a factor of 0.8.

SETPOINT	ACCURACY: + / - 20% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
5 psig	-1.0 psig	1.0 psig	2.5 to 5.5 psig	GE30343X012 / Yellow
0.34 bar	-69 mbar	69 mbar	0.17 to 0.38 bar	

Table 27. Types CS820, CS823 and CS824 Internal Registration Flow Capacities for 5 psig / 0.34 bar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40															
10	0.69	1530	41.1	2710	72.8	4370	117	5880	158	6680	179	8470	227	9740	262	12,040	323
15	1.0	1960	52.6	3750	101	6250	168	7870	211	9620	258	11,330	304	12,580	338	15,210	408
20	1.4	2310	62.0	4720	127	7850	211	10,140	272	11,480	308	13,870	372	14,580	391		
25	1.7	2640	70.9	5520	148	9360	251	10,840	291	13,070	351	15,030	404	16,530	444		
30	2.1	2880	77.3	6390	172	10,570	284	12,760	343	14,620	393	16,620	446	16,990	456		
40	2.8	3560	95.6	7870	211	12,500	336	15,170	407	16,890	453	19,270	517				
50	3.4	4240	114	9360	251	14,840	398	16,650	447	18,310	492	21,270	571				
60	4.1	4950	133	11,000	295	16,380	440	17,530	471	19,970	536	22,640	608				
80	5.5	6310	169	13,840	372	19,090	513	20,400	548	22,710	610						
100	6.9	7690	206	16,280	437	21,380	574										
125	8.6	9390	252	19,280	518												
psig	bar	Body Size: 2 in. / DN 50															
10	0.69	1500	40.3	2840	76.2	4780	128	5970	160	8000	215	9400	252	10,550	283	13,590[2]	365[2]
15	1.0	1970	52.9	3870	104	6960	187	8540	229	11,770	316	12,740	342	15,830	425	19,260[2]	517[2]
20	1.4	2330	62.6	4700	126	8600	231	10,760	289	14,810	398	16,600	446	19,810	532		
25	1.7	2660	71.4	5700	153	10,060	270	13,260	356	17,350	466	19,690	529	21,840	586		
30	2.1	2970	79.7	6500	175	11,660	313	15,530	417	20,540	551	20,950	562	24,770	665		
40	2.8	3670	98.5	7910	212	14,470	389	20,460	549	24,480	657	25,870	695				
50	3.4	4320	116	9340	251	17,690	475	23,180	622	29,880	802	30,750	826				
60	4.1	5010	135	11,120	299	20,100	540	27,820	747	31,780	853	33,840	909				
80	5.5	6340	170	13,740	369	25,800	693	34,910	937	36,270	974						
100	6.9	7710	207	16,900	454	31,450	844										
125	8.6	9410	253	20,580	553												

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on the Type CS823.
2. Type CS824 exhibits a 20% reduction in capacity for indicated orifice size. Multiply listed values by a factor of 0.8.

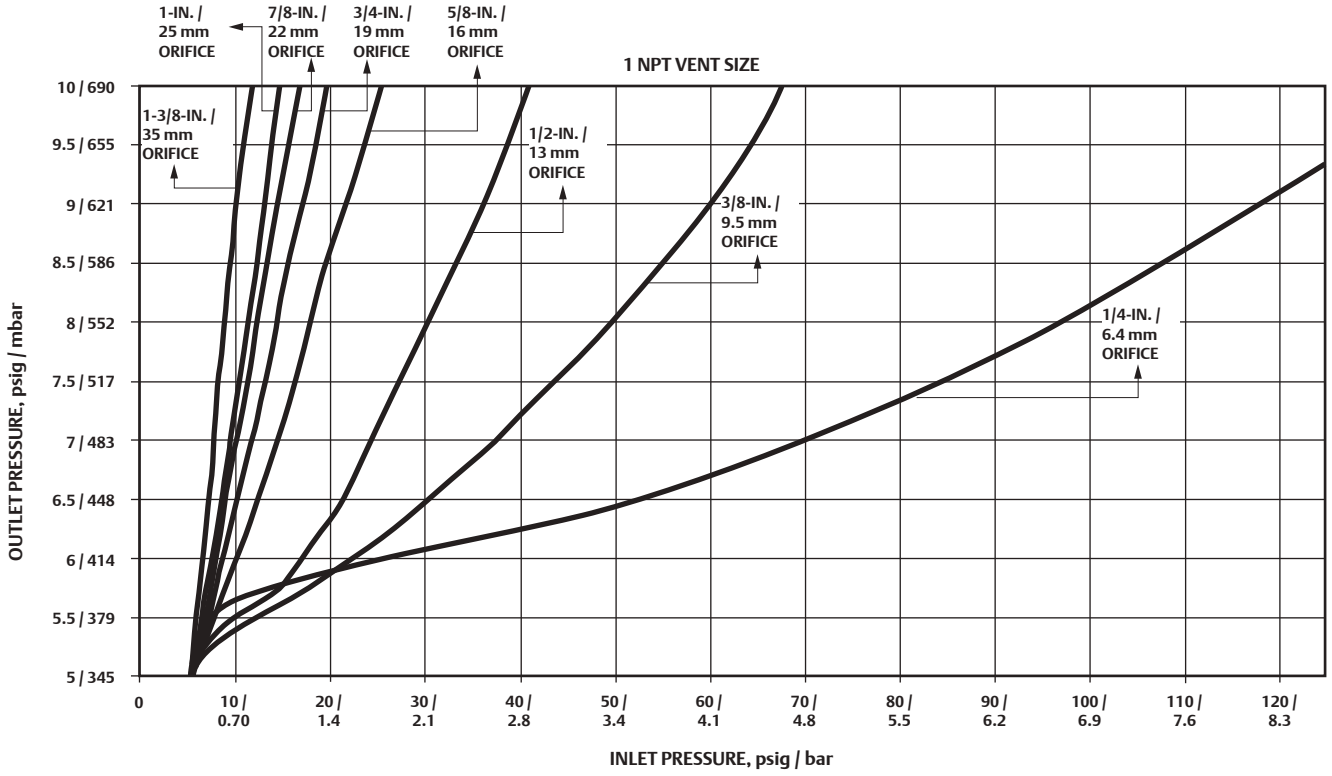


Figure 17. *Type CS820IR Relief Curves (Blocked Open per Orifice Size) at 5 psig / 0.34 bar Set Pressure*

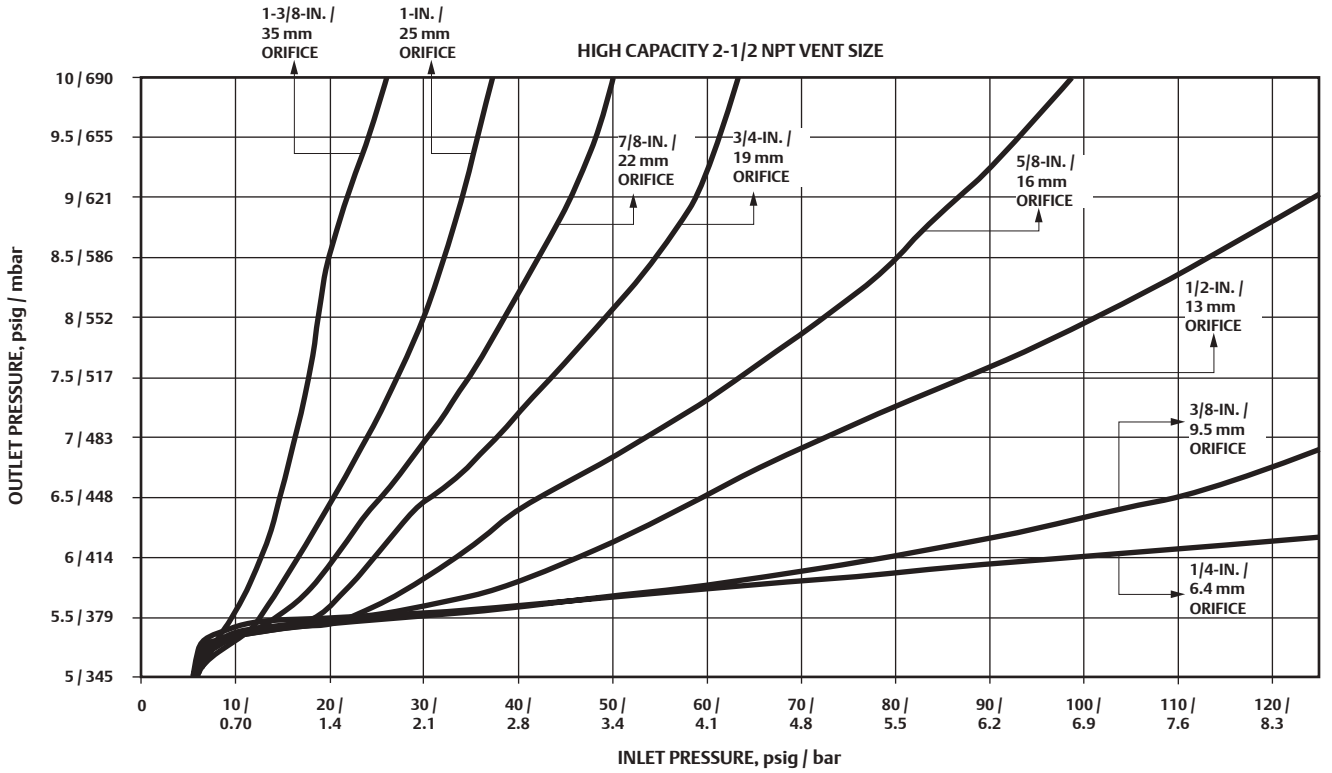


Figure 18. *Type CS820IQ High Capacity Relief Curves (Blocked Open per Orifice Size) at 5 psig / 0.34 bar Set Pressure*

SETPOINT	ACCURACY: +/- 10% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
10 psig	-1 psig	1 psig	5 to 10 psig	GE30344X012 / Green with White Stripe
0.69 bar	-69 mbar	69 mbar	345 to 690 bar	

Table 28. Types CS850 and CS854 Internal Registration Flow Capacities for 10 psig / 0.69 bar Setpoint at 10% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: 1-1/2 and 2 in. / DN 40 and 50															
15	1.0	1300	34.9	1780	47.9	2460	66.1	2780	74.7	3140	84.2	4040	108	4040	108	6010	161
20	1.4	1960	52.6	2240	60.1	2980	80.0	3640	97.5	4370	117	5230	140	6060	163		
25	1.7	2430	65.2	2860	76.9	4020	108	4780	128	5180	139	6530	175	7210	193		
30	2.1	2910	78.1	3210	86.2	4470	120	5720	153	6540	175	7400	198	8420	226		
40	2.8	3560	95.4	4080	109	6090	163	7150	192	8680	233	9860	264				
50	3.4	4230	113	5020	135	7760	208	9730	261	10,750	288	11,210	300				
60	4.1	4790	129	6360	170	8900	238	10,530	282	12,960	347	13,720	368				
80	5.5	6110	164	7950	213	10,840	290	13,920	373	15,610	418						
100	6.9	7610	204	9730	261	12,780	343										
125	8.6	8960	240	11,890	319												

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
10 psig	-2 psig	2 psig	5 to 10 psig	GE30344X012 / Green with White Stripe
0.69 bar	-1.4 bar	1.4 bar	345 to 690 bar	

Table 29. Type CS850 Internal Registration Flow Capacities for 10 psig / 0.69 bar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: 1-1/2 and 2 in. / DN 40 and 50															
15	1.0	1820	48.8	3160	84.8	4670	125	6050	162	6650	178	8250	221	9420	252	11,730	314
20	1.4	2190	58.8	3850	103	6450	173	7820	210	9380	251	11,000	295	12,560	336		
25	1.7	2570	69.0	4920	132	8110	217	9780	262	11,240	301	14,080	377	14,750	395		
30	2.1	2950	79.2	5780	155	9090	244	11,710	314	14,110	378	15,450	414	17,370	465		
40	2.8	3620	97.0	7330	197	11,740	315	14,830	398	16,820	451	19,590	525				
50	3.4	4310	116	8910	239	14,510	389	17,600	472	19,840	532	22,180	594				
60	4.1	4940	133	10,410	279	16,430	440	19,720	528	23,450	628	23,920	641				
80	5.5	6260	168	13,140	352	20,040	537	23,940	641	28,110	753						
100	6.9	7660	205	16,210	434	23,050	618										
125	8.6	9290	249	19,320	517.8												

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
7 in. w.c.	-2 in. w.c.	2 in. w.c.	5.5 to 8.5 in. w.c.	GE30338X012 / Black
17 mbar	-5 mbar	5 mbar	13 to 21 mbar	

Table 30. Types CS800, CS803 and CS804 External Registration Flow Capacities for 7 In. w.c. / 17 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35(1)	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: 1-1/2 and 2 in. / DN 40 and 50															
0.4	0.03			550	14.8	780	20.9	1090	29.3	1000	26.8	1390	37.3	1640	44.0	1780	47.8
0.51	0.04	360	9.7	630	16.9	930	25.0	1100	29.5	1530	41.1	1530	41.1	1940	52.1	2400	64.4
1	0.07	500	13.4	830	22.3	1290	34.6	1730	46.4	1980	53.2	2320	62.3	2860	76.8	3780	102
2	0.14	720	19.3	1330	35.7	2010	54.0	2550	68.5	3260	87.5	3740	100	4360	117	5930	159
3	0.21	870	23.4	1650	44.3	2500	67.1	3180	85.4	4130	111	4760	128	5250	141	7110	191
5	0.34	1120	30.1	2070	55.6	3410	91.5	4380	118	5620	151	6400	172	7500	201	9370	252
10	0.69	1480	39.7	2990	80.3	5010	135	6480	174	8420	226	9820	264	11,600	311	14,600	392
15	1.0	1810	48.6	3710	99.6	6410	172	8320	223	10,800	290	12,770	343	15,130	406	19,610	526
20	1.4	2170	58.3	4560	122	7720	207	10,750	289	13,660	367	15,080	405	18,520	497		
25	1.7	2520	67.7	5320	143	9030	242	12,220	328	16,340	439	18,630	500	21,950	589		
30	2.1	2770	74.4	5990	161	10,440	280	13,770	370	17,790	478	20,350	546				
40	2.8	3400	91.3	7360	198	12,490	335	16,720	449	20,320	546	25,650	689				
50	3.4	4010	108	8700	234	14,510	390	18,750	503	24,220	650	26,390	709				
60	4.1	4630	124	10,110	271	16,810	451	22,130	594	26,490	711						
80	5.5	5960	160	12,550	337	19,580	526										
100	6.9	7280	195	15,030	404	22,540	605										
125	8.6	8150	219	16,990	456												

■ - Black areas show where indicated droop/boost would be exceeded regardless of capacity.
□ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on Type CS803.

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
14 in. w.c.	-2 in. w.c.	2 in. w.c.	10 to 16 in. w.c.	GE30340X012 / White
35 mbar	-5 mbar	5 mbar	25 to 40 mbar	

Table 31. Types CS800, CS803 and CS804 External Registration Flow Capacities for 14 in. w.c. / 35 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35(1)	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: 1-1/2 and 2 in. / DN 40 and 50															
1	0.07	430	11.5	520	14.0	1210	32.5	1210	32.5	1290	34.6	1540	41.3	1790	48.1	2510	67.4
2	0.14	630	16.9	990	26.6	1690	45.4	2010	54.0	2440	65.5	2900	77.9	3350	89.9	4500	121
3	0.21	770	20.7	1350	36.2	1870	50.2	2540	68.2	2890	77.6	3730	100	4230	114	5660	152
5	0.34	1030	27.7	1800	48.3	2760	74.1	3280	88.1	4020	108	5320	143	5730	154	7160	192
10	0.69	1380	37.0	2560	68.7	4000	107	5110	137	6320	170	7700	207	8530	229	13,160	353
15	1.0	1700	45.6	3220	86.4	4980	134	6400	172	8180	220	10,270	276	11,690	314	19,100	513
20	1.4	1970	52.9	4040	109	6270	168	8110	218	10,620	285	15,320	411	17,550	471		
25	1.7	2340	62.8	4890	131	7810	210	9570	257	12,530	336	18,870	507	20,710	556		
30	2.1	2710	72.8	5320	143	8280	222	10,890	292	13,070	351	19,710	529				
40	2.8	3300	88.6	6900	185	10,980	295	13,280	357	16,560	444	26,440	710				
50	3.4	3890	104	8290	223	12,990	349	16,060	431	18,020	484	30,650	823				
60	4.1	4490	121	9710	261	15,400	413	18,340	492	21,170	568						
80	5.5	5770	155	12,450	334	18,900	507										
100	6.9	7000	188	15,030	404	21,320	572										
125	8.6	7900	212	16,680	448												

□ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on Type CS803.

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
1 psig	-5.5 in. w.c.	5.5 in. w.c.	14 to 30 in. w.c.	GE30341X012 / Dark Green
69 mbar	-14 mbar	14 mbar	35 to 75 mbar	

Table 32. Types CS800, CS803 and CS804 External Registration Flow Capacities for 1 psig / 69 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35(1)	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: 1-1/2 and 2 in. / DN 40 and 50															
2	0.14	680	18.3	1090	29.3	1830	49.1	2540	68.2	2950	79.2	3390	91.0	4140	111	6030	162
3	0.21	870	23.4	1500	40.3	2530	67.9	3360	90.2	4300	115	4870	131	5700	153	7310	196
5	0.34	1170	31.4	2050	55.0	3430	92.1	4690	126	6110	164	7000	188	8210	220	9760	262
10	0.69	1490	40.0	2960	79.5	4840	130	6550	176	8320	223	9480	255	11,380	306	14,700	395
15	1.0	1810	48.6	3790	102	6610	177	8740	235	10,590	284	11,840	318	13,980	375	20,000	537
20	1.4	2130	57.2	4920	132	7750	208	10,220	274	12,360	332	14,930	401	16,240	436		
25	1.7	2580	69.3	5590	150	9070	244	11,790	317	14,230	382	17,970	482	18,370	493		
30	2.1	2900	77.9	6570	176	10,070	270	13,200	354	16,450	442	19,880	534	22,620	607		
40	2.8	3640	97.7	7830	210	12,890	346	15,860	426	19,200	515	20,760	557				
50	3.4	4420	119	9360	251	15,480	416	18,380	493	22,670	609	24,280	652				
60	4.1	5100	137	10,910	293	18,120	486	21,070	566	24,680	663	26,750	718				
80	5.5	6460	173	13,140	353	20,770	558	23,970	644	27,780	746						
100	6.9	7930	213	16,420	441	23,090	620										
125	8.6	8730	234	19,710	529												

▭ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on Type CS803.

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
2 psig	-0.40 psig	0.40 psig	1 to 2.5 psig	GE30342X012 / Dark Blue
138 mbar	-28 mbar	28 mbar	69 to 170 mbar	

Table 33. Types CS820, CS823 and CS824 External Registration Flow Capacities for 2 psig / 138 mbar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35(1)	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: 1-1/2 and 2 in. / DN 40 and 50															
3	0.21	760	20.4	1220	32.8	1820	48.9	2780	74.6	2780	74.6	4180	112	5360	144	5540	149
5	0.34	1080	29.0	1770	47.5	2880	77.3	3710	99.6	4840	130	5570	150	6950	187	8570	230
10	0.69	1460	39.2	2560	68.7	4400	118	6330	170	7400	197	8750	235	9180	246	12,710	341
15	1.0	1760	47.2	3560	95.6	5540	149	7870	211	9590	257	11,280	303	11,890	319	15,220	409
20	1.4	2090	56.1	4310	116	6680	179	9610	258	11,940	321	13,420	360	14,300	384		
25	1.7	2350	63.1	5100	137	7600	204	10,780	289	13,440	361	14,020	376	15,510	416		
30	2.1	2710	72.8	5760	155	8980	241	12,410	333	15,040	404	15,770	423	17,220	462		
40	2.8	3390	91.0	7290	196	10,560	284	14,810	398	16,840	452	18,260	490				
50	3.4	3970	107	8530	229	12,490	335	16,790	451	18,370	493	19,490	523				
60	4.1	4570	123	9930	267	14,050	377	18,570	499	19,310	518	21,120	567				
80	5.5	5880	158	12,420	333	16,150	434	20,330	546	21,450	576						
100	6.9	7250	195	14,670	394	18,850	506										
125	8.6	8960	241	16,450	442												

▭ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Not available on Type CS823.

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
5 psig	-1 psig	1 psig	2.5 to 5.5 psig	GE30343X012 / Yellow
345 mbar	-69 mbar	69 mbar	170 to 380 mbar	

Table 34. Types CS820, CS823 and CS824 External Registration Flow Capacities for 5 psig / 345 mbar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35[1]	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: 1-1/2 and 2 in. / DN 40 and 50															
10	0.69	1430	38.4	2320	62.3	4370	117	4780	128	5920	159	7360	198	8670	233	10,820	291
15	1.0	1800	48.3	3370	90.5	5370	144	7030	189	8520	229	11,130	299	11,870	319	15,610	419
20	1.4	2120	56.9	4510	121	6640	178	8920	240	11,730	315	13,420	360	15,360	412		
25	1.7	2430	65.2	5340	143	7770	209	11,420	307	14,150	380	15,880	426	18,530	497		
30	2.1	2730	73.3	5960	160	9120	245	13,180	354	15,890	427	17,100	459	20,070	539		
40	2.8	3410	91.5	7210	194	11,410	306	16,620	446	18,800	505	19,890	534				
50	3.4	4040	109	8640	232	13,540	364	17,940	482	21,260	571	24,110	647				
60	4.1	4560	122	10,140	272	15,530	417	21,730	583	24,520	658	26,500	711				
80	5.5	5880	158	12,840	345	20,480	550	25,360	681	29,700	797						
100	6.9	7230	194	15,560	418	23,710	637										
125	8.6	8910	239	20,320	546												

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

1. Not available on Type CS823.

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
7 psig	-1.4 psig	1.4 psig	5 to 10 psig	GE30344X012 / Green with White Stripe
483 mbar	-96 mbar	96 mbar	345 to 690 mbar	

Table 35. Types CS850 and CS854 External Registration Flow Capacities for 7 psig / 483 mbar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm															
		1/4 / 6.4		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22		1 / 25		1-3/8 / 35	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Sizes: 1-1/2 and 2 in. / DN 40 and 50															
10	0.69	1410	37.9	1750	47.0	2030	54.5	3630	97.4	4130	111	4770	128	5390	145	7360	198
15	1.0	1880	50.5	2840	76.2	4040	109	5350	144	6970	187	7280	195	9050	243	12,240	329
20	1.4	2230	59.9	3710	99.6	5200	140	6840	184	8520	229	9550	256	11,390	306		
25	1.7	2590	69.5	3710	99.6	6250	168	8580	230	10,630	285	11,740	315	13,260	356		
30	2.1	2860	76.8	5140	138	7120	191	9970	268	12,780	343	14,020	376	14,890	400		
40	2.8	3540	95.0	6440	173	9050	243	12,630	339	14,690	394	16,690	448				
50	3.4	4290	115	7710	207	11,610	312	14,930	401	18,140	487	21,190	569				
60	4.1	4980	134	8920	240	13,370	359	16,650	447	20,110	540	23,550	632				
80	5.5	6010	161	11,490	309	17,230	463	19,220	516	24,430	656						
100	6.9	7360	198	15,110	406	20,130	540										
125	8.6	9090	244	17,490	470												

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY		SPRING	
	Droop	Boost	Set Range	Part Number / Color
7 in. w.c.	-1 in. w.c.	2 in. w.c.	5.5 to 8.5 in. w.c.	GE30338X012 / Black
17 mbar	-2.5 mbar	5 mbar	13 to 21 mbar	

Table 36. Types CS805 and CS806 Internal Registration Flow Capacities for 7 In. w.c. / 17 mbar Setpoint

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40									
0.51	0.04					730	19.6	850	22.8	910	24.4
1	0.07	580	15.6	800	21.5	880	23.6	1050	28.2	1060	28.5
2	0.14	900	24.2	1140	30.6	1520	40.8	1610	43.2	1610	43.2
3	0.21	1080	29.0	1480	39.7	1920	51.5	2250	60.4	2260	60.7
5	0.34	1620	43.5	2120	56.9	2560	68.7	3370	90.5	3470	93.2
10	0.69	2520	67.7	3100	83.2	5200	140	5620	151	5680	153
15	1.0	3150	84.6	5350	144	6400	172	7500	201	7140	192
20	1.4	3910	105	6500	175	7200	193	7500	201	8610	231
25	1.7	4680	126	7600	204	7600	204	7600	204	8610	231
30	2.1	5160	139	7700	207	7700	207	7700	207	9550	256
40	2.8	6140	165	7800	209	7900	212	7900	212	9550	256
50	3.4	7120	191	7900	212	8000	215	8000	215	9550	256
60	4.1	7500	201	8000	215	8000	215	8000	215		
80	5.5	8500	228	8500	228						
100	6.9	8500	228	8500	228						
125	8.6	8500	228								

■ - Black areas show where indicated droop/boost would be exceeded regardless of capacity.
□ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY: + / - 10% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
1 psig	-2.8 in. w.c.	2.8 in. w.c.	14 to 30 in. w.c.	GE30341X012 / Dark Green
0.07 bar	-7 mbar	7 mbar	35 to 75 mbar	

Table 37. Types CS805 and CS806 Internal Registration Flow Capacities for 1 psig / 0.07 bar Setpoint at 10% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40									
2	0.14	840	22.6	1200	32.2	1310	35.2	1820	48.9	1610	43.2
3	0.21	1100	29.5	1520	40.8	1760	47.2	2430	65.2	2700	72.5
5	0.34	1680	45.1	2280	61.2	2820	75.7	3490	93.7	3710	99.6
10	0.69	2410	64.7	3430	92.1	4480	120	5630	151	6480	174
15	1.0	3080	82.7	4770	128	6910	186	7850	211	8520	229
20	1.4	4080	110	5970	160	8540	229	9100	244	9670	260
25	1.7	4690	126	7400	199	9030	242	9700	260	10,190	274
30	2.1	5790	155	8680	233	10,380	279	10,240	275	10,790	290
40	2.8	7310	196	10,290	276	11,660	313	11,470	308	11,930	320
50	3.4	9270	249	11,010	296	12,140	326	11,740	315	12,550	337
60	4.1	10,320	277	11,200	301	12,490	335	12,220	328		
80	5.5	11,810	317	11,610	312						
100	6.9	12,180	327	12,030	323						
125	8.6	11,730	315								

□ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY: + / - 20% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
1 psig	-5.5 In. w.c.	5.5 In. w.c.	14 to 30 In. w.c.	GE30341X012 / Dark Green
0.07 bar	-14 mbar	14 mbar	35 to 75 mbar	

Table 38. Types CS805 and CS806 Internal Registration Flow Capacities for 1 psig / 0.07 bar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40									
2	0.14	1120	30.1	1710	45.9	2130	57.2	2600	69.8	2910	78.1
3	0.21	1620	43.5	2320	62.3	2510	67.4	3590	96.4	3750	101
5	0.34	2250	60.4	3090	83.0	3650	98.0	5190	139	5230	140
10	0.69	3150	84.6	4610	124	6320	170	7720	207	8330	224
15	1.0	3990	107	6310	169	8480	228	9390	252	10,000	269
20	1.4	4970	133	7600	204	9950	267	10,710	288	11,480	308
25	1.7	5490	147	8860	238	11,100	298	11,880	319	12,340	331
30	2.1	6590	177	9910	266	12,110	325	12,120	325	13,160	353
40	2.8	7890	212	11,640	313	13,000	349	13,590	365	13,920	374
50	3.4	9350	251	12,680	340	14,120	379	13,940	374	14,440	388
60	4.1	10,860	292	13,000	349	14,540	390	14,080	378		
80	5.5	13,310	357	13,780	370						
100	6.9	13,750	369	14,360	386						
125	8.6	13,750	369								

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY: + / - 10% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
2 psig	-0.20 ps ig	0.20 psig	1 to 2.5 psig	GE30342X012 / Dark Blue
0.14 bar	-14 mbar	14 mbar	0.07 to 0.17 bar	

Table 39. Types CS825 and CS826 Internal Registration Flow Capacities for 2 psig / 0.14 bar Setpoint at 10% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40									
3	0.21	740	19.9	1580	42.4	1230	33.0	1620	43.5	1860	49.9
5	0.34	990	26.6	1720	46.2	2020	54.2	2730	73.3	2870	77.0
10	0.69	2040	54.8	2970	79.7	3490	93.7	4820	129	5290	142
15	1.0	2890	77.6	4170	112	5000	134	6510	175	7010	188
20	1.4	3600	96.6	5350	144	6580	177	8620	231	8690	233
25	1.7	4370	117	6430	173	7950	213	9240	248	9530	256
30	2.1	4960	133	7690	206	9030	242	10,240	275	11,060	297
40	2.8	6800	183	9790	263	11,040	296	11,890	319	12,590	338
50	3.4	8140	219	11,460	308	12,760	343	13,290	357	14,450	388
60	4.1	9850	264	12,100	325	13,760	369	14,020	376		
80	5.5	12,110	325	13,830	371						
100	6.9	13,720	368	14,800	397						
125	8.6	13,880	373								
psig	bar	Body Size: 2 in. / DN 50									
3	0.21	810	21.7	1080	29.0	1340	36.0	1560	41.9	1780	47.8
5	0.34	1240	33.3	1760	47.2	2170	58.3	2750	73.8	3170	85.1
10	0.69	2100	56.4	2670	71.7	4130	111	4910	132	6300	169
15	1.0	2900	77.9	4220	113	6230	167	7920	213	9310	250
20	1.4	3640	97.7	5770	155	8400	226	10,470	281	12,460	335
25	1.7	4530	122	7180	193	10,660	286	13,300	357	14,970	402
30	2.1	5190	139	8840	237	12,270	330	15,280	410	17,900	481
40	2.8	7140	192	12,040	323	16,610	446	19,630	527	22,700	609
50	3.4	9020	242	14,530	390	20,410	548	23,830	640	26,840	721
60	4.1	10,720	288	17,070	458	24,980	671	27,450	737		
80	5.5	13,660	367	22,220	597						
100	6.9	16,760	450	27,350	734						
125	8.6	20,350	546								

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY: + / - 20% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
2 psig	-0.40 psig	0.40 psig	1 to 2.5 psig	GE30342X012 / Dark Blue
0.14 bar	-28 mbar	28 mbar	0.07 to 0.17 bar	

Table 40. Types CS825 and CS826 Internal Registration Flow Capacities for 2 psig / 0.14 bar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40									
3	0.21	1170	31.4	2020	54.2	2150	57.7	2570	69.0	3110	83.5
5	0.34	1770	47.5	2540	68.2	3130	84.0	4100	110	4520	121
10	0.69	3080	82.7	4420	119	5370	144	6800	183	7330	197
15	1.0	3880	104	5600	150	7180	193	8730	234	9850	264
20	1.4	4830	130	6970	187	9130	245	10,390	279	11,410	306
25	1.7	5740	154	8500	228	10,630	285	12,150	326	12,640	339
30	2.1	6180	166	9670	260	11,650	313	13,330	358	14,210	382
40	2.8	7810	210	12,190	327	13,870	372	15,330	412	15,860	426
50	3.4	9250	248	13,800	371	15,660	420	16,330	438	17,440	468
60	4.1	10,570	284	14,780	397	16,310	438	17,480	469		
80	5.5	13,170	354	16,800	451						
100	6.9	15,740	423	18,200	489						
125	8.6	17,430	468								
psig	bar	Body Size: 2 in. / DN 50									
3	0.21	1070	28.7	1470	39.5	2080	55.8	2540	68.2	2710	72.8
5	0.34	1760	47.2	2660	71.4	3420	91.8	4130	111	4660	125
10	0.69	2860	76.8	4260	114	5930	159	7190	193	8360	224
15	1.0	3880	104	5950	160	8200	220	9920	266	11,340	304
20	1.4	4740	127	7360	198	10,200	274	12,310	331	14,410	387
25	1.7	5590	150	8830	237	12,560	337	15,100	405	16,980	456
30	2.1	6310	169	10,150	273	14,290	384	17,140	460	19,320	519
40	2.8	7820	210	12,990	349	18,360	493	21,510	577	23,500	631
50	3.4	9370	252	15,320	411	22,350	600	25,450	683	28,260	759
60	4.1	10,860	292	17,710	475	26,420	709	29,670	797		
80	5.5	13,750	369	22,830	613						
100	6.9	16,800	451	27,610	741						
125	8.6	20,510	551								

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY: + / - 10% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
5 psig	-0.50 psig	0.50 psig	2.5 to 5.5 psig	GE30343X012 / Yellow
0.34 bar	-34 mbar	34 mbar	0.17 to 0.38 bar	

Table 41. Types CS825 and CS826 Internal Registration Flow Capacities for 5 psig / 0.34 bar Setpoint at 10% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40									
10	0.69	1750	47.0	2360	63.4	2860	76.8	3630	97.4	4290	115
15	1.0	2400	64.4	3530	94.8	4370	117	5400	145	5960	160
20	1.4	3110	83.5	4270	115	5660	152	6630	178	7540	202
25	1.7	3640	97.7	5320	143	6910	186	7870	211	8920	240
30	2.1	4350	117	6240	168	7950	213	9530	256	10,490	282
40	2.8	5490	147	7730	208	9760	262	11,740	315	12,770	343
50	3.4	6850	184	9270	249	11,900	320	13,230	355	14,360	386
60	4.1	7970	214	11,280	303	13,470	362	15,070	405		
80	5.5	10,650	286	13,750	369						
100	6.9	12,440	334	15,460	415						
125	8.6	14,500	389								
psig	bar	Body Size: 2 in. / DN 50									
10	0.69	1730	46.4	2400	64.4	2840	76.2	3620	97.2	4060	109
15	1.0	2500	67.1	3410	91.5	4300	115	5360	144	6490	174
20	1.4	3230	86.7	4360	117	5610	151	6950	187	8760	235
25	1.7	3810	102	5280	142	6860	184	8960	241	11,030	296
30	2.1	4410	118	6340	170	8430	226	10,780	289	13,080	351
40	2.8	5550	149	8640	232	11,810	317	15,280	410	17,290	464
50	3.4	6980	187	11,120	299	15,070	405	19,630	527	21,680	582
60	4.1	8750	235	13,630	366	18,300	491	23,260	624		
80	5.5	11,970	321	18,590	499						
100	6.9	15,030	404	23,560	633						
125	8.6	19,350	520								

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

SETPOINT	ACCURACY: + / - 20% GAUGE		SPRING	
	Droop	Boost	Set Range	Part Number / Color
5 psig	-1.0 psig	1.0 psig	2.5 to 5.5 psig	GE30343X012 / Yellow
0.34 bar	-69 mbar	69 mbar	0.17 to 0.38 bar	

Table 42. Types CS825 and CS826 Internal Registration Flow Capacities for 5 psig / 0.34 bar Setpoint at 20% Accuracy

CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Inlet Pressure		Orifice Size, In. / mm									
		3/8 / 9.5		1/2 / 13		5/8 / 16		3/4 / 19		7/8 / 22	
		SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
psig	bar	Body Size: 1-1/2 in. / DN 40									
10	0.69	2460	66.0	3650	98.0	4680	126	5880	158	6610	177
15	1.0	3460	92.9	5200	140	6520	175	8240	221	9120	245
20	1.4	4370	117	6650	179	8300	223	10,120	272	11,110	298
25	1.7	5220	140	7700	207	10,020	269	12,050	324	13,400	360
30	2.1	6060	163	8980	241	11,440	307	13,520	363	15,180	408
40	2.8	7580	204	11,060	297	14,160	380	16,400	440	17,610	473
50	3.4	9150	246	12,850	345	16,250	436	17,880	480	19,590	526
60	4.1	10,490	282	15,370	413	18,130	487	20,170	542		
80	5.5	13,270	356	18,410	494						
100	6.9	15,310	411	20,820	559						
125	8.6	18,730	503								
psig	bar	Body Size: 2 in. / DN 50									
10	0.69	2440	65.5	3650	98.0	4660	125	5740	154	6660	179
15	1.0	3540	95.0	5220	140	6790	182	8260	222	9740	262
20	1.4	4480	120	6650	179	8720	234	10,670	286	12,370	332
25	1.7	5260	141	7950	213	10,580	284	13,090	351	15,060	404
30	2.1	6100	164	9370	252	12,540	337	15,440	415	17,410	467
40	2.8	7650	205	11,860	318	16,150	434	19,860	533	22,580	606
50	3.4	9230	248	14,510	390	19,730	530	24,260	651	27,210	731
60	4.1	10,710	288	16,820	452	23,710	637	28,650	769		
80	5.5	13,670	367	21,930	589						
100	6.9	16,630	446	27,000	725						
125	8.6	20,310	545								

☐ - Blank areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

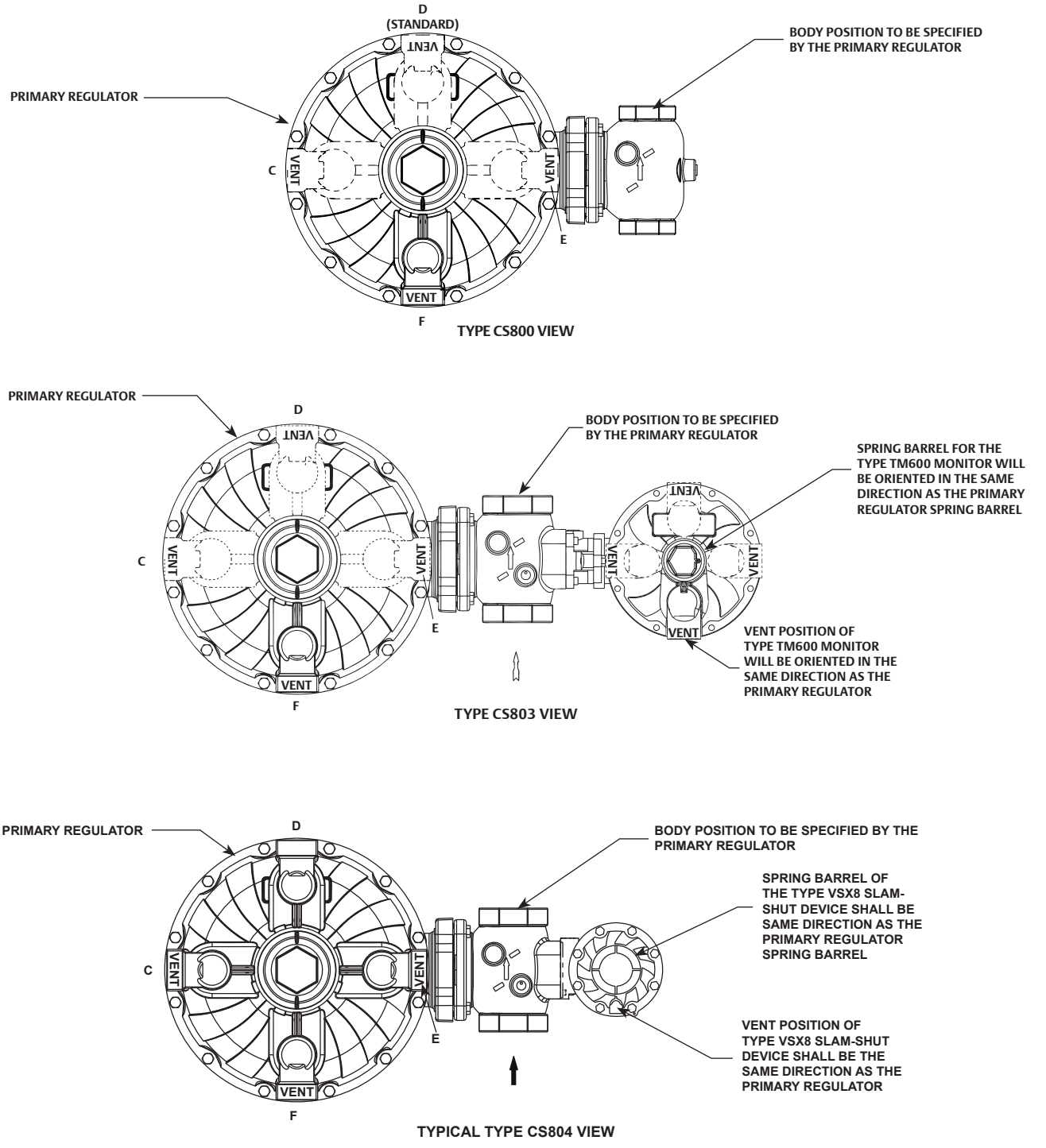


Figure 19. *Spring Case Vent and Body Orientation*

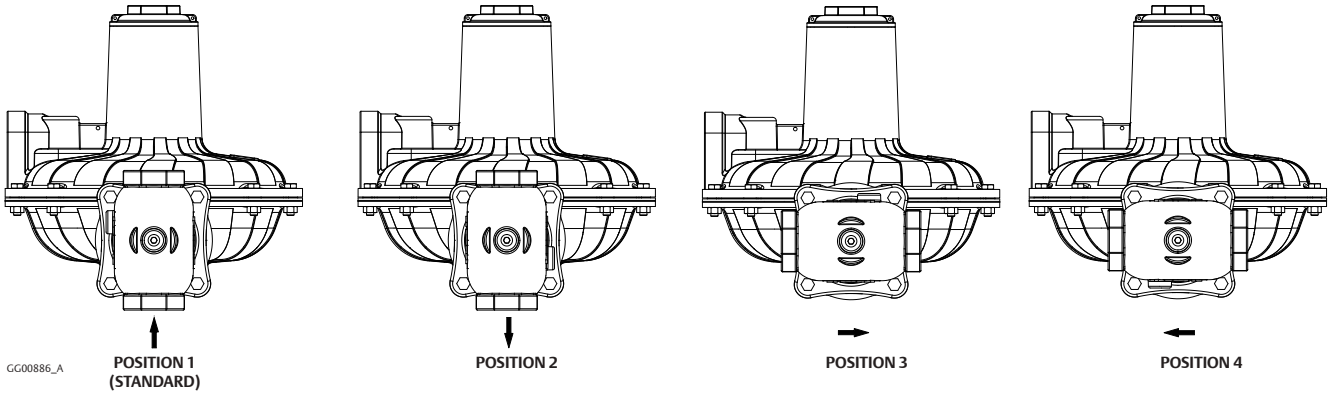


Figure 19. *Spring Case Vent and Body Orientation (continued)*

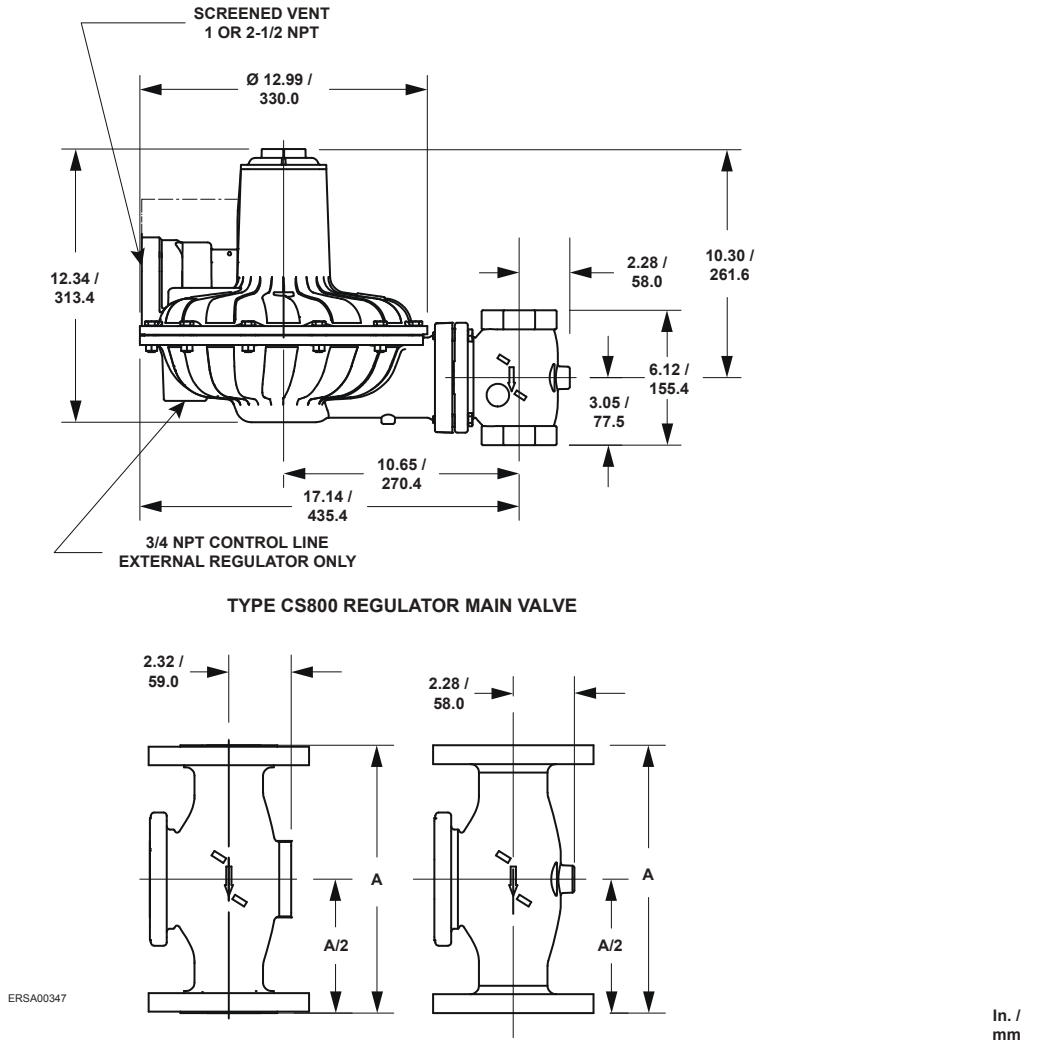


Figure 20. *Dimensions*

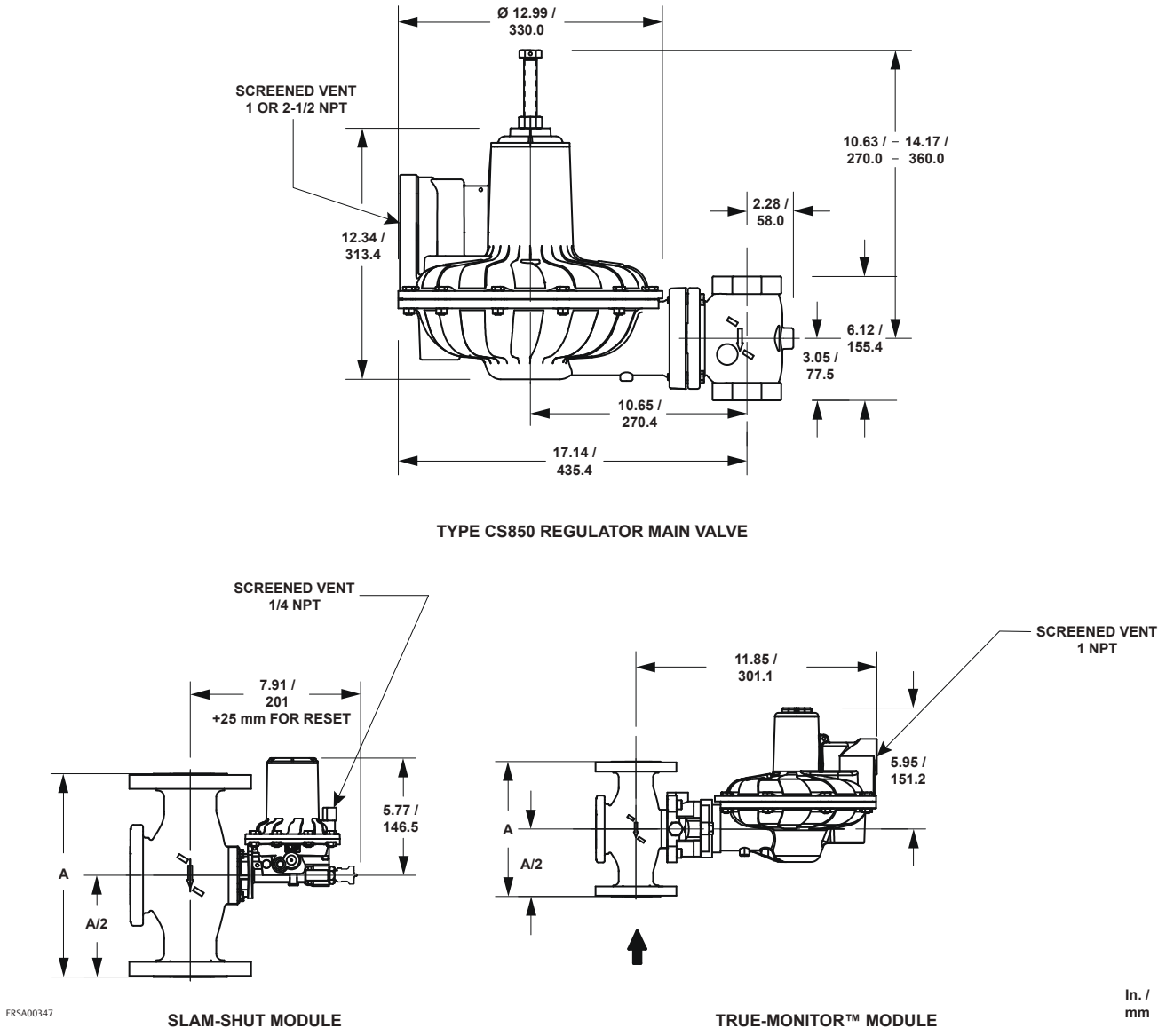


Figure 20. *Dimensions (continued)*

Table 43. Dimension

BODY SIZE		END CONNECTION STYLE	DIMENSION A			
in.	DN		in.		mm	
1-1/4 to 2	- - - -	NPT	6.12		155	
2[1]	50	CL125 FF Flange	7.5	10	191	254
2[2]	50	CL125 FF, CL150 FF or PN 10/16 Flange				
2[2]	50	CL125 FF or CL150 FF Flange	10.5		267	
2[3]	50	CL150 RF or PN 16 Flange	10		254	

1. For Cast iron.
2. For Ductile iron.
3. For Steel.

Ordering Guide

Type (See Table 1 for Construction Features) (Select One)

Stand-Alone Regulator

- ☐ CS800IN
- ☐ CS800IR
- ☐ CS800IT
- ☐ CS800IQ
- ☐ CS800IL
- ☐ CS800EN
- ☐ CS800ET
- ☐ CS800EL
- ☐ CS820IN
- ☐ CS820IR
- ☐ CS820IT
- ☐ CS820IQ
- ☐ CS820IL
- ☐ CS820EN
- ☐ CS820ET
- ☐ CS820EL
- ☐ CS850IN
- ☐ CS850EN

With Integral True-Monitor™ Module

- ☐ CS803IN
- ☐ CS803IT
- ☐ CS803IL
- ☐ CS803EN
- ☐ CS803ET
- ☐ CS803EL
- ☐ CS823IN
- ☐ CS823IT
- ☐ CS823IL
- ☐ CS823EN
- ☐ CS823ET
- ☐ CS823EL

With Type Secondary Seat™ Protection Without Vent

- ☐ CS805IN
- ☐ CS805IR
- ☐ CS805IT
- ☐ CS805IQ
- ☐ CS825IN
- ☐ CS825IR
- ☐ CS825IT
- ☐ CS825IQ

With Type Secondary Seat Protection with Vent

- ☐ CS806IR
- ☐ CS806IQ
- ☐ CS826IR
- ☐ CS826IQ

With Slam Shut

- ☐ CS804IN
- ☐ CS804IT
- ☐ CS804IL
- ☐ CS804EN
- ☐ CS804ET
- ☐ CS804EL
- ☐ CS824IN
- ☐ CS824IT
- ☐ CS824IL
- ☐ CS824EN
- ☐ CS824ET
- ☐ CS824EL
- ☐ CS854IN
- ☐ CS854EN

Body Material, Body Size and End Connection (Select One)

Gray Cast Iron (Types CS800, CS805, CS806, CS820, CS825, CS826 and CS850)

- ☐ 1-1/4 NPT***
- ☐ 1-1/2 NPT***
- ☐ 2 NPT***
- ☐ NPS 2 / DN 50, CL125 FF***
  - *Face-to-face dimension:*
    - ☐ 7.5 in. / 191 mm
    - ☐ 10 in. / 254 mm

Body Material, Body Size and End Connection (Select One) (continued)

Gray Cast Iron (Types CS803, CS823, CS804, CS824 and CS854)

- ☐ 2 NPT***

Ductile Iron (Types CS800, CS803, CS820, CS823 and CS850)

- ☐ 1-1/4 NPT***
- ☐ 1-1/2 NPT***
- ☐ 2 NPT***
- ☐ Rp 1-1/4***
- ☐ Rp 1-1/2***
- ☐ Rp 2***
- ☐ NPS 2 / DN 50, CL125 FF / CL150 FF***
  - *Face-to-face dimension:*
    - ☐ 7.5 in. / 191 mm
    - ☐ 10 in. / 254 mm
    - ☐ 10.5 in. / 267 mm
- ☐ NPS 2 / DN 50, PN 10/16***
  - *Face-to-face dimension:*
    - ☐ 7.5 in. / 191 mm
    - ☐ 10 in. / 254 mm

Ductile Iron (Types CS804, CS824 and CS854)

- ☐ 1-1/2 NPT***
- ☐ 2 NPT***
- ☐ Rp 2***
- ☐ NPS 2 / DN 50, CL125 FF / CL150 FF***
  - *Face-to-face dimension:*
    - ☐ 10 in. / 254 mm
    - ☐ 10.5 in. / 267 mm
- ☐ NPS 2 / DN 50, PN 10/16***(1)

WCC Steel (Types CS800, CS803, CS820, CS823 and CS850)

- ☐ 1-1/4 NPT***
- ☐ 1-1/2 NPT***
- ☐ 2 NPT***
- ☐ Rp 1-1/4***
- ☐ Rp 1-1/2***
- ☐ Rp 2***
- ☐ NPS 2 / DN 50, CL150 RF***(1)
- ☐ NPS 2 / DN 50, PN 10/16***(1)

WCC Steel (Types CS804, CS824 and CS854)

- ☐ 1-1/2 NPT***
- ☐ 2 NPT***
- ☐ Rp 2***
- ☐ NPS 2 / DN 50, CL150 RF***(1)
- ☐ NPS 2 / DN 50, PN 10/16***(1)

1. 10 in. / 254 mm face-to-face dimension

-continued-

Ordering Guide (continued)

Outlet Pressure Range (See Table 4) (Select One)

- ☐ 3.5 to 6 in. w.c. / 9 to 15 mbar, Red
- ☐ 5.5 to 8.5 in. w.c. / 13 to 21 mbar, Black
- ☐ 5.5 to 8.5 in. w.c. / 13 to 21 mbar, Brown (Use with Enhanced Low Inlet (LIN) Option)
- ☐ 8 to 12 in. w.c. / 20 to 30 mbar, Purple
- ☐ 10 to 16 in. w.c. / 25 to 40 mbar, White
- ☐ 14 to 30 in. w.c. / 35 to 75 mbar, Dark Green
- ☐ 1 to 2.5 psig / 69 to 170 mbar, Dark Blue
- ☐ 1.5 to 3.5 psig / 100 to 241 mbar, Orange
- ☐ 2.5 to 5.5 psig / 170 to 380 mbar, Yellow
- ☐ 5 to 10 psig / 345 to 690 mbar, Green with White Stripe

Orifice Size (Select One)

Types CS800, CS804, CS820, CS824, CS850 and CS854

- ☐ 1/4 in. / 6.4 mm
- ☐ 3/8 in. / 9.5 mm
- ☐ 1/2 in. / 13 mm
- ☐ 5/8 in. / 16 mm
- ☐ 3/4 in. / 19 mm
- ☐ 7/8 in. / 22 mm
- ☐ 1 in. / 25 mm
- ☐ 1-3/8 in. / 34.9 mm

Types CS803 and CS823

- ☐ 1/4 in. / 6.4 mm
- ☐ 3/8 in. / 9.5 mm
- ☐ 1/2 in. / 13 mm
- ☐ 5/8 in. / 16 mm
- ☐ 3/4 in. / 19 mm
- ☐ 7/8 in. / 22 mm
- ☐ 1 in. / 25 mm

Types CS805, CS825, CS855, CS806, CS826 and CS856

- ☐ 3/8 in. / 9.5 mm
- ☐ 1/2 in. / 13 mm
- ☐ 5/8 in. / 16 mm
- ☐ 3/4 in. / 19 mm
- ☐ 7/8 in. / 22 mm

Body Orientation (Select One, see Figure 19)

- ☐ Position 1 **(standard)*** **
- ☐ Position 2***
- ☐ Position 3***
- ☐ Position 4***

Vent Orientation (Select One, see Figure 19)

- ☐ Position C***
- ☐ Position D **(standard)*** **
- ☐ Position E***
- ☐ Position F***

True-Monitor™ Control Pressure Range (See Tables 6 and 7) (Select One)

CS803 and C823 Series

- ☐ 12 to 21 in. w.c. / 30 to 52 mbar
- ☐ 18 to 30 in. w.c. / 45 to 75 mbar
- ☐ 26 to 40 in. w.c. / 65 to 99 mbar
- ☐ 1.4 to 2.9 psig / 97 to 200 mbar
- ☐ 2.6 to 3.7 psig / 179 to 255 mbar
- ☐ 3.6 to 6 psig / 248 to 414 mbar
- ☐ 5.1 to 7.5 psig / 352 to 517 mbar

Slam-Shut Trip Pressure Setting

CS804, CS824 and CS854 Series

(Select one if applicable and specify setpoint/s, see Tables 10 and 11)

- ☐ **Overpressure Protection Only (OPSO)**
  Supply setpoint required_____
- ☐ **Overpressure and Underpressure Protection (OPSO/UPSO)**
  Supply overpressure setpoint required
  _____
  Supply underpressure setpoint required
  _____

Options (Select all that apply)

- ☐ **Enhanced Low Inlet Pressure Flow Performance**
  Choose this option for enhanced flow performance for low inlet pressure systems, up to 25 psig / 1.7 bar. This option applies to the 5.5 to 8.5 in. w.c. / 13 to 21 mbar spring range when combined with 2 in. threaded or flanged bodies only.
- ☐ **Low Relief Start-to-Discharge (STD) Spring**
  This option provides a relief start-to-discharge range of 7 to 14 in. w.c. / 17 to 35 mbar above setpoint for the Type CS800IR or CS800IQ with a spring range of up to 10 to 16 in. w.c. / 25 to 40 mbar.
- ☐ **Closing Cap and Setpoint Seal Wire**

Ordering Guide (continued)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Speed of regulator response, in order: • Direct-operated • Two-path pilot-operated • Unloading pilot-operated • Control valve Note: Although direct-operated regulators give the fastest response, all types provide quick response.

CSB400 Series

Commercial/Industrial Pressure Reducing Regulators

FISHER

Introduction

The CSB400 Series direct-operated, spring-loaded regulators have been engineered to fit a multitude of pressure-reducing applications including commercial and industrial installations. This flexibility is provided by the numerous body sizes and end connections, outlet pressure settings, as well as the option for internal, external or dual pressure registration. In addition to application flexibility, the CSB400 Series offers multiple overpressure protection options to meet your demands on application requirements.

Body Sizes and End Connection Styles

See Table 3

Pressure Registration

Internal, External or Dual (Internal and External)

Operating Pressure Ranges

See Table 3

Regulator Type

Differential Strength (DS)

Operating Temperature (TS)

-20 to 66°C / -4 to 150°F

Orifice Size

11/16 in. / 17.5 mm

Maximum Inlet Pressure Ratings

Regulator: See Table 6
Integral Monitor Module: See Table 7
Slam-Shut Module: See Table 8

Maximum Outlet Pressures

Emergency: 58 psig / 4.0 bar
To Avoid Internal Parts Damage:
All other Types: 5.0 psig / 0.34 bar above outlet pressure setting
Type CSB450: 14.5 psig / 1 bar above outlet pressure setting
Operating: 43.5 psig / 3.0 bar

Accuracy Class

AC 5/10

Lockup Class

Up to SG10

Spring Case Vent Connection

1 NPT

Failure Mode

Fail Open (FO)

PED Conformity Statement and Information

See Table 5

Approximate Shipping Weight

With Threaded Body:
Type CSB400: 9 lbs / 4 kg
Type CSB403: 20 lbs / 9 kg
Type CSB404: 11 lbs / 5 kg
With Flanged Body:
Add 9 lbs / 4 kg to weights listed

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com



Figure 1. *CSB400 Series Pressure Reducing Regulator*

Features

- **Integral True Monitor Option**
- **Slam-Shut Option**
- **Ductile Cast Iron and WCC Steel Bodies Available**
- **Wide Variety of Body Sizes and End Connections**
- **No Special Tools for Pressure Adjustment and Orifice Removal**

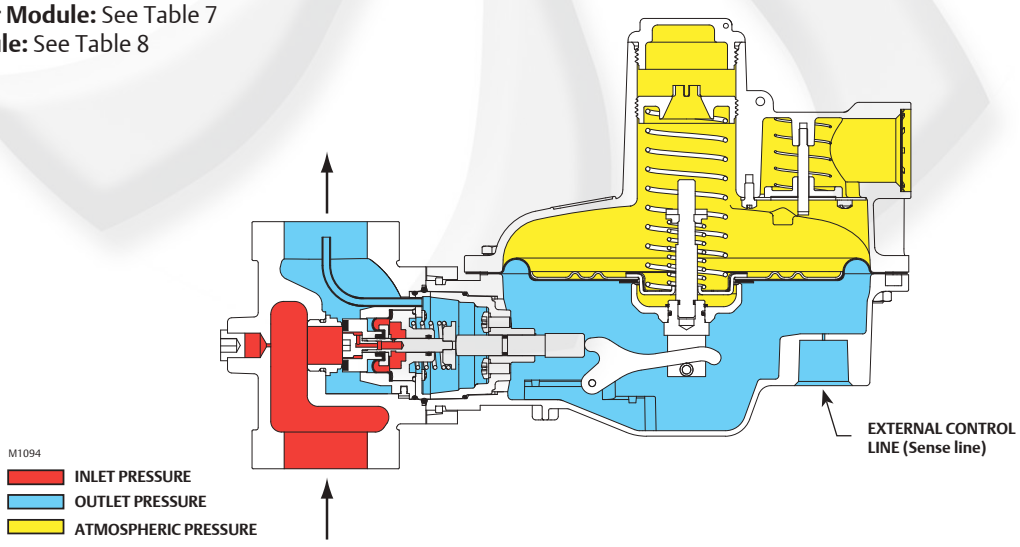


Figure 2. *Type CSB400ET with External Pressure Registration and Token Relief Operational Schematic*

EMERSON. Process Management

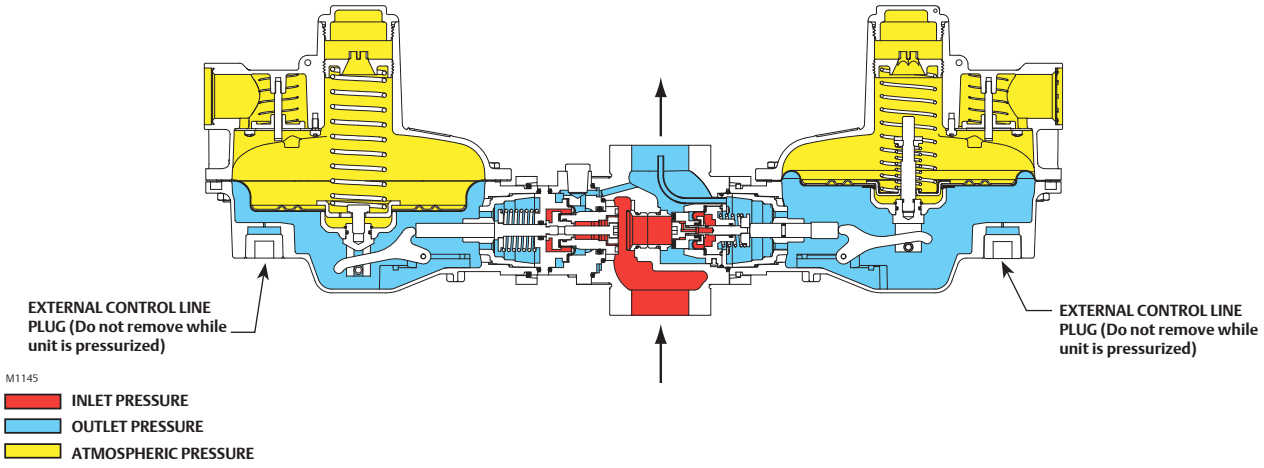


Figure 3. *Type CSB403IT with True Monitor, Internal Pressure Registration and Token Relief Operational Schematic*

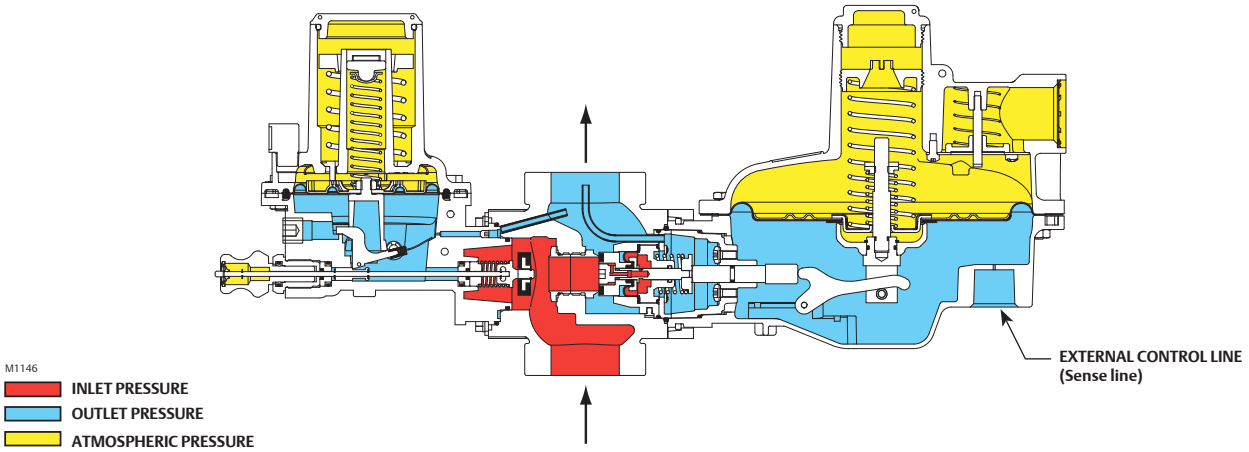


Figure 4. *Type CSB404ET with Slam-Shut Module, External Pressure Registration and Token Relief Operational Schematic*

Table 1. Available Configurations

TYPE NUMBER								OPTION
C	S	B	4					**PRESSURE CONSTRUCTION AND UPSTREAM MONITOR APPLICATION**
				0				Low Pressure Applications *(Outlet Pressure: 7 to 40 in. w.c. / 17 to 100 mbar)*
				1				Low Pressure, Upstream Monitoring Applications[1][3] *(Outlet Pressure: 7 to 40 in. w.c. / 17 to 100 mbar)*
				2				Medium Pressure Applications *(Outlet Pressure: 40 to 208 in. w.c. / 100 to 517 mbar)*
				3				Medium Pressure, Upstream Monitoring Applications[1][3] *(Outlet Pressure: 40 to 208 in. w.c. / 100 to 517 mbar)*
				5				High Pressure Applications[2] *(Outlet Pressure: 7 to 43.5 psig / 0.50 to 3.0 bar)*
					0			**OVERPRESSURE PROTECTION**
					0F			Without Overpressure Protection Module
					3			Low Temperature Capability, Without Overpressure Protection Module
					3F			With Integral True-Monitor™ Module[4]
					4			Low Temperature Capability, With Integral True-Monitor Module[4]
					4F			With Type VSX4 Slam-shut Module[5]
						D		Low Temperature Capability, With Type VSX4 Slam-shut Module[5]
						E		**PRESSURE REGISTRATION**
						I		Dual Registration (Best Solution for Quick Changing Loads)
								External Registration
							N	Internal Registration
							T	**RELIEF**
								No Relief
								Internal Token Relief

Example: Type number **CSB424DT:** CSB400 Series regulator constructed for medium pressure applications, with Type VSX4 slam-shut module, Dual pressure registration and Internal Token relief.

1. Not available with Integral True-Monitor option.
2. Not available with Integral True-Monitor or Token Relief option.
3. Available with External Pressure Registration only.
4. Reference Instruction Manual D103126X012 for information regarding the Type TM600 Integral True-Monitor module.
5. Reference Instruction Manual D103127X012 for information regarding the Type VSX4 Slam-shut module.

Table 2. Construction Material

CSB400 SERIES MAIN VALVE ACTUATOR							
Body	**Body O-ring**	**Closing Cap**	**Adjusting Screw**	**Relief Valve Seat**	**Diaphragm and Disk**	**Control Spring**	**Relief Valve Spring**
Ductile Cast Iron and WCC Steel	Nitrile (NBR)	Aluminum	Aluminum	Aluminum	Nitrile (NBR)	302 Stainless steel	302 Stainless steel

TM600 SERIES TRUE MONITOR ACTUATOR						
Diaphragm Case, Spring Case, Diaphragm Plate and Valve Stem	**Diaphragm and Disk**	**Control Spring**	**Vent Screen**	**Vent Screen Retainer**	**Closing Cap**	**Adjusting Screw**
Aluminum	Nitrile (NBR)	302 Stainless steel	18-8 Stainless steel	Stainless steel	Aluminum	Aluminum

TYPE VSX-4 SLAM-SHUT DEVICE					
Diaphragm Case, Spring Case, Diaphragm Plate and Valve Stem	**Control Spring**	**Vent Screen**	**Vent Screen Retainer**	**Closing Cap**	**Adjusting Screw**
Aluminum	Music Wire or 302 Stainless steel	18-8 Stainless steel	Zinc-plated steel	Aluminum	Aluminum

Table 3. Body Sizes, Material, End Connections and Pressure Rating

BODY MATERIAL	INLET SIZE		OUTLET SIZE		END CONNECTION	FACE-TO-FACE DIMENSION		BODY PRESSURE RATING	
	NPS	DN	NPS	DN		In.	mm	psig	bar
Ductile Iron	1	25	1	25	NPT	4	100	290	20
	1-1/4	32	1-1/4	32		4.5	114		
	1-1/2	40	1-1/2	40		4.5	114		
	2	50	2	50		5	127		
	1	25	1	25	Rp	4	100		
	1	25	1-1/4	32		4.5	114		
	1-1/4	32	1-1/4	32		4.5	114		
	1-1/2	40	1-1/2	40		4.5	114		
	2	50	2	50		5	127		
	2	50	2	50	CL125 FF/CL150 FF	10	254		
					PN 10/16	10	254	232	16
	1-1/2[1]	40[1]	1-1/2[1]	40[1]	PN 16 Slip-On	7.24	184	232	16
	1	25	2-1/4	57	Rp x GAZ	4.1	105	290	20
Steel	1	25	1	25	NPT	4	100		
	1-1/4	32	1-1/4	32		4.5	114		
	1-1/2	40	1-1/2	40		4.5	114		
	1	25	1	25	Rp	4	100		
	1-1/4	32	1-1/4	32		4.5	114		
	1-1/2	40	1-1/2	40		4.5	114		

1. Uses Rp 1-1/2 x 1-1/2 threaded body with PN 16 slip-on flanges.

Table 4. CSB400 Series Primary Regulator Outlet Pressure Range

TYPE	OPERATING PRESSURE RANGES, W_d		PART NUMBER	SPRING COLOR	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
	In. w.c.	mbar			In.	mm	In.	mm
CBS400, CSB400F, CSB403, CSB403F, CSB404, CSB404F, CSB410 and CSB414	6.8 to 9.6	17 to 24	GE30191X012	Pink	0.080	2.03	6.00	152
	9.6 to 14	24 to 35	GE43955X012	Orange Stripe	0.086	2.19	4.35	110
	14 to 24.1	35 to 60	GE30201X012	Dark Green	0.127	3.23	4.35	110
	21.7 to 40	54 to 100	GE30202X012	Tan	0.112	2.85	5.00	127
CSB420, CSB420F, CSB423, CSB423F, CSB424, CSB424F, CSB430 and CSB434	1.45 to 2.3 psig	100 to 160	GE35081X012	Purple Stripe	0.152	3.86	4.90	124
	2.0 to 4.4 psig	138 to 300	GE30192X012	Dark Blue	0.168	4.27	4.65	118
	4 to 7.5 psig	276 to 517	GE33121X012	Red	0.194	4.93	4.65	118
CSB450 and CSB454	7.3 to 14.5 psig	0.50 to 1.00 bar	GE30203X012	Light Blue	0.220	5.59	4.00	102
	14.5 to 43.5 psig	1.00 to 3.0 bar	GE30204X012	Light Green	0.265	6.73	3.95	100

Table 5. PED Information

TYPE	DESCRIPTION	PED CATEGORY	FLUID GROUP
CSB400, CSB410, CSB420, CSB430, CSB450	Base regulator	I	1
CSB403, CSB423	Regulator with Integral Monitor module	IV	
CSB404, CSB414, CSB424, CSB434, CSB454	Regulator with Slam-Shut module	IV	

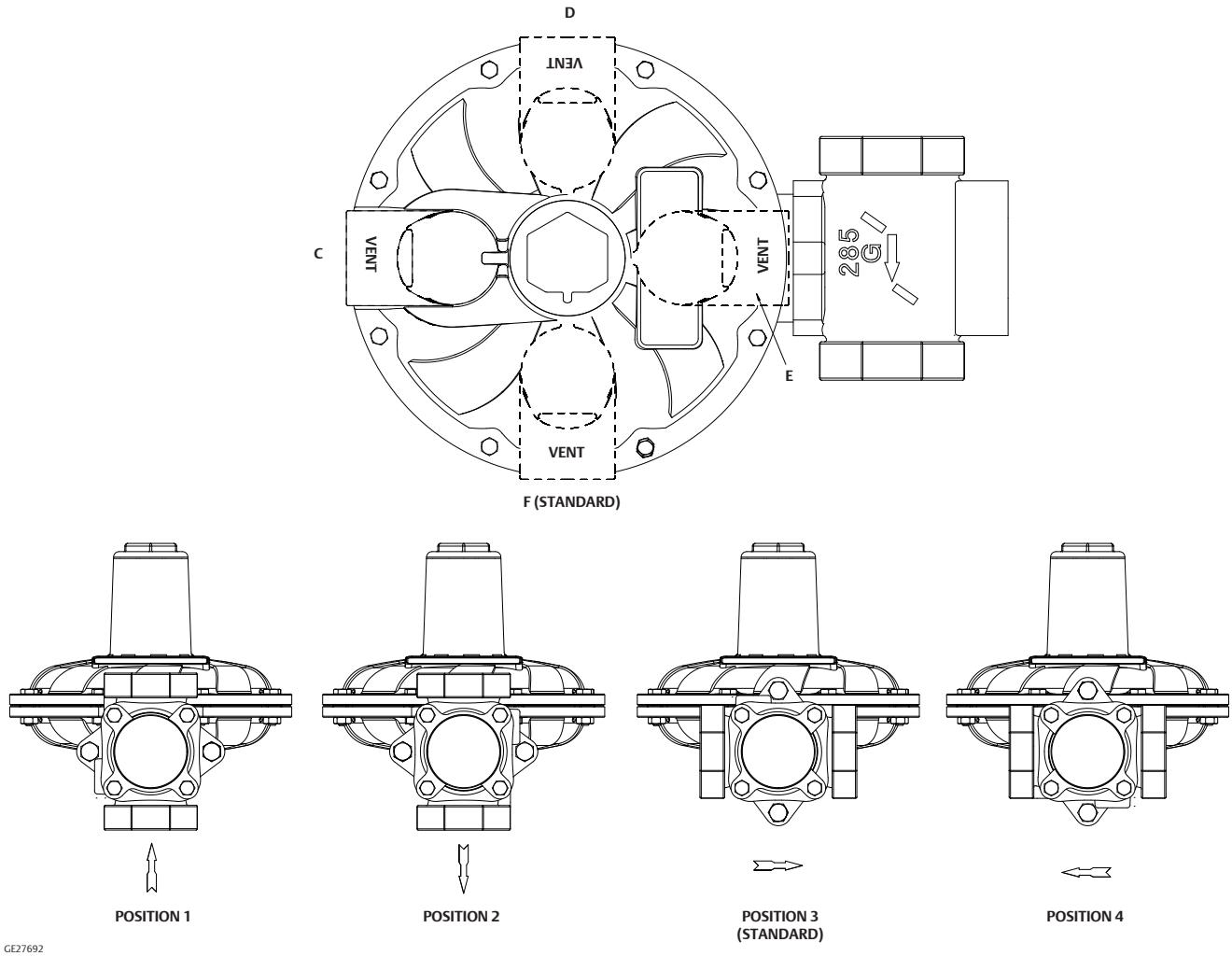


Figure 5. *CSB400 Series Spring Case Vent and Body Orientation*

Table 6. Maximum Inlet Pressure Ratings and Flow Coefficients

TYPE	MAXIMUM ALLOWABLE PRESSURE[1] / MAXIMUM EMERGENCY INLET PRESSURE		MAXIMUM OPERATING INLET PRESSURE[1]	
	P_S		P_{umax}	
	psig	bar	psig	bar
CSB400, CSB400F, CSB404 and CSB404F	58	4.0	58	4.0
CSB420, CSB420F, CSB424 and CSB424F				
CSB450 and CSB454				
CSB410 and CSB414				
CSB403, CSB403F, CSB423 and CSB423F				
CSB403 and CSB423				

1. For the Integral Strength (IS) version, the maximum value of P_S and P_{umax} should be similar to the PSD used for the Differential Strength (DS) version.

Table 7. Integral Monitor Outlet Pressure Range

PRIMARY REGULATOR Setpoint		Spring Color	INTEGRAL MONITOR SETPOINT		MAXIMUM OUTLET PRESSURE THAT THE INTEGRAL MONITOR WILL ALLOW AT NO FLOW CONDITION (LOCKUP)		INTEGRAL MONITOR SPRING PART NUMBER	SPRING COLOR
In. w.c.	mbar		In. w.c.	mbar	psi	bar		
8.0	20	Pink	14	35	1	0,07	GE30189X012	Blue
14.1	35	Dark Green	21	52	1	0,07	GE30196X012	Green
1 psi	0.07 bar	Tan	1.5 psi	0.10 bar	2	0,14	GE30225X012	Orange
2 psi	0.14 bar	Purple Stripe	2.5 psi	0.17 bar	3	0,21	GE30190X012	Black
3 psi	0.21 bar	Dark Blue	4 psi	0.28 bar	5	0,35	GE30197X012	Yellow
5 psi	0.35 bar	Red	6 psi	0.41 bar	7	0,48	GE33121X012	Red

Table 8. Slam-Shut Module Spring Range

REGULATOR					SAFETY SHUTOFF DEVICE									
Type	Nominal Setpoint		Spring Range		Overpressure Shutoff (OPSO)					Underpressure Shutoff (UPSO)				
					Nominal Set		Range		Spring Part Number	Nominal Set		Range		Spring Part Number
	psig	bar	psig	bar	psig	bar	psig	bar		psig	bar	psig	bar	
CSB404, CSB404F, CSB414	0.29	0.02	0.25 to 0.35	0.017 to 0.024	0.62	0.043	0.40 to 0.90	0.03 to 0.06	GF02167X012	0.15	0.01	0.07 to 0.17	0.005 to 0.012	T14168T0012
	0.30	0.021												
	0.39	0.027	0.35 to 0.87	0.024 to 0.06	0.65	0.045								
	0.44	0.03			0.87	0.06				0.32	0.022			
	0.50	0.034			1.00	0.07	0.70 to 1.90	0.05 to 0.13	GF02168X012					
	0.70	0.05			1.70	0.12				0.44	0.03	0.15 to 1.10	0.01 to 0.08	T14169T0012
	0.87	0.06												
	1.10	0.08	0.78 to 1.50	0.05 to 0.10	2.00	0.14	1.40 to 3.90	0.097 to 0.27	GF02169X012	0.58	0.04			
	1.50	0.10			2.30	0.16				0.73	0.05			
CSB424, CSB424F, CSB434	2.20	0.15	1.50 to 2.30	0.10 to 0.16	3.60	0.25			GF02170X012	1.00	0.07	0.36 to 2.30	0.03 to 0.16	T14170T0012
	2.30	0.16								1.70	0.12			
	4.40	0.30	2.30 to 4.40	0.16 to 0.30	6.40	0.44	3.80 to 8.70	0.26 to 0.60	GF02171X012	2.60	0.18	1.50 to 7.30	0.10 to 0.50	FA142869X12
	7.30	0.50	4.00 to 7.50	0.28 to 0.52	13.1	0.90	5.80 to 16.0	0.40 to 1.1	GF02172X012	3.60	0.25			FA142869X12
CSB454	14.5	1.0	7.30 to 14.5	0.50 to 1.0	21.0	1.4	11.6 to 23.2	0.80 to 1.6	GF02173X012	5.10	0.35	1.50 to 10.8	0.10 to 0.75	T14171T0012
	17.4	1.2	14.5 to 43.5	1.0 to 3.0	29.0	2.0	16.0 to 29.0	1.1 to 2.0	GF02171X012	10.2	0.70	7.30 to 29.0	0.50 to 2.0	FA142869X12
	21.6	1.5			36.3	2.5	29.0 to 50.8	2.0 to 3.5	GF02172X012	14.5	1.0			
	29.0	2.0			43.5	3.0								
	43.5	3.0			58.0	4.0	40.6 to 79.8	2.8 to 5.5	GF02173X012	29.0	2.0	7.30 to 40.6	0.50 to 2.8	T14171T0012

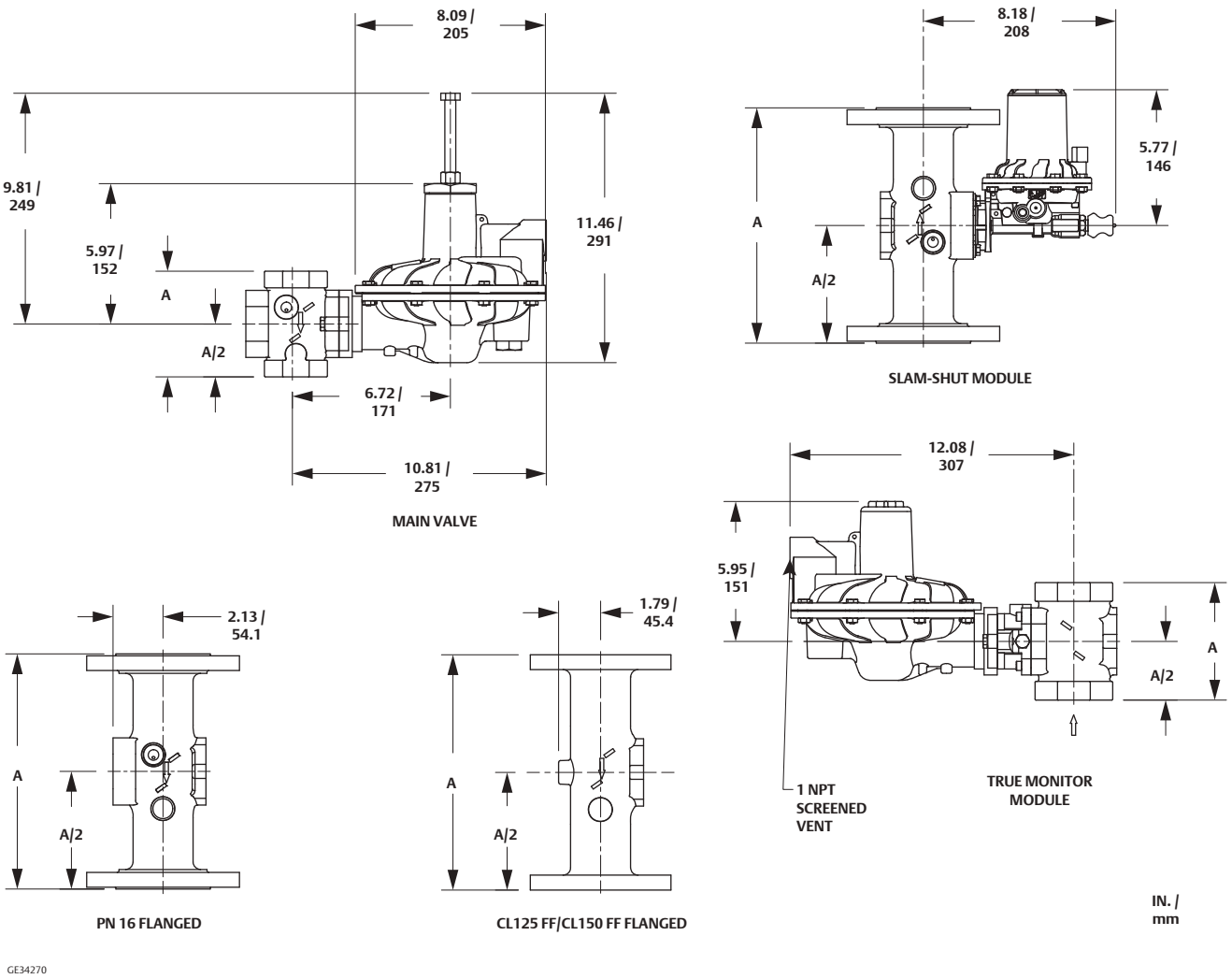


Figure 6. *CSB400 Series Dimensions*

Table 9. Dimension

BODY SIZE				DIMENSION							
Inlet		Outlet		NPT, ISO 7/1		ISO 228/GAZ		CL125 FF/CL150 FF		PN 16	
NPS	DN	NPS	DN	in.	mm	in.	mm	in.	mm	in.	mm
1	25	1	25	4	100	----		----		----	
1-1/4	32	1-1/4	32	4.49	114	----		----		----	
1-1/2	40	1-1/2	40	4.49	114	----		----		----	
1	25	1	25	3.94	100	----		----		----	
		2-1/4	57	----		4.09	104	----		----	
2	50	2	50	5	127	----		10	254	10	254

Ordering Guide

Type (See Table 1 for Construction details) (Select One)

Stand-alone Regulator
- ☐ CSB400IN
- ☐ CSB400IT
- ☐ CSB400DT
- ☐ CSB400DN
- ☐ CSB400ET
- ☐ CSB400EN
- ☐ CSB410EN
- ☐ CSB420IN
- ☐ CSB420IT
- ☐ CSB420DN
- ☐ CSB420DT
- ☐ CSB420EN
- ☐ CSB420ET
- ☐ CSB430EN
- ☐ CSB450IN
- ☐ CSB450DN
- ☐ CSB450EN

With Integral True-Monitor™ Module
- ☐ CSB403IN
- ☐ CSB403IT
- ☐ CSB403DT
- ☐ CSB403DN
- ☐ CSB403ET
- ☐ CSB403EN
- ☐ CSB423IN
- ☐ CSB423IT
- ☐ CSB423DN
- ☐ CSB423DT
- ☐ CSB423EN
- ☐ CSB423ET

With Type VSX4 Slam-Shut Module
- ☐ CSB454IN
- ☐ CSB454DN
- ☐ CSB454EN
- ☐ CSB404IN
- ☐ CSB404IT
- ☐ CSB404DT
- ☐ CSB404DN
- ☐ CSB404ET
- ☐ CSB404EN
- ☐ CSB414EN
- ☐ CSB424IN
- ☐ CSB424IT
- ☐ CSB424DN
- ☐ CSB424DT
- ☐ CSB424EN
- ☐ CSB424ET
- ☐ CSB434EN

Body Size, Material and End Connection (Select One)

Ductile Cast Iron (Types CSB400, CSB420 and CSB450)
- ☐ 1 NPT***
- ☐ 1-1/4 NPT***
- ☐ 1-1/2 NPT***
- ☐ 2 NPT***
- ☐ Rp 1 ISO 7/1***
- ☐ Rp 1-1/4 ISO 7/1***
- ☐ Rp 1-1/2 ISO 7/1***
- ☐ Rp 2 ISO 7/1***
- ☐ NPS 2 / DN 50, CL125 FF/ CL150 FF***
- ☐ NPS 2 / DN 50, PN 10/16***
- ☐ Rp 1 x G 2-1/4 Gaz***

Steel (Types CSB400, CSB420 and CSB450)
- ☐ 1 NPT***
- ☐ 1-1/2 NPT***
- ☐ 1-1/2 ISO 7/1***
- ☐ Rp 1 ISO 7/1***
- ☐ Rp 1-1/4 ISO 7/1***
- ☐ Rp 1-1/2 ISO 7/1***

Outlet Pressure Range (Select One)
- ☐ 6.8 to 9.6 in. w.c. / 17 to 24 mbar, Pink***
- ☐ 9.6 to 14 in. w.c. / 24 to 35 mbar, Orange Stripe***
- ☐ 14.5 to 24 in. w.c. / 35 to 60 mbar, Dark Green***
- ☐ 21.7 to 40 in. w.c. / 54 to 100 mbar, Tan***
- ☐ 1.45 to 2.3 psig / 100 to 160 mbar, Purple Stripe***
- ☐ 2.0 to 4.4 psig / 138 to 300 mbar, Dark Blue***
- ☐ 4 to 7.5 psig / 276 to 517 mbar, Red***
- ☐ 7.3 to 14.5 psig / 0.50 to 1.00 bar, Light Blue***
- ☐ 14.5 to 43.5 psig / 1.00 to 3.0 bar, Light Green***

Body Orientation (For the Types CSB403 and CSB404, choose the body orientation of the primary regulator only. The Integral Monitor and Slam-Shut spring barrel will be oriented in the same direction as the Primary Regulator spring barrel) (Select One)
- ☐ Position 1***
- ☐ Position 2***
- ☐ Position 3 **(standard)*****
- ☐ Position 4***

- continued -

Ordering Guide (continued)

Vent Orientation (For the Types CSB403 and CSB404, choose the vent orientation of the primary regulator only. The Integral Monitor and Slam-Shut vent will be oriented to point in the same direction as the Primary Regulator) (Select One)

- ☐ Position C* * *
- ☐ Position D* * *
- ☐ Position E* * *
- ☐ Position F **(standard)*** * *

Slam-Shut Trip Pressure Setting
(Select One if applicable)

- ☐ Overpressure (OPSO) trip only (supply high pressure trip pressure) Indicate trip pressure _____
- ☐ Over and Underpressure (OPSO / UPSO) trip (supply high and low trip pressure) Indicate trip points _____

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

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Regulators Quick Order Guide	
* * *	Readily Available for Shipment
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*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired?	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

A disk with a cookie cut appearance probably means you had an overpressure situation. Thus, investigate further.

CSB600 Series

Commercial/Industrial Pressure Reducing Regulators

FISHER

Introduction

The CSB600 Series direct-operated, spring-loaded regulators have been engineered to fit a multitude of pressure reducing applications including commercial and industrial installations. This flexibility is provided by the numerous body sizes and end connections, outlet pressure settings, as well as the option for internal and external pressure registration. In addition to application flexibility, the CSB600 Series offers multiple overpressure protection options to meet your application requirements.

Available Configurations

See Table 1

Body Sizes, Materials, End Connections and Pressure Ratings

See Table 3

Inlet Pressure Ratings

See Tables 4 and 5

Maximum Outlet Pressure

Emergency Casing:
Type CSB600/CSB620/CSB620F:
58 psig / 4.0 bar
Type CSB650:
72.5 psig / 5.0 bar

To Avoid Internal Parts Damage:
Type CSB600/CSB620/CSB620F:
5 psig / 0.34 bar over set pressure
Type CSB650:
21.8 psig / 1.5 bar – not to exceed maximum emergency outlet

Operating: 72.5 psig / 5.0 bar

Outlet Pressure Ranges

0.11 to 72.5 psig / 7.5 to 5000 mbar
See Table 6

Orifice Size

1 in. / 25 mm

Flow and IEC Sizing Coefficients

See Table 5

Temperature Capabilities[1][2]

According to PED Standards:
-4 to 140°F / -20 to 60°C

Non-PED:
-22 to 151°F / -30 to 66°C

Spring Case Vent Connection

1 NPT

Spring Case Vent and Body Orientation

See Figure 4

Type VSX8 Slam-Shut Device

Maximum Inlet Pressure:
290 psig / 20 bar
Maximum Operating Inlet Pressure:
232 psig / 16 bar

Approximate Weights

With Threaded body
Type CSB600: 9 lbs / 4.1 kg
Type CSB604: 11 lbs / 5 kg

With Flanged body
Add 9 lbs / 4.1 kg to weights listed

Designed, Tested and Evaluated Consistent With:

ANSI B16, ASME Section 8, ASTM B117 (Corrosion Resistance), EN 334 and EN 14382

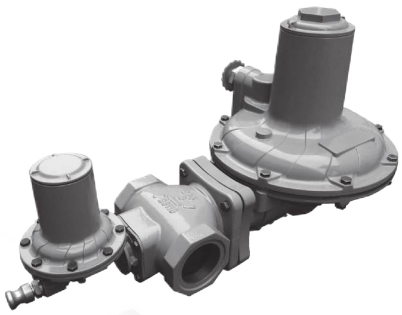
Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Ductile Iron and WCC Steel Bodies Available**
- **Wide Variety of Body Sizes and End Connections**
- **With Type VSX8 Slam-Shut Option**
- **No Special Tools for Pressure Adjustment and Orifice Removal**



TYPE CSB604: CSB600 SERIES WITH TYPE VSX8 SLAM-SHUT

Figure 1. *Typical CSB600 Series Pressure Reducing Regulator*

1. Standard token relief set values listed in Table 7 are based on -4 to 140°F / -20 to 60°C.
2. Product has passed Emerson Process Management Regulator Technologies, Inc. testing for lockup, relief start-to-discharge and reseal down to -40°.

EMERSON
Process Management

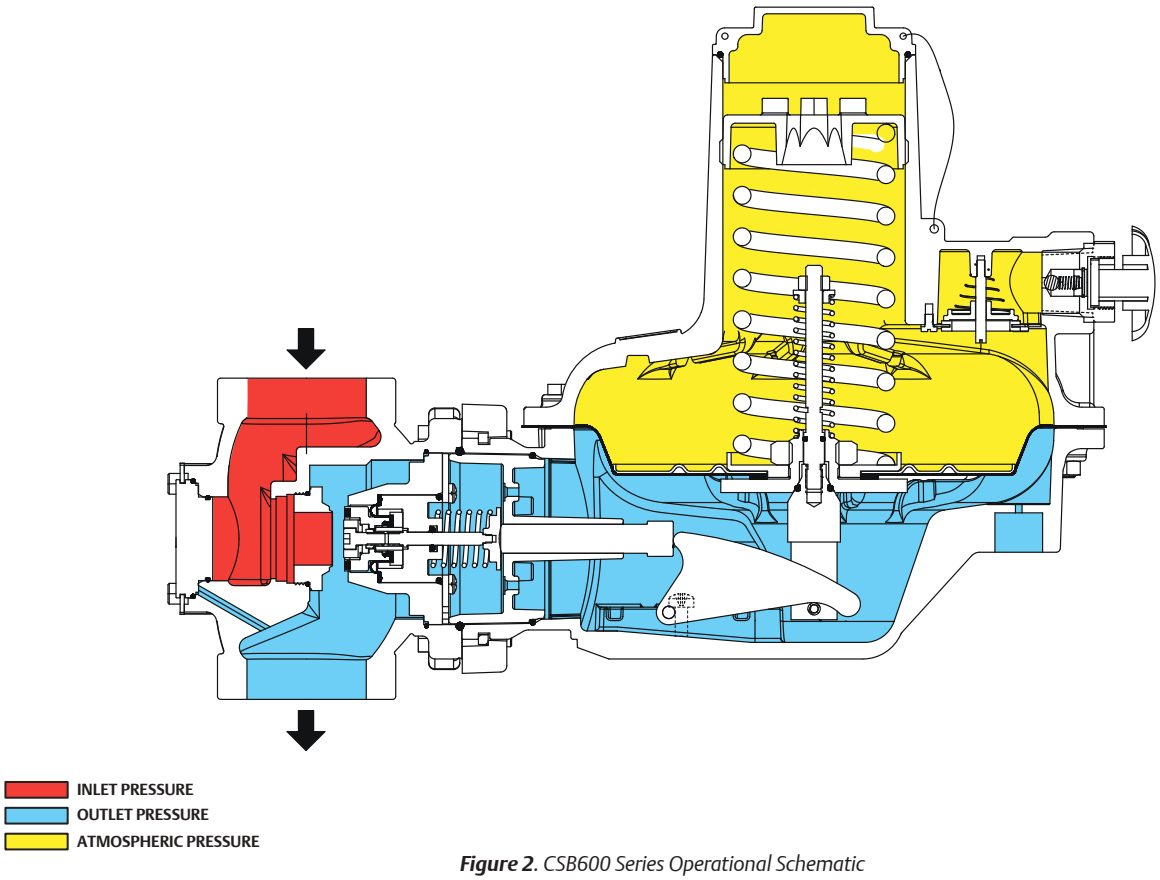


***Figure 2**. CSB600 Series Operational Schematic*

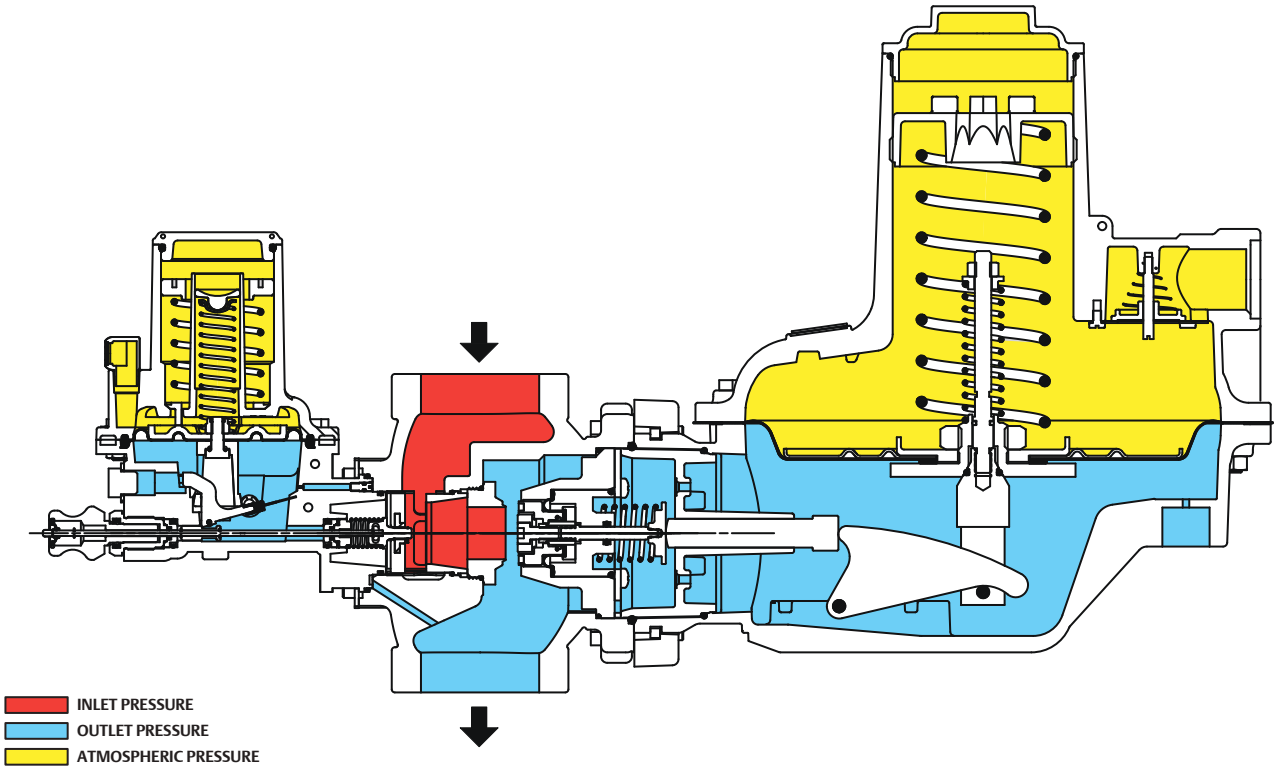


***Figure 3.** Type CSB604ET Externally Registered Regulator and Slam-Shut Operational Schematic*

Table 1. Available Configurations

TYPE NUMBER	OPTIONS
	FLOW CAPABILITY
CSB6	Low-Capacity Applications (1 in. / 25 mm orifice size)
	PRESSURE CONSTRUCTION
0	Low Pressure Applications *(Outlet Pressure: 0.11 to 1.89 psig / 7.5 to 130 mbar - Maximum Operating Inlet: 145 psig / 10 bar, Maximum Emergency Inlet Pressure: 174 psig / 12 bar, Lever: 2:1)*
2	Medium Pressure Applications *(Outlet Pressure: 1.45 to 11.9 psig / 100 to 820 mbar - Maximum Operating Inlet: 232 psig / 16 bar, Maximum Emergency Inlet Pressure: 290.1 psig / 20.0 bar, Lever 2:1)*[2]
5	High Pressure Applications *(Outlet Pressure: 10.2 to 72.5 psig / 700 mbar to 5 bar, Lever: 1:1) Maximum Operating Inlet: 232 psig / 16 bar, Maximum Emergency Inlet Pressure: 290.1 psig / 20.0 bar*
	OVERPRESSURE PROTECTION
0	Without Overpressure Protection Module
0F	Without Overpressure Protection Module *(Outlet Pressure: 0.30 and 4.35 psig / 21 and 300 mbar, GrDF version only)* Low Pressure Applications *(Maximum Operating Inlet: 87.02 psig / 6 bar, Maximum Emergency Inlet Pressure: 174 psig / 12 bar, Lever: 2:1)*
4	With Type VSX8 Slam-Shut Module[1]
4F	With Type VSX8 Slam-shut Module[1] *(Outlet Pressure: 0.30 and 4.35 psig / 21 and 300 mbar, GrDF version only)* Medium Pressure Applications - *Maximum Operating Inlet: 87.02 psig / 6 bar, Maximum Emergency Inlet Pressure: 174 psig / 12 bar, Lever 2:1)*[2]
	PRESSURE REGISTRATION
E	External
I	Internal
	RELIEF
N	None
T	Token Internal Relief

Example: Type number **CSB624ET:** CSB600 Series regulator constructed for medium pressure applications, with Type VSX8 slam-shut module, with External pressure registration and with Token relief.

1. Reference Instruction Manual D103127X012 for information regarding the Type VSX8 Slam-Shut Module.
2. The pressure/temperature limits in this Application Guide and any applicable standard or code limitation should not be exceeded.

Table 2. Construction Materials

CSB600 SERIES MAIN VALVE ACTUATOR			
Body	**Body O-ring, Diaphragm and Disk**	**Closing Cap, Adjusting Screw, Casing, Valve Stem, Orifice, Pusher Post and Relief Valve Seat**	**Control Spring and Relief Valve Spring**
Ductile Iron or WCC Steel	Nitrile (NBR)	Aluminum	Music Wire

TYPE VSX8 SLAM-SHUT DEVICE				
Casing, Valve Stem and Closing Cap	**Diaphragm and Disk**	**Vent Screen**	**Vent Screen Retainer**	**Control Spring**
Aluminum	Nitrile (NBR)	Stainless steel	Zinc-plated steel	Steel

Table 3. CSB600 Series Body Sizes, Material, End Connections and Pressure Ratings

BODY MATERIAL	BODY SIZE		END CONNECTION	FACE-TO-FACE DIMENSION		BODY PRESSURE RATING	
	NPS	DN		In.	mm	psig	bar
Ductile Iron	1-1/4	32	NPT	6.10	155	290	20
	1-1/2	40					
	2	50					
	1-1/4	32	Rp				
	1-1/2	40					
	2	50					
	2	50	CL125 FF / CL150 FF	7.5	191		
	2	50		10	254		
	2	50		10.5	267		
	2	50	PN 10/16	10	254	232	16
	2	50		7.5	191		
	1-1/4	32	PN 16 Slip-On	7.87	200		
	1-1/2	40		8.74	222		
WCC Steel	1-1/4	32	NPT	6.10	155	290	20
	1-1/2	40					
	2	50					
	1-1/4	32	Rp				
	1-1/2	40					
	2	50					
	2	50	CL150 RF	10	254	290	20
	2	50	PN 10/16			232	16

Table 4. Integral Strength (IS) Pressure Ratings

TYPE	MAXIMUM ALLOWABLE PRESSURE[1] / MAXIMUM EMERGENCY INLET PRESSURE		MAXIMUM OPERATING INLET PRESSURE[1]	
	P_s		P_{umax}	
	psig	bar	psig	bar
CSB600, CSB604, CSB600F and CSB604F	58	4	58	4
CSB620F and CSB624F				
CSB620 and CSB624				
CSB650 and CSB654	73	5	73	5

1. For the Integral Strength (IS version), the maximum value of P_s and P_{umax} should be similar to the P_{SD} used for the Differential Strength (DS) version.

Table 5. Differential Strength (DS) Pressure Ratings and Flow and Sizing Coefficients

TYPE	SPECIFIC MAXIMUM ALLOWABLE PRESSURE / MAXIMUM EMERGENCY OUTLET PRESSURE[1]		MAXIMUM EMERGENCY INLET PRESSURE[1]		MAXIMUM OPERATING INLET PRESSURE[1]		ORIFICE SIZE		FLOW COEFFICIENTS WIDE OPEN			IEC SIZING COEFFICIENT		
	P_{SD}		P_s		P_{umax}									
	psig	bar	psig	bar	psig	bar	In.	mm	C_g	C_v	C_1	X_T	F_D	F_L
CSB600 and CSB604	58	4	174	12	145	10	1	25	675	17.9	37.8	0.91	0.89	0.73
CSB600F and CSB604F					87	6								
CSB620F and CSB624F					87	6								
CSB620 and CSB624			290	20	232	16								
CSB650 and CSB654	73	5			232	16								

1. The pressure/temperature limits in this Application Guide and any applicable standard or code limitation should not be exceeded.

Table 6. CSB600 Series Primary Regulator Outlet Pressure Ranges

TYPE	OPERATING PRESSURE RANGE, W_d		PART NUMBER	SPRING COLOR	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
	psig	mbar			In.	mm	In.	mm
CSB600 and CSB604	0.11 to 0.24	7.5 to 16.5	GE30336X012	Silver	0.118	3.00	8.82	224
	0.23 to 0.40	15.8 to 27.5	ERSA01138A0	Red	0.138	3.50	10.39	264
	0.32 to 0.57	22.0 to 39.0	GE30338X012	Black Stripe	0.170	4.32	6.78	172
	0.46 to 0.73	32.0 to 50.0	GE30339X012	Purple	0.171	4.34	7.35	187
	0.61 to 1.03	42.0 to 71.0	GE30340X012	White Stripe	0.182	4.62	7.40	188
	0.87 to 1.89	60.0 to 130	ERSA03656A0	Dark Green	0.192	4.88	8.80	224
CSB600F and CSB604F	0.23 to 0.40	15.8 to 27.5	ERSA01138A0	Red	0.138	3.50	10.39	264
CSB620 and CSB624	1.45 to 1.89	100 to 130	ERSA03656A0	Dark Green	0.192	4.88	8.80	224
	1.52 to 3.77	105 to 260	ERSA03657A0	Blue	0.234	5.94	8.53	217
	3.05 to 5.51	210 to 380	GG06247X012	Pink	0.315	8.00	8.13	206
	4.64 to 8.70	320 to 600	ERSA01582A0	Red with White Stripe	0.343	8.71	6.97	177
	7.40 to 11.9	510 to 820	ERSA05055A0	Blue with White Stripe	0.394	10.0	7.13	181
CSB620F and CSB624F	3.92 to 4.79	270 to 330	ERAA11747A0	Pink Stripe	0.256	6.50	9.25	235
CSB650 and CSB654	10.2 to 17.4	700 to 1200	GE30345X012	Purple Stripe	0.354	9.00	8.87	225
	15.2 to 39.2	1050 to 2700	GE30346X012	Brown	0.433	11.0	8.88	226
	33.4 to 55.1	2300 to 3800	ERSA01125A0	Grey with Red Stripe	0.496	12.6	8.87	225
	46.4 to 72.5	3200 to 5000	ERSA01126A0	Grey with Orange Stripe	0.539	13.7	8.89	226

Table 7. CSB600 Series Regulator and Slam-Shut OPSO and UPSO Pressure Ranges

	REGULATOR										SLAM SHUT							
Type	Set Pressure Range		Factory Setpoint		Token Relief Set[1][2]		Available Token Relief Range Shown as a % of Regulator Setpoint		Minimum Required Difference Between Token Relief and OPSO Set		Standard OPSO Set Value[1], P_{dso}		OPSO Set Range as a % of Regulator Setpoint		Standard UPSO Set Value[1], P_{dsu}		UPSO Set Range as a % of Regulator Setpoint	
	psig	mbar	psig	mbar	psig	mbar	Min[2]	Max	psig	mbar	psig	mbar	Min	Max	psig	mbar	Min	Max
CSB604	0.11 to 0.24	7.5 to 16.5	0.15	10	0.25	17	170	215	0.12	8	0.61	42	420	520	----	----	----	----
			0.22	15	0.38	26							280	345				
	0.23 to 0.40	15.8 to 27.5	0.29	20	0.49	34	170	215	0.12	8	0.62	43	215	270	0.15	10	50	56
			0.30	21	0.52	36					0.65	45			0.16	11		
	0.32 to 0.57	22 to 39	0.39	27	0.59	41	150	160	0.15	10	0.74	51	190	200	0.2	14	50	60
			0.44	30	0.65	45					0.83	57			0.22	15		
	0.46 to 0.73	32 to 50	0.51	35	0.76	52.5	150	160	0.15	10	0.91	67	190	200	0.26	18	50	60
	0.61 to 1.03	42 to 71	0.73	50	1.02	70	140	158	0.23	16	1.31	90	180	200	0.36	25	50	70
			0.87	60	1.22	84					1.57	108			0.44	30		
	0.87 to 1.9	60 to 130	1.09	75	1.42	98	130	140	0.29	20	1.86	128	170	190	0.55	38	50	70
CSB604F	0.23 to 0.40	15.8 to 27.5	0.30	21	0.52	35.7	170	215	0.12	8	0.65	45	215	270	0.16	11	50	56
CSB624	1.45 to 1.9	100 to 130	1.45	100	1.89	130	130	140	0.29	20	2.46	170	170	190	0.73	50	50	70
	1.52 to 3.77	105 to 260	1.74	120	2.26	156	130	140	0.58	40	2.87	198	165	175	0.87	60	50	70
			2.18	150	2.83	195					3.6	248			1.09	75		
			2.32	160	3.02	208					3.83	264			1.16	80		
			2.9	200	3.63	250	125	140	0.73	50	4.35	300	150	165	1.45	100	50	70
	3.05 to 5.51	210 to 380	4.35	300	5.44	375	125	140	0.73	50	6.53	450	150	165	2.18	150	50	70
	4.64 to 8.7	320 to 600	7.3	500	9.07	625	125	140	0.87	60	10.2	700	140	180	3.63	250	50	70
	7.4 to 11.9	510 to 820	8.9	600	10.88	750	125	140	1.02	70	12.2	840	140	180	4.35	300	50	70
			10.9	750	13.6	937.5					15.2	1050			5.44	375		
CSB624F	3.92 to 4.79	270 to 330	4.35	300	5.44	375	125	140	0.73	50	6.53	450	150	165	2.18	150	50	70
CSB654	10.2 to 17.4	700 to 1200	14.5	1000	18.1	1250	125	140	1.02	70	20.3	1400	140	180	7.25	500	50	70
	15.2 to 39.2	1050 to 2700	17.4	1200	20.2	1392	116	120	1.16	80	20.9	1440	120	140	8.7	600	50	70
			21.8	1500	25.2	1740					26.1	1800			10.88	750		
			29	2000	33.6	2320					34.8	2400			14.5	1000		
	33.4 to 55.1	2300 to 3800	43.5	3000	50.5	3480	116	120	1.45	100	52.2	3600	120	140	21.76	1500	50	70
	46.4 to 72.5	3200 to 5000	58	4000	67.3	4640			1.45	100	69.6	4800			29.01	2000		

1. Standard factory set shown. Factory set is at the Minimum value of the range indicated. Range indicated is a percentage of Setpoint. Percentage indicated is based on the Set Pressure Range in which that setpoint resides. If non-standard sets are required, adherence must be made to constraints shown in Table 7, including Token Relief Set Range, OPSO and UPSO set range and Minimum Required difference between Token Relief and OPSO Set.
2. Minimum Token Relief values apply to -4 to 140°F / -20 to 60°C service temperatures. For service below -4°F / -20°C, add 0.12 psig 8 mbar to the minimum Token Relief value listed.

Example: *If a non-standard setpoint is needed, see the following example for the proper use of Table 7. Non-standard setpoint = 2 psig / 140 mbar, using the value presented above, the factory set of the token relief will be 1.3 x 2 = 2.6 psig / 182 mbar. The factory OPSO and UPSO set pressures are 165% and 50% of the non-standard setpoint, respectively. The resulting settings are: OPSO = 3.4 psig / 231 mbar and UPSO = 1 psig / 70 mbar.*

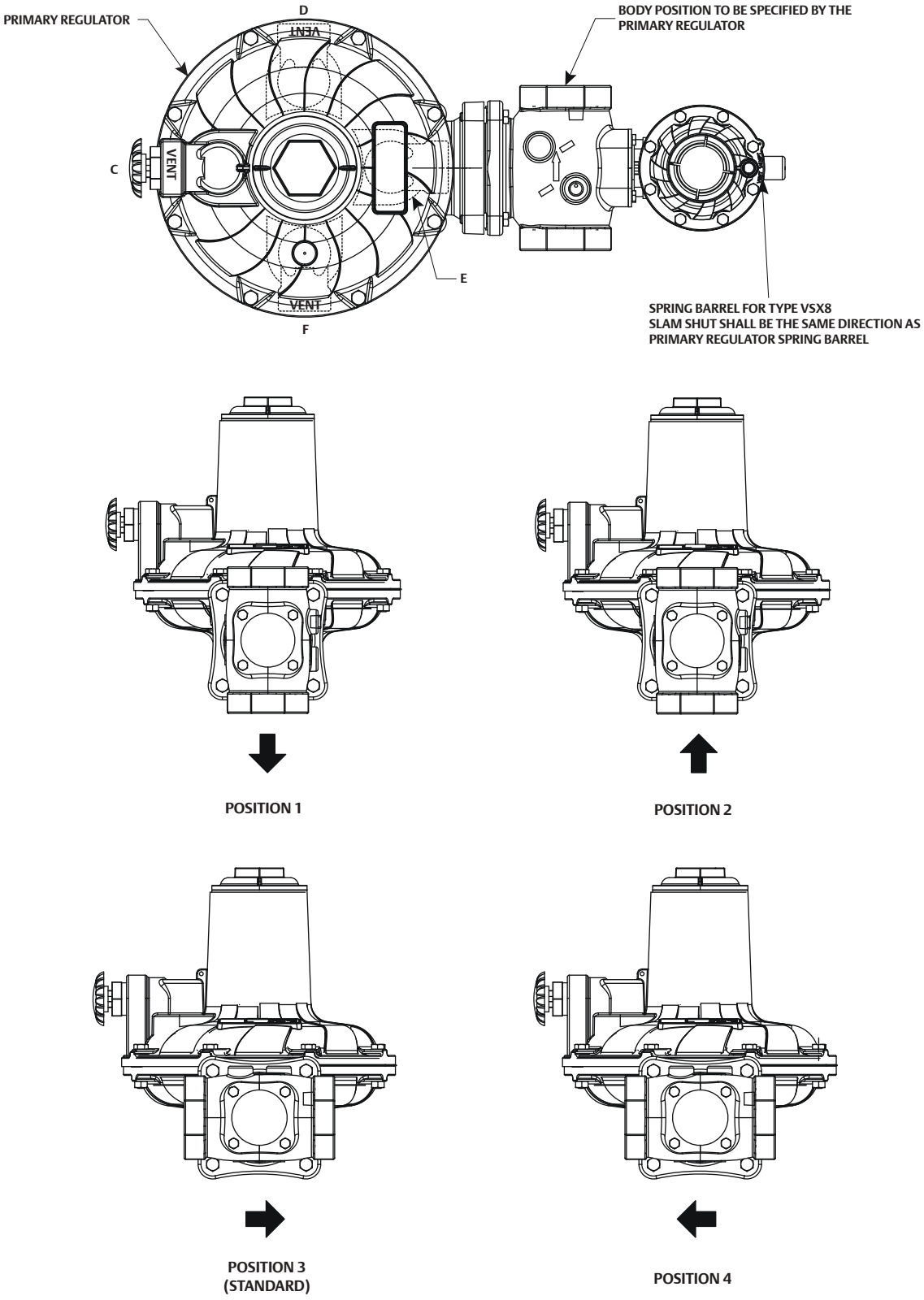
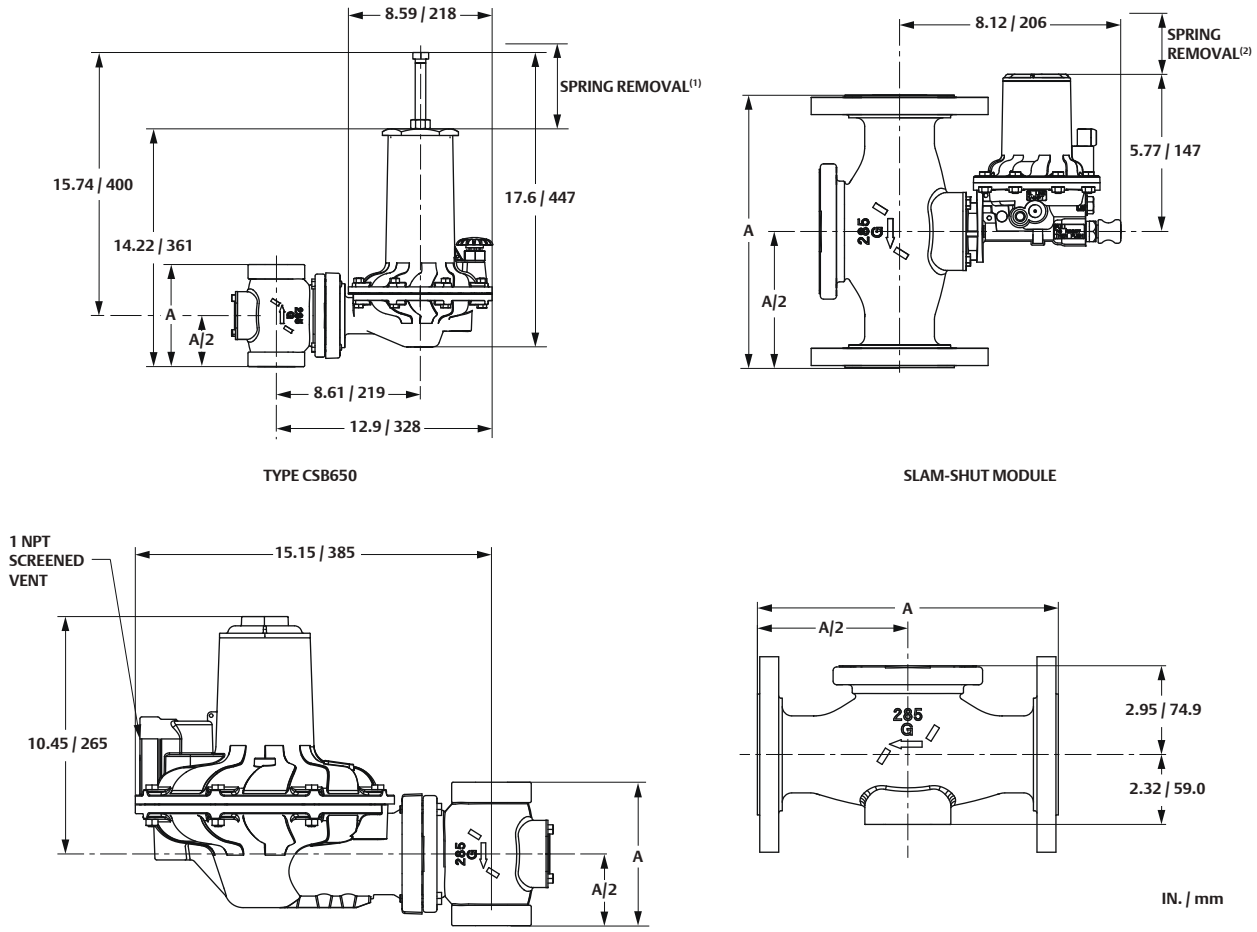


Figure 4. *Types CSB600 and CSB604 Spring Case Vent and Body Orientation*



1. Maximum spring removal clearance for the primary regulator is 6.2 in. / 158 mm.
2. Maximum spring removal clearance for the slam shut is 3.1 in. / 80 mm.

Figure 5. *CSB600 Series Dimensions*

Table 8. CSB600 Series Dimensions

BODY SIZE		BODY END CONNECTION STYLE	FACE-TO-FACE DIAMETER (A)	
NPS	DN		In.	mm
1-1/4	32	NPT or Rp	6.1	155
1-1/2	40			
2	50			
2	50	CL125 FF / CL150 FF or PN 10/16	7.5	191
			10	254
		CL125 FF / CL150 FF	10.5	267
1-1/4	32	PN 16 Slip-On	7.87	200
1-1/2	40		8.74	222
2	50	CL150 RF	10	254

Ordering Guide

Type (See Table 1, Select One)

Stand-Alone Regulator

- ☐ CSB600IN
- ☐ CSB600IT
- ☐ CSB600EN
- ☐ CSB600ET
- ☐ CSB600FIN
- ☐ CSB600FIT
- ☐ CSB600FEN
- ☐ CSB600FET
- ☐ CSB620FIN
- ☐ CSB620FIT
- ☐ CSB620FEN
- ☐ CSB620FET
- ☐ CSB620IN
- ☐ CSB620IT
- ☐ CSB620EN
- ☐ CSB620ET
- ☐ CSB650IN
- ☐ CSB650IT
- ☐ CSB650EN
- ☐ CSB650ET

With Type VSX8 Slam-shut Module

- ☐ CSB604IN
- ☐ CSB604IT
- ☐ CSB604ET
- ☐ CSB604EN
- ☐ CSB604FIN
- ☐ CSB604FIT
- ☐ CSB604FEN
- ☐ CSB604FET
- ☐ CSB624FIN
- ☐ CSB624FIT
- ☐ CSB624FEN
- ☐ CSB624FET
- ☐ CSB624IN
- ☐ CSB624IT
- ☐ CSB624EN
- ☐ CSB624ET
- ☐ CSB654IN
- ☐ CSB654IT
- ☐ CSB654EN
- ☐ CSB654ET

Body Size and End Connection Style (Select One)

Ductile Iron

- ☐ 1-1/2 NPT
- ☐ 1-1/4 NPT
- ☐ 2 NPT***
- ☐ Rp 1-1/4***
- ☐ Rp 1-1/2***
- ☐ Rp 2***
- ☐ NPS 2 / DN 50, CL150 FF***
- ☐ NPS 2 / DN 50, CL125 FF***
- ☐ NPS 2 / DN 50, PN 10/16***
- ☐ NPS 1-1/2 / DN 40, PN 16 slip-on flanged body
- ☐ NPS 1-1/4 / DN 32, PN 16 slip-on flanged body

WCC Steel

- ☐ 1-1/4 NPT***
- ☐ 1-1/2, NPT***
- ☐ 2 NPT***
- ☐ Rp 1-1/4***
- ☐ Rp 1-1/2***
- ☐ Rp 2***
- ☐ NPS 2 / DN 50, CL150 RF
- ☐ NPS 2 / DN 50, PN 10/16

Outlet Pressure Range (Select One)

Type CSB600/CSB604

- ☐ 0.11 to 0.24 psig / 7.5 to 16.5 mbar, Silver***
- ☐ 0.23 to 0.40 psig / 15.8 to 27.5 mbar, Red***
- ☐ 0.32 to 0.57 psig / 22.0 to 39.0 mbar, Black Stripe***
- ☐ 0.46 to 0.73 psig / 32.0 to 50.0 mbar, Purple***
- ☐ 0.61 to 1.03 psig / 42.0 to 71.0 mbar, White Stripe***
- ☐ 0.87 to 1.89 psig / 60.0 to 130 mbar, Dark Green***

Type CSB600F/CSB604F

- ☐ 0.23 to 0.40 psig / 15.8 to 27.5 mbar, Red***

Type CSB620/CSB624

- ☐ 1.45 to 1.89 psig / 100 to 130 mbar, Dark Green***
- ☐ 1.52 to 3.77 psig / 105 to 260 mbar, Blue***
- ☐ 3.05 to 5.51 psig / 210 to 380 mbar, Pink***
- ☐ 4.64 to 8.70 psig / 320 to 600 bar, Red with White Stripe***
- ☐ 7.40 to 11.9 psig / 510 to 820 bar, Blue with White Stripe***

Type CSB620F/CSB624F

- ☐ 3.92 to 4.79 psig / 270 to 330 mbar, Pink Stripe***

Type CSB650/CSB654

- ☐ 10.2 to 17.4 psig / 700 to 1200 mbar, Purple Stripe***
- ☐ 15.2 to 39.2 psig / 1050 to 2700 mbar, Brown***
- ☐ 33.4 to 55.1 psig / 2300 to 3800 mbar, Grey with Red Stripe***
- ☐ 46.4 to 72.5 psig / 3200 to 5000 mbar, Grey with Orange Stripe***

Body Orientation[1] (See Figure 4, Select One)

- ☐ Position 1***
- ☐ Position 2***
- ☐ Position 3 **(standard)***
- ☐ Position 4***

Vent Orientation[2] (See Figure 4,Select One)

- ☐ Position C***
- ☐ Position D***
- ☐ Position E***
- ☐ Position F **(standard)***

Slam-Shut Trip Pressure Setting (Select One if applicable)

- ☐ Overpressure (OPSO) trip only
  Indicate Overpressure Trip Point _____
- ☐ Over and Underpressure (OPSO/UPSO) trip
  Indicate Overpressure Trip Point _____
  Indicate Underpressure Trip Point _____

1. For the Type CSB604, choose the body orientation of the primary regulator only. The Slam-Shut spring barrel will be oriented in the same direction as the primary regulator spring barrel.
2. For the Type CSB604, choose the vent orientation of the primary regulator only. The Slam-Shut vent will be oriented to point in the same direction as the primary regulator.

Ordering Guide (continued)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

If two or more available springs have published pressure ranges that include the desired pressure setting, use the spring with the lower range for better accuracy.

Introduction

The CSB700 Series direct-operated, spring-loaded regulators have been engineered to fit a multitude of pressure reducing applications including commercial and industrial installations. This flexibility is provided by the numerous body sizes and end connections, outlet pressure settings, as well as the option for internal or external pressure registration. In addition to application flexibility, CSB700 Series offers multiple overpressure protection options to meet your application requirements.

Available Configurations

See Table 1

Body Sizes, Materials, End Connections and Pressure Ratings

See Table 2

Inlet Pressure Ratings

See Tables 3 and 4

Maximum Outlet Pressure

Emergency Casing:
Type CSB700/CSB700F/ CSB720/CSB720F: 58 psig / 4.0 bar
Type CSB750: 72.5 psig / 5.0 bar
To Avoid Internal Parts Damage:
Type CSB700/CSB700F/CSB720/ CSB720F: 5 psig / 0.34 bar over set pressure
Type CSB750: 21.8 psig / 1.5 bar — not to exceed maximum emergency outlet
Operating Casing: 72.5 psig / 5.0 bar

Outlet Pressure Ranges

0.11 to 72.5 psig / 7.5 to 5000 mbar
See Table 5

Orifice Size

1-3/8 in. / 34.9 mm

Flow and IEC Sizing Coefficients

See Table 4

Temperature Capabilities(1)(2)

According to PED Standards:
-4 to 140°F / -20 to 60°C
Non-PED:
-22 to 151°F / -30 to 66°C

Spring Case Vent Connection

1 NPT

Spring Case Vent and Body Orientation

See Figure 4

Type VSX8 Slam-Shut Device

Maximum Inlet Pressure:
290 psig / 20 bar
Maximum Operating Inlet Pressure:
232 psig / 16 bar

Approximate Weights

with Threaded body
Type CSB700: 9 lbs / 4.1 kg
Type CSB704: 11 lbs / 5 kg
with Flanged body
Add 9 lbs / 4.1 kg to weights listed

Designed, Tested and Evaluated Consistent With:

ANSI B16, ASME Section 8, ASTM B117 (Corrosion Resistance), EN334 and EN 14382

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

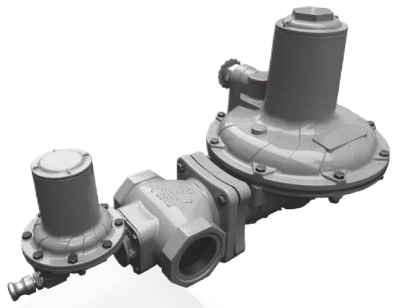


Figure 1. *Type CSB704 with Type VSX8 Slam-Shut*

Features

- **Ductile Iron and WCC Steel Bodies Available**
- **Wide Variety of Body Sizes and End Connections**
- **With Type VSX8 Slam-shut Option**
- **No Special Tools for Pressure Adjustment and Orifice Removal**

1. Standard token relief set values listed in Table 6 are based on -4 to 140°F / -20 to 60°C.
2. Product has passed Emerson Process Management Regulator Technologies, Inc. testing for lockup, relief start-to-discharge and reseal down to -40°.

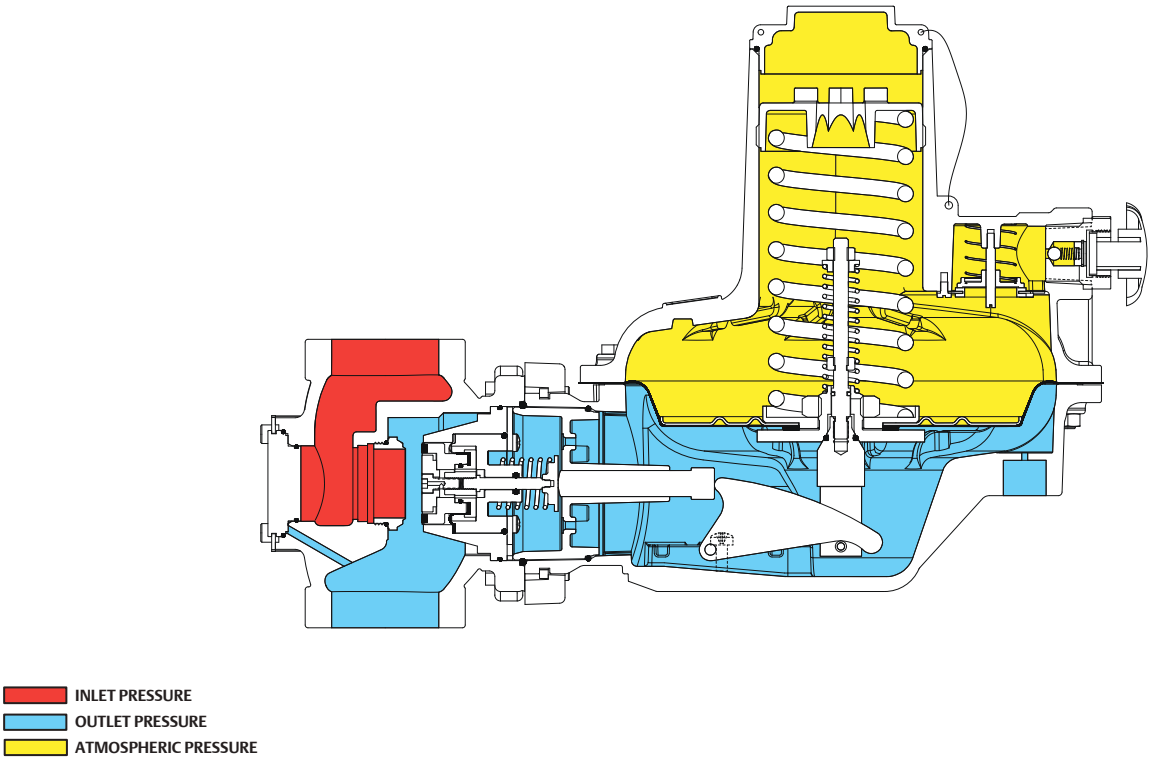


Figure 2. *CSB700 Series Operational Schematic*

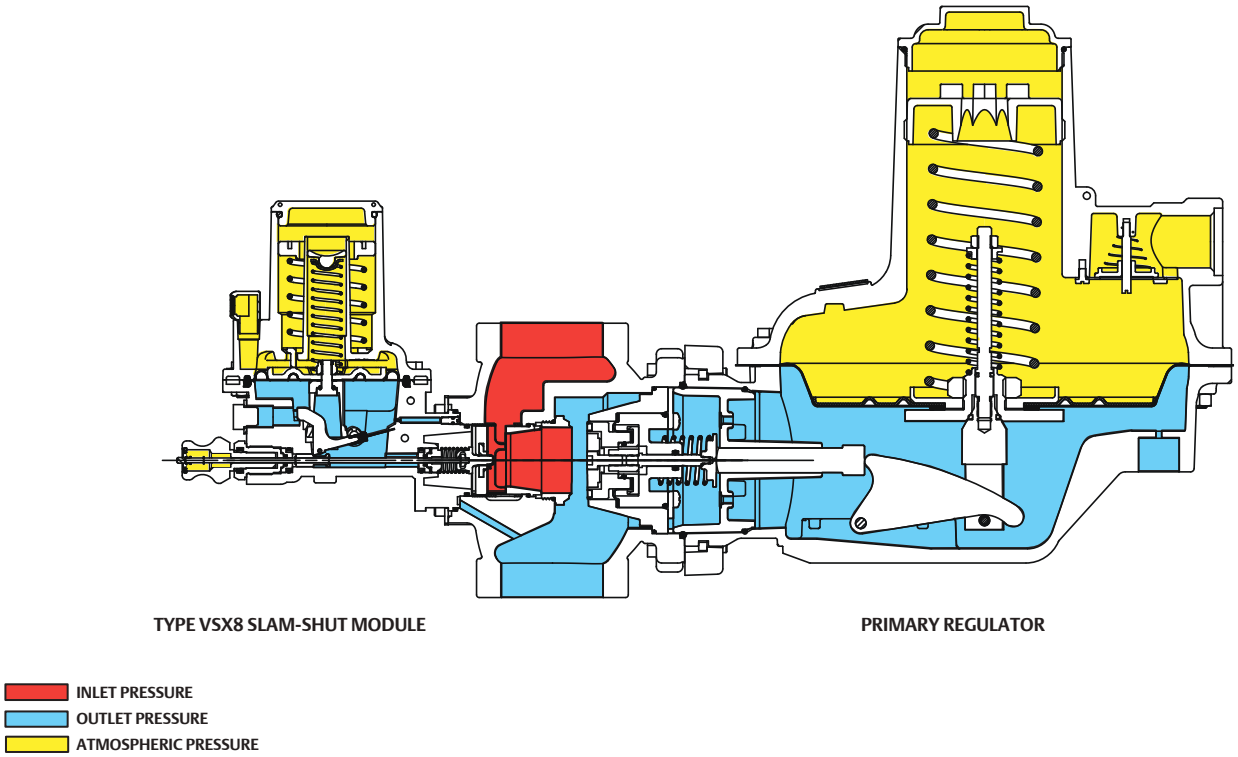


Figure 3. *Type CSB704ET Externally Registered Regulator and Slam-Shut Operational Schematic*

Table 1. Available Configurations

TYPE NUMBER	OPTION
	FLOW CAPABILITY
CSB7	Low-Capacity Applications (1-3/8 in. / 34.9 mm orifice size)
	PRESSURE CONSTRUCTION
0	Low Pressure Applications *(Outlet Pressure: 0.11 to 1.89 psig / 7.5 to 130 mbar, Maximum Operating Inlet: 145 psig / 10 bar, Maximum Emergency Pressure: 145 psig / 10 bar, Lever: 2:1)*
2	*Medium Pressure Applications (Outlet Pressure: 1.45 to 11.9 psig / 100 to 820 mbar - Maximum Operating Inlet: 232 psig / 16 bar, Maximum Emergency Pressure: 290 psig / 20.0 bar, Lever 2:1)*[2]
5	High Pressure Applications *(Outlet Pressure: 10.2 to 72.5 psig / 700 mbar to 5 bar, Lever 1:1)*
	OVERPRESSURE PROTECTION
0	Without Overpressure Protection Module
0F	Without Overpressure Protection Module *(Outlet Pressure: 0.30 psig and 4.35 psig / 21 mbar and 300 mbar, GrDF version only)* Low Pressure Applications *(Maximum Operating Inlet: 87.02 psig / 6 bar- Maximum Emergency Pressure: 145 psig / 10 bar, Lever: 2:1)*
4	With Type VSX8 Slam-shut Module[1]
4F	With Type VSX8 Slam-shut Module[1] *(Outlet Pressure: 0.30 psig and 4.35 psig / 21 mbar and 300 mbar, GrDF version only)* Medium Pressure Applications *(Outlet Pressure: 1.45 to 11.9 psig / 100 to 820 mbar - Maximum Operating Inlet: 87.02 psig / 6 bar, Maximum Emergency Pressure: 174 psig / 12 bar, Lever 2:1)*[2]
	PRESSURE REGISTRATION
E	External
I	Internal
	RELIEF
N	None
T	Token Internal Relief

Example: Type number CSB724ET: Type CSB700 regulator constructed for medium pressure applications, with Type VSX8 Slam-shut Module, with External pressure registration and with Token relief.

1. Reference Instruction Manual D103127X012 for information regarding the Type VSX8 Slam-shut Module.
2. External registration only.
3. The pressure/temperature limits in this document and any applicable standard or code limitation should not be exceeded.

Table 2. Body Sizes, Material, End Connections and Pressure Ratings

BODY MATERIAL	BODY SIZE		END CONNECTION	FACE-TO-FACE DIMENSION		BODY PRESSURE RATING	
	NPS	DN		In.	mm	psig	bar
Ductile Iron	1-1/2	40	NPT	6.1	155	290	20
	2	50					
	1-1/2	40	Rp				
	2	50					
	2	50	CL125 FF/CL150 FF	7.5	191		
	2	50		10	254		
	2	50		10.5	267		
	2	50	PN 10/16	7.5	191	232	16
	2	50		7.87	200		
	2	50		10	254		
	1-1/2	40	PN 16 Slip-On	8.74	222		
WCC Steel	1-1/2	40	NPT	6.1	155	290	20
	2	50					
	1-1/2	40	Rp				
	2	50					
	2	50	CL150 RF	10	254		
	2	50	PN 10/16			232	16
	2	50	PN 10/16	7.5	191		

Table 3. Integral Strength (IS) Pressure Ratings

TYPE	MAXIMUM ALLOWABLE PRESSURE / MAXIMUM EMERGENCY INLET PRESSURE		MAXIMUM OPERATING INLET PRESSURE(1)	
	P_s		P_{umax}	
	psig	bar	psig	bar
CSB700 and CSB704	58	4	58	4
CSB700F and CSB704F				
CSB720 and CSB724				
CSB720F and CSB724F				
CSB750 and CSB754	73	5	73	5

1. For the Integral Strength (IS version), the maximum value of P_s and P_{umax} should be similar to the P_{SD} used for the Differential Strength (DS) version.

Table 4. Differential Strength (DS) Pressure Ratings and Flow and Sizing Coefficients

TYPE	SPECIFIC MAXIMUM ALLOWABLE PRESSURE / MAXIMUM EMERGENCY OUTLET PRESSURE(1)		MAXIMUM ALLOWABLE PRESSURE / MAXIMUM EMERGENCY INLET PRESSURE(1)		MAXIMUM OPERATING INLET PRESSURE(1)		ORIFICE SIZE		WIDE-OPEN FLOW COEFFICIENT			IEC SIZING COEFFICIENT		
	P_{SD}		P_s		P_{umax}									
	psig	bar	psig	bar	psig	bar	In.	mm	C_g	C_v	C_1	X_T	F_D	F_L
CSB700 and CSB704	58	4	174	12	145	10	1-3/8	34.9	1080	27.7	39	0.96	0.89	0.66
CSB700F and CSB704F			174	12	87	6								
CSB720F and CSB724F			174	12	87	6								
CSB720 and CSB724			290	20	232	16								
CSB750 and CSB754	73	5	290	20	232	16								

1. The pressure/temperature limits in this document and any applicable standard or code limitation should not be exceeded.

Table 5. CSB700 Series Primary Regulator Outlet Pressure Ranges

TYPE	OPERATING PRESSURE RANGES, W_d		PART NUMBER	SPRING COLOR	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
	psig	mbar			In.	mm	In.	mm
CSB700 and CSB704	0.11 to 0.24	7.5 to 16.5	GE30336X012	Silver	0.118	3.00	8.82	224
	0.23 to 0.40	15.8 to 27.5	ERSA01138A0	Red	0.138	3.50	10.39	264
	0.32 to 0.57	22 to 39	GE30338X012	Black Stripe	0.170	4.32	6.78	172
	0.46 to 0.73	32 to 50	GE30339X012	Purple	0.171	4.34	7.35	187
	0.61 to 1.03	42 to 71	GE30340X012	White Stripe	0.182	4.62	7.40	188
	0.87 to 1.9	60 to 130	ERSA03656A0	Dark Green	0.192	4.88	8.80	224
CSB700F and CSB704F	0.23 to 0.40	15.8 to 27.5	ERSA01138A0	Red	0.138	3.50	10.39	264
CSB720 and CSB724	1.45 to 1.9	100 to 130	ERSA03656A0	Dark Green	0.192	4.88	8.80	224
	1.52 to 3.77	105 to 260	ERSA03657A0	Blue	0.234	5.94	8.53	217
	3.05 to 5.51	210 to 380	GG06247X012	Pink	0.315	8.00	8.13	206
	4.64 to 8.70	320 to 600	ERSA01582A0	Red with White Stripe	0.343	8.71	6.97	177
	7.4 to 11.9	510 to 820	ERSA05055A0	Blue with White Stripe	0.394	10	7.13	181
CSB720F and CSB724F	3.92 to 4.79	270 to 330	ERAA11747A0	Pink Stripe	0.256	6.5	9.25	235
CSB750 and CSB754	10.2 to 17.4	700 to 1200	GE30345X012	Purple Stripe	0.354	9.00	8.87	225
	15.2 to 39.2	1050 to 2700	GE30346X012	Brown	0.433	11.0	8.88	226
	33.4 to 55.1	2300 to 3800	ERSA01125A0	Grey with Red Stripe	0.496	12.6	8.87	225
	46.4 to 72.5	3200 to 5000	ERSA01126A0	Grey with Orange Stripe	0.539	13.7	8.89	226

Table 6. Regulator and Slam-shut OPSO and UPSO Pressure Ranges

REGULATOR											SLAM-SHUT MODULE							
Type	Set Pressure Range		Factory Setpoint		Token Relief Set[1][2]		Available Token Relief Range Shown as a % of Regulator Setpoint		Minimum Required Difference Between Token Relief and OPSO Set		Overpressure Shutoff (OPSO)				Underpressure Shutoff (UPSO)			
											Standard OPSO Set Value[1], P_{dso}		OPSO Set Range as a % of Regulator Setpoint		Standard UPSO Set Value[1], P_{dsu}		UPSO Set Range as a % of Regulator Setpoint	
	psig	mbar	psig	mbar	psig	mbar	Min[2]	Max	psig	mbar	psig	mbar	Min	Max	psig	mbar	Min	Max
CSB704	0.11 to 0.24	7.5 to 16.5	0.15	10	0.25	17	170	215	0.12	8	0.61	42	420	520	----	----	----	----
			0.22	15	0.38	26							280	345				
	0.23 to 0.40	15.8 to 27.5	0.29	20	0.49	34	170	215	0.12	8	0.62	43	215	270	0.15	10	50	56
			0.3	21	0.52	36					0.65	45			0.16	11		
	0.32 to 0.57	22 to 39	0.39	27	0.59	41	150	160	0.15	10	0.74	51	190	200	0.2	14	50	60
			0.44	30	0.65	45					0.83	57			0.22	15		
	0.46 to 0.73	32 to 50	0.51	35	0.77	53	150	160	0.15	10	0.97	67	190	200	0.26	18	50	60
	0.61 to 1.03	42 to 71	0.73	50	1.02	70	140	158	0.23	16	1.31	90	180	200	0.36	25	50	70
			0.87	60	1.22	84					1.57	108			0.44	30		
	0.87 to 1.9	60 to 130	1.09	75	1.42	98	130	140	0.29	20	1.86	128	170	190	0.55	38	50	70
CSB704F	0.23 to 0.40	15.8 to 27.5	0.3	21	0.52	36	170	215	0.12	8	0.65	45	215	270	0.16	11	50	56
CSB724	1.45 to 1.9	100 to 130	1.45	100	1.89	130	130	140	0.29	20	2.47	170	170	190	0.73	50	50	70
	1.52 to 3.77	105 to 260	1.7	120	2.26	156	130	140	0.58	40	2.87	198	165	175	0.87	60	50	70
			2.2	150	2.83	195					3.60	248			1.09	75		
			2.3	160	3.02	208					3.83	264			1.16	80		
			2.9	200	3.63	250	125	140	0.73	50	4.35	300	150	165	1.45	100		
	3.05 to 5.51	210 to 380	4.35	300	5.44	375	125	140	0.73	50	6.53	450	150	165	2.18	150	50	70
	4.64 to 8.70	320 to 600	7.3	500	9.07	625	125	140	0.87	60	10.15	700	140	180	3.63	250	50	70
	7.4 to 11.9	510 to 820	8.7	600	10.88	750	125	140	1.02	70	12.18	840	140	180	4.35	300	50	70
			10.9	750	13.61	938					15.23	1050			5.44	375		
CSB724F	3.92 to 4.79	270 to 330	4.35	300	5.44	375	125	140	0.73	50	6.53	450	150	165	2.18	150	50	70
CSB754	10.2 to 17.4	700 to 1200	14.5	1000	18.1	1250	125	140	1.02	70	20.31	1400	140	180	7.25	500	50	70
	15.2 to 39.2	1050 to 2700	17.4	1200	20.2	1392	116	120	1.16	80	20.89	1440	120	140	8.7	600	50	70
			21.8	1500	25.2	1740					26.11	1800			10.88	750		
			29	2000	33.7	2320					34.81	2400			14.5	1000		
	33.4 to 55.1	2300 to 3800	43.5	3000	50.5	3480	116	120	1.45	100	52.21	3600	120	140	21.76	1500	50	70
	46.4 to 72.5	3200 to 5000	58	4000	67.3	4640	116	120	1.45	100	69.62	4800	120	140	29.01	2000	50	70

1. Standard factory set shown. Factory set is at the Minimum value of the range indicated. Range indicated is a percentage of Setpoint. Percentage indicated is based on the Set Pressure Range in which that setpoint resides. If non-standard sets are required, adherence must be made to constraints shown in Table 6, including Token Relief Set Range, OPSO and UPSO set range and Minimum Required difference between Token Relief and OPSO Set.
2. Minimum Token Relief values apply to -4 to 140°F / -20 to 60°C service temperatures. For service below -4°F / -20°C, add 0.12 psig / 8 mbar to the minimum Token Relief value listed.

Example: *If a non-standard setpoint is needed, see the following example for the proper use of Table 6. Non-standard setpoint = 2 psig / 140 mbar, using the value presented above, the factory set of the token relief will be 1.3 x 2= 2.6 psig / 182 mbar. The factory OPSO and UPSO set pressures are 165% and 50% of the non-standard setpoint, respectively. The resulting settings are: OPSO = 3.4 psig / 231 mbar and UPSO = 1 psig / 70 mbar.*

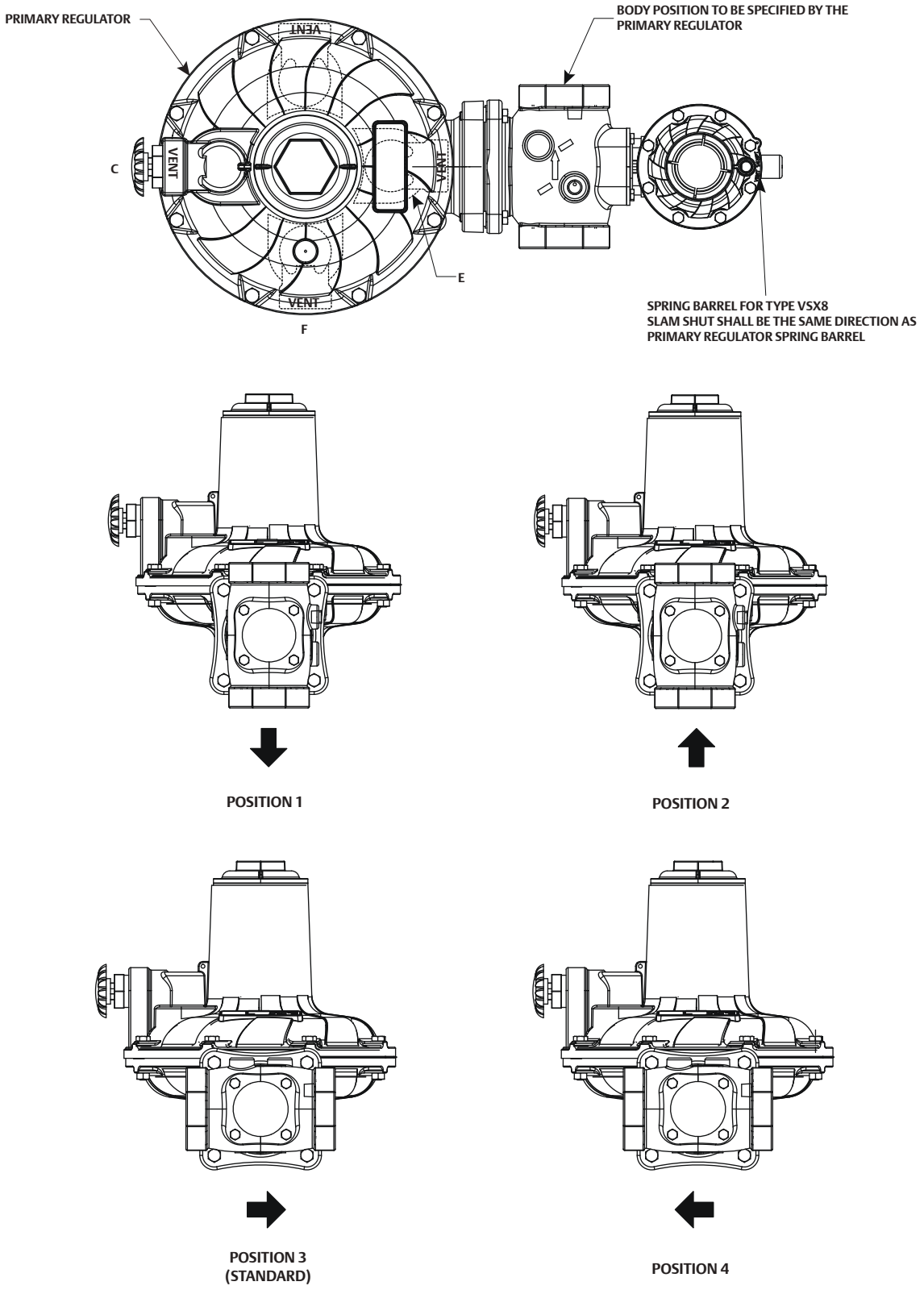
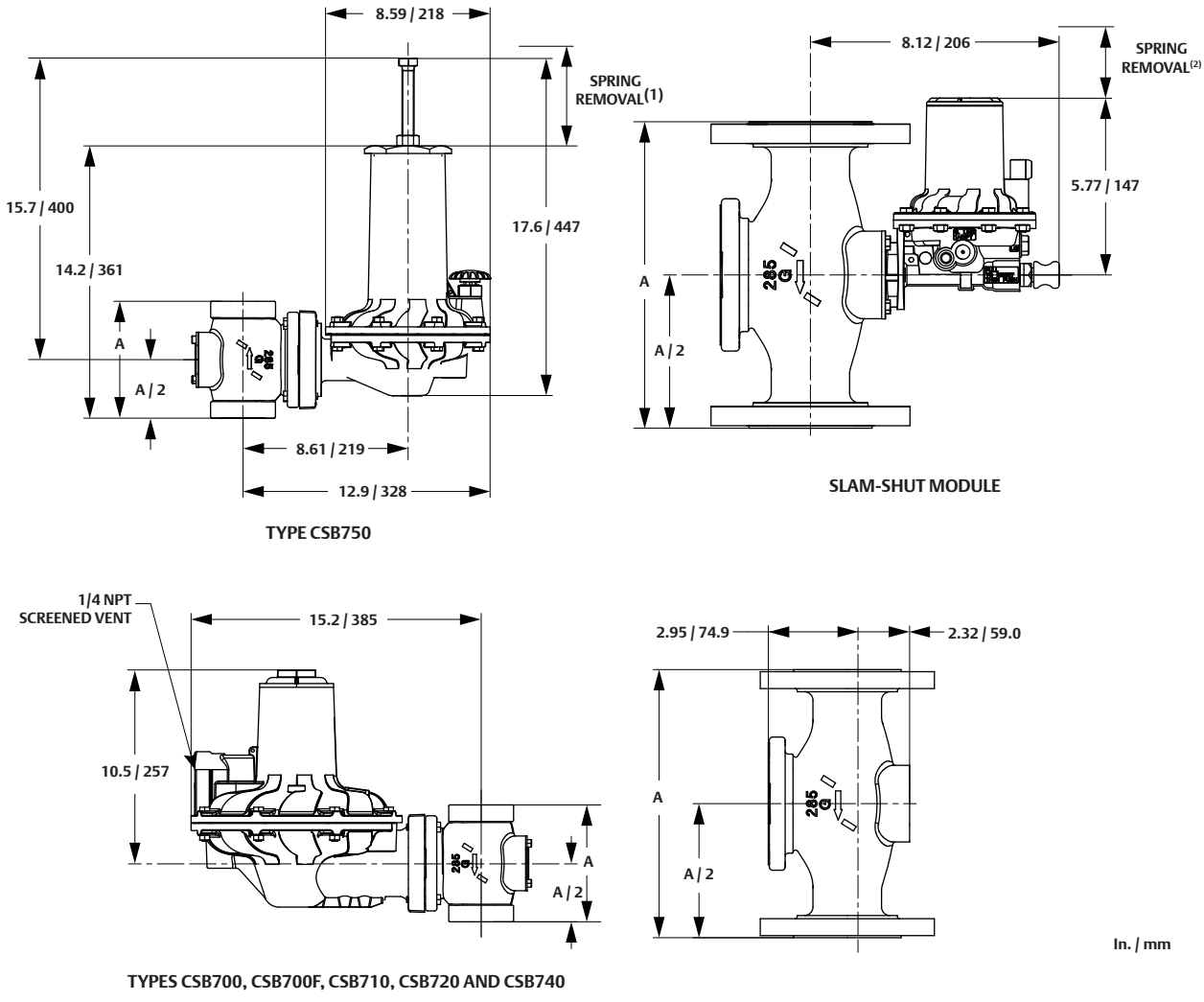


Figure 4. *CSB700 Series Vent and Body Positions*



1. MAXIMUM SPRING REMOVAL CLEARANCE FOR THE PRIMARY REGULATOR IS 6.2 in. / 158 mm.
2. MAXIMUM SPRING REMOVAL CLEARANCE FOR THE SLAM SHUT IS 3.1 in. / 80 mm.

Figure 5. *CSB700 Series Dimensions*

Table 7. CSB700 Series Dimensions

BODY SIZE		BODY END CONNECTION STYLE	FACE-TO-FACE DIAMETER (A)	
NPS	DN		In.	mm
1-1/2	40	NPT or Rp	6.1	155
2	50	NPT or Rp	6.1	155
2	50	CL125 FF/CL150 FF	7.50	191
			10.0	254
			10.5	267
		CL150 RF	10	254
		PN 10/16	7.5	191
			7.87	200
			10	254
1-1/2	40	PN 16 Slip-on	8.74	222

Ordering Guide

Type (See Table 1 for Construction details) (Select One)

Stand-Alone Regulator

- ☐ CSB700IN
- ☐ CSB700IT
- ☐ CSB700EN
- ☐ CSB700ET
- ☐ CSB700FEN
- ☐ CSB700FET
- ☐ CSB700FIN
- ☐ CSB700FIT
- ☐ CSB720FIN
- ☐ CSB720FIT
- ☐ CSB720FEN
- ☐ CSB720FET
- ☐ CSB720IN
- ☐ CSB720IT
- ☐ CSB720EN
- ☐ CSB720ET
- ☐ CSB750IN
- ☐ CSB750IT
- ☐ CSB750EN
- ☐ CSB750ET

With Type VSX8 Slam-Shut Module

- ☐ CSB704IN
- ☐ CSB704IT
- ☐ CSB704EN
- ☐ CSB704ET
- ☐ CSB704FEN
- ☐ CSB704FET
- ☐ CSB704FIN
- ☐ CSB704FIT
- ☐ CSB724FIN
- ☐ CSB724FIT
- ☐ CSB724FEN
- ☐ CSB724FET
- ☐ CSB724IN
- ☐ CSB724IT
- ☐ CSB724EN
- ☐ CSB724ET
- ☐ CSB754IN
- ☐ CSB754IT
- ☐ CSB754EN
- ☐ CSB754ET

Body Size and End Connection Style (Select One)

Ductile Iron

- ☐ 1-1/2 NPT
- ☐ 2 NPT***
- ☐ Rp 1-1/2***
- ☐ Rp 2***
- ☐ NPS 2 / DN 50, CL125 FF***
- ☐ NPS 2 / DN 50, CL150 FF***
- ☐ NPS 2 / DN 50, PN 10/16***
- ☐ NPS 1-1/2 / DN 40, PN 16 slip-on flanged body

WCC Steel

- ☐ 1-1/2 NPT***
- ☐ 2 NPT***
- ☐ Rp 1-1/2***
- ☐ Rp 2***
- ☐ NPS 2 / DN 50, CL150 RF
- ☐ NPS 2 / DN 50, PN 10/16

Outlet Pressure Range (Select One)

Type CSB700/CSB704

- ☐ 0.11 to 0.24 psig / 7.5 to 16.5 mbar, Silver***
- ☐ 0.23 to 0.40 psig / 15.8 to 27.5 mbar, Red***
- ☐ 0.32 to 0.57 psig / 22.0 to 39.0 mbar, Black Stripe***
- ☐ 0.46 to 0.73 psig / 32.0 to 50.0 mbar, Purple***
- ☐ 0.61 to 1.03 psig / 42.0 to 71.0 mbar, White Stripe***
- ☐ 0.87 to 1.89 psig / 60.0 to 130 mbar, Dark Green***

Type CSB700F/CSB704F

- ☐ 0.23 to 0.40 psig / 15.8 to 27.5 mbar, Red

Type CSB720/CSB724

- ☐ 1.45 to 1.9 psig / 100 to 130 mbar, Dark Green***
- ☐ 1.52 to 3.77 psig / 105 to 260 mbar, Blue***
- ☐ 3.05 to 5.51 psig / 210 to 380 mbar, Pink***
- ☐ 4.64 to 8.70 psig / 320 to 600 bar, Red with White Stripe***
- ☐ 7.40 to 11.9 psig / 510 to 820 bar, Blue with White Stripe***

Type CSB720F/CSB724F

- ☐ 3.92 to 4.79 psig / 270 to 330 mbar, Pink Stripe

Type CSB750/CSB754

- ☐ 10.2 to 17.4 psig / 700 to 1200 mbar, Purple Stripe***
- ☐ 15.2 to 39.2 psig / 1050 to 2700 mbar, Brown***
- ☐ 33.4 to 55.1 psig / 2300 to 3800 mbar, Grey with Red Stripe***
- ☐ 46.4 to 72.5 psig / 3200 to 5000 mbar, Grey with Orange Stripe***

Body Orientation[1] (Select One)

- ☐ Position 1***
- ☐ Position 2***
- ☐ Position 3 **(standard)*****
- ☐ Position 4***

- continued -

1. For the Type CSB704, choose the body orientation of the primary regulator only. The slam-shut spring barrel will be oriented in the same direction as the primary regulator spring barrel.

Ordering Guide (continued)

Vent Orientation[2] (Select One)

- ☐ Position C* * *
- ☐ Position D* * *
- ☐ Position E* * *
- ☐ Position F **(standard)*** * *

Slam-Shut Trip Pressure Setting
(Select One if applicable)

- ☐ Overpressure (OPSO) trip only
  Indicate Overpressure Trip Point _____
- ☐ Over and Underpressure (OPSO/UPSO) trip
  Indicate Overpressure Trip Point _____
  Indicate Underpressure Trip Point _____

2. For the Type CSB704, choose the vent orientation of the primary regulator only. The slam-shut vent will be oriented to point in the same direction as the primary regulator.

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired?	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Regulators with high flows and large pressure drops generate noise. Noise can wear parts which can cause failure and/or inaccurate control. Keep regulator noise below 110 dBA.

Type Dosaodor-D

Odorant Injection System Controlled by Type Electronic Control Unit

TARTARINI

Introduction

Type Dosaodor-D is a computerized odorant injection system for natural gas that uses patented solenoid injector technology that eliminates the need for plunger pumps.

The solenoid injectors permit odorant injection accuracy to be maintained over the entire range of the system, approaching infinite turndown.

Automatic calibration during operation adjusts for any changes in mechanical components and detects failures for report by exception alarming. The system can also be configured to use two solenoid injection valves and/or an emergency backup absorption system.

The system can be configured and operation data can be viewed using an integrated push button panel and display. A printer option is also available for local hard copy documentation of system operations (gas flow rates, injection rates, configuration changes, and alarms).

Type Dosaodor-D has standard modbus registers for real-time data and archiving history. This data can be read locally by a laptop computer or remotely using third party SCADA products.

DosaLink mini-SCADA software is available for local or remote configuration and operation of the system including: automatic polling and display of real time and historical data, monitoring for report by exception alarming and relational data base archival of historical data. The historical data can be exported in ODBC format for analysis and reports using commercially available relational data base software products.

Type Dosaodor-D controlled by Type Electronic Control Unit is available in Asia Pacific, Europe, Middle East, and Africa only.

Software Specifications

Modes of Operation:
System: Automatic, Manual, Wash, and Disabled

Injector:
Injector 1, Injector 2, Injector 1-2 (dual injector solenoid valve option only)

Pneumatic Panel Specifications

Material: Stainless steel plate

Installation: Wall mount

Weight: 55 to 100 lbs / 25 to 45 kg (based on configuration type)

Overpressure Relief Valve:
Stainless steel with following rating options:

203 psi / 14 bar
551 psi / 38 bar
870 psi / 60 bar

Electrical Protection:
Explosion proof and intrinsically safe

Material Electrical Protection:
Available for European and North American standards

Mechanical Connections:
Odorant Inlet and Discharge:
1/4-inch / 6.4 mm double ferrule fitting for 6 x 1-inch / 15 x 2.5 mm pipe

Gas Inlet and Discharge:
1/4-inch / 6.4 mm single ferrule fitting for 8 x 1-inch / 20 x 2.5 mm pipe

Maximum Working Pressure:
Supply: 1450 psi / 100 bar

Injection:
203 psi / 14 bar
551 psi / 38 bar
870 psi / 60 bar

Odorant Flow Rate:
0.89 to 24.97 lbs/h at 6.75 lbs/gal / 0.5 to 14.0 l/h

Electronic Control Unit Specifications

Material: 10/10 mm steel plate

Installation: Wall mounted

Weight: 49 lbs / 22 kg (medium complexity configuration)

Power Supply Options:
12 Vdc+/-15%
115 Vac 60Hz
230 Vac 50Hz

Electrical Protection:
Explosion proof/intrinsically safe

Communication Ports Included:
One RS-232 serial port is available for local configuration or connected to an GSM modem.

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.Tartarini-Naturalgas.com

Features

- **Consistent Odorization Proportional to Entire Range of Gas Flow Rate**
- **Significantly Reduced Maintenance**
- **Variety of Redundancy Options for Odorization**
- **User Friendly Configuration Software**
- **Automatic Calibration During Operation**
- **Standard and Scalable Hardware Platform**



Figure 1. *Type Dosaodor-D Pneumatic Panel*



Figure 2. Type Electronic Control Unit



Figure 3. *Standard Wick Insert (Pipeline Injection)*

EMERSON
Process Management

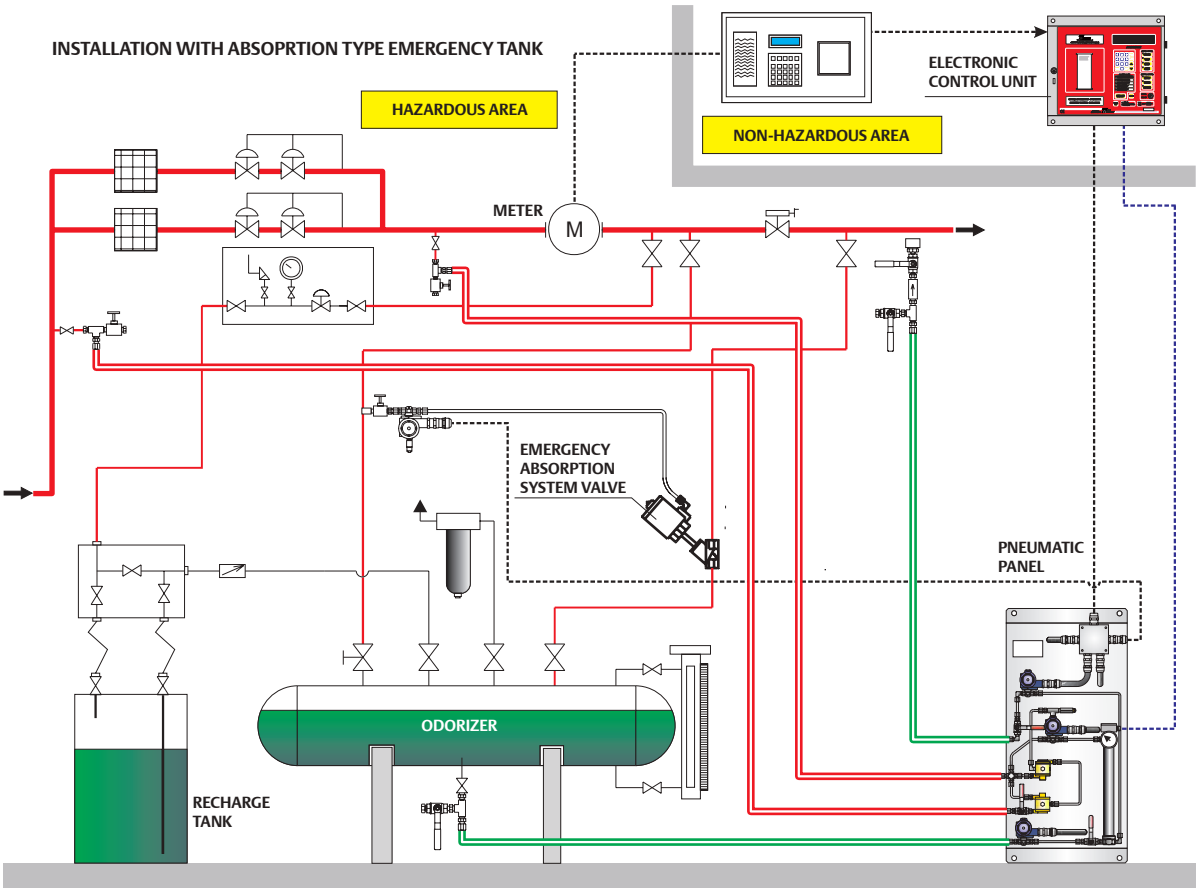
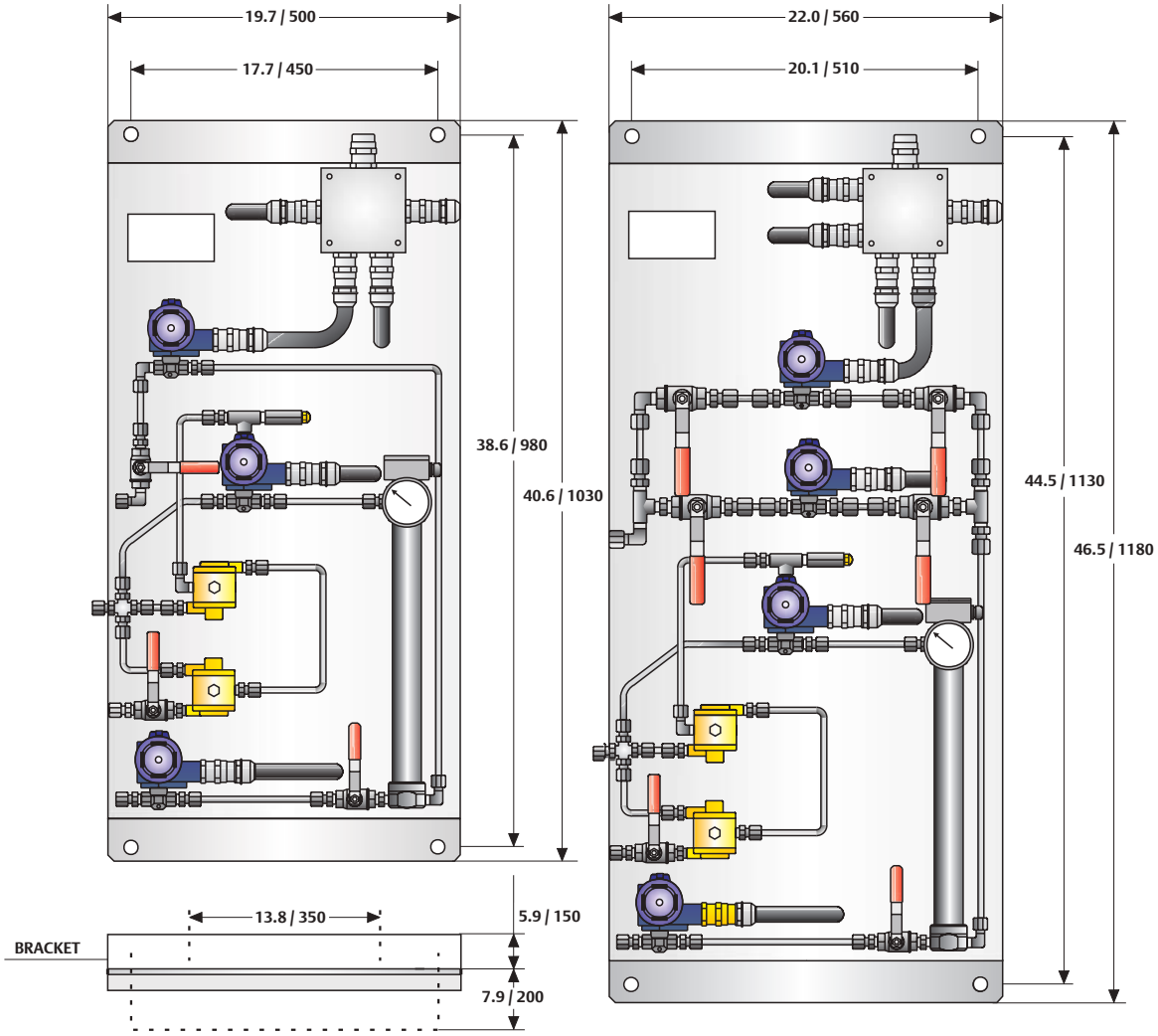


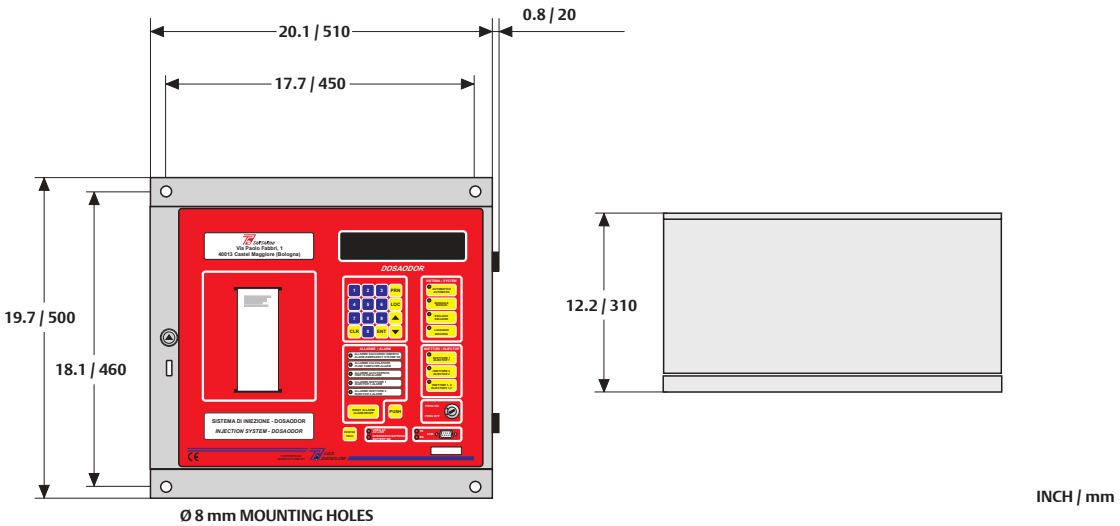
Figure 4. *Typical Type Dosaodor-D Installation Schematic*

Table 1. Maximum Odorant Injection Rate

MAXIMUM INJECTION RATE, l/h	MAXIMUM GAS VOLUME IN Sm^3/h		MAXIMUM INJECTION RATE, lbs/h (at 6.75 lbs/h)	MAXIMUM GAS VOLUME MSCF/h	
	40 mg/Sm^3 (THT)	10 mg/Sm^3 (Mercaptan)		1.0 lbs/MMSCF (THT)	0.5 lbs/MMSCF (Mercaptan)
0.5	12,500	50,000	0.89	892	1783
1.0	25,500	100,000	1.78	1783	3567
2.0	50,000	200,000	3.57	3567	7133
4.0	100,000	400,000	7.13	7133	14,267
6.0	150,000	600,000	10.68	10,698	21,400
8.0	200,000	800,000	14.27	14,267	28,534
10.0	250,000	1,000,000	17.83	17,834	35,667
12.0	300,000	1,200,000	21.40	21,400	42,800
14.0	350,000	1,400,000	24.97	24,967	49,934



PNEUMATIC PANEL



ELECTRONIC CONTROL UNIT

Figure 5. *Pneumatic Panel and Electronic Control Unit Overall Dimensions*

Ordering Guide

Base Unit (Select One)

☐ **A1:** Type Dosaodor-D odorant injection system completed with:
Pneumatic Panel
- Stainless steel panel
- Installation kit (bracket, pipe connection, injector, valves, etc.)
- EEx element certificate for installation in hazardous area zone 1 according to EN 60079 -10

Electronic Control Unit
- Steel cabinet IP55 for non hazardous locations
- Display LCD (4X40)
- Membrane keyboard 26 keys
- Memory lithium battery for data retain

☐ **A4:** Type Dosaodor-D odorant injection system completed with:
Pneumatic Panel
- Stainless steel panel
- Installation kit (bracket, pipe connection, injector, valves, etc.)
- EEx element certificate for installation in hazardous area zone 1 according to EN 60079 -10 (Junction box and cable glands Elcon). According to Polish market requirements.

Electronic Control Unit
- Steel cabinet IP55 for non hazardous locations
- Display LCD (4X40)
- Membrane Keyboard 26 keys
- Memory Lithium battery for data retain

Model (Select One)

☐ **B1:** Single Injector
☐ **B2:** Dual Injector

Maximum Odorant Injection Rate (Select One)

☐ **C1:** 0.89 lbs/h / 0.5 l/h
☐ **C2:** 1.78 lbs/h / 1.0 l/h
☐ **C3:** 3.57 lbs/h / 2.0 l/h
☐ **C4:** 7.13 lbs/h / 4.0 l/h
☐ **C5**[1]**:** 10.68 lbs/h / 6.0 l/h
☐ **C6**[1]**:** 14.27 lbs/h / 8.0 l/h
☐ **C7**[1]**:** 17.83 lbs/h / 10.0 l/h
☐ **C8**[1]**:** 21.40 lbs/h / 12.0 l/h
☐ **C9**[1]**:** 24.97 lbs/h / 14.0 l/h

1. Options are not available with I1 option.

Options (Select One, None, or More Options)

☐ **D1:** Printer (1)
☐ **D2:** 6 Ampere/h (Ah) UPS (Uninterruptible Power Supply)
☐ **D3:** 18 Ampere/h (Ah) UPS (Uninterruptible Power Supply)
☐ **D4:** Accessory Kit for Emergence Absorption System with Injection Pressure ≤ 6 bar (tanks not included)
☐ **D5:** Accessory Kit for Emergence Absorption System with Injection Pressure 6 to 14 bar (tanks not included)
☐ **D6:** Accessory Kit for Emergence Absorption System with Injection Pressure > 14 bar (tanks not included)

Main Power Supply (Select One or More Options)

☐ **E1:** 230 V to 50 Hz, 12 Vcc
☐ **E2:** 115 V to 60 Hz, 12 Vcc

Front Panel Language (Select One)

☐ **F1:** Italian / English
☐ **F2:** Byelorussian / English
☐ **F3:** English

Display and Printer Language (Select One)

☐ **G1:** Italian
☐ **G2:** Byelorussian
☐ **G3:** Spanish
☐ **G4:** Polish
☐ **G5:** English I.S. Units - International System
☐ **G6:** English Imperial U.S. Units – Imperial System
☐ **G7:** French
☐ **G8:** Ukraine

Communication (Select One)

☐ **H2:** Dial-up modem for electronic control unit
☐ **H3:** GSM Modem for Electronic control unit
☐ **H6:** Telealarm and warning messaging
Available with DosaLink software - DSL
Available for Italian market only
For other markets please ask for availability.

- continued -

Ordering Guide (continued)

Maximum Working Pressure (Select One)

- ☐ **I1:** 203 psig / 14 bar (odorant SG>=0.7)
- ☐ **I2:** 551 psig / 38 bar (odorant SG>=0.55)
- ☐ **I3:** 870 psig / 60 bar (odorant SG>=0.7)

Special Versions (Select One, Both, or None Options)

- ☐ **L1:** Skid Mounted
- ☐ **L2:** Low Temperature

Installation Options - Injector (Select One)

- ☐ **M1:** DN 3/4-inch long injector (for downstream size >= 10 inches / DN 250)
- ☐ **M2:** DN 3/4-inch short injector (for downstream size < 10 inches / DN 250)
- ☐ **M3:** DN 1/2-inch long injector (for downstream size >= 10 inches / DN 250)
- ☐ **M4:** DN 1/2-inch short injector (for downstream size < 10 inches / DN 250)

Installation Options - Emergency Absorption System Valve (Select One or None Options)

Standard: Pneumatic Valve (normally open) - Threaded 1-inch / DN 25 NPT-F PN 16

- ☐ **N0:** Pneumatic Valve (normally open) - Threaded 1-1/2-inch / DN 40 NPT-F - Max operating pressure 64 bar
- ☐ **N1**[2]**:** Valve + Pneumatic Actuator (normally open) - 2-1/2-inches / DN 65, CL150 Flanged
- ☐ **N2**[2]**:** Valve + Pneumatic Actuator (normally open) - 1-1/2-inches / DN 40 CL150 Flanged
- ☐ **N3:** Valve + Pneumatic Actuator (normally open) - 1-1/2-inches /DN 40 PN 64 Flanged
- ☐ **N4:** Valve + Pneumatic Actuator (normally open) - Threaded 1-inch / DN 25 NPT-F - Max operating pressure 64 bar
- ☐ **N5**[2]**:** Pneumatic Valve (normally open) - 3/4-inch / DN 20 PN 16 Flanged
- ☐ **N6**[2]**:** Pneumatic Valve (normally open) - 1-inch / DN 25 PN 16 Flanged
- ☐ **N7**[2]**:** Pneumatic Valve (normally open) - 1-1/4-inches / DN 32 PN 16 Flanged
- ☐ **N8**[2]**:** Pneumatic Valve (normally open) - 1-1/2-inches / DN 40 PN 16 Flanged
- ☐ **N9**[2]**:** Pneumatic Valve (normally open) - 2-inches / DN 50 PN 16 Flanged

2. Options can not be ordered if the D6 option is selected.

Optional Components

Containing Tank

- ☐ **VASC:** Stainless steel containing tank, installed under the pneumatic panel, to collect eventual odorant liquid loss

Remote Control Center Components

Software for Management and Programming

- ☐ **DSL:** DosaLink mini-SCADA Software

External Modem for Personal Computer (Select One or More Options)

- ☐ **DUP:** External dial-up modem for Personal Computer, to be used with DosaLink software - DSL
- ☐ **GSM:** External GSM modem for Personal Computer, to be used with DosaLink software - DSL Necessary in presence of telealarm - H6

Ordering Guide (continued)

To order this product, complete this page or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Regulator Tip:

Looking for a specific product? When you know the application and Type or Series of the product you need, you can use the Quick Product Index in the Table of Contents, the Section Outline in the Application Map of each section, or the Product Index at the back of this Application Guide to direct you to the page on which the product is described.

Type Dosaodor-D

Odorant Injection System Controlled by Type ROC809

TARTARINI

Introduction

Type Dosaodor-D is a computerized odorant injection system for natural gas that uses patented solenoid injector technology that eliminates the need for plunger pumps.

The solenoid injectors permit odorant injection accuracy to be maintained over the entire flow range of the system, approaching infinite turn down.

Automatic calibration during operation adjusts for any changes in mechanical components and detects failures for alarming. Report by exception alarming is a configurable option.

The system can also be configured to use redundant injectors and/or an emergency backup or bypass absorption system.

Real time and historical data can be read locally by a laptop computer using ROCLINK 800 configuration software or remotely using third party SCADA products utilizing modbus or ROC protocol.

ROCLINK 800 software is available for complete configuration and operation of the system including: display of real time and historical data, configuration of alarms and archival of historical data.

Type Dosaodor-D controlled by Type ROC809 is available in North America only.

Remote Telemetry Unit

For Technical Specifications please refer to the Type ROC800 Series pages

Required Equipment Includes:
Type ROC809E Controller
ROC800 Series Power Supply
ROC800 Series Discrete Relay Output Card
ROC800 Series Discrete Input Card
DS800 Runtime License
Input Card Options for Flow Rate Input:
ROC800 Series Analog Input Card
ROC800 Series Pulse Input Card

Optional Equipment:

- Type ROCLINK800 Software (at least 1 license required)
- Type ROC800 LOI Cable
- Type ROC800 Ethernet Crossover Cable
- Type ROC800 RS232 Comm Module
- Type ROC800 RS485 Comm Module
- Type ROC800 14.4 Dial-up Modem Comm
- Type ROC800 Analog Output Card
- Power Supply Charger 12 Vdc

Software Specifications

Modes of Operation:

- Auto, Manual, Minimal, Refill, Purge/Wash and Disabled
- ROC and/or modbus protocol
- Event, Alarm and History archive
- RBX and SRBX alarms

Pneumatic Panel Specifications

Material:
Stainless steel plate

Installation:
Wall mount

Weight:
55 to 100 lbs / 25 to 45 kg
(based on configuration)

Overpressure Relief Valve:
Stainless steel with following rating options:
200 psi / 13.8 bar
550 psi / 37.9 bar
870 psi / 60 bar

Electrical Protection:
Explosion proof
Class I, Division 1 and 2 - Groups B, C, D
Class I, Zone 1 and 2 - Groups IIB+H2, IIA

Material Electrical Protection:
Available for European and North American standards

Mechanical Connections:
Odorant Inlet and Discharge:
1/4-in. / 6.4 mm OD Tube Fitting (double Ferrule)
Gas Inlet and Discharge:
3/8-in. / 10 mm OD Tube fitting (single Ferrule)

Maximum Working Pressure:
Supply: 1450 psi / 100 bar
Injection: 870 psi / 60 bar

Odorant Flow Rate:
0.13 to 3.70 gallons per hour / 0.5 to 14.0 L/hr
(0.89 to 24.97 lbs/hr at 6.75 lbs/gal)

Temperature Range:
14 to 140°F / -10 to 60°C

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Consistent Odorization Proportional to Entire Range of Gas Flow Rate**
- **Significantly Reduced Maintenance**
- **Variety of Redundancy Options for Odorization**
- **User Friendly Configuration Software**
- **Automatic Calibration During Operation**
- **Standard and Scalable Hardware Platform**



Figure 1. *Type Dosaodor-D Pneumatic Panel*



Figure 2. *Type ROC809 Remote Telemetry Unit*



Figure 3. *Standard Wick Insert (Pipeline Injection)*

EMERSON. Process Management

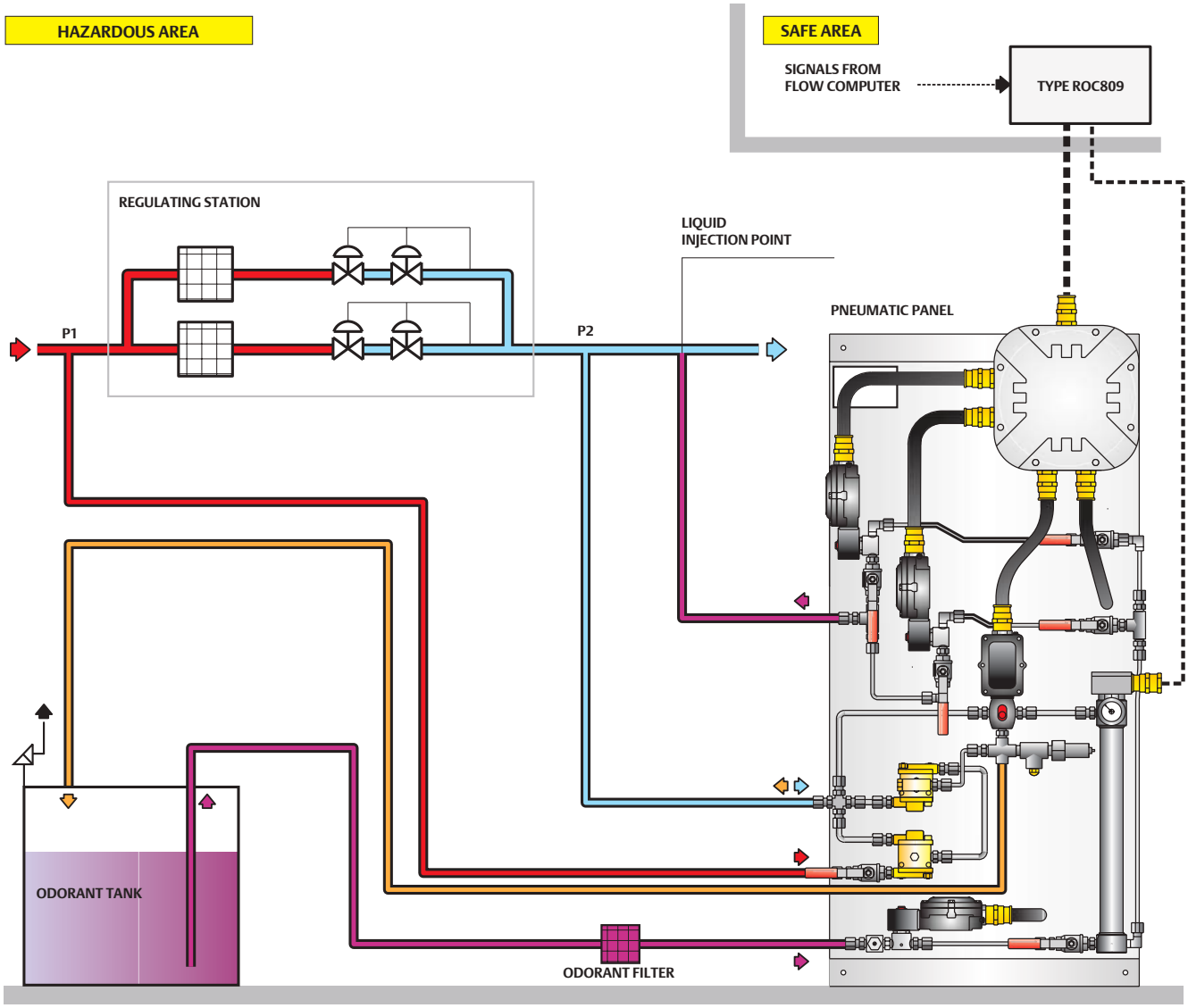


Figure 4. *Typical Type Dosaodor-D Installation Schematic*

Table 1. Maximum Odorant Injection Rate

ORDER FROM CONFIGURATION	MAXIMUM INJECTION RATE		MAXIMUM GAS VOLUME IN Sm^3/h		MAXIMUM INJECTION RATE, lbs/h (at 6.75 lbs/h)	MAXIMUM GAS VOLUME, MMSCF/h	
	gal/hr	L/h	40 mg/Sm^3 (THT)	10 mg/Sm^3 (Mercaptan)		1.0 lbs/MMSCF (THT)	0.5 lbs/MMSCF (Mercaptan)
C1	0.13	0.5	12,500	50,000	0.89	0.89	1.78
C2	0.26	1.0	25,500	100,000	1.78	1.78	3.57
C3	0.53	2.0	50,000	200,000	3.57	3.57	7.13
C4	1.06	4.0	100,000	400,000	7.13	7.13	14.27
C5	1.58	6.0	150,000	600,000	10.70	10.70	21.40
C6	2.11	8.0	200,000	800,000	14.27	14.27	28.53
C7	2.64	10.0	250,000	1,000,000	17.83	17.83	35.67
C8	3.17	12.0	300,000	1,200,000	21.40	21.40	42.80
C9	3.70	14.0	350,000	1,400,000	24.97	24.97	49.93

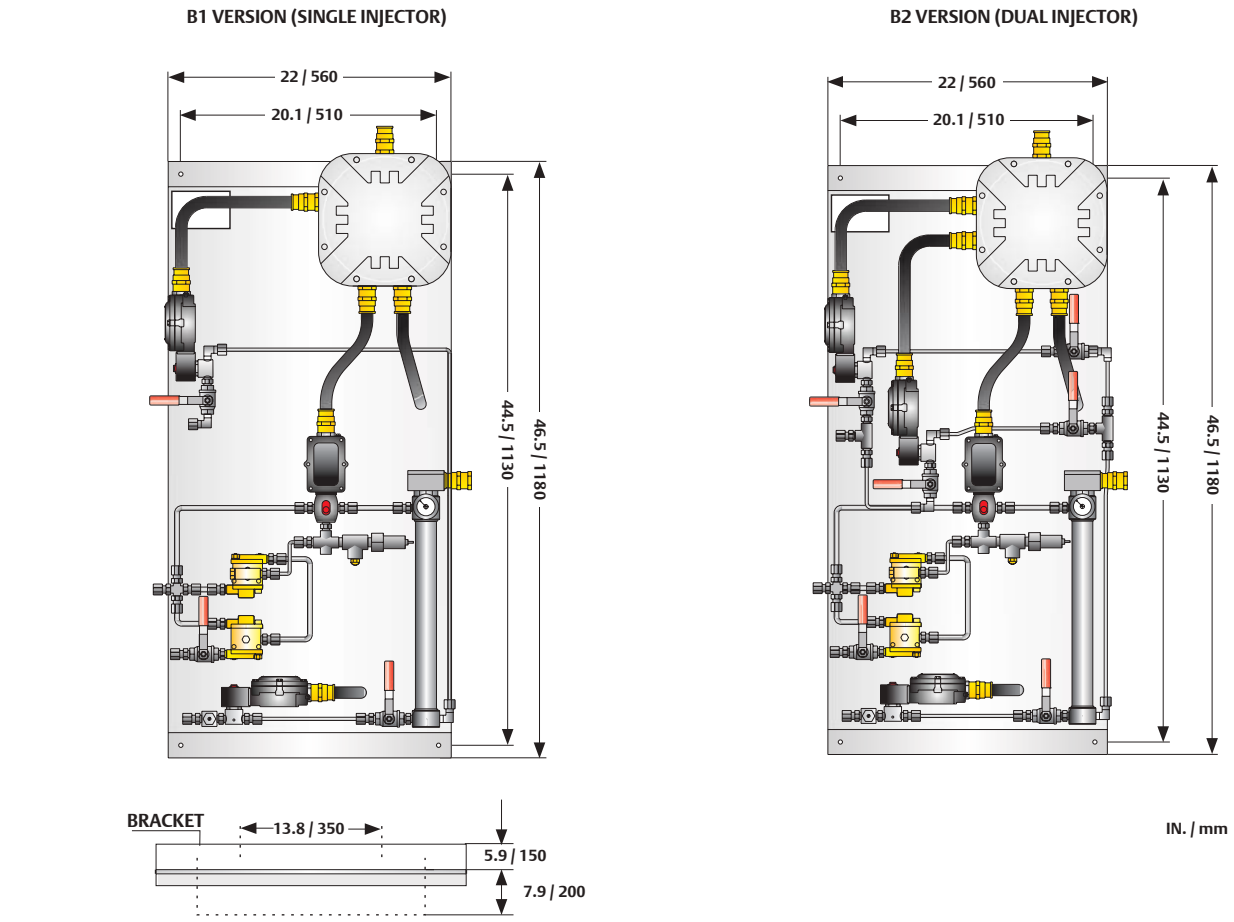


Figure 5. *Pneumatic Panel Overall Dimensions*

Ordering Guide

Base Unit (Select One)

■ **A6:** Type Dosaodor-D odorant injection system completed with:
Pneumatic Panel
- Stainless steel panel
- Installation kit (bracket, pipe connection, injector, valves, etc.)
- Explosion proof Class I, Division 1 and 2 - Groups B, C, D - Class I, Zone 1 and 2 - Groups IIB+H2, IIA
- Included 1/4-in. NPT fitting connectors for 3/8-in. / 9.5 mm and 1/4-in. / 6.4 mm OD tubing

Model (Select One)

☐ **B1:** Single Injector
☐ **B2:** Dual Injector

Maximum Odorant Injection Rate (Select One, See Table 1)

☐ **C1:** 0.13 gal/h / 0.5 l/h
☐ **C2:** 0.26 gal/h / 1.0 l/h
☐ **C3:** 0.53 gal/h / 2.0 l/h
☐ **C4:** 1.06 gal/h / 4.0 l/h
☐ **C5:** 1.58 gal/h / 6.0 l/h
☐ **C6:** 2.11 gal/h/ 8.0 l/h
☐ **C7:** 2.64 gal/hr / 10.0 l/h
☐ **C8:** 3.17 gal/hr / 12.0 l/h
☐ **C9:** 3.70 gal/hr / 14.0 l/h

Maximum Working Pressure (Select One)

☐ **I1:** 200 psi / 13.6 bar (odorant ρ ≥ 5.8 lbs/gallon / 0.70 kg/dm³)
☐ **I2:** 550 psi / 37.9 bar (odorant ρ ≥ 4.6 lbs/gallon / 0.55 kg/dm³)
☐ **I3:** 870 psi / 60 bar (odorant ρ ≥ 5.8 lbs/gallon / 0.70 kg/dm³)

- continued -

Ordering Guide (continued)

Installation Options - Wick Insert (Select One)

☐ Standard Wick Insert (for downstream size < 10-in. / DN 250)
☐ Long Wick Insert (for downstream size ≥ 10-in. / DN 250)

Installation Options - Fittings (Bulk Brand as Standard)

☐ Swagelok fittings

Cabinet for Pneumatic Panel (Optional Component)

☐ Stainless steel Cabinet for Pneumatic Panel

Automation Software and License Key

■ Software for Pneumatic Panel Control, available with Type ROC809 plus Type Dosaodor-D License Key

Type ROC809 Configurations and Options

Required Components

Quantity	Description
■ 1	Type ROC809E Controller
■ 1	Type ROC800 12 Vdc Power Supply
■ 2	Type ROC800 Discrete Relay Output Card
■ 1	Type ROC800 Discrete Input Card
■ 1	Type DS800 Runtime License

Select Input Card Type for Flow Rate Input (Choose Only One for Configuration)

Quantity	Description
☐ 1	Type ROC800 Analog Input Card
☐ 1	Type ROC800 Pulse Input Card

Optional Equipment

Quantity	Description
☐ 1	Type ROCLINK800 Software (at least1 license required)
☐ 1	Type ROC800 LOI Cable
☐ 1	Type ROC800 Ethernet Crossover Cable
☐ 1	Type ROC800 RS232 Comm Module
☐ 1	Type ROC800 RS485 Comm Module
☐ 1	Type ROC800 14.4 Dial-up Modem Comm
☐ 1	Type ROC800 Analog Output Card
☐ 1	Power Supply Charger 12 Vdc

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

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To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
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Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Regulator Tip:

If you don't see what you're looking for in this Application Guide. . . ask us about it.
Space in this Application Guide does not always permit us to list all of the options or products available to you. If you don't see the product you're looking for, just pick up the phone and ask your local Sales Office to help you find the item you need. To locate your local Sales Office, log on to www.emersonprocess.com/regulators.

EZH and EZHOSX Series

Pressure Reducing Regulators

FISHER

Introduction

Types EZH (Spring-to-Close version) and EZHSO (Spring-to-Open version) regulators are accurate pilot-operated, pressure balanced, soft-seated regulators. They are designed for use in high pressure natural gas transmission, city gate stations, large capacity distribution systems and power plant feeds. They provide smooth, reliable operation, tight shutoff and long life.

For underpressure or overpressure protection, the Types EZHOSX (Spring-to-Close) and EZHSO-OSX (Spring-to-Open) are available with an integral slam-shut device to completely shutoff the flow of gas to the downstream system. The slam-shut has a mechanism box and a manometric device. The manometric device is a spring and diaphragm actuator. Its movement activates the detection stage of the mechanism box. The shutoff is a two-stage process, the detection stage and the power stage. This separation between detection stage and power stage provides maximum precision, alleviating many false trips caused by environmental vibrations. The slam-shut device includes a bypass valve that will allow pressure to be equalized when resetting the device. Once the slam-shut device has been tripped, it must be manually reset.

Available Configurations

See Table 1

Body Sizes and End Connection Styles

See Tables 2 and 3

Flow Capacities

See Tables 8 to 14

IEC Sizing Coefficients

See Tables 9, 11, 12, 13 and 14

Maximum Allowable Pressures

Inlet Pressure: 1500 psig / 103 bar

Outlet (Casing) Pressure:
1500 psig / 103 bar

Emergency Casing Pressure:
1500 psig / 103 bar

Operating Differential Pressure:

NPS 1 / DN 25, Type EZHSO/EZHSO-OSX:
1400 psid / 96.5 bar d

All Others: 1500 psid / 103 bar d

Minimum Differential Pressures

See Table 6

Outlet Pressure Ranges

See Tables 4 and 5

Flow Coefficients

See Table 5

Pressure Registration

External

Main Valve Flow Coefficients

See Tables 8 and 9

Type PRX Pilot Flow Coefficients

C_g: 10.5; **C_v:** 0.36; **C_1:** 29

Type SA/2 Flow Coefficient

C_g: 4.9

Temperature Capabilities

Nitrile (NBR) Version:
-20 to 180°F / -29 to 82°C

Fluorocarbon (FKM) Version:
0 to 180°F / -18 to 82°C
Types PRX and SA/2 Fluorocarbon (FKM) elastomer is limited to 0°F / -18°C

Polyurethane (PU) Version:
-22 to 180°F / -30 to 82°C

Noise Comparison Diagram

See Figure 6

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com



Figure 1. *Type EZH Pressure Reducing Regulator*



Figure 2. *Type EZHOSX Pressure Reducing Regulator with Type OS2 Slam-Shut Device*

Features

- **1500 psig / 103 bar Inlet / Outlet Rating**
- **Common Body Platform**
- **Bubble Tight Shutoff**
- **Absolutely No Atmospheric Bleed**
- **Full Usable Capacity**
- **In-Line Maintenance**
- **Long Life in Severe Service Applications**
- **Precise Pressure Control**
- **High Turn Down Capability**
- **Optional Whisper Trim™ Cage Noise Abatement (Up to 8 dBA)**
- **Noise Abatement Cage (not Available to NPS 1 / DN 25 body)**
- **Integral Slam-Shut for Overpressure and Underpressure Protection**

EMERSON
Process Management

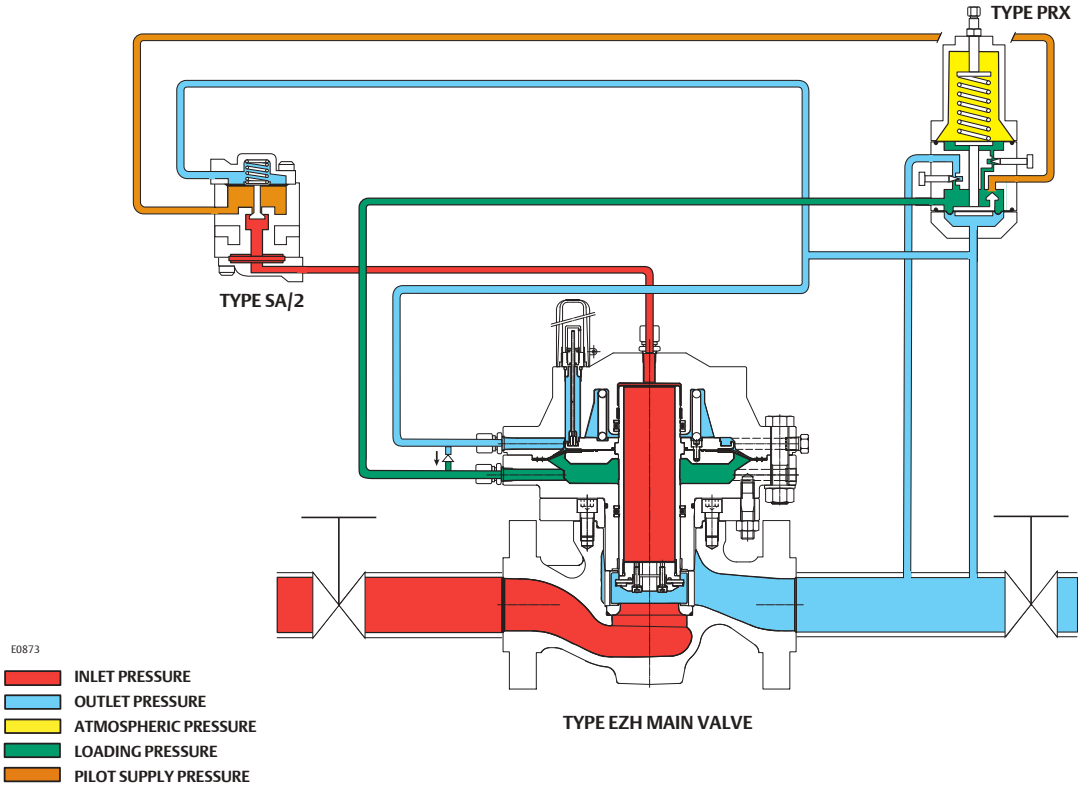


Figure 3. *Type EZH (Spring-to-Close Version) Operational Schematic*

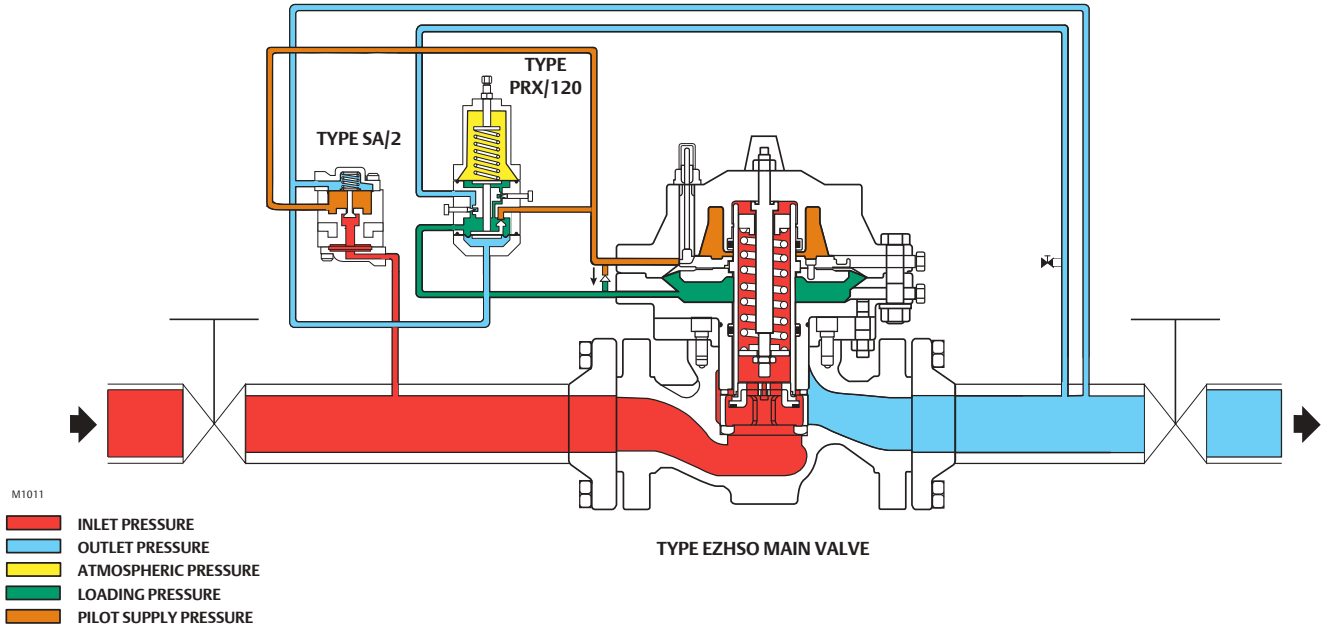


Figure 4. *Type EZHSO (Spring-to-Open Version) Operational Schematic*

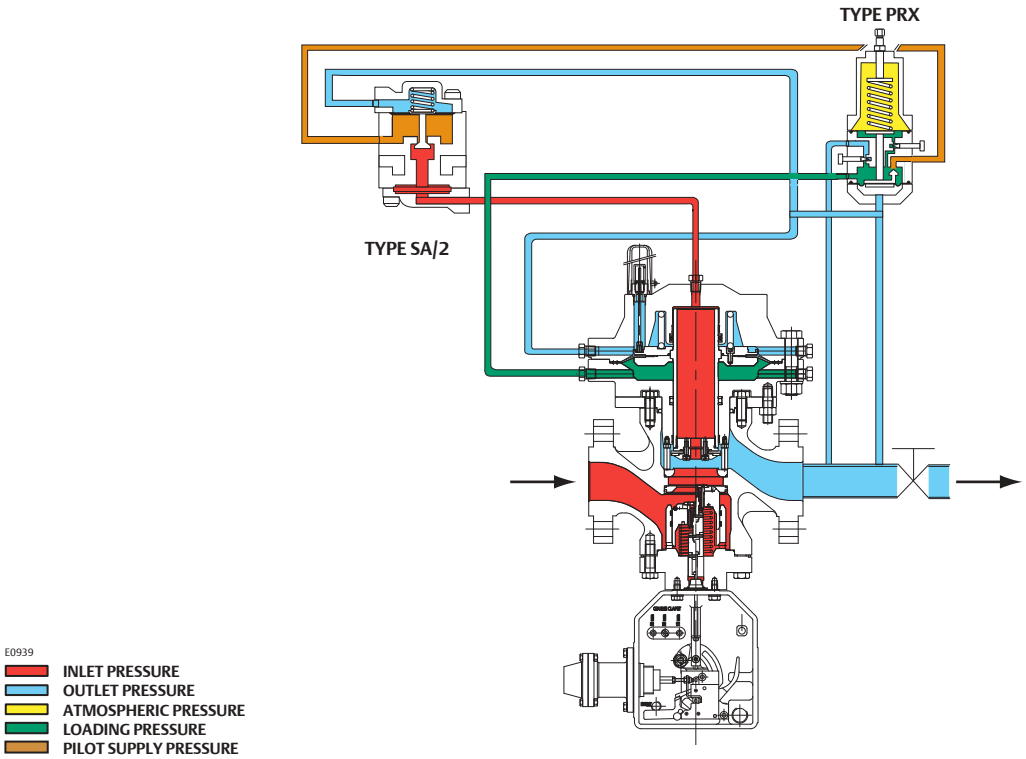


Figure 5. *Type EZHOSX Operational Schematic*

Table 1. Available Configuration

TYPE	SPRING ORIENTATION	DESCRIPTION
EZHOSX	Spring-to-Close	Pilot-operated pressure reducing regulatorfor low to high outlet pressure with a Type OS2 slam-shut for overpressure (OPSO) or overpressure and underpressure (OPSO/UPSO) protection
EZHSO-OSX	Spring-to-Open	Pilot-operated pressure reducing regulator for low to high outlet pressure with a Type OS2 slam-shut for overpressure (OPSO) or overpressure and underpressure (OPSO/UPSO) protection

Table 2. Main Valve Body Size and End Connection Style for Types EZH and EZHSO(1)

MAIN VALVE BODY SIZE		MAIN VALVE BODY MATERIAL	END CONNECTION STYLE
NPS	DN		
1	25	LCC or WCC Steel	NPT(2), SCH 40 BWE, SCH 80 BWE, SWE, CL150 RF, CL300 RF, CL600 RF or PN 16/25/40
2	50		NPT, SCH 40 BWE, SCH 80 BWE, SWE, CL150 RF, CL300 RF, CL600 RF or PN 16/25/40
3	80		SCH 40 BWE, SCH 80 BWE, CL150 RF, CL300 RF, CL600 RF or PN 25/40
4	100		SCH 40 BWE, SCH 80 BWE, CL150 RF, CL300 RF or CL600 RF
			CL150 RF, CL300 RF, CL600 RF, CL600 RF or PN 16/25/40

1. Valve bodies are available in Standard (without drain), Tapped Inlet (pilot supply) or Tapped Inlet and Outlet body style. Contact your local Sales Office for more information.
2. Also available in 1-1/4 NPT End Connection.

Table 3. Main Valve Body Size, End Connection Style and Body Rating

MAIN VALVE BODY SIZE		MAIN VALVE BODY MATERIAL	END CONNECTION STYLE	STRUCTURAL DESIGN RATING	
NPS	DN			psig	bar
1 2 3 4(1)	25 50 80 100(1)	LCC Steel	CL150 RF	290	20.0
			CL300 RF	750	51.7
			CL600 RF or BWE	1500	103

1. Available to Type EZHOSX configuration only.

Table 4. Type EZH/EZHSO Outlet Pressure Range

TYPE	OUTLET PRESSURE RANGE		AC (ACCURACY CLASS)(1)(2)		PILOT CONTROL SPRING INFORMATION	
	psig	bar	Type EZH	Type EZHSO	Spring Color	Part Number
PRX/120 PRX/125	14.5 to 26 23 to 44 41 to 80 73 to 123	1.00 to 1.8 1.6 to 3.0 2.8 to 5.5 5.0 to 8.5	± 2.5%	± 2.5%	Yellow Green Blue Black	GD25524X012 GD25523X012 GD25518X012 GD25522X012
	116 to 210 203 to 334 319 to 435	8.0 to 14.5 14.0 to 23.0 22.0 to 30.0	± 1%	± 2.5%	Silver Gold Aluminum	GD25521X012 GD25520X012 GD25586X012
PRX/120-AP PRX/125-AP	435 to 1160	30.0 to 80.0	± 1%	± 2.5%	Clear	GD27379X012

1. Accuracy class accounts outlet pressure drop plus hysteresis (friction), but does not include lockup.
2. Restrictor screw is one turn counterclockwise from fully seated.

Table 5. Type EZHOSX/EZHSO-OSX Outlet Pressure Range

TYPE	OUTLET PRESSURE RANGE		AC (ACCURACY CLASS)		PILOT CONTROL SPRING INFORMATION	
	psig	bar	Type EZHOSX	Type EZHSO-OSX	Spring Color	Part Number
PRX/120 PRX/125	7.3 to 16 14.5 to 26 23 to 44 41 to 80 73 to 123	0.50 to 1.1 1.00 to 1.8 1.6 to 3.0 2.8 to 5.5 5.0 to 8.5	5% 2.5% 2.5% 2.5% 2.5%	2.5% 2.5% 2.5% 2.5% 2.5%	White Yellow Green Blue Black	GD25525X012 GD25524X012 GD25523X012 GD25518X012 GD25522X012
	116 to 210 203 to 334 319 to 435	8.0 to 14.5 14.0 to 23.0 22.0 to 30.0	1% 1% 1%	2.5% 2.5% 2.5%	Silver Gold Aluminum	GD25521X012 GD25520X012 GD25586X012
PRX/120-AP, PRX/125-AP	435 to 1160	30.0 to 80.0	1%	2.5%	Clear	GD27379X012

Table 6. Minimum Differential Pressure(1)

TYPE	MAIN VALVE BODY SIZE		MINIMUM DIFFERENTIAL			
			For 90% Capacity		For 100% Capacity	
	NPS	DN	psid	bar d	psid	bar d
EZH	1	25	15.2	1.1	15.7	1.1
	2	50	12.0	0.83	13.8	0.95
	3	80	10.6	0.73	12.8	0.88
	4	100	15.8	1.1	16.4	1.1
EZHSO	1	25	55	3.8	55	3.8
	2	50				
	3	80				
	4	100				
EZHOSX	1	25	15.2	1.1	15.7	1.1
	2	50	12.0	0.83	13.8	0.95
	3	80	10.6	0.73	12.8	0.88
	4	100	15.8	1.1	16.4	1.1
EZHSO-OSX	1	25	55	3.8	55	3.8
	2	50	55	3.8	55	3.8
	3	80	55	3.8	55	3.8

1. When using a Type SA/2 pilot supply filter regulator, the differential pressure across the regulator must be at least 45 psid / 3.1 bar d for optimum regulator performance. The Type SA/2 can be removed if differential pressure across the regulator is less than 45 psid / 3.1 bar d and inlet pressure stays at or below 200 psig / 13.8 bar.

Table 7. Construction Material

TYPES EZH AND EZHSO MAIN VALVE	
Main Body	WCC Steel or LCC Steel (for EMA Market Only)
Intermediate Flange and Actuator Casing	Steel, ASTM A350 LF2
Diaphragm Plate	Steel, ASTM A105
Diaphragm	Nitrile (NBR) with PVC coating
Main Valve O-ring	Nitrile (NBR) or Fluorocarbon (FKM)
Actuator O-ring	Fluorocarbon (FKM)
Disk	Nitrile (NBR) or Fluorocarbon (FKM)
PRX SERIES PILOTS	
Body	Steel, ASTM A105
Trim	Stainless steel
Elastomer	Nitrile (NBR) or Fluorocarbon (FKM)
Disk	Polyurethane (PU) or Fluorocarbon (FKM)
TYPE SA/2 PILOT SUPPLY FILTER REGULATOR	
Body	Steel
Diaphragm	Nitrile (NBR) with PVC coating
O-ring/Disk	Nitrile (NBR) or Fluorocarbon (FKM)
TYPE OS2 SLAM-SHUT DEVICE	
Mechanism Box	Aluminum alloy
First and Second Stage Mechanism	LCC/WCC Steel
Diaphragm	Nitrile (NBR)
Bellow	316 Stainless steel

Table 8. Types EZH and EZHSO Main Valve with Standard Cage Regulating Flow Coefficient

MAIN VALVE BODY SIZE		TRIM, % OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING		
NPS	DN		C_g	C_v	C_1	C_g	C_v	C_1
1	25	100	564	16.3	34.6	544	15.3	35.5
		80	436	12.3	35.4	423	10.9	38.7
		50	284	8.4	33.7	249	6.3	39.7
		30	172	5.3	32.5	157	4.0	39.1
2	50	100	2278	58.5	38.9	2110	62.9	33.5
		80	1719	47.1	36.5	1609	50.5	31.9
		50	1213	31.0	39.1	1177	33.0	35.6
		30	707	16.9	41.7	718	18.8	38.2
3	80	100	4960	133	37.3	4396	143	30.8
		80	3950	109	36.2	3294	97.2	33.9
		50	2550	63.6	40.1	2069	54.7	37.80
		30	1530	36.7	41.7	1339	39.8	33.6
4	100	100	7250	227	31.9	7170	229	31.3
		80	5750	165	34.8	5630	165	34.1
		50	3510	95.9	36.6	3460	95.5	36.2
		30	2130	56.7	37.6	2080	56.2	37.0

Table 9. Types EZHOSX and EZHSO-OSX Main Valve with Standard Cage Flow and Sizing Coefficient

MAIN VALVE BODY SIZE	TRIM, % OF CAPACITY	LINE SIZE EQUALS BODY SIZE						2:1 LINE SIZE TO BODY SIZE PIPING					
		C_g	C_v	C_1	IEC Sizing Coefficient			C_g	C_v	C_1	IEC Sizing Coefficient		
					X_T	F_D	F_L				X_T	F_D	F_L
Regulating													
NPS 1 / DN 25	100	560	16.3	34.4	0.75	0.61		550	17.6	31.3	0.94	0.63	
	80	428	12.0	35.7	0.81	0.52		408	11.9	34.3	0.68	0.53	
	50	282	8.3	33.9	0.73	0.44		245	7.3	33.6	0.26	0.44	
	30	171	5.3	32.3	0.65	0.35		154	4.8	32.1	0.87	0.35	
NPS 2 / DN 50	100	2259	53.5	42.3	0.78	0.61		2092	54.6	38.3	0.86	0.60	
	80	1837	52.0	35.4	0.79	0.55		1762	50.0	35.3	0.92	0.54	
	50	1297	32.9	39.4	0.98	0.45		1301	33.5	38.80	0.95	0.44	
	30	746	17.9	41.7	1.10	0.35		746	18.3	40.80	1.05	0.31	
NPS 3 / DN 80	100	4620	125	37.0	0.87	0.56	0.89	4359	142	30.8	0.59	0.56	0.89
	80	3920	106	37.0	0.87	0.52		3266	96.4	33.9	0.72	0.51	
	50	2560	64.9	39.4	0.98	0.41		2052	54.3	37.8	0.90	0.40	
	30	1540	36.8	41.8	1.11	0.31		1328	39.5	33.6	0.71	0.31	
NPS 4 / DN 100[1]	100	7120	209	34.1	0.73	0.61		6920	213	32.5	0.66	0.61	
	80	5920	162	36.5	0.84	0.74		5760	163	35.3	0.78	0.74	
	50	3550	93.3	38.0	0.91	0.76		3420	91.7	37.3	0.88	0.75	
	30	2080	56.4	36.9	0.86	0.78		2060	55.6	37.1	0.87	0.77	

1. Available to Type EZHOSX configuration only.

- continued -

Table 9. Types EZHOSX and EZHSO-OSX Main Valve with Standard Cage Flow and Sizing Coefficient (continued)

MAIN VALVE BODY SIZE	TRIM, % OF CAPACITY	LINE SIZE EQUALS BODY SIZE						2:1 LINE SIZE TO BODY SIZE PIPING					
		C_g	C_v	C_1	IEC Sizing Coefficient			C_g	C_v	C_1	IEC Sizing Coefficient		
					X_T	F_D	F_L				X_T	F_D	F_L
Wide-Open													
NPS 1 / DN 25	100	582	16.95	34.34	0.75	0.61	0.89	572	18.3	31.26	0.94	0.63	0.89
	80	445	12.48	35.66	0.81	0.52		424	12.38	34.25	0.68	0.53	
	50	293	8.66	33.83	0.73	0.44		255	7.59	33.60	0.26	0.44	
	30	178	5.51	32.30	0.65	0.35		160	4.99	32.06	0.87	0.35	
NPS 2 / DN 50	100	2349	55.59	42.26	0.78	0.61		2176	56.75	38.34	0.86	0.60	
	80	1911	54.04	35.36	0.79	0.55		1832	51.97	35.25	0.92	0.54	
	50	1348	34.21	39.40	0.98	0.45		1352	34.87	38.77	0.95	0.44	
	30	776	18.62	41.68	1.10	0.35		775	19.01	40.77	1.05	0.31	
NPS 3 / DN 80	100	4805	130	36.96	0.87	0.56		4533	147	30.77	0.59	0.56	
	80	4077	110	36.98	0.87	0.52		3397	100	33.89	0.72	0.51	
	50	2662	67.50	39.44	0.98	0.41		2134	56.46	37.80	0.90	0.40	
	30	1602	38.27	41.86	1.11	0.31		1381	41.05	33.64	0.71	0.31	
NPS 4 / DN 100[1]	100	7330	215	34.0	0.73	0.61		7130	219	32.4	0.66	0.61	
	80	6100	167	36.5	0.84	0.74		5930	168	35.2	0.78	0.74	
	50	3660	96.1	38.0	0.91	0.76		3520	94.5	37.4	0.88	0.75	
	30	2140	58.1	36.9	0.86	0.78		2120	57.3	37.1	0.87	0.77	

1. Available to Type EZHOSX configuration only.

Table 10. Types EZH and EZHSO with Standard Cage Wide-Open Flow Coefficient

MAIN VALVE BODY SIZE		TRIM, % OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING		
NPS	DN		C_g	C_v	C_1	C_g	C_v	C_1
1	25	100	587	16.95	34.63	566	15.94	35.51
		80	453	12.79	35.42	440	11.37	38.70
		50	295	8.76	33.68	259	6.52	39.72
		30	179	5.51	32.49	163	4.16	39.18
2	50	100	2369	60.89	38.91	2194	65.44	33.53
		80	1788	48.94	36.53	1673	52.52	31.85
		50	1261	32.26	39.09	1224	34.35	35.63
		30	735	17.62	41.71	747	19.57	38.17
3	80	100	5158	138	37.29	4571	149	30.77
		80	4108	113	36.24	3426	101	33.89
		50	2652	66.14	40.10	2152	56.94	37.79
		30	1591	38.17	41.68	1393	41.40	33.65
4	100	100	7470	234	31.6	7390	236	31.4
		80	5920	170	34.8	5800	170	34.2
		50	3620	98.8	36.7	3560	98.4	36.3
		30	2190	58.4	37.3	2140	57.9	37.3

Table 11. Types EZH and EZHSO Main Valve with Standard Cage IEC Sizing Coefficient

MAIN VALVE BODY SIZE		TRIM, % OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING		
NPS	DN		X_T	F_D	F_L	X_T	F_D	F_L
1	25	100	0.61	0.61	0.89	0.80	0.64	0.89
		80	0.72	0.53		0.95	0.54	
		50	0.69	0.44		0.99	0.44	
		30	0.66	0.35		0.97	0.35	
2	50	100	0.73	0.63		0.69	0.63	
		80	0.84	0.55		0.72	0.55	
		50	0.97	0.45		0.84	0.45	
		30	0.99	0.35		0.92	0.35	
3	80	100	0.88	0.58		0.60	0.58	
		80	0.83	0.52		0.73	0.52	
		50	1.02	0.41		0.90	0.41	
		30	1.10	0.32		0.72	0.32	
4	100	100	0.63	0.63		0.62	0.63	
		80	0.76	0.74		0.74	0.74	
		50	0.85	0.77		0.83	0.77	
		30	0.88	0.78		0.88	0.77	

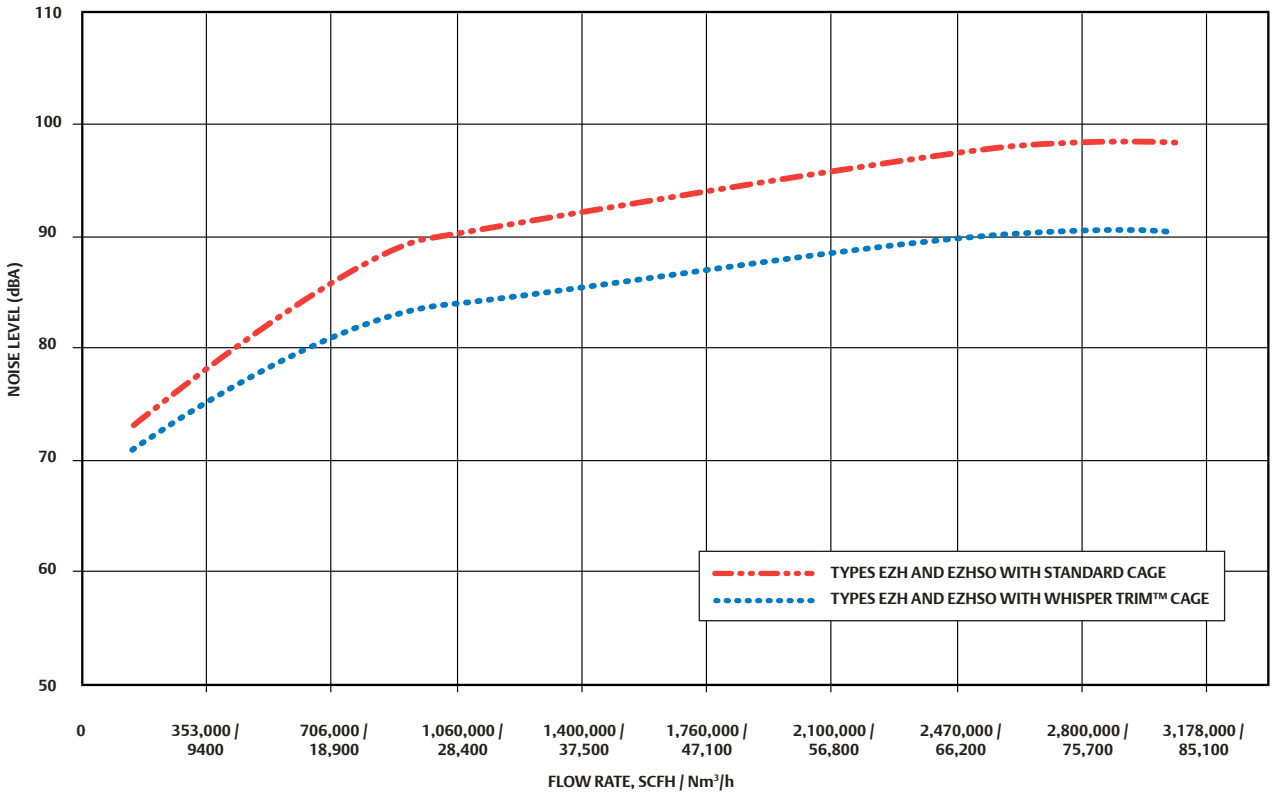


Figure 6. *Noise Comparison Diagram*

Table 12. Whisper Trim™ Cage Regulating Flow and Sizing Coefficient

MAIN VALVE BODY SIZE		TRIM, % OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING			IEC SIZING COEFFICIENT				
									1:1 Line to Body Size		2:1 Line to Body Size		F_L
NPS	DN		C_g	C_v	C_1	C_g	C_v	C_1	X_T	F_D	X_T	F_D	
2	50	100	1627	42.5	38.3	1539	45.9	33.5	0.82	0.03	0.71	0.03	0.89
		80	1466	37.6	39.0	1389	40.7	34.1	0.90	0.03	0.74	0.03	
		50	1114	28.0	39.8	1099	30.8	35.7	0.99	0.02	0.81	0.02	
		30	689	16.6	41.6	695	18.4	37.7	0.99	0.02	0.90	0.02	
3	80	100	3502	103	34.1	3313	108	30.8	0.59	0.02	0.60	0.02	
		80	2928	81.4	36.0	2774	82.6	33.6	0.72	0.02	0.71	0.02	
		50	1934	49.3	39.2	1908	51.4	37.1	0.95	0.01	0.87	0.01	
		30	1355	32.9	41.2	1366	35.0	39.0	1.02	0.01	0.96	0.01	
4	100	100	5570	179	31.1	5410	178	30.4	0.61	0.02	0.59	0.02	
		80	4860	148	32.8	4730	146	32.4	0.67	0.02	0.66	0.02	
		50	3340	93.4	35.8	3320	93.0	35.7	0.80	0.01	0.79	0.01	
		30	2080	54.3	38.3	2050	55.0	37.3	0.92	0.01	0.88	0.01	

Table 13. Whisper Trim™ Cage Wide-Open Flow and Sizing Coefficient

MAIN VALVE BODY SIZE		TRIM, % OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING			IEC SIZING COEFFICIENT				
									1:1 Line to Body Size		2:1 Line to Body Size		F_L
NPS	DN		C_g	C_v	C_1	C_g	C_v	C_1	X_T	F_D	X_T	F_D	
2	50	100	1692	44.2	38.2	1600	47.7	33.5	0.82	0.03	0.71	0.03	0.89
		80	1524	39.1	39.0	1444	42.3	34.1	0.90	0.03	0.74	0.03	
		50	1159	29.1	39.8	1143	31.9	35.8	0.99	0.02	0.81	0.02	
		30	718	17.2	41.7	722	19.2	37.6	0.99	0.02	0.90	0.02	
3	80	100	3642	107	34.1	3445	112	30.7	0.59	0.02	0.60	0.02	
		80	3045	84.7	35.9	2885	85.8	33.6	0.72	0.02	0.71	0.02	
		50	2011	51.3	39.2	1985	53.4	37.1	0.95	0.01	0.87	0.01	
		30	1409	34.2	41.2	1421	36.3	39.1	1.02	0.01	0.96	0.01	
4	100	100	5740	184	31.0	5570	183	30.5	0.61	0.02	0.59	0.02	
		80	5010	152	32.7	4870	150	32.4	0.67	0.02	0.66	0.02	
		50	3440	96.2	35.6	3420	95.8	35.3	0.80	0.01	0.79	0.01	
		30	2140	55.9	38.1	2110	56.7	37.3	0.92	0.01	0.88	0.01	

Table 14. Types EZHOSX and EZHSO-OSX Main Valve with Whisper Trim® Cage Flow and Sizing Coefficient

MAIN VALVE BODY SIZE		TRIM, % OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING			IEC SIZING COEFFICIENT				
									1:1 Line to Body Size		2:1 Line to Body Size		F_L
NPS	DN		C_g	C_v	C_1	C_g	C_v	C_1	X_T	F_D	X_T	F_D	
Regulating													
2	50	100	1494	39.9	37.4	1516	41.0	37.0	0.89	0.03	0.87	0.03	0.89
		80	1473	39.3	37.5	1482	39.5	37.5	0.89	0.03	0.89	0.03	
		50	1171	30.0	39.0	1169	29.6	39.5	0.96	0.02	0.99	0.02	
		30	721	17.0	42.4	718	18.2	39.4	1.14	0.02	0.98	0.02	
3	80	100	3472	102	34.1	3285	107	30.8	0.73	0.02	0.59	0.02	
		80	2903	80.7	36.0	2751	81.9	33.6	0.82	0.02	0.71	0.02	
		50	1918	48.9	39.2	1892	51.0	37.1	0.97	0.01	0.96	0.01	
		30	1344	32.6	41.2	1354	34.7	39.0	1.07	0.01	0.96	0.01	
4[1]	100[1]	100	5490	167	32.9	5320	168	31.7	0.68	0.02	0.63	0.02	
		80	4960	144	34.4	4810	141	34.1	0.74	0.02	0.73	0.02	
		50	3270	89.9	36.4	3190	87.7	36.4	0.83	0.01	0.80	0.01	
		30	2040	54.4	37.5	2020	53.7	37.6	0.89	0.01	0.90	0.01	
Wide-Open													
2	50	100	1554	41.5	37.4	1577	42.6	37.1	0.89	0.03	0.87	0.03	0.89
		80	1532	40.9	37.5	1542	41.1	37.5	0.89	0.03	0.89	0.03	
		50	1218	31.2	39.0	1216	30.8	39.4	0.96	0.02	0.99	0.02	
		30	750	17.7	42.3	747	19.0	39.3	1.14	0.02	0.98	0.02	
3	80	100	3611	106	34.1	3416	111	30.7	0.73	0.03	0.59	0.03	
		80	3020	81.0	35.9	2861	82.2	33.6	0.82	0.03	0.71	0.03	
		50	1994	50.9	39.1	1968	53.0	37.1	0.97	0.02	0.86	0.02	
		30	1397	33.9	41.2	1409	36.1	39.0	1.07	0.02	0.96	0.02	
4[1]	100[1]	100	5650	172	32.9	5480	173	31.6	0.68	0.02	0.63	0.02	
		80	5110	148	34.2	4950	145	34.1	0.74	0.02	0.73	0.02	
		50	3370	92.6	36.3	3290	89.7	36.8	0.83	0.01	0.86	0.01	
		30	2100	56.0	37.6	2080	55.3	37.6	0.89	0.01	0.90	0.01	

1. Available to Type EZHOSX configuration only.

Table 15. Capacities for Types EZH and EZHSO with PRX Series Pilot and Type SA/2 Pilot Supply Filter Regulator

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING							
				NPS 1 / DN 25		NPS 2 / DN 50		NPS 3 / DN 80		NPS 4 / DN 100	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
30	2.1	15	1.0	27	0.7	112	3.0	229	6.1	365	9.8
40	2.8	15	1.0	37	0.9	149	4.0	309	8.2	483	13.0
		25	1.7	31	0.8	128	3.4	260	6.9	420	11.3
50	3.4	15	1.0	45	1.2	183	4.9	382	10.2	588	15.8
		25	1.7	41	1.1	169	4.5	347	9.3	550	14.8
		35	2.4	35	0.9	142	3.8	288	7.7	469	12.6
60	4.1	Up to 16	Up to 1.1	53	1.4	214	5.7	450	12.0	687	18.4
		20	1.3	52	1.3	211	5.6	440	11.8	678	18.2
		30	2.0	48	1.3	197	5.3	406	10.8	641	17.2
		45	3.1	38	1.0	156	4.2	314	8.4	513	13.8
75	5.2	Up to 22	Up to 1.5	63	1.7	257	6.9	541	14.5	825	22.1
		30	2.0	61	1.6	250	6.7	520	13.9	806	21.6
		40	2.7	58	1.5	235	6.3	483	12.9	764	20.5
		60	4.1	42	1.1	174	4.6	349	9.3	574	15.4
100	6.9	Up to 32	Up to 2.2	81	2.2	329	8.8	692	18.5	1055	28.3
		40	2.7	79	2.1	322	8.6	672	18.0	1038	27.9
		50	3.4	76	2.0	309	8.3	639	17.1	1003	26.9
		85	5.8	49	1.3	200	5.3	401	10.7	663	17.8
125	8.6	Up to 43	Up to 2.9	99	2.7	400	10.7	841	22.6	1283	34.4
		50	3.4	97	2.6	394	10.6	824	22.1	1269	34.1
		75	5.2	88	2.4	356	9.5	730	19.6	1163	31.2
		110	7.5	55	1.4	224	6.0	447	12.0	742	19.9
150	10.3	Up to 52	Up to 3.5	117	3.1	473	12.7	994	26.6	1515	40.7
		75	5.2	110	2.9	449	12.0	929	24.9	1453	39.0
		95	6.5	101	2.7	411	11.0	841	22.5	1345	36.1
		130	8.9	68	1.8	278	7.5	557	14.9	923	24.8

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Table 15. Capacities for Types EZH and EZHSO with PRX Series Pilot and Type SA/2 Pilot Supply Filter Regulator (continued)

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING							
				NPS 1 / DN 25		NPS 2 / DN 50		NPS 3 / DN 80		NPS 4 / DN 100	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
200	13.8	Up to 73	Up to 5.0	152	4.1	616	16.5	1295	34.7	1974	53.0
		100	6.9	145	3.9	588	15.8	1219	32.7	1903	51.1
		125	8.6	133	3.6	544	14.6	1113	29.8	1775	47.7
		185	12.8	69	1.8	283	7.6	563	15.1	940	25.2
300	20.7	Up to 115	Up to 7.9	222	6.0	902	24.2	1895	50.8	2892	77.6
		150	10.3	213	5.7	866	23.2	1798	48.2	2802	75.2
		200	13.8	190	5.1	773	20.7	1579	42.3	2532	67.9
		275	19.0	107	2.9	440	11.8	877	23.5	1462	39.2
400	27.6	Up to 155	Up to 10.7	293	7.9	1189	31.9	2500	67.0	3813	102
		200	13.8	282	7.6	1145	30.7	2377	63.7	3701	99.3
		250	17.2	261	7.0	1061	28.4	2176	58.3	3463	92.9
		300	20.7	227	6.1	926	24.8	1876	50.3	3047	81.8
		350	24.1	171	4.6	698	18.7	1399	37.5	2316	62.2
500	34.5	Up to 196	Up to 13.5	364	9.8	1476	39.6	3103	83.2	4732	127
		225	15.5	357	9.6	1451	38.9	3031	81.2	4673	125
		300	20.7	330	8.8	1345	36.0	2765	74.1	4379	117
		400	27.6	259	7.0	1058	28.4	2134	57.2	3492	93.6
600	41.4	Up to 237	Up to 16.3	435	11.7	1763	47.2	3705	99.3	5651	151
		300	20.7	419	11.2	1701	45.6	3535	94.7	5498	147
		375	25.9	388	10.4	1579	42.3	3238	86.8	5149	138
		450	31.0	338	9.1	1378	37.0	2793	74.9	4535	122
700	48.3	Up to 278	Up to 19.2	505	13.5	2049	55.0	4308	115	6570	176
		350	24.1	487	13.1	1979	53.0	4114	110	6397	171
		400	27.6	469	12.6	1907	51.1	3934	105	6196	166
		600	41.4	314	8.4	1283	34.4	2575	69.0	4251	114
800	55.2	Up to 350	Up to 24.1	569	15.2	2311	62.0	4836	130	7431	199
		450	31.0	538	14.4	2187	58.6	4517	121	7100	190
		609	42.0	441	11.8	1800	48.2	3644	97.7	5926	159
900	62.1	Up to 350	Up to 24.1	649	17.4	2630	70.5	5535	148	8424	226
		500	34.5	606	16.2	2466	66.1	5098	137	8003	214
		609	42.0	552	14.8	2249	60.3	4591	123	7361	197
1000	69.0	Up to 350	Up to 24.1	726	19.5	2942	79.0	6219	167	9391	252
		500	34.5	693	18.6	2814	75.4	5851	157	9092	244
		609	42.0	650	17.4	2645	71.0	5437	146	8615	231
1100	75.8	Up to 350	Up to 24.1	802	21.5	3248	87.0	6894	185	10,342	277
		500	34.5	775	20.8	3147	84.3	6576	176	10,131	272
		609	42.0	740	19.8	3011	80.7	6226	167	9769	262
1200	82.7	Up to 350	Up to 24.1	877	24.0	3551	95.2	7562	203	11,281	302
		500	34.5	855	23.0	3470	93.0	7282	195	11,137	298
		609	42.0	827	22.2	3359	90.0	6980	187	10,859	291
1300	89.6	Up to 350	Up to 24.1	952	26.0	3852	103	8224	220	12,211	327
		500	34.5	934	25.0	3786	101	7976	214	12,121	325
		609	42.0	910	24.4	3694	99.0	7709	207	11,906	319
1400	96.5	Up to 350	Up to 24.1	1026	27.5	4151	111	8883	238	13,140	352
		500	34.5	1011	27.1	4098	110	8660	232	13,088	351
		609	42.0	991	26.6	4021	108	8422	226	12,924	346
1480	102	Up to 350	Up to 24.1	1085	29.1	4388	118	9408	252	13,883	372
		500	34.5	1072	28.7	4344	116	9201	247	13,852	371
		609	42.0	1054	28.2	4277	115	8983	241	13,722	368

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Table 16. Capacities for Types EZHOSX and EZHSO-OSX with PRX Series Pilot and Type SA/2 Pilot Supply Filter Regulator

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING							
				NPS 1 / DN 25 Body		NPS 2 / DN 50 Body		NPS 3 / DN 80 Body		NPS 4 / DN 100(1) Body	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
30	2.1	up to 7.3 15	up to 0.50 1.0	30 27	0.8 0.7	122 108	3.3 2.9	243 214	6.5 5.7	390 351	10.5 9.4
40	2.8	up to 8 15 25	up to 0.55 1.0 1.7	38 36 31	1.0 1.0 0.8	154 145 124	4.1 3.9 3.3	308 289 244	8.2 7.7 6.5	490 467 401	13.1 12.5 10.8
50	3.4	up to 12 15 25 35	up to 0.83 1.0 1.7 2.4	45 45 41 35	1.2 1.2 1.1 0.9	182 179 164 138	4.9 4.8 4.4 3.7	364 357 325 270	9.8 9.6 8.7 7.2	580 572 529 447	15.6 15.4 14.2 12.0
60	4.1	up to 16 20 30 45	up to 1.1 1.4 2.1 3.1	52 52 48 38	1.4 1.4 1.3 1.0	210 206 192 150	5.6 5.5 5.1 4.0	421 412 380 294	11.3 11.0 10.2 7.9	669 659 617 489	18.0 17.7 16.6 13.1
75	5.2	up to 22 30 40 60	up to 1.5 2.1 2.8 4.1	63 61 57 42	1.7 1.6 1.5 1.1	252 244 228 167	6.8 6.5 6.1 4.5	505 486 452 327	13.5 13.0 12.1 8.8	804 781 735 545	21.6 21.0 19.7 14.6
100	6.9	up to 32 40 50 85	up to 2.2 2.8 3.4 5.9	81 79 75 49	2.2 2.1 2.0 1.3	323 315 301 193	8.7 8.4 8.1 5.2	647 628 598 376	17.3 16.8 16.0 10.1	1029 1008 968 629	27.6 27.0 26.0 16.9
125	8.6	up to 43 50 75 110	up to 3.0 3.4 5.2 7.6	98 96 87 54	2.6 2.3 2.3 1.4	392 386 346 215	10.5 10.3 9.3 5.8	786 770 684 420	21.1 20.6 18.3 11.3	1251 1233 1117 703	33.6 33.1 30.0 18.9
150	10.3	up to 52 75 95 130	up to 3.6 5.2 6.6 9.0	116 110 100 68	3.1 3.0 2.7 1.8	464 437 399 268	12.4 11.7 10.7 7.2	929 869 788 523	24.9 23.3 21.1 14.0	1478 1405 1290 875	39.7 37.7 34.6 23.5
200	13.8	up to 73 100 125 185	up to 5.0 6.9 8.6 12.8	151 144 133 69	4.0 3.9 3.6 1.8	604 573 528 272	16.2 15.4 14.2 7.3	1210 1140 1043 529	32.4 30.6 28.0 14.2	1925 1841 1705 889	51.7 49.4 45.8 23.9
300	20.7	up to 115 150 200 275	up to 7.9 10.3 13.8 19.0	221 212 188 107	5.9 5.7 5.0 2.9	884 845 750 422	23.7 22.6 20.1 11.3	1771 1682 1479 823	47.5 45.1 39.6 22.1	2819 2712 2426 1383	75.7 72.8 65.1 37.1
400	27.6	up to 155 200 250 300 350	up to 10.7 13.8 17.2 20.7 24.1	291 280 259 225 170	7.8 7.5 6.9 6.0 4.6	1166 1117 1031 895 672	31.2 29.9 27.6 24.0 18.0	2337 2224 2038 1758 1312	62.6 59.6 54.6 47.1 35.2	3718 3583 3327 2907 2196	99.8 96.2 89.3 78.0 58.9
500	34.5	up to 196 225 300 400	up to 13.5 15.5 20.7 27.6	361 355 328 257	9.7 9.5 8.8 6.9	1447 1419 1308 1021	38.8 38.0 35.1 27.4	2900 2834 2589 2001	77.7 76.0 69.4 53.6	4614 4539 4215 3323	124 122 113 89.2
600	41.4	up to 237 300 375 450	up to 16.3 20.7 25.9 31.0	431 416 385 335	11.6 11.1 10.3 9.0	1729 1661 1534 1333	46.3 44.5 41.1 35.7	3463 3307 3033 2618	92.8 88.6 81.3 70.2	5510 5325 4949 4328	148 143 133 116
700	48.3	up to 278 350 400 600	up to 19.2 24.1 27.6 41.4	502 484 465 312	13.5 13.0 12.5 8.4	2010 1933 1857 1236	53.9 51.8 49.8 33.1	4027 3849 3683 2415	108 103 98.7 64.7	6406 6196 5975 4034	172 166 160 108
800	55.2	up to 350 450 609	up to 24.1 31.0 42.0	565 534 438	15.1 14.3 11.7	2262 2130 1740	60.6 57.1 46.6	4522 4227 3416	121 113 91.5	7227 6851 5652	194 184 152
900	62.1	up to 350 500 609	up to 24.1 34.5 42.0	644 602 548	17.3 16.1 14.7	2580 2403 2181	69.1 64.4 58.5	5173 4771 4301	139 128 115	8220 7726 7055	221 207 189
1000	68.9	up to 350 500 609	up to 24.1 34.5 42.0	721 688 645	19.3 18.4 17.3	2891 2748 2571	77.5 73.6 68.9	5811 5473 5091	156 147 136	9189 8808 8290	247 236 223
1100	75.8	up to 350 500 609	up to 24.1 34.5 42.0	796 770 735	21.3 20.6 19.7	3197 3079 2934	85.7 82.5 78.6	6439 6149 5827	173 165 156	10,142 9844 9432	272 264 253

1. Available to Type EZHOSX configuration only.

Table 17. Capacities for Types EZH and EZHSO with PRX-AP Series Pilot and Type SA/2 Pilot Supply Filter Regulator

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING							
				NPS 1 / DN 25		NPS 2 / DN 50		NPS 3 / DN 80		NPS 4 / DN 100	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
500	34.5	250 300 400	17.2 20.7 27.6	350 330 259	9.4 8.8 7.0	1423 1345 1058	38.1 36.0 28.4	2956 2765 2134	79.2 74.1 57.2	4600 4379 3492	123 117 93.6
600	41.4	250 350 500	17.2 24.1 34.5	432 400 288	11.6 10.7 7.7	1752 1626 1176	47.0 43.6 31.5	3675 3351 2364	98.5 89.8 63.4	5628 5289 3889	151 142 104
700	48.3	250 300 400 550	17.2 20.7 27.6 37.9	510 501 469 371	13.7 13.4 12.6 10.0	2068 2032 1907 1514	55.4 54.5 51.1 40.6	4366 4256 3934 3058	117 114 105 82.0	6607 6530 6196 4992	177 175 166 134
800	55.2	Up to 300 400 500 650	Up to 20.7 27.6 34.5 44.8	579 556 515 401	15.5 14.9 13.8 10.7	2349 2257 2096 1639	63.0 60.5 56.2 44.0	4951 4693 4301 3302	133 126 115 88.5	7517 7295 6835 5414	202 196 184 145
900	62.1	Up to 350 400 600 800	Up to 24.1 27.6 41.4 55.2	649 638 557 361	17.4 17.1 15.0 9.7	2630 2589 2271 1475	70.5 69.4 60.9 39.5	5535 5416 4641 2952	148 145 124 79.1	8424 8331 7428 4897	226 224 199 131
1000	69.0	Up to 400 500 600 800	Up to 27.6 34.5 41.4 55.2	718 693 654 514	19.2 18.6 17.5 13.8	2910 2814 2662 2097	78.0 75.4 71.3 56.2	6118 5851 5477 4231	164 157 147 113	9330 9092 8665 6922	250 244 232 186
1100	75.8	Up to 450 600 800 1000	Up to 31.0 41.4 55.2 68.9	786 744 635 402	21.1 20.0 17.0 10.8	3190 3025 2589 1646	85.5 81.1 69.4 44.1	6700 6259 5261 3287	180 168 141 88.1	10,234 9807 8504 5469	275 263 228 147
1200	82.7	Up to 500 600 800 1100	Up to 34.5 41.4 55.2 75.8	855 829 741 422	23.0 22.2 19.9 11.3	3470 3370 3020 1724	93.0 90.3 80.9 46.2	7282 7008 6172 3442	195 188 165 92.2	11,137 10,888 9876 5734	299 292 265 154
1300	89.6	Up to 500 600 800 1160	Up to 34.5 41.4 55.2 80.0	934 912 839 513	25.0 24.4 22.5 13.7	3786 3704 3414 2096	101 99.3 91.5 56.2	7976 7735 7014 4193	214 207 188 112	12,121 11,930 11,125 6958	325 320 298 187
1400	96.5	Up to 500 600 800 1160	Up to 34.5 41.4 55.2 80.0	1011 993 930 674	27.1 26.6 25.0 18.1	4098 4029 3785 2753	110 108 101 73.8	8660 8444 7812 5540	232 226 209 148	13,088 12,942 12,294 9102	351 347 330 244
1480	102	Up to 500 600 800 1160	Up to 34.5 41.4 55.2 80.0	1072 1056 1001 782	28.7 28.3 26.8 21.0	4344 4284 4070 3191	116 115 109 85.5	9201 9004 8428 6447	247 241 226 173	13,852 13,737 13,188 10,518	372 369 354 282

Table 18. Capacities for Types EZHOSX and EZHSO-OSX with PRX-AP Series Pilot and Type SA/2 Pilot Supply Filter Regulator

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING							
				NPS 1 / DN 25 Body		NPS 2 / DN 50 Body		NPS 3 / DN 80 Body		NPS 4 / DN 100[1] Body	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
500	34.5	250 300 400	17.2 20.7 27.6	348 328 257	9.3 8.8 6.9	1389 1308 1021	37.2 35.1 27.4	2766 2589 2001	74.1 69.4 53.6	4454 4215 3323	120 113 89.2
600	41.4	250 350 500	17.2 24.1 34.5	429 397 286	11.5 10.6 7.7	1717 1308 1021	46.0 42.4 30.4	3436 3137 2217	92.1 84.1 59.4	5480 5097 3695	147 137 99.2
700	48.3	250 300 400 550	17.2 20.7 27.6 37.9	507 497 465 368	13.6 13.3 12.5 9.9	2031 1990 1857 1462	54.4 53.3 49.8 39.2	4079 3979 3683 2867	109 107 98.7 76.8	6460 6354 5975 4755	173 171 160 128
800	55.2	up to 300 400 500 650	up to 20.7 27.6 34.5 44.8	575 552 511 399	15.4 14.8 13.7 10.7	2306 2204 2036 1581	61.8 59.1 54.6 42.4	4627 4390 4027 3097	124 118 108 83.0	7341 7066 6571 5149	197 190 176 138
900	62.1	up to 350 400 600 800	up to 24.1 27.6 41.4 55.2	644 633 553 358	17.3 17.0 14.8 9.6	2580 2534 2203 1420	69.1 67.9 59.0 38.1	5173 5064 4347 2770	139 136 117 74.2	8220 8099 7123 4639	221 217 191 125
1000	69.0	up to 400 500 600 800	up to 27.6 34.5 41.4 55.2	712 688 649 510	19.1 18.4 17.4 13.7	2854 2748 2589 2025	76.5 73.6 69.4 54.3	5719 5473 5128 3968	153 147 137 106	9097 8808 8343 6589	244 236 224 177
1100	75.8	up to 450 600 800 1000	up to 31.0 41.4 55.2 69.0	781 739 630 400	20.9 19.8 16.9 10.7	3127 2948 2506 1582	83.8 79.0 67.2 42.4	6263 5858 4930 3084	168 157 132 82.7	9974 9474 8128 5176	268 254 218 139
1200	82.7	up to 500 600 800 1100	up to 34.5 41.4 55.2 75.8	849 824 736 419	22.8 22.1 19.7 11.2	3401 3291 2929 1658	91.1 88.2 78.5 44.4	6807 6556 5781 3230	182 176 155 86.6	10,849 10,549 9472 5424	291 283 254 146
1300	89.6	up to 500 600 800 1160	up to 34.5 41.4 55.2 80.0	927 906 833 509	24.8 24.3 22.3 13.6	3716 3623 3319 2017	99.6 97.1 89.0 54.1	7454 7233 6568 3934	200 194 176 105	11,833 11,587 10,702 6591	318 311 287 177
1400	96.5	up to 500 600 800 1160	up to 34.5 41.4 55.2 80.0	1004 986 924 669	26.9 26.4 24.8 17.9	4027 3946 3686 2655	108 106 98.8 71.2	8091 7895 7312 5195	217 212 196 139	12,802 12,598 11,858 8651	343 338 318 232
1480	102	up to 500 600 800 1160	up to 34.5 41.4 55.2 80.0	1065 1049 994 776	28.5 28.1 26.6 20.8	4273 4201 3968 3082	115 113 106 82.6	8596 8416 7887 6045	230 226 211 162	13,568 13,392 12,746 10,021	364 360 342 269

1. Available to Type EZHOSX configuration only.

Table 19. Type EZH/EZHSO Dimension

BODY SIZE, NPS / DN	DIMENSION, In. / mm													
	A				C	D (Maximum)	E	F		G	H	J	R	
	NPT or SWE	CL150 RF	CL300 RF	CL600 RF or BWE				Type PRX	Type PRX-AP				Type PRX	Type PRX-AP
1 / 25	8.25 / 210	7.25 / 184	7.75 / 197	8.25 / 210	1.50 / 38.1	2.10 / 53	7.50 / 190	11.30 / 287	13.05 / 331	11.10 / 282	5.10 / 130	9.25 / 235	16.80 / 427	18.55 / 471
2 / 50	11.3 / 287	10.0 / 254	10.50 / 267	11.30 / 287	1.50 / 38,1	3.10 / 79	11.25 / 286	13.00 / 330	14.75 / 375	11.30 / 287	6.50 / 165	8.75 / 222	18.50 / 470	20.30 / 516
3 / 80	13.25 / 337	11.75 / 298	12.50 / 317	13.25 / 337	2.00 / 50.8	3.81 / 97	13.75 / 349	13.61 / 346	15.36 / 390	16.75 / 425	8.00 / 203	14.25 / 362	18.60 / 472	20.86 / 530
4 / 100	----	13.9 / 353	14.5 / 368	15.5 / 394	2.00 / 50.8	5.06 / 129	15.5 / 394	14.1 / 358	15.85 / 403	16.8 / 427	10.03 / 255	6.5 / 165	26.1 / 663	26.1 / 663

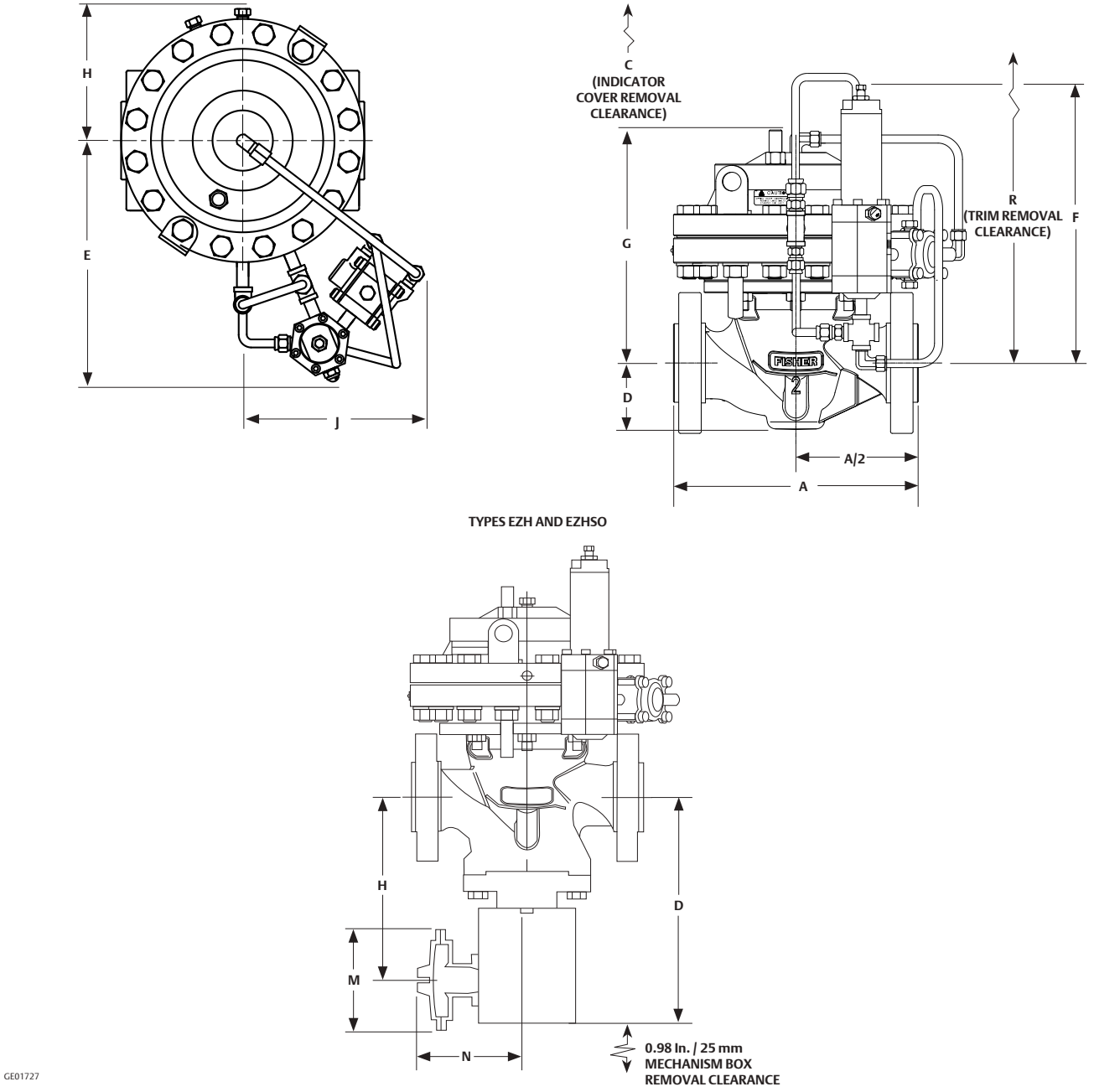


Figure 7. *Dimensions*

Table 20. Type EZHOSX/EZHSO-OSX Dimension

BODY SIZE		DIMENSION WITH SLAM-SHUT													
		D		H		M[1]				N					
						Diaphragm		Piston		Diaphragm		Piston		Bellow	
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1	25	12.0	305	9.8	249	6.4	163	2.8	71	6.9	175	8.0	203	8.8	224
2	50	13.0	330	10.4	264	6.38	162			6.89	175	8.03	204	8.78	223
3	80	14.4	366	11.8	300										
4[2]	100[2]	16.8	427	13.6	345										

1. Type 71 BMS with a diaphragm has an M dimension of 2.80 in. / 71 mm.
2. Available to Type EZHOSX configuration only.

Table 21. Type EZH/EZHSO Shipping Weight

BODY SIZE		APPROXIMATE SHIPPING WEIGHT													
		NPT		SWE		CL150 RF		CL300 RF		CL600 RF		BWE		For Type OSX	
NPS	DN	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
1	25	77	35	77	35	79	36	83	38	87	39	77	35	Add 17	Add 8
2	50	136	62	136	62	139	63	143	65	150	68	136	62	Add 30	Add 14
3	80	390	177	390	177	394	179	397	180	410	186	390	177	Add 41	Add 19
4	100	----		433	197	451	205	481	219	514	234	433	197	Add 57	Add 26

Table 22. Type EZHOSX/EZHSO-OSX Shipping Weight

BODY SIZE		APPROXIMATE SHIPPING WEIGHT							
		CL150 RF		CL300 RF		CL600 RF		For Type OSX	
NPS	DN	lbs	kg	lbs	kg	lbs	kg	lbs	kg
1	25	79	36	83	38	87	39	Add 17	Add 8
2	50	139	63	143	65	150	68	Add 30	Add 14
3	80	394	179	397	180	410	186	Add 41	Add 19
4(1)	100(1)	451	205	481	219	514	234	Add 57	Add 26

1. Available to Type EZHOSX configuration only.

Ordering Guide

Type and Body Material (Select One)

WCC Steel
- ☐ Type EZH (Spring-to-Close Version)***
- ☐ Type EZHSO (Spring-to-Open Version)***

LCC Steel
- ☐ Type EZHOSX (Spring-to-Close Version with Slam shut)***
- ☐ Type EZHSO-OSX (Spring-to-Open Version with Slam shut)***

Body Size (Select One)

- ☐ NPS 1 / DN 25***
- ☐ NPS 2 / DN 50***
- ☐ NPS 3 / DN 80***
- ☐ NPS 4 / DN 100 (Available to Types EZH and EZHOSX Configurations Only)***

Body Material and End Connection Style (Select One)

WCC Steel (Types EZH and EZHSO Only)
- ☐ NPT (1 or 2 NPT only)***
- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ CL600 RF***
- ☐ SWE (Available for NPS 1 and 2 / DN 25 and 50 Body Sizes only)**
- ☐ SCH 40 BWE**
- ☐ SCH 80 BWE**
- ☐ PN 16/25/40** _____ (please specify)

LCC Steel (Types EZHSOX and EZHSO-OSX Only)
- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ CL600 RF***
- ☐ CL600 RTJ**
- ☐ PN 16/25/40** _____ (please specify)

Main Valve Disk and O-ring Material (Select One)

- ☐ Nitrile (NBR) **(standard)***
- ☐ Fluorocarbon (FKM)***

Pilot Type (Select One)

- ☐ Type PRX/120***
- ☐ Type PRX/120-AP***
- ☐ Type PRX/125 (monitor override pilot)***
- ☐ Type PRX/125-AP (monitor override pilot)***

Outlet Pressure Range (Select One)

Type PRX/120 or PRX/125 Pilot
- ☐ 14.5 to 26 psig / 1.00 to 1.8 bar, Yellow***
- ☐ 23 to 44 psig / 1.6 to 3.0 bar, Green***
- ☐ 41 to 80 psig / 2.8 to 5.5 bar, Blue***
- ☐ 73 to 123 psig / 5.0 to 8.5 bar, Black***
- ☐ 116 to 210 psig / 8.0 to 14.5 bar, Silver***
- ☐ 203 to 334 psig / 14.0 to 23.0 bar, Gold***
- ☐ 319 to 435 psig / 22.0 to 30.0 bar, Aluminum***

Type PRX/120-AP or PRX/125-AP Pilot
- ☐ 435 to 1160 psig / 30.0 to 80.0 bar, Clear***

Type SA/2 Elastomer Material (Select One)

- ☐ Nitrile (NBR) **(standard)***
- ☐ Fluorocarbon (FKM)***

Pilot Elastomer Material (Select One)

- ☐ Nitrile (NBR)/Polyurethane (PU) **(standard)***
- ☐ Fluorocarbon (FKM)***

Whisper Trim™ Cage Construction (Optional) (Not available to NPS 1 / DN 25 Body Size)

- ☐ Yes***

- continued -

Ordering Guide (continued)

Travel Indicator (Optional)

☐ Yes***

Pre-piped Pilot Supply (Optional)

☐ Yes***

Slam-Shut Trip Pressure Setting (Select One)

Overpressure Protection Only
☐ Supply setpoint required _____

Underpressure Protection Only
☐ Supply setpoint required _____

Overpressure Protection and Underpressure Protection
☐ Supply overpressure setpoint required _____
☐ Supply underpressure setpoint required _____

Overpressure Protection, Overpressure Protection and Underpressure Protection
☐ Supply overpressure setpoint required _____
☐ Supply overpressure setpoint required _____
☐ Supply underpressure setpoint required _____

Explosion-Proof Limit Switch (Optional)

☐ Yes***

Main Valve Replacement Parts Kit (Optional)

☐ Yes, send one replacement parts kit to match this order.

Pilot Replacement Parts Kit (Optional)

☐ Yes, send one replacement parts kit to match this order.

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired?	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Cutting the supply pressure to a pilot-operated regulator reduces the regulator gain or sensitivity and, thus, may improve regulator stability. (This can only be used with two path control.)

Type EZH Relief

Relief Valve or Backpressure Regulator

Introduction

Type EZH is an accurate pilot-operated, pressure-balanced, soft-seated relief valve or backpressure regulator. It is designed for use in high pressure natural gas transmission/city gate stations, large capacity distribution systems and power plant feeds. It provides smooth and reliable operation, tight shutoff and long life.

The Type EZH relief valve or backpressure regulator includes a Type PRX/182 or Type PRX-AP/182 pilot mounted on the EZH Series main valves for relief valve or backpressure regulator applications.

Body Sizes, End Connection Styles and Pressure Ratings

See Table 1

Maximum Allowable Pressures

Inlet Pressure: 1500 psig / 103 bar
Outlet (Casing) Pressure: 1500 psig / 103 bar
Emergency Casing Pressure: 1500 psig / 103 bar

Minimum Buildup Pressure

Main Valve: 1500 psid / 103 bar d
Pilot *(Between loading pressure in pilot and loading sense pressure):* 1233 psid / 85.0 bar d

Minimum Differential Pressures

See Table 3

Relief Set Pressure Ranges

See Table 2

Flow and Sizing Coefficients

See Tables 5 and 6

Flow Capacities

See Table 7

Pilot and Filter-Regulator Flow Coefficients

Type PRX Pilot: C_g: 10.5; C_v: 0.36; C_1: 29

Pressure Registration

External

Pilot Connections

1/4 NPT

Temperature Capabilities

Nitrile (NBR) Version:
-20 to 180°F / -29 to 82°C
Fluorocarbon (FKM) Version:
0 to 180°F / -18 to 82°C(1)

Option

- Travel Indicator

Construction Materials

Main Valve
Main Valve Body: WCC Steel
Intermediate Flange and Actuator Casings: Steel
Diaphragm Plates: Steel
Diaphragm: Nitrile (NBR) with PVC coating
O-rings: Fluorocarbon (FKM)
Disk: Nitrile (NBR) or Fluorocarbon (FKM)

PRX Series Pilots
Body: Steel
Trim: Stainless Steel
Elastomers:
Nitrile (NBR) or Fluorocarbon (FKM)
Disk: Polyurethane (PU) or Fluorocarbon (FKM)

Approximate Weights

See Table 9

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com



P1668

Figure 1. *Type EZH Relief Valve or Backpressure Regulator*

Features

- **1500 psig / 103 bar Inlet or Outlet Rating**
- **Common Body Platform**
- **Bubble Tight Shutoff**
- **Full Usable Capacity**
- **In-Line Maintenance**
- **NPS 1 through 4 / DN 25 through 100 Body Sizes Available**
- **Precise Pressure Control**

Table 1. Main Valve Body Sizes, End Connection Styles and Body Ratings

MAIN VALVE BODY SIZE		MAIN VALVE BODY MATERIAL	END CONNECTION STYLE	STRUCTURAL DESIGN RATING	
NPS	DN			psig	bar
1	25	WCC Steel	NPT or SWE	1500	103
			CL150 RF	290	20.0
			CL300 RF	750	51.7
			CL600 RF or BWE	1500	103
2	50		NPT or SWE	1500	103
			CL150 RF	290	20.0
			CL300 RF	750	51.7
			CL600 RF or BWE	1500	103
3	80		CL150 RF	290	20.0
			CL300 RF	750	51.7
			CL600 RF or BWE	1500	103
4	100		CL150 RF	290	20.0
			CL300 RF	750	51.7
			CL600 RF or BWE	1500	103

1. Type PRX Fluorocarbon (FKM) elastomer is limited to 0°F / -18°C.

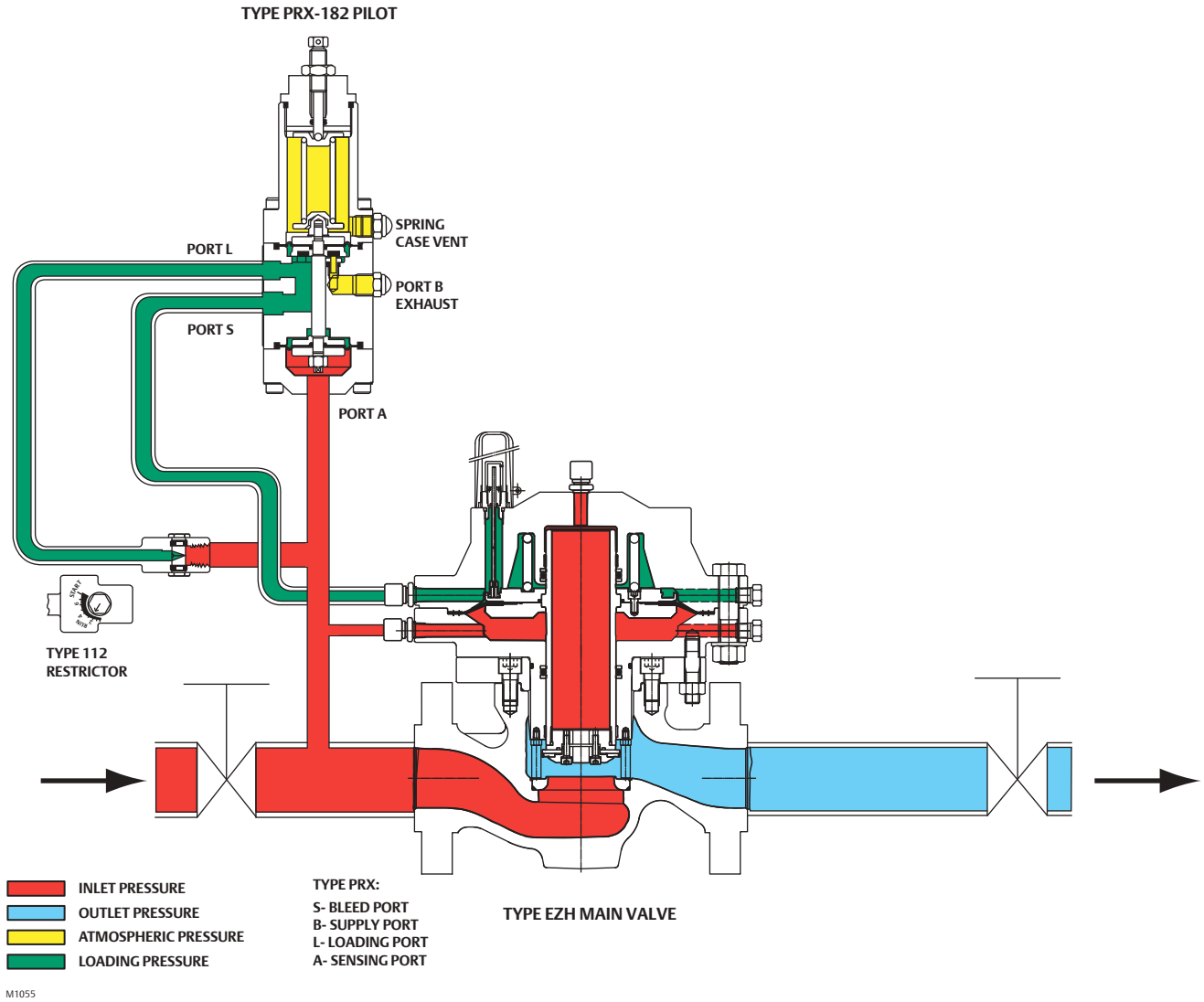


Figure 2. *Type EZH with Type PRX-182 Pilot*

Table 2. Relief Set Pressure Ranges

PILOT TYPE	RELIEF SET PRESSURE RANGE		PILOT CONTROL INFORMATION									
	psig	bar	Part Number	Color	Wire Diameter		Free Length		Maximum Operating Pressure		Maximum Emergency Pressure	
					In.	mm	In.	mm	psig	bar	psig	bar
PRX/182	29 to 116 73 to 290 217 to 609	2.0 to 8.0 5.0 to 20.0 15.0 to 42.0	M0255220X12 M0255200X12 M0255190X12	Black Gold Red	0.157 0.217 0.256	4.00 5.50 6.50	2.16 2.01 1.97	55 51 50	609	42.0	1480	102
PRX-AP/182	435 to 1160	30.0 to 80.0	M0273790X12	Clear	0.335	8.50	3.94	100	1160	80.0	1480	102

Table 3. Minimum Differential Pressures

TYPE	MAIN VALVE BODY SIZE		MINIMUM DIFFERENTIAL			
	NPS	DN	For 90% Capacity		For 100% Capacity	
			psid	bar d	psid	bar d
EZH	1	25	15.2	1.1	15.7	1.1
	2	50	12.0	0.83	13.8	0.95
	3	80	10.6	0.73	12.8	0.88
	4	100	15.8	1.1	16.4	1.1

Table 4. Relief Set Pressure Build-Up Table

PILOT TYPE	SET PRESSURE CONTROL RANGE, SPRING PART NUMBER AND COLOR, psig / bar	SET PRESSURE[1]		BUILD-UP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE[2]		BUILD-UP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE[3]		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESEAT PILOT	
		psig	bar	psig	bar	psig	bar	psig	bar
PRX/182	29 to 116 / 2 to 8 M0255220X12 Black	30	2.1	1.7	0.12	3.4	0.23	0.9	0.06
		60	4.1	2.7	0.19	4.7	0.32	0.9	0.06
		80	5.5	2.8	0.19	5.3	0.36	0.9	0.06
		100	6.9	3.8	0.26	6.3	0.43	0.9	0.06
	73 to 290 / 5 to 20 M0255200X12 Gold	75	5.2	3.7	0.25	7.7	0.53	1.9	0.13
		100	6.9	3.7	0.25	9.2	0.63	1.9	0.13
		150	10.3	4.7	0.32	9.8	0.68	1.9	0.13
		200	13.8	5.0	0.34	10.9	0.75	1.9	0.13
		250	17.2	5.0	0.34	11.5	0.79	1.9	0.13
	217 to 609 / 14.9 to 41.7 M0255190X12 Red	225	15.5	5.0	0.34	13.7	0.95	2.5	0.17
		300	20.7	5.1	0.35	14.0	0.97	2.5	0.17
		400	27.6	5.2	0.36	14.5	1.00	2.5	0.17
		450	31.0	5.4	0.37	14.5	1.00	2.5	0.17
PRX-AP/182	435 to 1160 / 30 to 80 M0273790X12 Clear	450	31.0	5.4	0.37	14.9	1.03	2.9	0.20
		500	34.5	5.4	0.37	14.9	1.03	3.2	0.22
		600	41.4	6.2	0.43	14.9	1.03	3.2	0.22
		1050	72.4	6.2	0.43	15.6	1.08	3.2	0.22

1. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
2. Crack point pressure of the main valve of the inlet pressure build-up over the set pressure at which the main valve starts audible flow.
3. Inlet pressure build-up over the set pressure for the main valve to achieve wide-open flow capacity.

Table 5. Type EZH Main Valve with Standard Cage Regulating Flow Coefficients

MAIN VALVE BODY SIZE		TRIM, % OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING		
NPS	DN		C_g	C_v	C_1	C_g	C_v	C_1
1	25	100	564	16.3	34.6	544	15.3	35.5
		80	436	12.3	35.4	423	10.9	38.7
		50	284	8.4	33.7	249	6.3	39.7
		30	172	5.3	32.5	157	4.0	39.1
2	50	100	2278	58.5	38.9	2110	62.9	33.5
		80	1719	47.1	36.5	1609	50.5	31.9
		50	1213	31.0	39.1	1177	33.0	35.6
		30	707	16.9	41.7	718	18.8	38.2
3	80	100	4960	133	37.3	4396	143	30.8
		80	3950	109	36.2	3294	97.2	33.9
		50	2550	63.6	40.1	2069	54.7	37.8
		30	1530	36.7	41.7	1339	39.8	33.6
4	100	100	7250	227	31.9	7170	229	31.3
		80	5750	165	34.8	5630	165	34.1
		50	3510	95.9	36.6	3460	95.5	36.2
		30	2130	56.7	37.6	2080	56.2	37.0

Table 6. Type EZH Main Valve with Standard Cage IEC Sizing Coefficients

MAIN VALVE BODY SIZE		TRIM, % OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING		
NPS	DN		X_T	F_D	F_L	X_T	F_D	F_L
1	25	100	0.61	0.61	0.89	0.80	0.59	0.89
		80	0.72	0.67		0.95	0.63	
		50	0.69	0.80		0.99	0.69	
		30	0.66	0.81		0.97	0.71	
2	50	100	0.73	0.59		0.69	0.61	
		80	0.84	0.68		0.72	0.70	
		50	0.97	0.69		0.84	0.72	
		30	0.99	0.70		0.92	0.74	
3	80	100	0.88	0.58		0.60	0.60	
		80	0.83	0.71		0.73	0.67	
		50	0.99	0.73		0.90	0.68	
		30	0.99	0.72		0.72	0.75	
4	100	100	0.63	0.63		0.62	0.63	
		80	0.76	0.74		0.74	0.74	
		50	0.85	0.77		0.83	0.77	
		30	0.88	0.78		0.88	0.77	

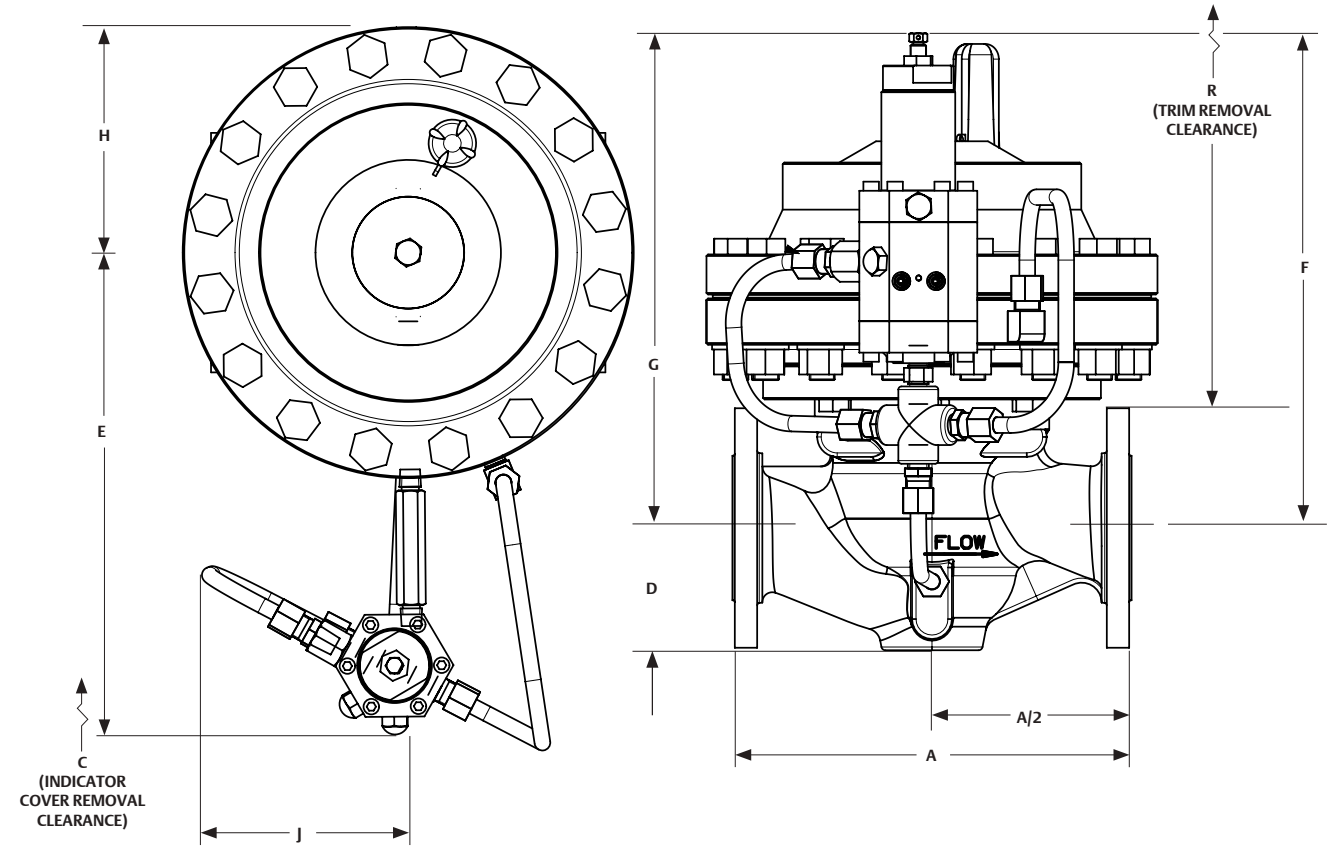


Figure 3. *Type EZH Dimensions (See Table 8)*

Table 7. Capacities for Type EZH with PRX Series Pilot

SET PRESSURE RANGE, PILOT SPRING PART NUMBER AND COLOR, psig / bar	SET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
			1 NPS / DN 25		2 NPS / DN 50		3 NPS / DN 80		4 NPS / DN 100	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
29 to 116 / 2 to 8 M0255220X12 Black	30	2.1	36	0.96	139	3.73	307	8.23	458	12.27
	60	4.1	59	1.58	235	6.30	518	13.88	756	20.26
	80	5.5	75	2.01	298	7.99	654	17.53	952	25.51
	100	6.9	91	2.44	363	9.73	795	21.31	1154	30.93
73 to 290 / 5 to 20 M0255200X12 Gold	75	5.2	72	1.93	286	7.66	628	16.83	914	24.50
	100	6.9	91	2.44	366	9.81	801	21.47	1163	31.17
	150	10.3	130	3.48	522	13.99	1141	30.58	1654	44.33
	200	13.8	169	4.53	678	18.17	1482	39.72	2148	57.57
	250	17.2	207	5.55	834	22.35	1822	48.83	2639	70.73
217 t o 609 / 14.9 to 41.7 M0255190X12 Red	225	15.5	189	5.07	762	20.42	1664	44.60	2410	64.59
	300	20.7	246	6.59	992	26.59	2165	58.02	3136	84.04
	400	27.6	322	8.63	1298	34.79	2833	75.92	4102	109.93
	450	31.0	360	9.65	1452	38.91	3168	84.90	4588	122.96
435 to 1160 / 30 to 80 M0273790X12 Clear	450	31.0	360	9.65	1452	38.91	3168	84.90	4588	122.96
	500	34.4	398	10.67	1605	43.01	3501	93.83	5071	135.90
	600	41.4	474	12.70	1911	51.21	4167	111.68	6035	161.74
	1050	72.4	815	21.84	3286	88.06	7164	192.00	10,375	278.05

Table 8. Type EZH Dimensions (See Figure 3)

BODY SIZE, NPS / DN	DIMENSION, In. / mm													
	A				C	D (Maximum)	E	F		G	H	J	R	
	NPT or SWE	CL150 RF	CL300 RF	CL600 RF or BWE				Type PRX	Type PRX-AP				Type PRX	Type PRX-AP
1 / 25	8.25 / 210	7.25 / 184	7.75 / 197	8.25 / 210	1.50 / 38.1	2.10 / 53	7.50 / 190	11.30 / 287	13.05 / 331	11.10 / 282	5.10 / 130	8.25 / 210	16.80 / 427	18.55 / 471
2 / 50	11.3 / 287	10.0 / 254	10.50 / 267	11.30 / 287	1.50 / 38.1	3.10 / 79	11.25 / 286	13.00 / 330	14.75 / 375	11.30 / 287	6.50 / 165	7.75 / 197	18.50 / 470	20.30 / 516
3 / 80	13.25 / 337	11.75 / 298	12.50 / 317	13.25 / 337	2.00 / 50.8	3.81 / 97	13.75 / 349	13.61 / 346	15.36 / 390	16.75 / 425	8.00 / 203	13.25 / 337	18.60 / 472	20.86 / 530
4 / 100	----	13.9 / 353	14.5 / 368	15.5 / 394	2.00 / 50.8	5.06 / 129	15.5 / 394	14.1 / 358	15.85 / 403	16.8 / 427	10.03 / 255	5.5 / 140	26.1 / 663	26.1 / 663

Table 9. Approximate Weights							
BODY SIZE, NPS / DN	APPROXIMATE SHIPPING WEIGHT, lbs / kg						
	NPT	SWE	CL150 RF	CL300 RF	CL600 RF	SCH 40	SCH 80
1 / 25	77 / 35	77 / 35	79 / 36	83 / 38	87 / 39	77 / 35	77 / 35
2 / 50	136 / 62	136 / 62	139 / 63	143 / 65	150 / 68	136 / 62	136 / 62
3 / 80	390 / 177	390 / 177	394 / 179	397 / 180	410 / 186	390 / 177	390 / 177
4 / 100	- - - -	433 / 197	451 / 205	481 / 219	514 / 234	433 / 197	433 / 197

Ordering Guide

Body Size (Select One)

- ☐ NPS 1 / DN 25***
- ☐ NPS 2 / DN 50***
- ☐ NPS 3 / DN 80***
- ☐ NPS 4 / DN 100***

Body Material and End Connection Style (Select One)

WCC Steel

- ☐ NPT (available for NPS 1 and 2 / DN 25 and 50 Body Sizes only)***
- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ CL600 RF***
- ☐ SWE (Available for NPS 1 and 2 / DN 25 and 50 Body Sizes only)**
- ☐ BWE**
- ☐ PN 16/40 (For NPS 1 and 2 / DN 25 and 50 Body Sizes only)**
- ☐ PN 25/40 (For NPS 3 / DN 80 Body Size only)**

Main Valve Disk Material (Select One)

- ☐ Nitrile (NBR) **(standard)***
- ☐ Fluorocarbon (FKM)***

Pilot Type and Outlet Pressure Range (Select One)

Type PRX/182 Pilot

- ☐ 29 to 116 psig / 2.0 to 8.0 bar, Black***
- ☐ 73 to 290 psig / 5.0 to 20.0 bar, Gold***
- ☐ 217 to 609 psig / 14.9 to 41.7 bar, Red***

Type PRX-AP/182 Pilot

- ☐ 435 to 1160 psig / 30.0 to 80.0 bar, Clear***

Pilot Elastomer Material (Select One)

- ☐ Nitrile (NBR)/Polyurethane (PU) **(standard)***
- ☐ Fluorocarbon (FKM)***

Travel Indicator (Optional)

- ☐ Yes***

Main Valve Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

Pilot Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement parts kit to match this order.

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
☐ Relief Valve ☐ Backpressure Regulator
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Type EZL

Pressure Reducing Regulator for Low Differential Pressure Applications

FISHER

Introduction

Type EZL regulators are accurate pilot-operated, pressure balanced, soft-seated regulators. They are designed for use in natural gas distribution applications such as district regulating stations and commercial/industrial meter sets. They provide low differential, smooth, reliable operation, tight shutoff and long life. For underpressure and/or overpressure protection, the Type EZL is available with an integral slam-shut device.

Body Sizes, End Connection Styles and Pressure Ratings

See Table 1

Maximum Inlet and Outlet (Casing) Pressures

290 psig / 20.0 bar

Maximum Emergency (Design Casing Pressure)

290 psig / 20.0 bar

Maximum Operating Differential Pressure

290 psid / 20.0 bar d

Outlet Pressure Ranges

See Table 3

Flow Coefficients

See Tables 5, 6, 7 and 8

IEC Sizing Coefficients

See Table 9

Flow Capacities

See Tables 10 and 11

Temperature Capabilities

Nitrile (NBR) Version:
-20 to 180°F / -29 to 82°C
Fluorocarbon (FKM) Version:
0 to 180°F / -18 to 82°C

Approximate Shipping Weights

See Table 15

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Bubble Tight Shutoff**
- **Pilot-Operated, Two Path Control**
- **Corrosion Resistant Anodized Aluminum Casing**
- **Common E-Body Platform**
- **Low Differential**
- **One Actuator/ One Main Spring**
- **Optional Travel Indicator**
- **High Capacity**
- **Top Entry Design for Ease of Maintenance**
- **Resistant to Aromatics and Particle Erosion**
- **Optional Slam-Shut Device**



Figure 1. *Type EZL Pressure Reducing Regulator*

Table 1. Main Valve Body Size, End Connection Style and Body Rating

MAIN VALVE BODY SIZE		MAIN VALVE BODY MATERIAL	END CONNECTION STYLE	STRUCTURAL DESIGN RATING(1)	
NPS	DN			psig	bar
2, 3 and 4	50, 80 and 100	WCC Steel	NPT(2) or SWE(2)	1500	103
			CL150 RF	290	20.0
			CL300 RF	750	51.7
			CL600 RF or BWE	1500	103
		Cast Iron	NPT(2)	400	27.6
			CL125 FF	200	13.8
			CL250 RF	500	34.5

1. Structural Design Rating is the rating for the main valve body. The Type EZL complete assembly is limited to 290 psig / 20.0 bar.
2. Only available in NPS 2 / DN 50 body size.

Table 2. Minimum Differential Pressure

TRIM, PERCENT OF CAPACITY	MINIMUM DIFFERENTIAL FOR FULL STROKE					
	NPS 2 / DN 50		NPS 3 / DN 80		NPS 4 / DN 100	
	psid	bar d	psid	bar d	psid	bar d
100	2.9	0.204	2.9	0.204	2.9	0.204
80	2.9	0.204	3.1	0.214	3.2	0.221
50	3.0	0.207	3.2	0.221	3.7	0.255
30	3.4	0.234	3.5	0.241	3.9	0.269

EMERSON. Process Management

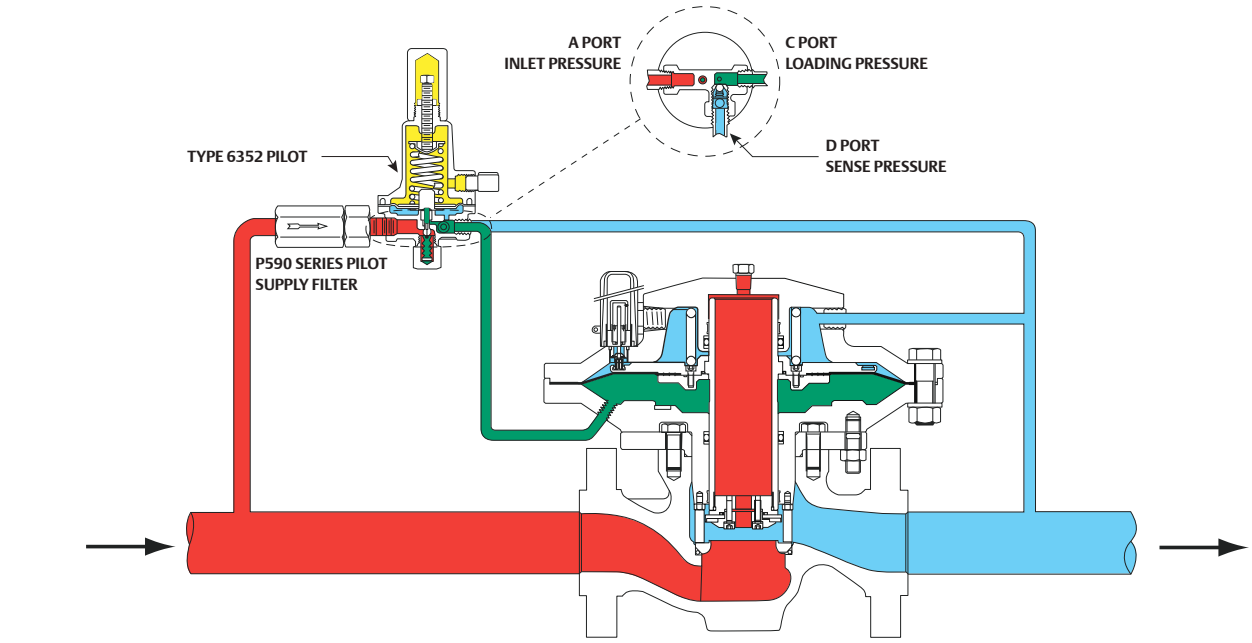


Figure 2. *Type EZL with Type 6352 Pilot and Type P590 Pilot Supply Filter Operational Schematic*

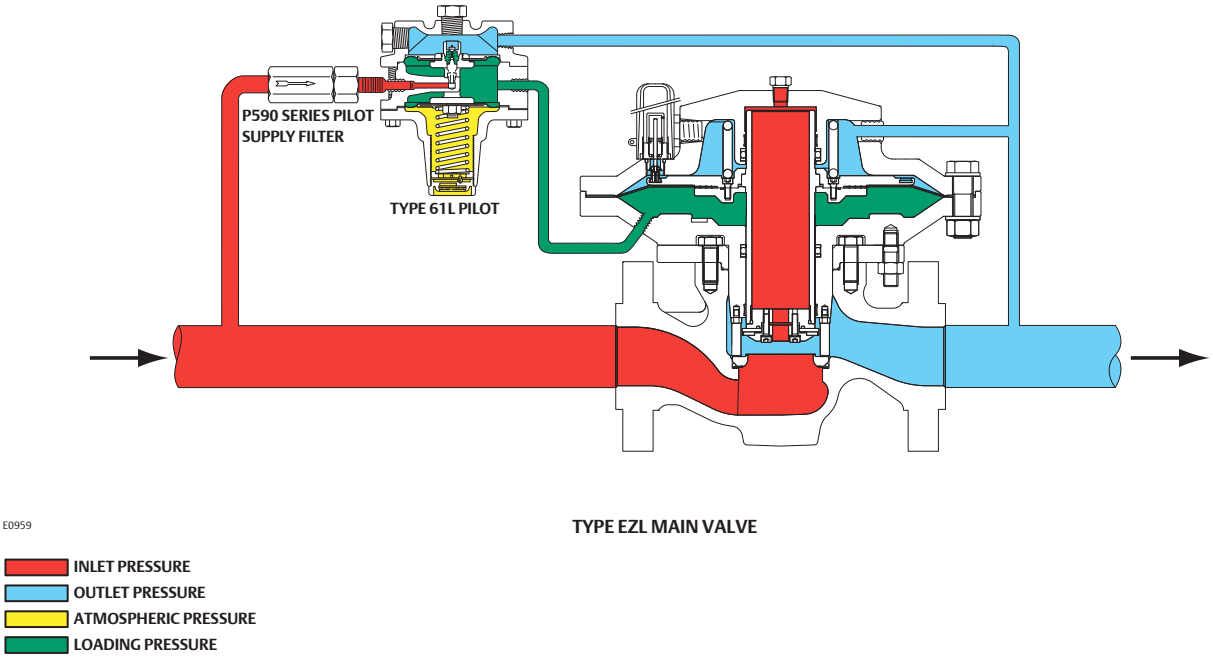


Figure 3. *Type EZL with Type 61L Pilot and Type P590 Pilot Supply Filter Operational Schematic*

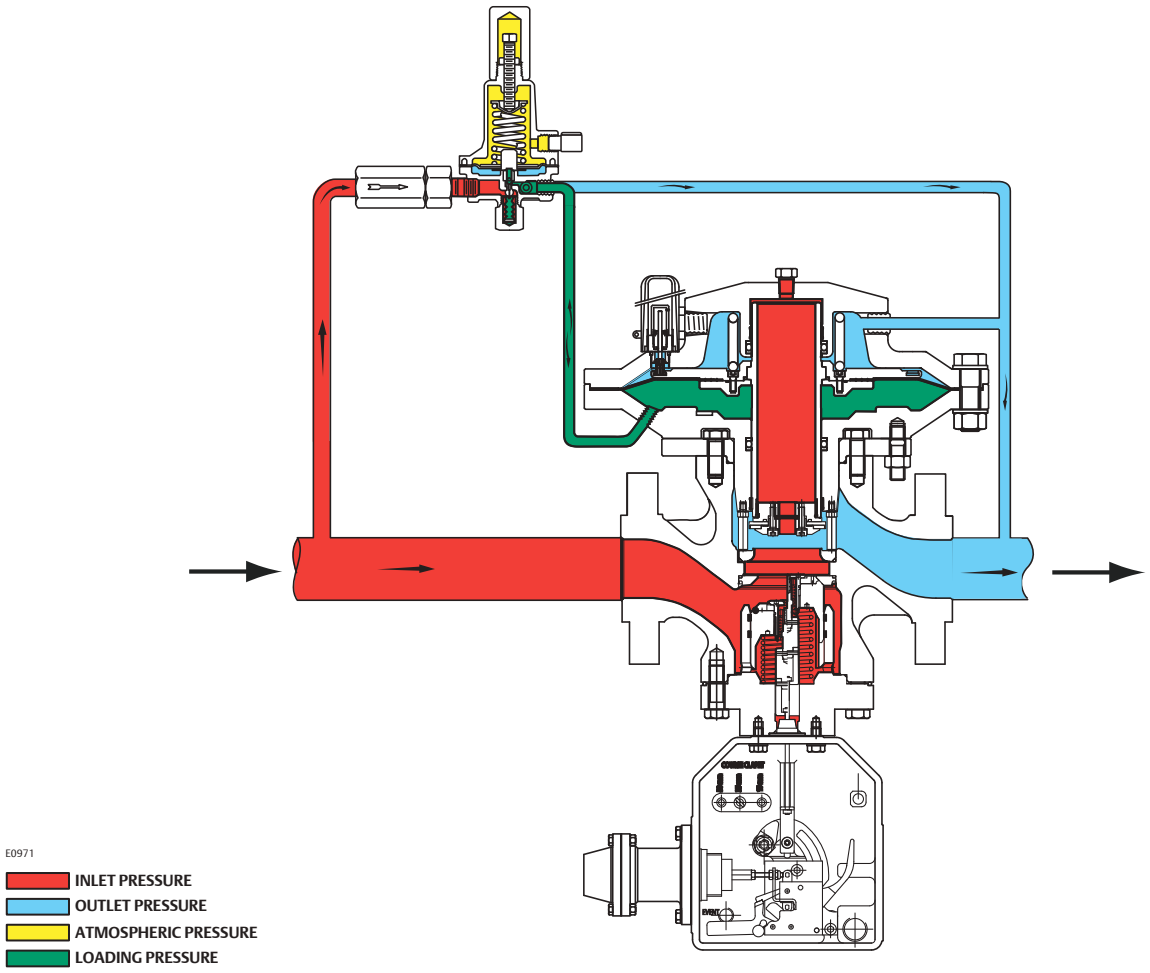


Figure 4. *Type EZLOSX Operational Schematic*

Table 3. Outlet (Control) Pressure Range

PILOT TYPE	OUTLET (CONTROL) PRESSURE RANGE		SPRING COLOR	SPRING PART NUMBER	APPROXIMATE PROPORTIONAL BAND	
	psig	bar			psig	bar
6352	2 to 10	0.14 to 0.69	Black	14A9673X012	0.3	0.02
6353	3 to 40 35 to 125	0.21 to 2.8 2.41 to 8.6	Yellow Red	1E392527022 1K748527202	0.5 1.0	0.03 0.07
6354L(1), 6354M(2) and 6354H(2)	85 to 200 175 to 220 200 to 300(4)	5.9 to 13.8 12.1 to 15.2 13.8 to 20.7(4)	Blue Blue Green	1L346127142 1L346127142 15A9258X012	3.0 3.0 5.0	0.2 0.2 0.34
61L	0.25 to 2 1 to 5 2 to 10 5 to 15 10 to 20	0.017 to 0.14 0.069 to 0.34 0.14 to 0.69 0.34 to 1.03 0.69 to 1.38	Red Yellow Blue Brown Green	1B886327022 1J857827022 1B886427022 1J857927142 1B886527022	0.15 0.2 0.3 0.5 0.7	0.01 0.01 0.02 0.03 0.05
61HP	15 to 45 35 to 100 100 to 300(4)	1.03 to 3.10 2.41 to 6.90 6.90 to 20.7(4)	Yellow Blue Red	1E392527022 1D387227022 1D465127142	1.0 1.5 3.0	0.07 0.1 0.2
161M(3)	5 to 15 10 to 125 120 to 300(4)	0.34 to 1.03 0.69 to 8.6 8.3 to 20.7(4)	Yellow Red Green	1E392527022 1K748527202 15A9258X012	0.5 2.0 5.0	0.03 0.14 0.34
161EBM(3)	5 to 15 10 to 40 30 to 75 70 to 140 130 to 200 200 to 350(4)	0.34 to 1.03 0.69 to 2.8 2.07 to 5.17 4.83 to 9.65 8.96 to 13.8 13.8 to 24.1(4)	White Yellow Black Green Blue Red	17B1260X012 17B1262X012 17B1259X012 17B1261X012 17B1263X012 17B1264X012	0.3 0.5 1.0 2.0 4.0 5.0	0.02 0.03 0.07 0.14 0.28 0.34

1. Without diaphragm limiter.
2. With diaphragm limiter.
3. Monitoring pilot for working monitors.
4. Operating range is limited to maximum pressure.

Table 4. Construction Material

TYPE EZL MAIN VALVE		
Main Body		WCC Steel or Cast iron
Intermediate Flange		Steel
Actuator Casing		Anodized Forged Aluminum
Inlet and Outlet Plate		Steel
Diaphragm		Nitrile (NBR) with PVC coating
O-ring		Nitrile (NBR) or Fluorocarbon (FKM)
Seat		Nitrile (NBR) or Fluorocarbon (FKM)
TYPE 6352, 6353, 6354L, 6354M OR 6354H PILOT (FOR PRESSURE REDUCING APPLICATION)		
Body, Body Plug, Spring Case and Closing Cap		Aluminum **(standard)** or Stainless steel
Control Spring		Zinc-plated steel
Bellows Assembly		Nickel and Stainless steel
Body Plug and Closing Cap Gasket		Composition
Other Metal Trim Part		Steel, Aluminum and/or Stainless steel
Diaphragm	**Type 6352**	Nitrile (NBR)
	Type 6353	Nitrile (NBR) or Fluorocarbon (FKM)
	6354 Series	Neoprene (CR) or Fluorocarbon (FKM)
O-ring and Soft Part		Nitrile (NBR) (**standard**) or Fluorocarbon (FKM) (high temperature)
61 SERIES PILOT (FOR PRESSURE REDUCING APPLICATION)		
Body and Spring Case		Cast iron
Upper and Lower Diaphragm	**Type 61L**	Nitrile (NBR) or Fluorocarbon (FKM)
	Type 61HP	Neoprene (CR) or Fluorocarbon (FKM)
Metal Trim Part		Steel, Stainless steel, Cast iron, Aluminum, Brass or Zinc
Gasketing		Neoprene (CR)
Elastomer Seat and O-ring		Nitrile (NBR) or Fluorocarbon (FKM)
TYPES 161M AND 161EBM PILOT (FOR MONITORING APPLICATION ONLY)		
Body		Stainless steel
Spring Case		Stainless steel
Body Plug and Diaphragm Limiter		Stainless steel
Control Spring		Plated steel
Adjusting Screw		Plated steel
Valve Plug, Diaphragm and O-ring		Nitrile (NBR) or Fluorocarbon (FKM)
PILOT AND ACTUATOR VENT		
Type Y602 vent assembly		
TYPE 252 PILOT SUPPLY FILTER		
Body		Aluminum or Stainless steel
Filter Cartridge		Polyethylene
O-ring		Nitrile (NBR)
Drain Valve or Pipe Plug		Stainless steel
TYPE P590 PILOT SUPPLY FILTER		
Body and Filter Head		Aluminum or Brass
Filter Element		Cellulose

Table 5. Type EZL Main Valve Regulating Flow Coefficient

MAIN VALVE BODY SIZE		TRIM, PERCENT OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING		
NPS	DN		C_g	C_v	C_1	C_g	C_v	C_1
2	50	100 80	2290 1914	63.2 56.7	36.2 33.8	2140 1760	61.5 51.5	34.8 34.2
		50 30	1290 858	41.4 25.5	31.2 33.6	1230 800	36.4 24.9	33.8 32.1
3	80	100 80	4800 3950	144 120	33.5 32.9	4580 3930	142 120	32.3 32.7
		50 30	2440 1560	69.2 44.8	35.3 34.9	2420 1570	72.5 48.7	33.4 32.3
4	100	100 80	6560 4550	200 129	32.6 35.2	6440 4500	192 146	33.6 30.8
		50 30	2740 1760	78.2 50.5	35.1 34.9	2750 1760	80.7 47.4	34.1 37.1

Table 6. Type EZL Main Valve Wide-Open Flow Coefficient

MAIN VALVE BODY SIZE		TRIM, PERCENT OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING		
NPS	DN		C_g	C_v	C_1	C_g	C_v	C_1
2	50	100 80	2360 1970	65.0 58.4	37.3 34.8	2200 1810	63.3 53.0	35.8 35.2
		50 30	1330 884	42.6 26.3	32.1 34.7	1270 820	37.5 25.7	34.8 33.1
3	80	100 80	4940 4060	148 123	34.5 33.9	4710 4050	146 124	33.3 33.7
		50 30	2510 1610	71.3 46.1	36.3 35.9	2500 1620	74.7 50.1	34.5 33.3
4	100	100 80	6760 4690	208 133	33.5 36.3	6630 4630	198 151	34.6 31.7
		50 30	2830 1820	80.5 52.0	35.2 36.0	2830 1810	83.1 48.7	35.1 38.2

Table 7. Type EZLOSX Main Valve Regulating Flow Coefficients

MAIN VALVE BODY SIZE		TRIM, PERCENT OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING		
NPS	DN		C_g	C_v	C_1	C_g	C_v	C_1
2	50	100 80	2210 1890	65.7 58.6	33.6 32.3	2058 1790	64.6 56.6	31.9 31.6
		50 30	1270 855	43.2 26.6	29.5 32.1	1250 872	40.3 28.5	31.1 30.6
3	80	100 80	4610 4060	134 117	34.5 34.5	4390 3900	134 118	32.9 33.1
		50 30	2600 1610	75.3 46.5	34.5 34.6	2420 1580	72.1 49.2	33.6 32.1
4	100	100 80	6280 4470	194 145	32.4 30.9	6160 4380	194 141	31.7 31.1
		50 30	2740 1770	88.3 61.0	31.0 29.0	2700 1780	86.3 65.8	31.2 27.1

Table 8. Type EZLOSX Main Valve Wide-Open Flow Coefficients

MAIN VALVE BODY SIZE		TRIM, PERCENT OF CAPACITY	LINE SIZE EQUALS BODY SIZE			2:1 LINE SIZE TO BODY SIZE PIPING		
NPS	DN		C_g	C_v	C_1	C_g	C_v	C_1
2	50	100 80	2280 1950	67.7 60.4	34.6 33.2	2120 1840	66.5 58.3	32.8 32.6
		50 30	1310 881	44.5 27.4	30.4 33.1	1290 898	41.5 29.4	32.0 31.5
3	80	100 80	4750 4180	138 121	35.5 35.6	4520 4020	138 121	33.9 34.1
		50 30	2680 1660	77.6 47.9	35.5 35.7	2490 1620	74.2 50.6	34.6 33.0
4	100	100 80	6470 4600	200 149	33.4 31.8	6340 4500	200 145	32.7 32.1
		50 30	2820 1820	91.0 62.8	31.9 29.8	2780 1840	88.9 67.8	32.2 27.9

Table 9. IEC Sizing Coefficient

MAIN VALVE BODY SIZE		TRIM, PERCENT OF CAPACITY	LINE SIZE EQUALS BODY SIZE		2:1 LINE SIZE TO BODY SIZE PIPING		F_L
NPS	DN		X_T	F_D	X_T	F_D	
2	50	100 80	0.829 0.723	0.61 0.58	0.766 0.740	0.60 0.55	0.89
		50 30	0.616 0.714	0.50 0.39	0.723 0.652	0.46 0.38	
3	80	100 80	0.710 0.685	0.61 0.55	0.660 0.676	0.60 0.55	
		50 30	0.788 0.770	0.42 0.34	0.706 0.660	0.43 0.35	
4	100	100 80	0.672 0.784	0.72 0.57	0.714 0.600	0.70 0.61	
		50 30	0.779 0.770	0.45 0.36	0.736 0.871	0.45 0.35	

Table 10. Capacities for Type EZL

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING					
				NPS 2 / DN 50 BODY		NPS 3 / DN 80 BODY		NPS 4 / DN 100 BODY	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
4	0.28	0.25	0.02	37	1.0	83	2.2	116	3.1
5	0.34	0.25 1 2	0.02 0.07 0.14	42 39 35	1.1 1.1 1.0	94 88 78	2.5 2.4 2.1	130 122 109	3.5 3.3 2.9
10	0.69	0.25 3 5 7	0.02 0.21 0.34 0.48	63 56 49 40	1.7 1.5 1.3 1.1	138 124 110 89	3.7 3.3 2.9 2.4	191 173 153 124	5.1 4.6 4.1 3.3
15	1.0	1 4 8 12	0.07 0.28 0.55 0.83	79 74 63 44	2.1 2.0 1.7 1.2	173 162 140 99	4.6 4.4 3.7 2.6	239 225 195 138	6.4 6.0 5.2 3.7
20	1.4	1 10 15 17	0.07 0.69 1.0 1.2	96 79 60 48	2.6 2.1 1.6 1.3	208 175 134 107	5.6 4.7 3.6 2.9	287 244 188 150	7.7 6.5 5.0 4.0
30	2.1	4 15 20 25	0.28 1.0 1.4 1.7	126 108 93 69	3.4 2.9 2.5 1.9	271 237 206 155	7.3 6.4 5.5 4.2	372 330 288 217	10.0 8.9 7.7 5.8
40	2.8	9 20 30 35	0.62 1.4 2.1 2.4	153 136 105 77	4.1 3.6 2.8 2.1	330 298 234 174	8.8 8.0 6.3 4.7	454 414 326 243	12.2 11.1 8.8 6.5
50	3.4	13 20 30 40 45	0.90 1.4 2.1 2.8 3.1	181 172 152 115 85	4.9 4.6 4.1 3.1 2.3	391 375 335 258 190	10.5 10.1 9.0 6.9 5.1	538 519 466 361 267	14.4 13.9 12.5 9.7 7.16
60	4.1	17 25 35 45 55	1.2 1.7 2.4 3.1 3.8	209 199 180 149 91	5.6 5.3 4.8 4.0 2.4	451 434 397 331 206	12.1 11.7 10.6 8.8 5.5	622 600 551 462 288	16.7 16.1 14.8 12.4 7.7
75	5.2	24 50 60 70	1.7 3.4 4.1 4.8	251 202 165 100	6.7 5.4 4.4 2.7	541 448 370 227	14.5 12.0 9.9 6.1	745 624 516 318	20.0 16.8 13.9 8.5
100	6.9	35 60 75	2.4 4.1 5.2	320 280 236	8.6 7.5 6.3	691 617 525	18.6 16.6 14.1	953 856 732	25.6 23.0 19.6
125	8.6	46 75	3.2 5.2	390 344	10.5 9.2	842 757	22.6 20.3	1160 1051	31.1 28.2
150	10.3	57 75 100 125	3.9 5.2 6.9 8.6	460 436 383 291	12.3 11.7 10.3 7.8	992 951 847 652	26.6 25.5 22.8 17.5	1367 1316 1179 911	36.7 35.3 31.6 24.5
175	12.1	68 75 100 125 150	4.7 5.2 6.9 8.6 10.3	530 522 482 419 316	14.2 14.0 12.9 11.3 8.5	1143 1129 1057 930 707	30.7 30.3 28.4 25.0 19.0	1574 1558 1465 1296 989	42.3 41.8 39.3 34.8 26.6
200	13.8	75 100 125 150 175	5.2 6.9 8.6 10.3 12.1	603 572 525 453 338	16.2 15.4 14.1 12.2 9.1	1300 1246 1155 1007 759	34.9 33.5 31.0 27.0 20.4	1789 1723 1603 1404 1062	48.0 46.3 43.0 37.7 28.5
225	15.5	75 100 125 150 175 200	5.2 6.9 8.6 10.3 12.1 13.8	683 657 619 564 484 359	18.3 17.6 16.6 15.1 13.0 9.6	1465 1424 1355 1246 1078 807	39.3 38.2 36.4 33.4 28.9 21.7	2013 1966 1877 1732 1504 1130	54.0 52.8 50.4 46.5 40.4 30.3
250	17.0	75 125 150 175 200 225	5.2 8.6 10.3 12.1 13.8 15.5	761 708 663 601 513 379	20.4 19.0 17.8 16.1 13.8 10.2	1627 1541 1456 1331 1145 853	43.7 41.4 39.1 35.7 30.7 22.9	2232 2131 2021 1853 1599 1194	59.9 57.2 54.2 49.7 42.9 32.1
285	20.0	75 125 150 175 200 225	5.2 8.6 10.3 12.1 13.8 15.5	869 826 791 744 681 595	23.3 22.2 21.2 20.0 18.3 16.0	1850 1789 1726 1635 1507 1327	49.7 48.0 46.3 43.9 40.5 35.6	2534 2467 2388 2270 2098 1852	68.0 66.2 64.1 60.9 56.3 49.7

Table 11. Capacities for Type EZLOSX

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING					
				NPS 2 / DN 50 BODY		NPS 3 / DN 80 BODY		NPS 4 / DN 100 BODY	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
4	0.3	0.25	0.02	38	1.02	78	2.09	111	2.98
5	0.3	0.25	0.02	43	1.15	88	2.36	125	3.37
		1	0.07	40	1.08	82	2.21	118	3.16
		2	0.14	36	0.96	73	1.96	105	2.82
10	0.7	0.25	0.02	63	1.70	130	3.49	183	4.92
		3	0.21	57	1.53	117	3.14	166	4.46
		5	0.34	50	1.35	103	2.77	147	3.96
		7	0.48	41	1.10	83	2.23	120	3.21
15	1.0	1	0.07	79	2.13	164	4.40	229	6.16
		4	0.28	75	2.00	153	4.12	217	5.81
		8	0.55	64	1.72	131	3.53	188	5.03
		12	0.83	45	1.22	92	2.48	133	3.57
20	1.4	1	0.07	96	2.57	198	5.30	275	7.38
		10	0.69	81	2.16	165	4.43	235	6.30
		15	1.03	62	1.66	126	3.38	181	4.85
		17	1.17	49	1.32	100	2.70	145	3.89
30	2.1	4	0.28	124	3.34	257	6.91	357	9.58
		15	1.03	109	2.93	224	6.01	317	8.51
		20	1.38	95	2.55	194	5.21	277	7.43
		25	1.72	71	1.91	145	3.90	209	5.61
40	2.8	9	0.62	152	4.07	314	8.42	436	11.7
		20	1.38	137	3.68	281	7.55	398	10.7
		30	2.07	107	2.88	219	5.88	314	8.42
		35	2.41	80	2.14	162	4.36	234	6.28
50	3.4	13	0.90	180	4.82	371	9.97	516	13.8
		20	1.38	172	4.63	355	9.54	498	13.4
		30	2.07	154	4.13	315	8.47	448	12.0
		40	2.76	119	3.18	242	6.49	347	9.32
		45	3.10	87	2.35	178	4.77	257	6.89
60	4.1	17	1.17	208	5.57	429	11.5	596	16.0
		25	1.72	200	5.36	411	11.0	576	15.5
		35	2.41	182	4.89	374	10.0	529	14.2
		45	3.10	152	4.08	311	8.34	444	11.9
		55	3.79	94	2.53	192	5.16	277	7.45
75	5.2	24	1.65	249	6.68	514	13.8	715	19.2
		50	3.45	206	5.53	422	11.3	600	16.1
		60	4.14	170	4.56	346	9.30	497	13.3
		70	4.83	104	2.79	212	5.68	306	8.21
100	6.9	35	2.41	318	8.54	657	17.7	913	24.5
		60	4.14	283	7.61	582	15.6	823	22.1
		75	5.17	241	6.47	493	13.2	704	18.9
125	8.6	46	3.17	387	10.4	801	21.5	1112	29.9
		75	5.17	348	9.34	714	19.2	1009	27.1
150	10	57	3.93	456	12.3	944	25.3	1311	35.2
		75	5.17	437	11.7	901	24.2	1263	33.9
		100	6.89	389	10.5	798	21.4	1133	30.4
		125	8.62	299	8.04	611	16.4	877	23.5
175	12	68	4.69	526	14.1	1087	29.2	1510	40.5
		75	5.17	519	13.9	1072	28.8	1495	40.1
		100	6.89	486	13.0	999	26.8	1407	37.8
		125	8.62	427	11.5	875	23.5	1246	33.4
		150	10.3	325	8.72	662	17.8	952	25.6
200	14	75	5.17	598	16.1	1237	33.2	1715	46.0
		100	6.89	573	15.4	1180	31.7	1654	44.4
		125	8.62	531	14.2	1089	29.2	1540	41.4
		150	10.3	462	12.4	946	25.4	1350	36.2
		175	12.1	348	9.35	710	19.1	1022	27.4
225	16	75	5.17	674	18.1	1396	37.5	1929	51.8
		100	6.89	655	17.6	1352	36.3	1885	50.6
		125	8.62	623	16.7	1281	34.4	1802	48.4
		150	10.3	572	15.4	1173	31.5	1664	44.7
		175	12.1	495	13.3	1012	27.2	1447	38.8
		200	13.8	371	10.0	755	20.3	1088	29.2
250	17	75	5.17	749	20.1	1553	41.7	2139	57.4
		125	8.62	709	19.0	1460	39.2	2045	54.9
		150	10.3	669	18.0	1375	36.9	1941	52.1
		175	12.1	612	16.4	1253	33.6	1781	47.8
		200	13.8	526	14.1	1075	28.8	1538	41.3
		225	15.5	392	10.5	798	21.4	1149	30.9
285	20	75	5.17	851	22.9	1769	47.5	2427	65.2
		125	8.62	823	22.1	1699	45.6	2366	63.5
		150	10.3	794	21.3	1634	43.9	2293	61.5
		175	12.1	752	20.2	1544	41.4	2180	58.5
		200	13.8	693	18.6	1419	38.1	2017	54.1
		225	15.5	609	16.4	1245	33.4	1781	47.8

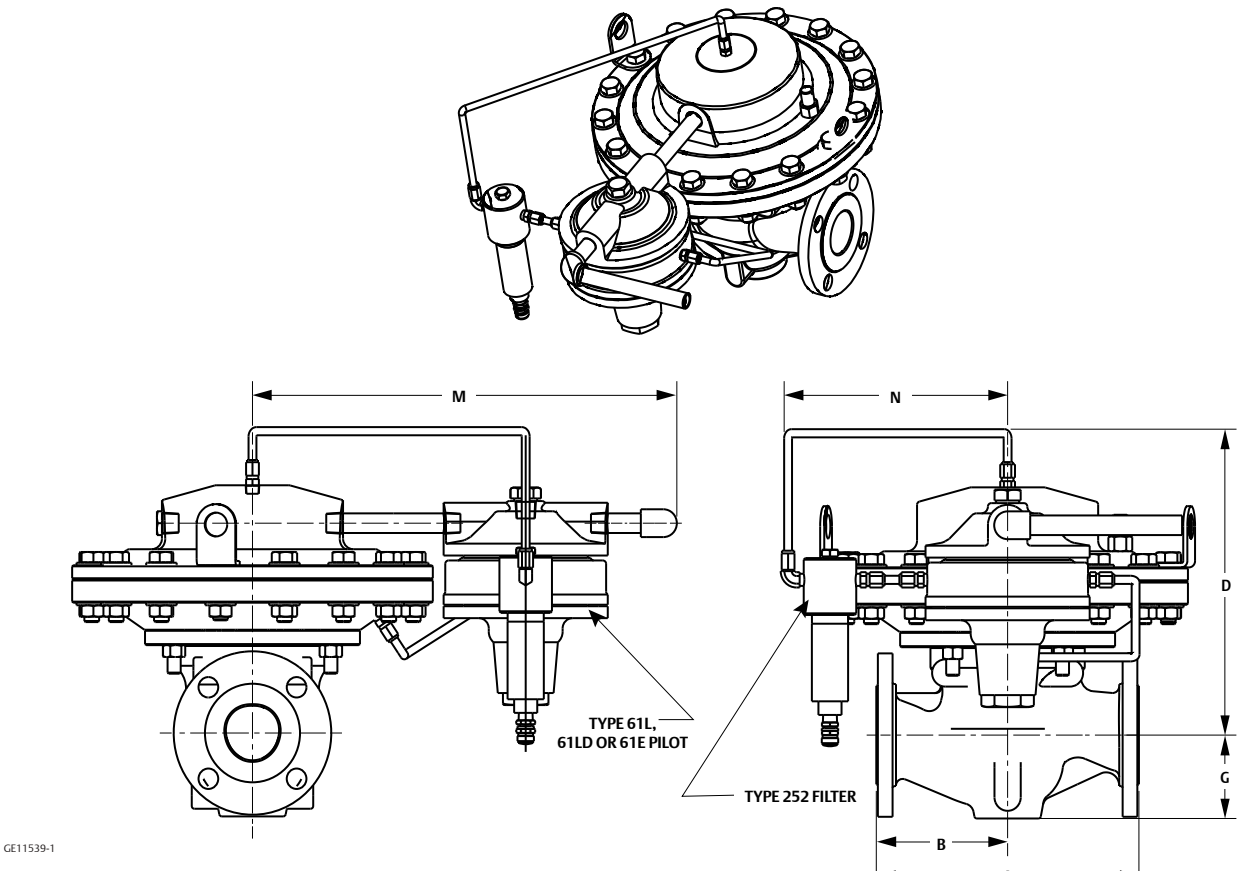


Figure 5. *Type EZL Dimensions*

Table 12. Type EZL with Type 61L Pilot Dimension

BODY SIZE		DIMENSION											
		A						B					
		CL125 FF, CL150 RF		CL250 RF, CL300 RF		CL600 RF		CL125 FF, CL150 RF		CL250 RF, CL300 RF		CL600 RF	
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
2	50	10.00	254	10.50	267	11.25	286	5.00	127	5.25	133	5.63	143
3	80	11.75	298	12.50	317	13.25	337	5.88	149	6.25	159	6.63	168
4	100	13.90	353	14.50	368	15.50	394	6.90	175	7.20	183	7.80	198

Table 12. Type EZL with Type 61L Pilot Dimension (continued)

BODY SIZE		DIMENSION							
		D		G		M		N	
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm
2	50	12.50	317	3.06	78	16.25	413	8.66	220
3	80	15.49	393	3.81	97	17.58	447	9.99	254
4	100	16.67	423	5.10	130	17.58	447	9.99	254

Table 13. Type EZL with Type 6352, 6353, 161M or 161EBM Pilot Dimension

BODY SIZE		DIMENSION											
		A						B					
		CL125 FF, CL150 RF		CL250 RF, CL300 RF		CL600 RF		CL125 FF, CL150 RF		CL250 RF, CL300 RF		CL600 RF	
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
2	50	10.00	254	10.50	267	11.25	286	5.00	127	5.25	133	5.63	143
3	80	11.75	298	12.50	317	13.25	337	5.88	149	6.25	159	6.63	168
4	100	13.90	353	14.50	368	15.50	394	6.90	175	7.20	183	7.80	198

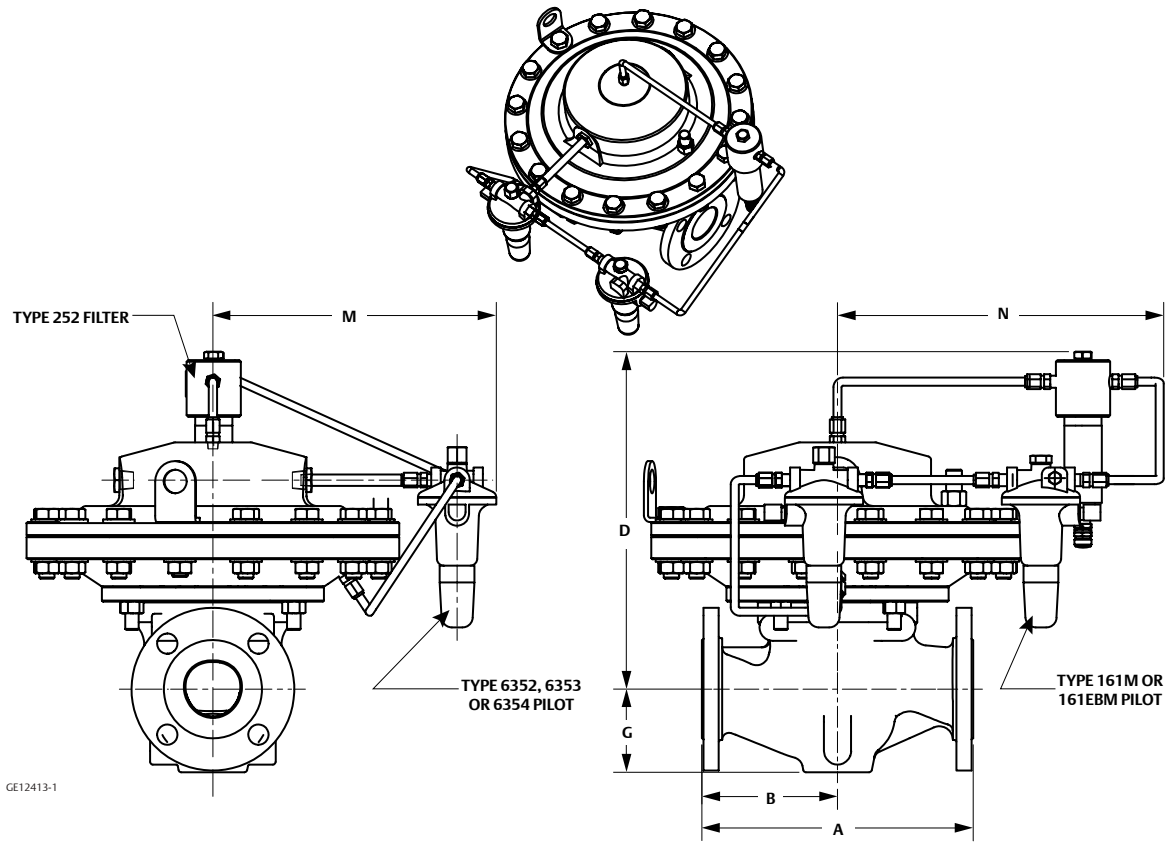


Figure 5. *Type EZL Dimensions (continued)*

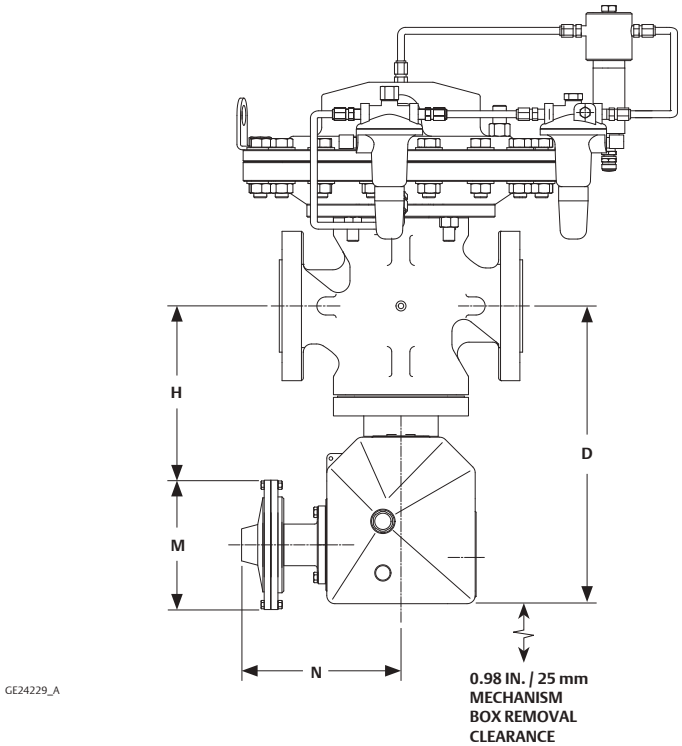


Figure 6. *Type EZLOSX Dimensions*

Table 13. Type EZL with Type 6352, 6353, 161M or 161EBM Pilot Dimension (continued)

BODY SIZE		DIMENSION							
		D		G		M		N	
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm
2	50	13.53	344	3.06	78	10.50	267	12.50	317
3	80	16.52	420	3.81	97	11.83	300	14.13	359
4	100	19.03	483	5.10	130	11.83	300	14.13	359

Table 14. Type EZLOSX Dimensions

BODY SIZE		DIMENSION WITH SLAM-SHUT													
		D		H		M(1)				N					
						Diaphragm		Piston		Diaphragm		Piston		Bellow	
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
2	50	13.0	330	10.4	264	6.38	162	2.80	71	6.89	175	8.03	204	8.78	223
3	80	14.34	364	11.78	299	6.38	162	2.80	71	6.89	175	8.03	204	8.78	223
4	100	15.64	397	13.09	332	6.38	162	2.80	71	6.89	175	8.03	204	8.78	223

1. Type 71 BMS with a diaphragm has an M dimension of 2.80 in. / 71 mm.

Table 15. Shipping Weight

BODY SIZE		APPROXIMATE SHIPPING WEIGHT													
		NPT		SWE		CL150 RF		CL300 RF		CL600 RF		SCH 40		Actuator Only	
NPS	DN	LB	kg	LB	kg	LB	kg	LB	kg	LB	kg	LB	kg	LB	kg
2	50	90	41	90	41	97	44	107	49	111	50	90	41	55	25
3	80	----	----	----	----	172	78	182	83	186	84	----	----	80	36
4	100	----	----	----	----	201	91	225	102	270	122	----	----	85	39

Ordering Guide

Type (Select One)

- ☐ Type EZL
- ☐ Type EZLOSX

Body Size (Select One)

- ☐ NPS 2 / DN 50 Body***
- ☐ NPS 3 / DN 80 Body***
- ☐ NPS 4 / DN 100 Body***

Body Material and End Connection Style (Select One)

WCC Steel

- ☐ NPT (2 in. only)***
- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ CL600 RF***
- ☐ BWE_____(Indicate Schedule 40 or 80)**
- ☐ SWE**

Cast Iron

- ☐ NPT (2 in. only)***
- ☐ CL125 FF***
- ☐ CL250 RF***

Main Valve Seat Material (Select One)

- ☐ Nitrile (NBR) **(standard)***
- ☐ Fluorocarbon (FKM)***

Outlet Pressure Range (Select One)

Type 61L

- ☐ 0.25 to 2 psig / 0.017 to 0.14 bar, Red***
- ☐ 1 to 5 psig / 0.069 to 0.34 bar, Yellow***
- ☐ 2 to 10 psig / 0.14 to 0.69 bar, Blue***
- ☐ 5 to 15 psig / 0.34 to 1.03 bar, Brown***
- ☐ 10 to 20 psig / 0.69 to 1.38 bar, Green***

Type 61HP

- ☐ 15 to 45 psig / 1.03 to 3.10 bar, Yellow***
- ☐ 35 to 100 psig / 2.41 to 6.90 bar, Blue***
- ☐ 100 to 300 psig / 6.90 to 20.7 bar, Red(1)***

Type 6352

- ☐ 2 to 10 psig / 0.14 to 0.69 bar, Black***

-continued-

1. Operating range is limited to maximum pressure.

Ordering Guide (continued)

Outlet Pressure Range (Select One) (continued)

Type 6353
- ☐ 3 to 40 psig / 0.21 to 2.8 bar, Yellow***
- ☐ 35 to 125 psig / 2.41 to 8.6 bar, Red***

Type 6354L, 6354M or 6354H
- ☐ 85 to 200 psig / 5.9 to 13.8 bar, Blue***
- ☐ 175 to 220 psig / 12.1 to 15.2 bar, Blue***
- ☐ 200 to 300 psig / 13.8 to 20.7 bar, Green(1)***

Type 161M
- ☐ 5 to 15 psig / 0.34 to 1.03 bar, Yellow***
- ☐ 10 to 125 psig / 0.69 to 8.6 bar, Red***
- ☐ 120 to 300 psig / 8.3 to 20.7 bar, Green(1)***

Type 161EBM
- ☐ 5 to 15 psig / 0.34 to 1.03 bar, White***
- ☐ 10 to 40 psig / 0.69 to 2.8 bar, Yellow***
- ☐ 30 to 75 psig / 2.07 to 5.17 bar, Black***
- ☐ 70 to 140 psig / 4.83 to 9.65 bar, Green***
- ☐ 130 to 200 psig / 8.96 to 13.8 bar, Blue***
- ☐ 200 to 350 psig / 13.8 to 24.1 bar, Red(1)***

Pilot Elastomer Material (Select One)
- ☐ Nitrile (NBR)/Polyurethane (PU) **(standard)*****
- ☐ Fluorocarbon (FKM)***

Slam-Shut Trip Pressure Setting (Select One)

Overpressure Protection Only
- ☐ Supply setpoint required _____

Underpressure Protection Only
- ☐ Supply setpoint required _____

Overpressure Protection and Underpressure Protection
- ☐ Supply overpressure setpoint required _____
- ☐ Supply underpressure setpoint required _____

Overpressure Protection, Overpressure Protection and Underpressure Protection
- ☐ Supply overpressure setpoint required _____
- ☐ Supply overpressure setpoint required _____
- ☐ Supply underpressure setpoint required _____

Travel Indicator (Optional)
- ☐ Yes***
- ☐ No***

Main Valve Replacement Parts Kit (Optional)
- ☐ Yes, send one replacement parts kit to match this order.

Pilot Replacement Parts Kit (Optional)
- ☐ Yes, send one replacement parts kit to match this order.

Explosion-Proof Limit Switch (Optional)
- ☐ Yes***

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Introduction

The Type EZR pilot-operated, pressure reducing regulator is designed for natural gas transmission/distribution systems and industrial/commercial applications. The Type EZR provides smooth, quiet operation, tight shutoff and long life, even in dirty service. Its internally actuated metal plug eliminates disadvantages associated with boot-style regulators, and the specially engineered flow path deflects debris, protecting the seat from damage and erosion.

The Type EZR is used in conjunction with a 161EB or 161AY Series pilot with the Type 112 restrictor, or with PRX Series pilot (with integral restrictor). The Type EZR pressure reducing regulator can be converted to a high pressure relief valve or backpressure regulator by simply changing to a relief piloting system (refer to Type EZR Relief pages).

For underpressure and/or overpressure protection, Type EZROSX Regulator includes Type EZR Regulator with a slam-shut device. The slam-shut device can provide either overpressure or overpressure and underpressure protection by completely shutting off the flow of gas to the downstream system. The slam-shut has a mechanism box and a manometric device.

Body Sizes and End Connection Styles

See Table 5

Flow Capacities

See Tables 19, 20 and 21

IEC Sizing Coefficients

See Table 18

Maximum Inlet Pressure and Pressure Drops

See Table 13

Maximum Outlet (Casing) Pressure

See Table 9

Outlet Pressure Ranges

See Tables 7 and 8

Differential Pressure Ranges

See Tables 12 and 13

Pressure Registration

External

Temperature Capabilities

See Table 11

Shipping Weights

See Table 24

Options

- Pre-piped Pilot Supply and Pilot Bleed
- Travel Indicator
- Inlet Strainer
- Type 252 Pilot Supply Filter
- Trim Package
- Restricted Capacity Trim
- Quick Disconnect Union for Pilot Mounting
- Integral Slam-Shut Device (refer to Type EZROSX Slam-Shut pages)
- Pilot Diaphragm for Pressure Loading

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Tight Shutoff**
- **Robust**
- **Quiet Operation**
- **Internally Actuated**
- **Debris Protection**
- **High Accuracy**
- **Easy In-Line Maintenance**
- **In-Service Travel Indicator**



W7399

Figure 1. *Type EZR Pressure Reducing Regulator*



W8136

Figure 2. *Type EZROSX Pressure Reducing Regulator with Integral Slam-Shut Device*

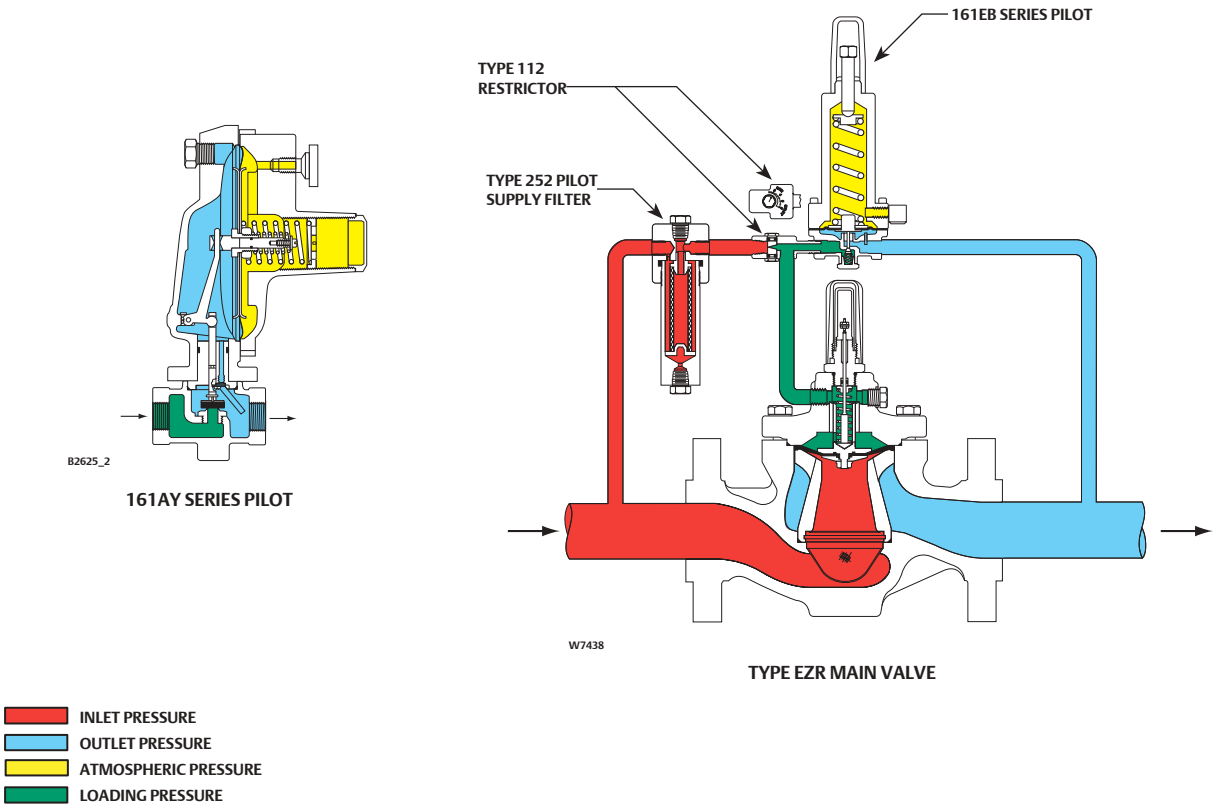


Figure 3. *Type EZR with 161EB or 161AY Series Pilot, Type 112 Restrictor and Type 252 Filter Operational Schematic*

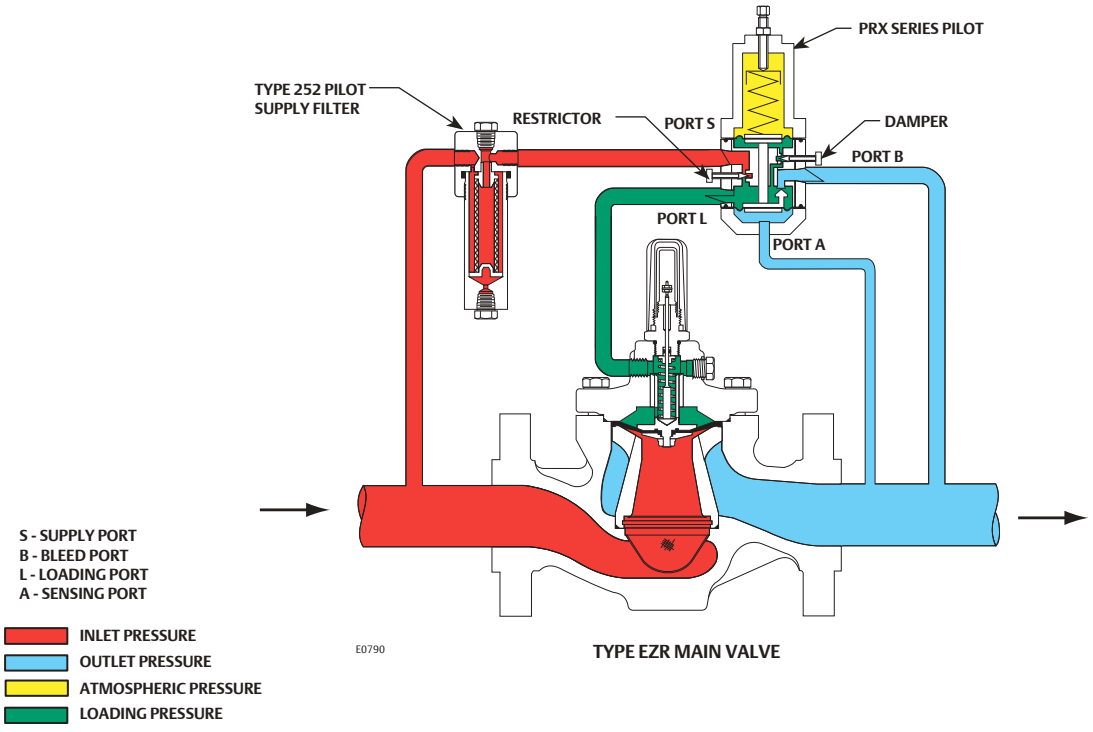
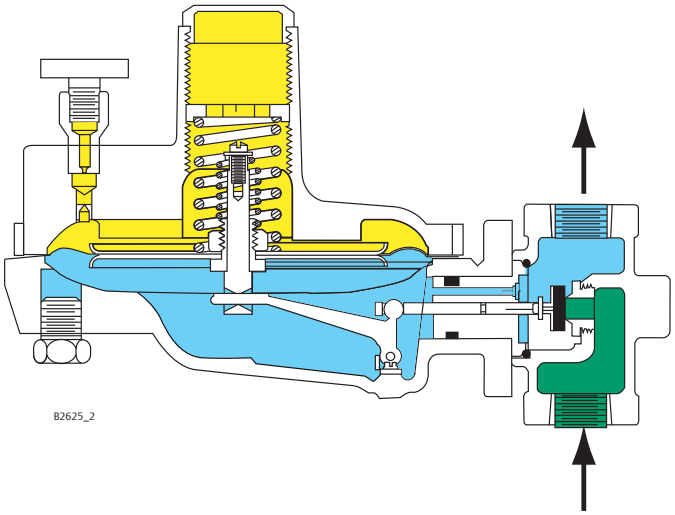
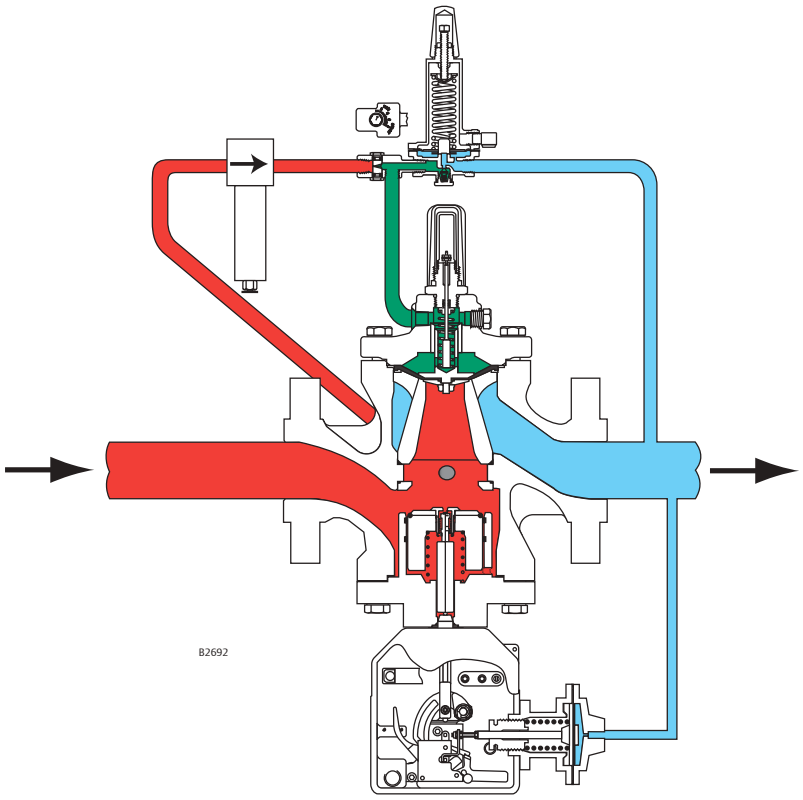


Figure 4. *Type EZR with PRX Series Pilot and Type 252 Filter Operational Schematic*



161AY SERIES PILOT



TYPE EZROSX WITH TYPE 161EB PILOT AND TYPE 252 PILOT SUPPLY FILTER

INLET PRESSURE
OUTLET PRESSURE
ATMOSPHERIC PRESSURE
LOADING PRESSURE

Figure 5. *Type EZROSX Operational Schematics*

Table 1. Construction Material	
TYPE EZR MAIN VALVE CONSTRUCTION MATERIAL	
BODY	Cast iron, WCC Steel, or LCC Steel
BONNET	LF2 Steel
CAGE	15-5 Stainless steel
SPRING	Zinc-plated steel or 17-7 Stainless steel
TOP PLUG	17-4 Stainless steel
BOTTOM PLUG	416 Stainless steel
INLET STRAINER	316 Stainless steel
DIAPHRAGM AND O-RING	Nitrile (NBR) or Fluorocarbon (FKM)
FLANGED LOCKNUT	Zinc-plated steel
BACKUP RING	Polytetrafluoroethylene (PTFE)
UPPER SPRING SEAT	416 Stainless steel
INDICATOR STEM	303 Stainless steel
INDICATOR FITTING	416 Stainless steel
TRAVEL INDICATOR PLUG	416 Stainless steel
TYPE EZROSX SLAM-SHUT DEVICE CONSTRUCTION MATERIAL	
MECHANISM BOX	Aluminum alloy
FIRST AND SECOND STAGE MECHANISM	Steel
DIAPHRAGM	Nitrile (NBR)
BELLOW	316 Stainless steel

Table 2. 161EB Series Pilot Construction Material								
BODY	**SPRING CASE**	**BODY PLUG**	**CONTROL SPRING**	**VALVE PLUG**	**ADJUSTING SCREW**	**DIAPHRAGM**	**DIAPHRAGM LIMITER**	**O-RING**
CF8M Stainless steel	CF8M Stainless steel	303 Stainless steel	Zinc-plated steel	Nitrile (NBR) or Fluorocarbon (FKM)	Zinc-plated steel	Nitrile (NBR) or Fluorocarbon (FKM)	303 Stainless steel	Nitrile (NBR)

Table 3. 161AY Series Pilot Construction Material									
BODY	**SPRING CASE AND LOWER CASING**	**STEM GUIDE**	**CONTROL SPRING**	**LEVER ASSEMBLY**	**PUSHER POST**	**DIAPHRAGM**	**O-RING**	**ORIFICE**	**DISK ASSEMBLY**
Cast iron	Ductile iron	303 Stainless steel	Zinc-plated steel	302 Stainless steel	303 Stainless steel	Nitrile (NBR) or Fluorocarbon (FKM)	Nitrile (NBR) or Fluorocarbon (FKM)	303 Stainless steel	Nitrile (NBR) or Fluorocarbon (FKM)

Table 4. PRX Series Pilot Construction Material			
BODY	**TRIM**	**ELASTOMER**	**DISK**
Steel, ASTM 105	Stainless steel	Nitrile (NBR) or Fluorocarbon (FKM)	Polyurethane (PU) or Fluorocarbon (FKM)

Table 5. Main Valve Body Size, End Connection Style and Body Rating					
TYPE	**MAIN VALVE BODY SIZE**	**MAIN VALVE BODY MATERIAL**	**END CONNECTION STYLE[1]**	**STRUCTURAL DESIGN RATING[2]**	
				psig	**bar**
EZR	2 x 1, 2, 3, 4 and 6-In. / DN 50 x 25, 50, 80, 100 and 150	Cast iron	NPT (2 x 1 and 2-In. only)	400	27.6
			CL125 FF	200	13.8
			CL250 RF	500	34.5
	1, 1-1/4 x 1[3], 2 x 1, 2, 3, 4, 6 x 4[4], 8 x 4[4], 6, 8 x 6[4] and 12 x 6[4]-In. / DN 25, 32 x 25[3], 50 x 25, 50, 80, 100, 150 x 100[4], 200 x 100 [4], 150, 200 x 150 [4] and 300 x 150 [4]	WCC Steel	NPT or SWE (1, 2 x 1 and 2-In. only)	1500	103
			CL150 RF	290	20.0
			CL300 RF	750	51.7
			CL600 RF or BWE	1500	103
	8-In. / DN 200	LCC Steel	CL150 RF	290	20.0
			CL300 RF	750	51.7
			CL600 RF	1500	103
EZROSX	NPS 1, 2 x 1, 2, 3, 4 and 6 / DN 25, 50 x 25, 50, 80, 100 and 150	WCC Steel	CL150 RF	290	20.0
			CL300 RF	750	52.0
			CL600 RF	1500	103

1. Ratings and end connections for other than ASME standard can usually be provided. Contact your local Sales Office for assistance.
2. See Tables 9, 10, 11 and 13 for diaphragm materials and additional pressure ratings.
3. Available in steel NPT only.
4. 6 x 4, 8 x 4, 8 x 6, 12 x 6-In. / DN 150 x 100, 200 x 100, 200 x 150, 300 x 150 Types EZR and 399 bodies are not the same as the EW valve bodies and are not interchangeable.

Table 6. Manometric Device Specifications[1]

SPRING RANGE		SPRING COLOR	SPRING PART NUMBER	MAXIMUM SENSING INLET PRESSURE		MANOMETRIC SENSING DEVICE TYPE	MANOMETRIC SENSING DEVICE TYPE	SETPOINT TOLERANCE[1]		MAXIMUM DIFFERENCE BETWEEN OVERPRESSURE AND UNDERPRESSURE[2]	
psig	bar			psig	bar			psig	bar	psig	bar
4.02 to 14.1 In. w.c	10 to 35 mbar	Purple	T14232T0012	75	5.2	162	Diaphragm	0.058	0.004	0.145	0.01
9.97 to 33.2 In. w.c	25 to 83 mbar	Orange	T14233T0012					0.073	0.005	0.363	0.03
18 In. w.c. to 2.0 psig	45 mbar to 0.14 bar	Red	T14234T0012					0.145	0.01	0.725	0.05
1.0 to 3.5	0.07 to 0.24	Yellow	T14235T0012					0.203	0.01	0.870	0.06
1.7 to 5.6	0.12 to 0.39	Green	T14236T0012					0.261	0.02	2.18	0.15
2 to 11	0.14 to 0.76	Gray	T14238T0012					0.725	0.05	5.08	0.35
4 to 19	0.28 to 1.3	Brown	T14239T0012					1.16	0.08	8.70	0.60
7 to 33	0.48 to 2.3	Black	T14240T0012					2.47	0.17	16.0	1.1
15 to 75	1.0 to 5.2	Blue	T14237T0012	235	16.2	71		5.08	0.35	36.3	2.5
31 to 161	2.1 to 11.0	Brown	T14239T0012					10.2	0.70	79.8	5.5
59 to 235	4.1 to 16.2	Black	T14240T0012					23.2	1.6	145	10.0
235 to 323	16.2 to 22.3	Brown	T14239T0012	1470	101	27	Piston	43.5	3.0	Requires use of a Types BMS1 and BMS2	
323 to 588	22.3 to 40.5	Black	T14240T0012					94.3	6.5		
588 to 808	40.5 to 55.7	Brown	T14239T0012	1470	101	17		102	7.0		
808 to 1470	55.7 to 101	Black	T14240T0012					174	12.0		
81 to 323	5.6 to 22.3	Brown	T14239T0012	514	35.4	236	Bellows	14.5	1.00	145	10.0
122 to 514	8.4 to 35.0	Black	T14240T0012					36.3	2.5	290	20.0
257 to 1058	17.7 to 72.9	Gray	T14238T0012	1058	72.9	315		72.5	5.0	479	33.0

1. Minimum suggested difference between slam-shut set pressure and normal operating pressure of the system.
2. Maximum difference between overpressure and underpressure when using one manometric device (Type BMS1) with tripping hook. For underpressure and overpressure points greater than this maximum number, use a second manometric device (Type BMS2) for underpressure protection.

Table 7. Outlet (Control) Pressure Range and Typical Proportional Band

TYPE	OUTLET (CONTROL) PRESSURE RANGE		PROPORTIONAL BAND[1][3]		PILOT CONTROL SPRING INFORMATION					
					Part Number	Color Code	Wire Diameter		Free Length	
	psig	bar	psig	bar			In.	mm	In.	mm
161AY or 161AYM	6 to 15 In. w.c.	15 to 37 mbar	1 In. w.c.[2]	2 mbar[2]	1B653927022	Olive Drab	0.105	2.67	3.75	95.3
	0.5 to 1.2	34 to 83 mbar	1 In. w.c.[2]	2 mbar[2]	1B537027052	Yellow	0.114	2.90	4.31	109
	1.2 to 2.5	83 mbar to 0.17 bar	0.5[2]	34 mbar[2]	1B537127022	Light Green	0.156	3.96	4.06	103
	2.5 to 4.5	0.17 to 0.31	0.5[2]	34 mbar[2]	1B537227022	Light Blue	0.187	4.75	3.94	100
	4.5 to 7	0.31 to 0.48	0.5[2]	34 mbar[2]	1B537327052	Black	0.218	5.54	3.98	101
161EB or 161EBM	5 to 15	0.34 to 1.0	0.5[2]	34 mbar[2]	17B1260X012	White	0.120	3.05	3.75	95.3
	10 to 40	0.69 to 2.8	0.5[2]	34 mbar[2]	17B1262X012	Yellow	0.148	3.76	3.75	95.3
	30 to 75	2.1 to 5.2	0.6[2]	41 mbar[2]	17B1259X012	Black	0.187	4.75	4.00	102
	70 to 140	4.8 to 9.7	1.3[2]	90 mbar[2]	17B1261X012	Green	0.225	5.72	3.70	94.0
	130 to 200	9.0 to 13.8	1.5[2]	0.10[2]	17B1263X012	Blue	0.262	6.66	3.85	97.8
	30 to 300[4]	2.1 to 20.7[4]	6	0.41	15A9258X012	Green	0.243	6.17	1.88	47.8
	200 to 350	13.8 to 24.1	3[2]	0.21[2]	17B1264X012	Red	0.294	7.47	4.22	107

1. Proportional band includes outlet pressure drop plus hysteresis (friction), but does not include lockup.
2. Proportional band was determined with a pressure drop ranging from 50 to 150 psi / 3.4 to 10.3 bar. Approximately double the proportional band if the pressure drop is less than 50 psi / 3.4 bar.
3. With Type 112 restrictor set on 2. With Type PRX restrictor turn the restrictor screw one turn counterclockwise from fully seated.
4. Outlet (control) pressure range should only be used as the intermediate reduction pilot on the Type EZR worker/monitor systems.

Table 8. Outlet (Control) Pressure Range and Accuracy Class

TYPE	OUTLET (CONTROL) PRESSURE RANGE		ACCURACY CLASS[1]	PILOT CONTROL SPRING INFORMATION					
				Part Number	Color Code	Wire Diameter		Free Length	
	psig	bar				In.	mm	In.	mm
PRX/120 PRX/125	14.5 to 26	1.00 to 1.8	± 2.5%	M0255240X12	Yellow	0.110	2.79	2.16	54.9
	23 to 44	1.6 to 3.0		M0255230X12	Green	0.126	3.20	2.16	54.9
	41 to 80	2.8 to 5.5		M0255180X12	Blue	0.138	3.51	2.16	54.9
	73 to 123	5.0 to 8.5		M0255220X12	Black	0.157	3.99	2.16	54.9
	116 to 210	8.0 to 14.5	± 1%	M0255210X12	Silver	0.177	4.50	2.16	54.9
	203 to 334	14.0 to 23.0		M0255200X12	Gold	0.197	5.00	2.01	51.1
	319 to 435	22.0 to 30.0		M0265860X12	Aluminum	0.236	6.00	2.01	51.1
PRX/120-AP PRX/125-AP	435 to 1000	30.0 to 69.0	± 1%	M0273790X12	Clear	0.335	8.51	3.94	100

1. Accuracy class accounts outlet pressure drop plus hysteresis (friction), but does not include lockup.

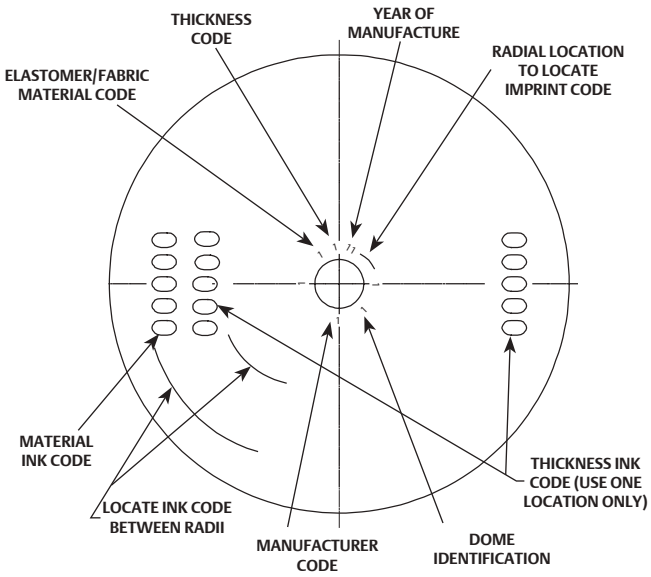


Figure 6. *Diaphragm Marking*

Table 9. Pilot Pressure Rating

TYPE	MAXIMUM INLET PRESSURE		MAXIMUM EMERGENCY OUTLET PRESSURE OR MAXIMUM EMERGENCY SENSE PRESSURE(1)		MAXIMUM OUTLET PRESSURE		MAXIMUM BLEED (EXHAUST) PRESSURE FOR MONITOR PILOT		MAXIMUM SENSE (CONTROL) PRESSURE FOR MONITOR PILOT	
	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
161AY	150	10.3	150	10.3	150	10.3	----		----	
161EB	1500	103	1200	82.7	750	51.7				
161AYM	150	10.3	150	10.3	----		150	10.3	150	10.3
161EBM	1500	103	1200	82.7			1500	103	750	51.7
PRX Series	1480	102	1480	102	1480	102	1480	102	1480	102

1. Maximum pressure to prevent the casings from bursting during abnormal operation (leaking to atmosphere and internal parts damage may occur).

Table 10. Diaphragm Imprint Code

THICKNESS		MATERIAL		DIAPHRAGM MATERIAL
Imprint	Ink Code	Imprint	Ink Code	
2	130	2	17E68	17E68 - Nitrile (NBR) (low temperature)
		4	17E88	17E88 - Fluorocarbon (FKM) (high aromatic hydrocarbon content resistant)
		5	17E97	17E97 - Nitrile (NBR) (high-pressure and/or erosion resistant)

Table 11. Diaphragm Temperature Capabilities, Erosion Resistance and Chemical Compatibility

	17E68 NITRILE (NBR)	17E97(1) NITRILE (NBR)	17E88 FLUOROCARBON (FKM)
Gas Temperature (for lower temperatures contact your local Sales Office)	-20 to 150°F / -29 to 66°C	0 to 150°F / -18 to 66°C	0 to 260°F / -18 to 127°C(2)
General Applications	Best for low temperatures	Best for high pressure conditions, i.e. transmission service or high pressure industrial service. It is also the best for abrasive or erosive service applications.	Best for natural gas having aromatic hydrocarbons. It is also the best for high temperature applications.
Heavy Particle Erosion	Fair	Excellent	Good
Natural Gas With:			
Up to 3% aromatic hydrocarbon content(3)	Good	Excellent	Excellent
3 to 15% aromatic hydrocarbon content(3)	Poor	Good	Excellent
15 to 50% aromatic hydrocarbon content(3)	Not recommended	Poor	Excellent
Up to 3% H_2S (hydrogen sulfide or sour gas)	Good	Good	Good
Up to 3% ketone	Fair	Fair	Fair
Up to 10% alcohol	Good	Good	Fair
Up to 3% synthetic lube	Fair	Fair	Good

1. The 6-In. / DN 150, 17E97 diaphragm will perform in gas temperatures as low as -20°F / -29°C.
2. For differential pressures above 400 psid / 27.6 bar d diaphragm temperature is limited to 150°F / 66°C.
3. The aromatic hydrocarbon content is based on percent volume.

Table 12. Main Valve Minimum Differential Pressures[1]

MAIN VALVE BODY SIZE		MAIN SPRING PART NUMBER AND COLOR CODE	DIAPHRAGM MATERIAL	MINIMUM DIFFERENTIAL, PERCENT OF CAGE CAPACITY											
				FOR 90% CAPACITY						FOR 100% CAPACITY					
				100% Trim		60% Trim		30% Trim		100% Trim		60% Trim		30% Trim	
In.	DN			psid	bar d	psid	bar d	psid	bar d	psid	bar d	psid	bar d	psid	bar d
1, 1-1/4 x 1	25, 32 x 25	19B2400X012, Light Blue	17E68 and 17E88	24	1.7	29	2.0	31	2.1	24	1.7	31	2.1	40	2.8
		GE12727X012, Black[3]	17E97	35	2.4	38	2.6	42	2.9	35	2.4	39	2.7	52	3.6
			17E68 and 17E88	30	2.1	35	2.4	39	2.7	30	2.1	36	2.5	52	3.6
		19B2401X012, Black with White Stripe[3]	17E88 and 17E97	43	3.0	50	3.4	56	3.9	43	3.0	53	3.7	68	4.7
2 x 1	50 x 25	19B2400X012, Light Blue	17E68 and 17E88	24	1.7	29	2.0	31	2.1	24	1.7	31	2.1	40	2.8
		19B2401X012, Black with White Stripe[3]	17E97	43	3.0	50	3.4	56	3.9	43	3.0	53	3.7	68	4.7
			17E68 and 17E88	43	3.0	50	3.4	56	3.9	43	3.0	53	3.7	68	4.7
		GE12501X012, Red Stripe[3]	17E97	68	4.7	73	5.0	88	6.1	72	5.0	81	5.6	102	7.0
2	50	19B0951X012, Yellow[2]	17E68 and 17E88	12	0.8	15	1.0	15	1.0	12	0.8	25	1.7	20	1.4
		18B2126X012, Green	17E97	24	1.7	25	1.7	26	1.8	24	1.7	30	2.1	37	2.6
			17E68 and 17E88	18	1.2	20	1.4	22	1.5	19	1.3	26	1.8	28	1.9
		18B5955X012, Red[3] GE05504X012, Purple[3]	17E88 and 17E97	29	2.0	29	2.0	31	2.1	31	2.1	35	2.4	43	3.0
3	80	T14184T0012, Yellow[2]	17E68 and 17E88	16	1.1	19	1.3	24	1.7	23	1.6	23	1.6	29	2.0
		19B0781X012, Light Blue	17E97	23	1.6	23	1.6	23	1.6	23	1.6	23	1.6	25	1.7
			17E68 and 17E88	21	1.5	22	1.5	28	1.9	28	1.9	28	1.9	33	2.3
		19B0782X012, Black[3]	17E88 and 17E97	32	2.2	33	2.3	43	3.0	38	2.6	38	2.6	50	3.4
4, 6 x 4 and 8 x 4	100, 150 x 100 and 200 x 100	T14184T0012, Yellow[2]	17E68, 17E88 and 17E97	10	0.7	12	0.8	14	1.0	25	1.7	25	1.7	25	1.7
		18B8501X012, Green	17E97	16	1.1	17	1.2	21	1.5	34	2.3	34	2.3	34	2.3
			17E68 and 17E88	16	1.1	17	1.2	20	1.4	30	2.1	30	2.1	30	2.1
		18B8502X012, Red[3]	17E88 and 17E97	21	1.5	24	1.7	26	1.8	40	2.8	40	2.8	40	2.8
6, 8 x 6 and 12 x 6	150, 200 x 150 and 300 x 150	19B0364X012, Yellow[2]	17E88	10	0.69	13	0.9	13	0.9	12	0.8	21	1.5	21	1.5
			17E97	10	0.69	11	0.8	14	1.0	12	0.8	16	1.1	16	1.1
		19B0366X012, Green	17E97	14	1.0	22	1.5	22	1.5	19	1.3	29	2.0	29	2.0
			17E88	17	1.2	21	1.5	21	1.5	20	1.4	36	2.5	36	2.5
		19B0365X012, Red[3]	17E88 and 17E97	23	1.6	29	2.0	29	2.0	30	2.1	41	2.8	41	2.8
8	200	GE09393X012, Yellow[2]	17E97	16	1.1	----		----		19	1.3	----		----	
		GE09396X012, Green		20	1.4					23	1.6				
		GE09397X012, Red[3]		26	1.8					30	2.1				

1. See Table 5 for structural design ratings, Table 9 for pilot ratings and Table 13 for maximum pressure ratings.
2. The white and yellow springs are only recommended for inlet pressures under 100 psig / 6.9 bar.
3. The red, black, purple, red stripe and black with white stripe springs are only recommended for applications where the maximum inlet pressure can exceed 500 psig / 34.5 bar.

Table 13. Main Valve Maximum Pressure Ratings, Diaphragm Selection Information and Main Spring Selection(1)

BODY SIZE		DIAPHRAGM MATERIAL	MAXIMUM OPERATING INLET PRESSURE(4)		MAXIMUM OPERATING DIFFERENTIAL PRESSURE(4)		MAXIMUM EMERGENCY INLET AND DIFFERENTIAL PRESSURE		MAIN SPRING COLOR	DIAPHRAGM DESIGNATION
In.	DN		psig	bar	psid	bar d	psid	bar d		
1, 1-1/4 x 1	25, 32 x 25	17E68 Nitrile (NBR) Low temperature	100	6.9	100.0	6.9	100	6.9	Light Blue	130
			460	31.7	400.0	27.6	460	31.7	Black(2)	
		17E97 Nitrile (NBR) High-pressure and/ or erosion resistant	500	34.5	500.0	34.5	1050	72.4	Black(2)	
			1050	72.4	800.0	55.2	1050	72.4	Black with White Stripe(2)	
		17E88 Fluorocarbon (FKM) High aromatic hydrocarbon content resistant	100	6.9	100.0	6.9	100	6.9	Light Blue	
			500	34.5	500(3)	34.5(3)	750	51.7	Black(2)	
			750	51.7	500(3)	34.5(3)	750	51.7	Black with White Stripe(2)	
2 x 1	50 x 25	17E68 Nitrile (NBR) Low temperature	100	6.9	100.0	6.9	100	6.9	Light Blue	130
			360	24.8	300.0	20.7	360	24.8	Black with White Stripe(2)	
		17E97 Nitrile (NBR) High-pressure and/ or erosion resistant	500	34.5	500.0	34.5	500	34.5	Black with White Stripe(2)	
			1050	72.4	800.0	55.2	1050	72.4	Red Stripe(2)	
		17E88 Fluorocarbon (FKM) High aromatic hydrocarbon content resistant	100	6.9	100.0	6.9	100	6.9	Light Blue	
			750	51.7	500(3)	34.5(3)	750	51.7	Black with White Stripe(2)	
2	50	17E68 Nitrile (NBR) Low temperature	100	6.9	100.0	6.9	100	6.9	Yellow	130
			460	31.7	400.0	27.6	460	31.7	Green	
		17E97 Nitrile (NBR) High-pressure and/ or erosion resistant	500	34.5	500.0	34.5	1050	72.4	Green	
			1050	72.4	800.0	55.2	1050	72.4	Red or Purple(2)	
		17E88 Fluorocarbon (FKM) High aromatic hydrocarbon content resistant	100	6.9	100.0	6.9	100	6.9	Yellow	
			500	34.5	500(3)	34.5(3)	750	51.7	Green	
			750	51.7	500(3)	34.5(3)	750	51.7	Red or Purple(2)	
3	80	17E68 Nitrile (NBR) Low temperature	100	6.9	100.0	6.9	100	6.9	Yellow	130
			360	24.8	300.0	20.7	500	34.5	Light Blue	
		17E97 Nitrile (NBR) High-pressure and/or erosion resistant	500	34.5	500.0	34.5	1050	72.4	Light Blue	
			1050	72.4	800.0	55.2	1050	72.4	Black(2)	
		17E88 Fluorocarbon (FKM) High aromatic hydrocarbon content resistant	100	6.9	100.0	6.9	100	6.9	Yellow	
			500	34.5	500(3)	34.5(3)	750	51.7	Light Blue	
			750	51.7	500(3)	34.5(3)	750	51.7	Black(2)	
4, 6 x 4 and 8 x 4	100, 150 x 100 and 200 x 100	17E68 Nitrile (NBR) Low temperature	100	6.9	100.0	6.9	100	6.9	Yellow	130
			360	24.8	300.0	20.7	500	34.5	Green	
		17E97 Nitrile (NBR) High-pressure and/or erosion resistant	100	6.9	100	6.9	100	6.9	Yellow	
			500	34.5	500.0	34.5	1050	72.4	Green	
			1050	72.4	800.0	55.2	1050	72.4	Red(2)	
		17E88 Fluorocarbon (FKM) High aromatic hydrocarbon content resistant	100	6.9	100.0	6.9	100	6.9	Yellow	
			500	34.5	500(3)	34.5(3)	750	51.7	Green	
			750	51.7	500(3)	34.5(3)	750	51.7	Red(2)	
6, 8 x 6 and 12 x 6	150, 200 x 150 and 300 x 150	17E97 Nitrile (NBR) High-pressure and/or erosion resistant	100	6.9	100.0	6.9	100	6.9	Yellow	130
			500	34.5	500.0	34.5	1050	72.4	Green	
			1050	72.4	800.0	55.2	1050	72.4	Red(2)	
		17E88 Fluorocarbon (FKM) High aromatic hydrocarbon content resistant	100	6.9	100.0	6.9	100	6.9	Yellow	
			500	34.5	500(3)	34.5(3)	750	51.7	Green	
			750	51.7	500(3)	34.5(3)	750	51.7	Red(2)	
8	200	17E97 Nitrile (NBR) High-pressure and/or erosion resistant	100	6.9	100.0	6.9	100	6.9	Yellow	130
			500	34.5	500.0	34.5	1050	72.4	Green	
			1050	72.4	800.0	55.2	1050	72.4	Red(2)	

1. See Table 5 for main valve structural design ratings and Table 9 for pilot ratings.
2. The red, black, purple, red stripe and black with white stripe springs are only recommended for applications where the maximum inlet pressure can exceed 500 psig / 34.5 bar.
3. For differential pressures above 400 psid / 27.6 bar d diaphragm temperatures are limited to 150°F / 66°C.
4. These are recommendations that provide the best regulator performance for a typical application. Please contact your local Sales Office for further information if a deviation from the standard recommendations are required.

Table 14. Restrictor Flow Coefficients

SET ON START		SET ON RUN		C_1
C_g	C_v	C_g	C_v	
6	0.17	1	0.03	35

Table 15. Pilot Flow Coefficients

161AY SERIES					161EB SERIES					PRX SERIES				
Orifice Size		C_g	C_v	C_1	Orifice Size		C_g	C_v	C_1	Orifice Size		C_g	C_v	C_1
3/32 In. 1/8 In. 1/4 In.	2.4 mm 3.2 mm 6.4 mm	6.9 12.3 50	0.20 0.35 1.43	35	1/8 In.	3.2 mm	8.5	0.28	30.4	1/8 In.	3.2 mm	10.5	0.36	29

Table 16. Main Valve Regulating Flow Coefficients for EZR Series, With or Without Slam-Shut Device

MAIN VALVE BODY SIZE		CAGE STYLE, PERCENT OF CAPACITY	LINE SIZE EQUALS BODY SIZE PIPING						2:1 LINE SIZE TO BODY SIZE PIPING					
			With Inlet Strainer			Without Inlet Strainer			With Inlet Strainer			Without Inlet Strainer		
In.	DN		C_g	C_v	C_1	C_g	C_v	C_1	C_g	C_v	C_1	C_g	C_v	C_1
1	25	100% 60% 30%	494 290 145	14.8 10.1 5.0	33.4 28.7 28.8	494 282 141	15.3 9.8 4.9	32.4 28.9 28.7	481 286 144	14.4 9.9 5.0	33.4 29.0 28.6	478 275 139	14.6 9.5 4.9	32.7 28.9 28.5
1-1/4 x 1	32 x 25	100% 60% 30%	572 283 145	17.0 10.5 5.5	33.7 26.9 26.3	573 291 149	16.5 10.8 5.6	34.6 26.9 26.4	547 293 142	16.1 10.9 5.4	34.1 26.7 26.1	550 303 147	15.9 11.3 5.6	34.7 26.9 26.3
2 x 1	50 x 25	100% 60% 30%	650 294 145	18.4 10.9 5.1	35.3 27.0 28.3	650 294 145	18.4 10.9 5.1	35.3 27.0 28.2	648 294 145	18.2 10.9 5.1	35.6 27.0 28.3	645 294 145	18.2 10.9 5.1	35.4 27.0 28.4
2	50	100% 60% 30%	1890 1040 570	50.8 35.6 21.4	37.2 29.2 26.6	1970 1050 570	54.6 36.3 21.4	36.1 28.9 26.6	1800 1020 560	50.4 35.9 21.5	35.7 28.4 26.0	1840 1020 560	53.0 35.9 21.5	34.7 28.4 26.0
3	80	100% 60% 30%	3550 2000 980	91.4 70.3 38.0	38.8 28.5 25.8	3720 2000 980	99.9 70.3 38.0	37.2 28.5 25.8	3390 1970 970	90.6 67.5 36.9	37.4 29.2 26.3	3510 1970 970	97.1 68.3 36.9	36.1 28.8 26.3
4	100	100% 60% 30%	5690 3360 1710	147 124 66.5	38.7 27.1 25.7	5830 3360 1710	154 124 66.5	37.9 27.1 25.7	5540 3300 1690	145 122 66.3	38.2 27.0 25.5	5640 3300 1690	151 121 66.8	37.4 27.3 25.3
6 x 4	150 x 100	100% 60% 30%	6150 3790 1900	159 140 74	38.7 27.1 25.7	6290 3810 1910	166 141 74	37.9 27.1 25.7	6142 3930 1970	161 146 77	38.2 27.0 25.5	6242 3890 1950	167 143 77	37.4 27.3 25.3
8 x 4	200 x 100	100% 60% 30%	6030 3640 1830	156 134 71	38.7 27.1 25.8	6170 3700 1860	163 137 72	37.9 27.1 25.8	5934 3720 1870	155 138 73	38.2 27.0 25.6	6034 3730 1880	161 137 74	37.4 27.3 25.3
6	150	100% 60% 30%	11,600 7120 3560	325 239 135	35.7 29.8 26.4	12,000 7200 3560	337 241 134	35.6 29.9 26.6	11,200 7150 3570	314 240 135	35.7 29.8 26.4	11,700 7230 3590	329 242 135	35.6 29.9 26.6
8 x 6	200 x 150	100% 60% 30%	13,400 8250 4150	376 277 157	35.7 29.8 26.4	13,700 8290 4150	385 277 156	35.6 29.9 26.6	12,940 8280 4160	363 278 157	35.7 29.8 26.4	13,360 8320 4180	376 279 157	35.6 29.9 26.6
12 x 6	300 x 150	100% 60% 30%	13,600 8210 4110	381 276 155	35.7 29.8 26.4	13,700 8220 4110	385 275 155	35.6 29.9 26.6	13,130 8240 4120	368 277 156	35.7 29.8 26.4	13,360 8250 4140	376 276 156	35.6 29.9 26.6
8	200	100%	19,700	505	39.0	20,100	517	38.9	19,500	503	38.8	19,700	509	38.7

Table 17. Main Valve Wide-Open Flow Coefficients for EZR Series, With or Without Slam-Shut Device

MAIN VALVE BODY SIZE		CAGE STYLE, PERCENT OF CAPACITY	LINE SIZE EQUALS BODY SIZE PIPING						2:1 LINE SIZE TO BODY SIZE PIPING					
			With Inlet Strainer			Without Inlet Strainer			With Inlet Strainer			Without Inlet Strainer		
In.	DN		C_g	C_v	C_1	C_g	C_v	C_1	C_g	C_v	C_1	C_g	C_v	C_1
1	25	100% 60% 30%	509 299 149	15.2 10.4 5.2	33.5 28.7 28.8	509 291 145	15.7 10.1 5.1	32.5 28.8 28.7	495 295 148	14.8 10.1 5.2	33.5 29.0 28.6	493 284 143	15.0 9.8 5.0	32.9 28.9 28.5
1-1/4 x 1	32 x 25	100% 60% 30%	590 291 149	17.5 10.8 5.7	33.7 26.9 26.3	590 299 154	17.0 11.2 5.8	34.6 26.9 26.4	564 301 146	16.5 11.3 5.6	34.1 26.7 26.1	566 312 151	16.3 11.6 5.8	34.7 26.9 26.3
2 x 1	50 x 25	100% 60% 30%	670 303 149	19.0 11.2 5.3	35.3 27.0 28.3	670 303 149	19.0 11.2 5.3	35.3 27.0 28.2	667 303 149	18.7 11.2 5.3	35.6 27.0 28.3	664 303 149	18.7 11.2 5.3	35.4 27.0 28.4
2	50	100% 60% 30%	1950 1070 590	52.4 36.6 22.2	37.2 29.2 26.6	2030 1080 590	56.2 37.4 22.2	36.1 28.9 26.6	1850 1050 580	51.8 37.0 22.3	35.7 28.4 26.0	1900 1050 580	54.6 37.0 22.3	34.7 28.4 26.0
3	80	100% 60% 30%	3660 2060 1010	94.1 72.4 39.1	38.8 28.5 25.8	3830 2060 1010	102.9 72.4 39.1	37.2 28.5 25.8	3490 2030 1000	93.3 69.5 38.0	37.4 29.2 26.3	3620 2030 1000	100.2 70.0 38.0	36.1 28.8 26.3
4	100	100% 60% 30%	5860 3460 1760	151 128 68.5	38.7 27.1 25.7	6000 3460 1770	158 128 68.2	37.9 27.1 26.0	5710 3400 1740	149 125 68.2	38.2 27.3 25.5	5810 3400 1740	155 125 68.8	37.4 27.3 25.3
6 x 4	150 x 100	100% 60% 30%	6250 3850 1940	162 142 75	38.7 27.1 25.7	6390 3870 1940	169 143 75	37.9 27.1 26.0	6131 3920 1970	161 144 77	38.2 27.3 25.5	6231 3880 1950	167 142 77	37.4 27.3 25.3
8 x 4	200 x 100	100% 60% 30%	6100 3680 1850	158 136 72	38.7 27.1 25.8	6240 3750 1880	165 138 72	37.9 27.1 26.1	5930 3720 1870	155 136 73	38.2 27.3 25.6	6030 3720 1880	161 136 74	37.4 27.3 25.3
6	150	100% 60% 30%	11,950 7330 3670	335 246 139	35.7 29.8 26.5	12,360 7420 3670	348 248 138	35.5 29.9 26.6	11,540 7360 3680	323 247 139	35.7 29.8 26.5	12,050 7450 3700	339 249 139	35.5 29.9 26.6
8 x 6	200 x 150	100% 60% 30%	13,800 8490 4280	386 285 162	35.7 29.8 26.5	14,110 8540 4280	397 286 161	35.5 29.9 26.6	13,330 8520 4290	373 286 162	35.7 29.8 26.5	13,760 8570 4310	387 287 162	35.6 29.9 26.6
12 x 6	300 x 150	100% 60% 30%	14,010 8450 4240	392 284 160	35.7 29.8 26.5	14,110 8470 4240	397 283 159	35.5 29.9 26.6	13,530 8480 4250	379 285 160	35.7 29.8 26.5	13,760 8500 4270	387 284 160	35.6 29.9 26.6
8	200	100%	20,300	520	39.0	20,700	533	38.8	20,100	518	38.8	20,300	524	38.7

Table 18. IEC Sizing Coefficients(1)

MAIN VALVE BODY SIZE		X_T	F_D	F_L
In.	DN			
1	25	0.71	0.06	0.94
2	50	0.88	0.09	0.96
3	80	0.95	0.09	0.97
4	100	0.95	0.09	0.92
6	150	0.81	0.13	0.91
8	200	0.96	0.10	0.89

1. At 100% capacity.

Table 19. Capacities for EZR Series with Type 161AY or 161AYM Pilot

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING WITHOUT INLET STRAINER											
				1-In. / DN 25		2-In. / DN 50		3-In. / DN 80		4-In. / DN 100		6-In. / DN 150		8-In. / DN 200	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
25	1.7	up to 2.5 3 5 7	up to 0.17 0.21 0.34 0.48	---- ---- ---- ----		101 95 93 ----	2.7 2.5 2.5 ----	191 177 173 ----	5.1 4.7 4.6 ----	299 275 268 260	8.0 7.4 7.2 7.0	586 583 571 556	15.7 15.6 15.3 14.9	941 936 912 884	25.2 25.1 24.4 23.7
30	2.1	up to 4.5 7	up to 0.31 0.48	28.0 ----	0.75 ----	114 105	3.1 2.8	215 196	5.8 5.2	336 304	9.0 8.1	660 646	17.7 17.3	1062 1033	28.5 27.7
35	2.4	up to 6 7	up to 0.41 0.48	31.3 31.1	0.84 0.83	126 119	3.4 3.2	239 223	6.4 6.0	374 346	10.0 9.3	738 732	19.7 19.6	1187 1177	31.8 31.5
40 45 50 55	2.8 3.1 3.4 3.8	up to 7	up to 0.48	34.5 37.9 41.2 44.4	0.93 1.02 1.10 1.19	139 152 164 177	3.7 4.1 4.4 4.7	262 286 310 334	7.0 7.7 8.3 8.9	411 449 487 524	11.0 12.0 13.1 14.0	817 900 981 1062	21.9 24.1 26.3 28.5	1317 1455 1592 1727	35.3 39.0 42.7 46.3
60 65 70 75	4.1 4.5 4.8 5.2	up to 7	up to 0.48	47.6 50.8 54.0 57.2	1.28 1.36 1.45 1.53	190 203 215 228	5.1 5.4 5.8 6.1	358 382 406 430	9.6 10.2 10.9 11.5	562 599 637 675	15.1 16.1 17.1 18.1	1143 1223 1302 1381	30.6 32.8 34.9 37.0	1862 1996 2129 2261	49.9 53.5 57.1 60.6
80 90 100 125 150	5.5 6.2 6.9 8.6 10.3	up to 7	up to 0.48	60.3 66.6 72.9 88.4 104	1.62 1.79 1.95 2.37 2.79	241 253 266 355 419	6.5 6.8 7.1 9.5 11.2	454 478 502 670 790	12.2 12.8 13.5 18.0 21.2	712 750 787 1051 1239	19.1 20.1 21.1 28.2 33.2	1460 1617 1773 2163 2551	39.1 43.3 47.5 58.0 68.4	2394 2658 2920 3575 4227	64.2 71.2 78.3 95.8 113

Note: Blank areas indicate where minimum main valve differential pressure is not met.

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Table 19. Capacities for EZR Series with Type 161AY or 161AYM Pilot (continued)

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING WITHOUT INLET STRAINER											
				1-1/4 x 1-In. / DN 32 x 25		2 x 1-In. / DN 50 x 25		6 x 4-In. / DN 150 x 100		8 x 4-In. / DN 200 x 100		8 x 6-In. / DN 200 x 150		12 x 6-In. / DN 300 x 150	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
25	1.7	up to 2.5 3 5 7	up to 0.17 0.21 0.34 0.48	---- ---- ---- ----		---- ---- ---- ----		299 297 290 281	8.0 8.0 7.8 7.5	294 292 285 277	7.9 7.8 7.6 7.4	669 666 652 634	17.9 17.8 17.5 17.0	669 666 652 634	17.9 17.8 17.5 17.0
30	2.1	up to 4.5 7	up to 0.31 0.48	35.9 35.1	1.0 0.9	35.9 ----	1.0 ----	337 328	9.0 8.8	331 323	8.9 8.7	754 737	20.2 19.8	754 737	20.2 19.8
35	2.4	up to 6 7	up to 0.41 0.48	40.1 39.8	1.1 1.1	40.1 39.8	1.1 1.1	376 374	10.1 10.0	370 367	9.9 9.8	842 836	22.6 22.4	842 836	22.6 22.4
40 45 50 55	2.8 3.1 3.4 3.8	up to 7	up to 0.48	44.4 48.9 53.3 57.7	1.2 1.3 1.4 1.5	44.4 48.9 53.3 57.7	1.2 1.3 1.4 1.5	417 461 504 546	11.2 12.4 13.5 14.6	411 454 496 537	11.0 12.2 13.3 14.4	933 1027 1120 1213	25.0 27.5 30.0 32.5	933 1027 1120 1213	25.0 27.5 30.0 32.5
60 65 70 75	4.1 4.5 4.8 5.2	up to 7	up to 0.48	62.0 66.3 70.6 74.9	1.7 1.8 1.9 2.0	62.0 66.3 70.6 74.9	1.7 1.8 1.9 2.0	588 630 672 714	15.8 16.9 18.0 19.1	579 620 661 702	15.5 16.6 17.7 18.8	1304 1396 1486 1577	34.9 37.4 39.8 42.3	1304 1396 1486 1577	34.9 37.4 39.8 42.3
80 90 100 125 150	5.5 6.2 6.9 8.6 10.3	up to 7	up to 0.48	79.2 87.7 96.1 117 138	2.1 2.3 2.6 3.1 3.7	79.2 87.7 96.1 117 138	2.1 2.3 2.6 3.1 3.7	755 838 920 1126 1330	20.2 22.5 24.7 30.2 35.7	743 825 906 1108 1309	19.9 22.1 24.3 29.7 35.1	1667 1846 2025 2470 2913	44.7 49.5 54.3 66.2 78.1	1667 1846 2025 2470 2913	44.7 49.5 54.3 66.2 78.1

Note: Blank areas indicate where minimum main valve differential pressure is not met.

Table 20. Capacities for EZR Series with Type 161EB, 161EBM or PRX Series Pilot

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING WITHOUT INLET STRAINER											
				1-In. / DN 25		2-In. / DN 50		3-In. / DN 80		4-In. / DN 100		6-In. / DN 150		8-In. / DN 200	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
30	2.1	5 10	0.35 0.69	28 ----	0.7 ----	107 101	2.9 2.7	200 188	5.4 5.0	310 292	8.3 7.8	658 623	17.6 16.7	1056 991	28.3 26.6
40	2.8	up to 8 15 20	up to 0.55 1.0 1.4	34 33 ----	0.9 0.9 ----	139 125 117	3.7 3.3 3.1	262 232 216	7.0 6.2 5.8	411 360 335	11.0 9.6 9.0	812 767 719	21.8 20.6 19.3	1307 1221 1134	35.0 32.7 30.4
50	3.4	up to 12 15 25 30	up to 0.83 1.0 1.7 2.1	41 40 38 ----	1.1 1.1 1.0 ----	164 154 141 131	4.4 4.1 3.8 3.5	310 287 261 242	8.3 7.7 7.0 6.5	487 446 404 373	13.1 12.0 10.8 10.0	961 945 865 804	25.8 25.3 23.2 21.5	1548 1516 1368 1263	41.5 40.6 36.7 33.8
60	4.1	up to 16 25 35 40	up to 1.1 1.7 2.4 2.8	47 45 42 ----	1.3 1.2 1.1 ----	190 172 155 143	5.1 4.6 4.1 3.8	358 319 287 264	9.6 8.5 7.7 7.1	562 495 444 409	15.1 13.3 11.9 11.0	1111 1055 954 882	29.8 28.3 25.6 23.6	1788 1680 1501 1380	47.9 45.0 40.2 37.0
75	5.2	up to 22 35 50 55	up to 1.5 2.4 3.4 3.8	57 54 47 ----	1.5 1.4 1.3 ----	228 203 175 160	6.1 5.4 4.7 4.3	430 378 322 296	11.5 10.1 8.6 7.9	675 585 498 456	18.1 15.7 13.3 12.2	1334 1250 1075 988	35.8 33.5 28.8 26.5	2149 1986 1684 1541	57.6 53.2 45.1 41.3
100	6.9	up to 32 60 75 80	up to 2.2 4.1 5.2 5.5	72 65 55 ----	1.9 1.7 1.5 ----	291 241 203 186	7.8 6.5 5.4 5.0	550 447 375 342	14.7 12.0 10.1 9.2	863 691 578 527	23.1 18.5 15.5 14.1	1707 1485 1252 1144	45.7 39.8 33.6 30.7	2750 2340 1952 1777	73.7 62.7 52.3 47.6
125	8.6	up to 43 60 90 105	up to 3.0 4.1 6.2 7.2	88 85 71 ----	2.4 2.3 1.9 ----	355 321 261 208	9.5 8.6 7.0 5.6	670 595 482 382	18.0 15.9 12.9 10.2	1051 923 745 589	28.2 24.7 20.0 15.8	2076 1969 1609 1282	55.6 52.8 43.1 34.4	3342 3134 2515 1985	89.6 84.0 67.4 53.2
150	10.3	up to 52 60 95 130	up to 3.6 4.1 6.6 9.0	104 103 92 ----	2.8 2.8 2.5 ----	419 393 342 228	11.2 10.5 9.2 6.1	790 732 632 419	21.2 19.6 16.9 11.2	1239 1137 977 646	33.2 30.5 26.2 17.3	2453 2412 2102 1406	65.7 64.6 56.3 37.7	3953 3868 3308 2175	106 104 88.7 58.3
200	13.8	up to 73 110 150 180	up to 5.0 7.6 10.3 12.4	135 127 106 ----	3.6 3.4 2.8 ----	546 479 390 264	14.6 12.8 10.5 7.1	1030 887 720 484	27.6 23.8 19.3 13.0	1615 1375 1112 746	43.3 36.9 29.8 20.0	3194 2941 2406 1628	85.6 78.8 64.5 43.6	5145 4662 3753 2511	138 125 101 67.3
300	20.7	up to 115 170 225 280	up to 7.9 11.7 15.5 19.3	198 186 157 ----	5.3 5.0 4.2 ----	800 698 577 324	21.4 18.7 15.5 8.7	1510 1295 1065 594	40.5 34.7 28.5 15.9	2367 2006 1645 914	63.4 53.8 44.1 24.5	4677 4292 3557 1998	125 115 95.3 53.5	7531 6801 5553 3076	202 182 149 82.4
400	27.6	up to 155 200 250 300 350	up to 10.7 13.8 17.2 20.7 24.1	261 253 237 208 158	7.0 6.8 6.3 5.6 4.2	1054 961 883 764 572	28.2 25.8 23.7 20.5 15.3	1990 1785 1635 1410 1052	53.3 47.8 43.8 37.8 28.2	3119 2769 2530 2177 1621	83.6 74.2 67.8 58.3 43.4	6169 5899 5432 4709 3530	165 158 146 126 94.6	9936 9405 8568 7352 5458	266 252 230 197 146
500	34.5	up to 196 250 300 350	up to 13.5 17.2 20.7 24.1	324 315 299 275	8.7 8.4 8.0 7.4	1308 1195 1121 1018	35.1 32.0 30.0 27.3	2470 2220 2078 1881	66.2 59.5 55.7 50.4	3871 3444 3217 2907	104 92.3 86.2 77.9	7656 7334 6894 6268	205 197 185 168	12,331 11,697 10,900 9827	330 313 292 263
600	41.4	up to 237 250 300 350	up to 16.3 17.2 20.7 24.1	387 386 376 362	10.4 10.3 10.1 9.7	1562 1481 1428 1358	41.9 39.7 38.3 36.4	2950 2760 2655 2517	79.1 74.0 71.2 67.5	4623 4287 4119 3899	124 115 111 104	9143 9079 8770 8346	245 243 235 224	14,726 14,593 13,989 13,217	395 391 375 354
700	48.3	up to 278 300 350	up to 19.2 20.7 24.1	450 447 438	12.1 11.9 11.7	1816 1715 1662	48.7 46.0 44.5	3430 3196 3090	91.9 85.7 82.8	5375 4964 4793	144 133 128	10,630 10,519 10,205	285 282 273	17,121 16,892 16,282	459 453 436
800	55.2	up to 350	up to 24.1	509	13.6	2070	55.5	3910	105	6127	164	11,958	320	19,189	514
900	62.1	up to 350	up to 24.1	577	15.5	2325	62.3	4389	118	6879	184	13,651	366	22,008	590
1000	68.9	up to 350	up to 24.1	644	17.3	2579	69.1	4869	130	7631	205	15,306	410	24,771	664
1050	72.4	up to 350	up to 24.1	677	18.1	2706	72.5	5109	137	8007	215	16,124	432	26,138	700

Note: Blank areas indicate where minimum main valve differential pressure is not met.

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Table 20. Capacities for EZR Series with Type 161EB, 161EBM or PRX Series Pilot (continued)

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING WITHOUT INLET STRAINER											
				1-1/4 x 1-In. / DN 32 x 25		2 x 1-In. / DN 50 x 25		6 x 4-In. / DN 150 x 100		8 x 4-In. / DN 200 x 100		8 x 6-In. / DN 200 x 150		12 x 6-In. / DN 300 x 150	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
30	2.1	5 10	0.34 0.69	32 ----	0.9 ----	36 ----	1.0 ----	335 315	9.0 8.4	330 310	8.8 8.3	751 712	20.1 19.1	751 712	20.1 19.1
40	2.8	up to 8 15 20	up to 0.55 1.0 1.4	39 37 ----	1.0 1.0 ----	44 42 ----	1.2 1.1 ----	415 388 362	11.1 10.4 9.7	408 382 356	10.9 10.2 9.5	927 876 821	24.8 23.5 22.0	927 876 821	24.8 23.5 22.0
50	3.4	up to 12 15 25 30	up to 0.83 1.0 1.7 2.1	46 46 42 ----	1.2 1.2 1.1 ----	52 51 47 ----	1.4 1.4 1.3 ----	491 481 436 403	13.2 12.9 11.7 10.8	483 473 429 397	12.9 12.7 11.5 10.6	1098 1079 988 918	29.4 28.9 26.5 24.6	1098 1079 988 918	29.4 28.9 26.5 24.6
60	4.1	up to 16 25 35 40	up to 1.1 1.7 2.4 2.8	54 51 46 ----	1.4 1.4 1.2 ----	60 57 52 ----	1.6 1.5 1.4 ----	567 534 479 441	15.2 14.3 12.8 11.8	558 526 471 434	15.0 14.1 12.6 11.6	1268 1204 1089 1007	34.0 32.3 29.2 27.0	1268 1204 1089 1007	34.0 32.3 29.2 27.0
75	5.2	up to 22 35 50 55	up to 1.5 2.4 3.4 3.8	64 61 52 ----	1.7 1.6 1.4 ----	73 68 59 ----	2.0 1.8 1.6 ----	681 632 538 493	18.3 16.9 14.4 13.2	671 622 529 485	18.0 16.7 14.2 13.0	1523 1427 1227 1128	40.8 38.2 32.9 30.2	1523 1427 1227 1128	40.8 38.2 32.9 30.2
100	6.9	up to 32 60 75 80	up to 2.2 4.1 5.2 5.5	82 72 61 ----	2.2 1.9 1.6 ----	93 81 68 ----	2.5 2.2 1.8 ----	872 746 624 569	23.4 20.0 16.7 15.2	858 734 614 560	23.0 19.7 16.5 15.0	1949 1695 1430 1306	52.2 45.4 38.3 35.0	1949 1695 1430 1306	52.2 45.4 38.3 35.0
125	8.6	up to 43 60 90 105	up to 3.0 4.1 6.2 7.2	100 95 79 ----	2.7 2.5 2.1 ----	113 107 88 ----	3.0 2.9 2.4 --	1060 997 804 636	28.4 26.7 21.5 17.0	1043 981 791 626	28.0 26.3 21.2 16.8	2370 2248 1837 1463	63.5 60.2 49.2 39.2	2370 2248 1837 1463	63.5 60.2 49.2 39.2
150	10.3	up to 52 60 95 130	up to 3.6 4.1 6.6 9.0	118 117 102 ----	3.2 3.1 2.7 ----	133 131 114 ----	3.6 3.5 3.1 ----	1253 1228 1055 697	33.6 32.9 28.3 18.7	1233 1208 1039 686	33.0 32.4 27.8 18.4	2801 2754 2400 1606	75.1 73.8 64.3 43.0	2801 2754 2400 1606	75.1 73.8 64.3 43.0
200	13.8	up to 73 110 150 180	up to 5.0 7.6 10.3 12.4	154 143 117 ----	4.1 3.8 3.1 ----	174 160 131 ----	4.7 4.3 3.5 ----	1631 1485 1200 806	43.7 39.8 32.2 21.6	1605 1461 1181 793	43.0 39.2 31.7 21.2	3647 3357 2746 1858	97.7 90.0 73.6 49.8	3647 3357 2746 1858	97.7 90.0 73.6 49.8
300	20.7	up to 115 170 225 280	up to 7.9 11.7 15.5 19.3	226 208 174 ----	6.1 5.6 4.7 ----	254 234 194 ----	6.8 6.3 5.2 ----	2388 2166 1776 987	64.0 58.0 47.6 26.5	2350 2132 1747 972	63.0 57.1 46.8 26.0	5339 4900 4061 2281	143 131 109 61.1	5339 4900 4061 2281	143 131 109 61.1
400	27.6	up to 155 200 250 300 350	up to 10.7 13.8 17.2 20.7 24.1	298 286 264 230 173	8.0 7.7 7.1 6.2 4.6	335 321 296 257 193	9.0 8.6 7.9 6.9 5.2	3150 2990 2732 2351 1750	84.4 80.1 73.2 63.0 46.9	3100 2943 2689 2313 1722	83.1 78.9 72.1 62.0 46.2	7043 6734 6202 5376 4030	189 180 166 144 108	7043 6734 6202 5376 4030	189 180 166 144 108
500	34.5	up to 196 250 300 350	up to 13.5 17.2 20.7 24.1	369 355 335 305	9.9 9.5 9.0 8.2	416 399 375 342	11.1 10.7 10.1 9.2	3910 3719 3473 3139	105 99.7 93.1 84.1	3847 3659 3418 3089	103 98.1 91.6 82.8	8740 8373 7870 7156	234 224 211 192	8740 8373 7870 7156	234 224 211 192
600	41.4	up to 237 250 300 350	up to 16.3 17.2 20.7 24.1	441 438 424 405	11.8 11.7 11.4 10.9	497 493 477 454	13.3 13.2 12.8 12.2	4669 4629 4447 4210	125 124 119 113	4595 4556 4376 4143	123 122 117 111	10,438 10,365 10,012 9528	280 278 268 255	10,438 10,365 10,012 9528	280 278 268 255
700	48.3	up to 278 300 350	up to 19.2 20.7 24.1	513 508 494	13.7 13.6 13.2	578 572 555	15.5 15.3 14.9	5428 5360 5175	145 144 139	5342 5275 5093	143 141 136	12,136 12,009 11,650	325 322 312	12,136 12,009 11,650	325 322 312
800	55.2	up to 350	up to 24.1	578	15.5	650	17.4	6090	163	5993	161	13,652	366	13,652	366
900	62.1	up to 350	up to 24.1	658	17.6	742	19.9	6976	187	6865	184	15,584	418	15,584	418
1000	68.9	up to 350	up to 24.1	737	19.8	831	22.3	7844	210	7719	207	17,474	468	17,474	468
1050	72.4	up to 350	up to 24.1	776	20.8	875	23.5	8273	222	8141	218	18,408	493	18,408	493

Note: Blank areas indicate where minimum main valve differential pressure is not met.

Table 21. Capacities for EZR Series with PRX Series Pilot

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING WITHOUT INLET STRAINER											
				1-In. / DN 25		2-In. / DN 50		3-In. / DN 80		4-In. / DN 100		6-In. / DN 150		8-In. / DN 200	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
300	20.7	250	17.2	134	3.6	489	13.1	901	24.1	1389	37.2	3019	80.9	4682	125
		280	19.3	----	----	324	8.7	594	15.9	914	24.5	1998	53.5	3076	82.4
400	27.6	250	17.2	237	6.4	883	23.7	1635	43.8	2530	67.8	5432	146	8568	230
		300	20.7	208	5.6	764	20.5	1410	37.8	2177	58.3	4709	126	7352	197
		350	24.1	158	4.2	572	15.3	1052	28.2	1621	43.4	3530	94.6	5458	146
		380	26.2	----	----	374	10.0	686	18.4	1056	28.3	2311	61.9	3552	95.2
500	34.5	250	17.2	315	8.4	1195	32.0	2220	59.5	3444	92.3	7334	197	11,697	313
		300	20.7	299	8.0	1121	30.0	2078	55.7	3217	86.2	6894	185	10,900	292
		350	24.1	275	7.4	1018	27.3	1881	50.4	2907	77.9	6268	168	9827	263
		400	27.6	238	6.4	871	23.3	1604	43.0	2475	66.3	5367	144	8348	224
		450	31.0	178	4.8	644	17.3	1183	31.7	1823	48.9	3977	107	6137	164
		480	33.1	----	----	418	11.2	768	20.6	1182	31.7	2586	69.3	3972	106
600	41.4	250	17.2	386	10.3	1481	39.7	2760	74.0	4287	115	9079	243	14,593	391
		300	20.7	376	10.1	1428	38.3	2655	71.2	4119	110	8770	235	13,989	375
		400	27.6	340	9.1	1264	33.9	2337	62.6	3614	96.9	7777	208	12,229	328
		500	34.5	265	7.1	966	25.9	1777	47.6	2741	73.5	5956	160	9240	248
		550	37.9	196	5.3	709	19.0	1302	34.9	2006	53.8	4379	117	6749	181
		580	40.0	----	----	459	12.3	841	22.5	1295	34.7	2834	76.0	4352	117
700	48.3	250	17.2	453	12.1	1755	47.0	3278	87.9	5099	134	10,751	288	17,381	466
		300	20.7	447	11.9	1715	46.0	3196	85.7	4964	133	10,519	282	16,892	453
		400	27.6	424	11.4	1594	42.7	2956	79.2	4579	123	9793	262	15,526	416
		500	34.5	377	10.1	1393	37.3	2572	68.9	3975	107	8577	230	13,435	360
		600	41.4	290	7.8	1052	28.2	1936	51.9	2984	80.0	6493	174	10,055	269
800	55.2	up to 300	up to 20.7	515	13.8	2070	55.5	3910	105	6127	164	12,202	327	19,697	528
		400	27.6	499	13.4	1896	50.8	3525	94.5	5468	147	11,640	312	18,574	498
		500	34.5	467	12.5	1745	46.8	3231	86.6	5001	134	10,732	288	16,938	454
		600	41.4	411	11.0	1512	40.5	2789	74.7	4308	115	9314	250	14,547	390
		700	48.3	312	8.4	1133	30.4	2082	55.8	3209	86.0	6990	187	10,809	290
900	62.1	up to 350	up to 24.1	577	15.5	2325	62.3	4389	118	6879	184	13,651	366	22,008	590
		400	27.6	571	15.3	2184	58.5	4067	109	6316	169	13,396	359	21,486	576
		500	34.5	547	14.7	2064	55.3	3830	103	5935	159	12,679	340	20,133	540
		600	41.4	507	13.6	1886	50.5	3487	93.5	5394	145	11,604	311	18,250	489
		700	48.3	442	11.8	1622	43.5	2991	80.2	4617	124	10,000	268	15,584	418
1000	68.9	up to 400	up to 27.6	639	17.1	2579	69.1	4869	130	7631	205	15,096	405	24,316	652
		500	34.5	622	16.7	2364	63.4	4394	118	6817	183	14,510	389	23,158	621
		600	41.4	592	15.9	2220	59.5	4115	110	6372	171	13,650	366	21,592	579
		700	48.3	545	14.6	2017	54.1	3727	99.9	5762	154	12,420	333	19,480	522
1050	72.4	up to 400	up to 27.6	673	18.0	2706	72.5	5109	137	8007	215	15,932	427	25,710	689
		500	34.5	658	17.6	2509	67.4	4668	125	7245	194	15,398	413	24,627	660
		600	41.4	632	16.9	2379	63.8	4412	118	6826	183	14,618	392	23,181	621
		700	48.3	591	15.8	2196	58.9	4063	109	6283	168	13,517	362	21,261	570
		900	62.1	432	11.6	1572	42.2	2892	77.6	4459	120	9694	260	15,024	403

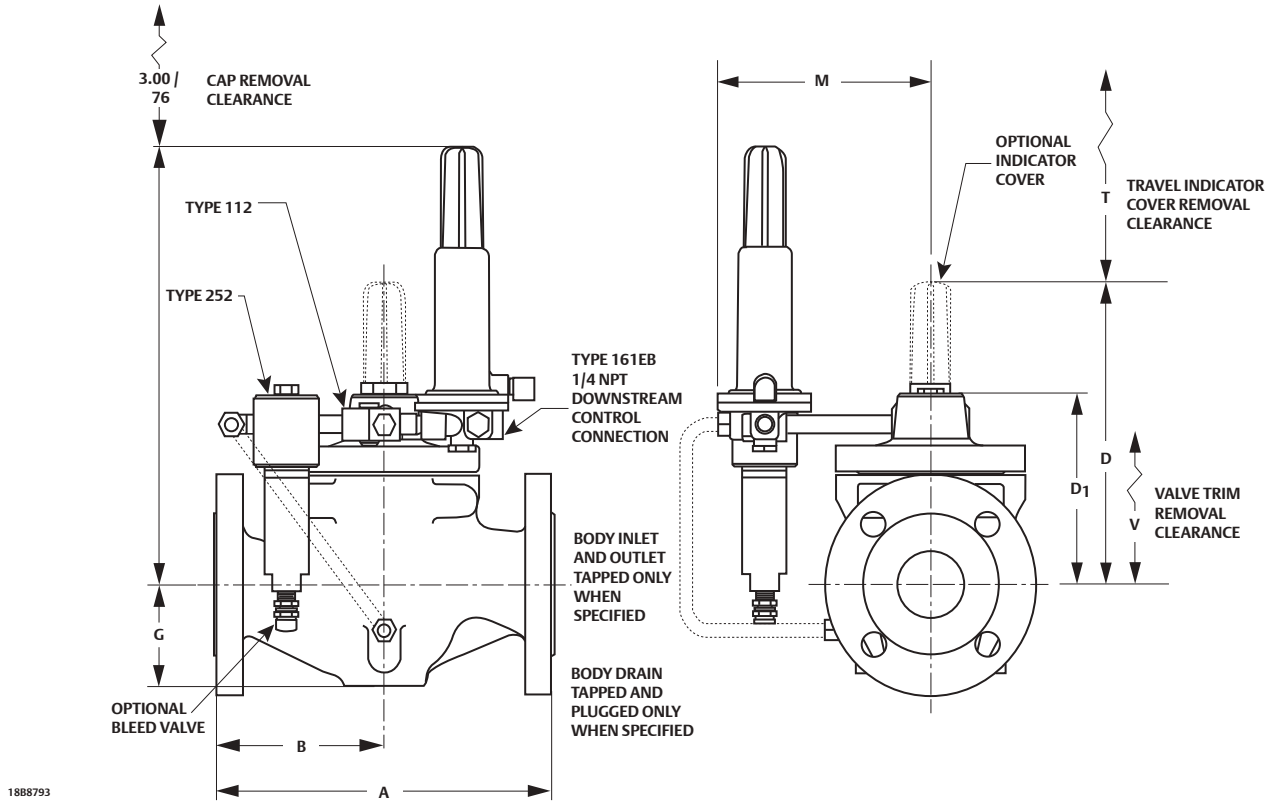
1. For outlet pressures above 435 psig / 30.0 bar, use Type PRX-AP pilot rather than Type PRX.
Note: Blank areas indicate where minimum main valve differential pressure is not met.

- continued -

Table 21. Capacities for EZR Series with PRX Series Pilot (continued)

INLET PRESSURE		OUTLET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS USING 1:1 LINE SIZE TO BODY SIZE PIPING WITHOUT INLET STRAINER											
				1-1/4 x 1-In. / DN 32 x 25		2 x 1-In. / DN 50 x 25		6 x 4-In. / DN 150 x 100		8 x 4-In. / DN 200 x 100		8 x 6-In. / DN 200 x 150		12 x 6-In. / DN 300 x 150	
psig	bar	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
300	20.7	250	17.2	148	4.0	165	4.4	1500	40.2	1476	39.6	3447	92.4	3447	92.4
		280	19.3	----	----	----	----	987	26.5	972	26.0	2281	61.1	2281	61.1
400	27.6	250	17.2	264	7.1	296	7.9	2732	73.2	2689	72.1	6202	166	6202	166
		300	20.7	230	6.2	257	6.9	2351	63.0	2313	62.0	5376	144	5376	144
		350	24.1	173	4.6	193	5.2	1750	46.9	1722	46.2	4030	108	4030	108
		380	26.2	----	----	----	----	1141	30.6	1123	30.1	2638	70.7	2638	70.7
500	34.5	250	17.2	355	9.5	399	10.7	3719	99.7	3659	98.1	8373	224	8373	224
		300	20.7	335	9.0	375	10.1	3473	93.1	3418	91.6	7870	211	7870	211
		350	24.1	305	8.2	342	9.2	3139	84.1	3089	82.8	7156	192	7156	192
		400	27.6	262	7.0	293	7.8	2672	71.6	2630	70.5	6128	164	6128	164
		450	31.0	195	5.2	217	5.8	1969	52.8	1937	51.9	4540	122	4540	122
		480	33.1	----	----	----	----	1276	34.2	1256	33.7	2952	79.1	2952	79.1
600	41.4	250	17.2	438	11.7	493	13.2	4629	124	4556	122	10,365	278	10,365	278
		300	20.7	424	11.4	477	12.8	4447	119	4376	117	10,012	268	10,012	268
		400	27.6	378	10.1	424	11.4	3903	105	3841	103	8879	238	8879	238
		500	34.5	291	7.8	325	8.7	2960	79.3	2913	78.1	6800	182	6800	182
		550	38.0	215	5.8	239	6.4	2166	58.0	2131	57.1	4999	134	4999	134
		580	40.0	----	----	----	----	1398	37.5	1376	37.0	3236	86.7	3236	86.7
700	48.3	250	17.2	518	13.9	584	15.6	5505	148	5418	145	12,274	329	12,274	329
		300	20.7	508	13.6	572	15.3	5360	144	5275	141	12,009	322	12,009	322
		400	27.6	475	12.7	533	14.3	4944	132	4865	130	11,180	300	11,180	300
		500	34.5	418	11.2	467	12.5	4292	115	4224	113	9793	262	9793	262
		600	41.4	318	8.5	354	9.5	3222	86.4	3171	85.0	7413	199	7413	199
800	55.2	up to 300	up to 20.7	588	15.8	663	17.8	6241	167	6142	165	13,931	373	13,931	373
		400	27.6	563	15.1	633	17.0	5904	158	5810	156	13,289	356	13,289	356
		500	34.5	522	14.0	584	15.7	5400	145	5314	142	12,253	328	12,253	328
		600	41.4	454	12.2	508	13.6	4651	125	4577	123	10,634	285	10,634	285
		700	48.3	342	9.2	381	10.2	3465	92.9	3410	91.4	7980	214	7980	214
900	62.1	up to 350	up to 24.1	658	17.6	742	19.9	6976	187	6865	184	15,584	418	15,584	418
		400	27.6	647	17.3	728	19.5	6820	183	6711	180	15,294	410	15,294	410
		500	34.5	615	16.5	690	18.5	6408	172	6306	169	14,475	388	14,475	388
		600	41.4	565	15.1	632	16.9	5824	156	5731	154	13,247	355	13,247	355
		700	48.3	488	13.1	545	14.6	4985	134	4906	131	11,416	306	11,416	306
1000	68.9	up to 400	up to 27.6	728	19.5	820	22.0	7709	207	7587	203	17,235	462	17,235	462
		500	34.5	702	18.8	789	21.1	7361	197	7243	194	16,566	444	16,566	444
		600	41.4	663	17.8	743	19.9	6880	184	6770	181	15,584	418	15,584	418
		700	48.3	605	16.2	677	18.1	6221	167	6122	164	14,179	380	14,179	380
1050	72.4	up to 400	up to 27.6	768	20.6	866	23.2	8147	218	8018	215	18,189	487	18,189	487
		500	34.5	745	20.0	837	22.4	7823	210	7699	206	17,579	471	17,579	471
		600	41.4	709	19.0	796	21.3	7381	198	7263	195	16,688	447	16,688	447
		700	48.3	658	17.6	736	19.7	6784	182	6677	179	15,432	414	15,432	414
		900	62.1	474	12.7	529	14.2	4811	129	4719	127	11,068	297	11,068	297

1. For outlet pressures above 435 psig / 30.0 bar, use Type PRX-AP pilot rather than Type PRX.
Note: Blank areas indicate where minimum main valve differential pressure is not met.



TYPE EZR WITH 161EB SERIES PILOT

Figure 7. *Type EZR Dimensions*

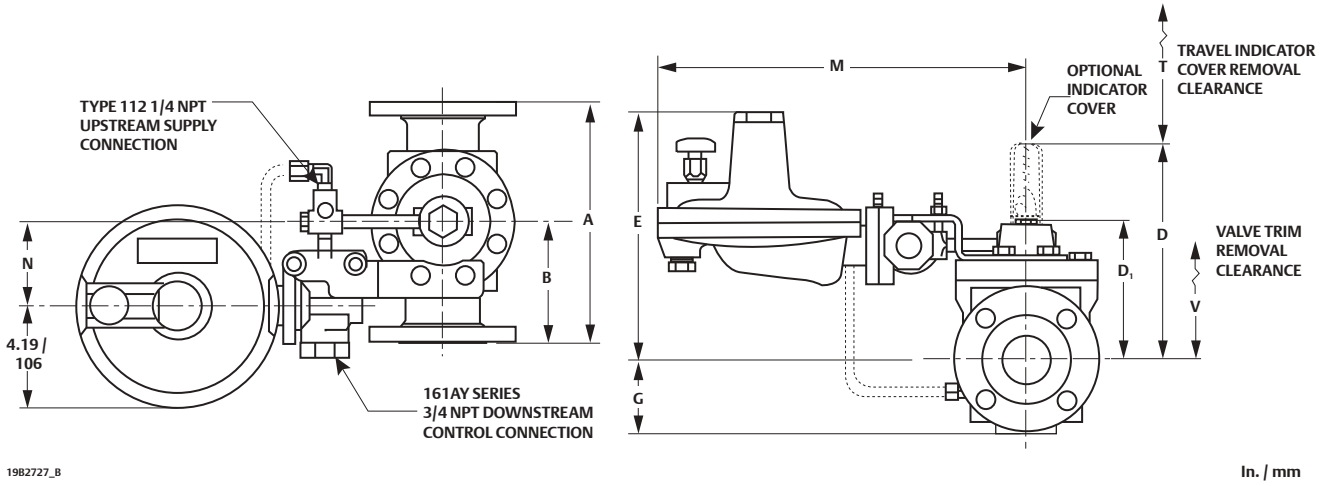
Table 22. Type EZR Dimension

DIMENSION														
TYPE	BODY SIZE		A						B					
			CL125 RF CL150 RF		CL250 RF CL300 RF		CL600 RF		CL125 RF CL150 RF		CL250 RF CL300 RF		CL600 RF	
	In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
Type EZR with 161EB Series Pilot	1	25	7.25	184	7.75	197	8.25	210	3.62	92	3.88	99	4.12	105
	2	50	10	254	10.5	267	11.25	286	5.00	127	5.25	133	5.62	143
	2 X 1	50 x 25												
	3	80	11.75	298	12.5	317	13.25	337	5.88	149	6.25	159	6.63	168
	4	100	13.88	353	14.5	368	15.5	394	6.94	176	7.25	184	7.75	197
	6	150	17.75	451	18.62	473	20	508	8.88	226	9.31	236	10.00	254
	6 x 4	150 x 100	17.75	451	18.63	473	20	508	8.88	225	9.31	236	10.00	254
	8 x 4	200 x 100	21.38	543	22.38	568	24	610	10.69	271	11.19	284	12.00	305

- continued -

Table 22. Type EZR Dimension (continued)

DIMENSION																
TYPE	BODY SIZE		D		D_1		E		G		M		T		V	
	In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
Type EZR with 161EB Series Pilot	1	25	8.67	220	6.11	155	12.67	322	2.50	64	6.23	158	2.00	50.8	8.00	203
	2	50	8.9	226	6.89	175	12. 96	329	3.06	78	6.60	168	2.00	51	11.00	279
	2 X 1	50 x 25														
	3	80	12.58	319	9.33	237	14.99	381	3.81	97	7.54	191	3.80	96	19.50	495
	4	100	14.72	374	10.47	266	16.55	420	5.06	129	7.38	187	3.80	96	20.70	526
	6	150	16.49	419	12.55	319	17.78	451	5.31	135	9.86	250	3.80	96	22.80	579
	6 x 4	150 x 100	15.75	400	11.81	300	17.87	454	5.31	135	8.96	228	3.80	96	21.60	549
	8 x 4	200 x 100	15.82	402	11.88	302	17.93	455	6.94	176	8.96	228	3.80	96	21.60	549



TYPE EZR WITH 161AY SERIES PILOT

Figure 7. *Type EZR Dimension (continued)*

Table 22. Type EZR Dimension (continued)

DIMENSION														
TYPE	BODY SIZE		A						B					
			CL125 RF CL150 RF		CL250 RF CL300 RF		CL600 RF		CL125 RF CL150 RF		CL250 RF CL300 RF		CL600 RF	
	In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
Type EZR with 161AY Series Pilot	2	50	10	254	10.5	267	11.25	286	5.00	127	5.25	133	5.62	143
	3	80	11.75	298	12.5	317	13.25	337	5.88	149	6.25	159	6.63	168
	4	100	13.8	353	14.5	368	15.5	394	6.94	176	7.25	184	7.75	197

- continued -

Table 22. Type EZR Dimension (continued)

DIMENSION																		
TYPE	BODY SIZE		D		D_1		E		G		M		N		T		V	
	In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
Type EZR with 161AY Series Pilot	2	50	8.9	226	6.89	175	10.17	258	3.06	78	15.22	387	3.47	88	2.00	51	4.38	111
	3	80	12.58	319	9.33	267	11.37	289	3.81	97	15.73	400	4.09	104			5.75	146
	4	100	13.5	343	10.47	266	12.75	324	5.06	129	15.59	396	4.62	117	2.88	73	7.00	178

Table 23. Typical EZROSX Dimension

BODY SIZE, NPS / DN	DIMENSION, IN / mm														
	A			B			C	D	D_1	E	F	G	M	T	V
	CL150 RF	CL300 RF	CL600 RF	CL150 RF	CL300 RF	CL600 RF									
1 / 25	7.24 / 184	7.76 / 197	8.27 / 210	3.62 / 92.0	3.88 / 98.5	4.13 / 105	9.78 / 248	9.19 / 233	6.63 / 168	13.22 / 336	10.33 / 262	12.34 / 313	6.23 / 158	2.70 / 68	1.40 / 37
2 / 50	10.08 / 256	10.59 / 269	11.30 / 287	5.04 / 128	5.30 / 135	5.65 / 144	10.39 / 264	9.55 / 243	7.49 / 190	13.58 / 345	10.94 / 278	12.95 / 329	6.53 / 166	2.00 / 51	11.00 / 279
3 / 80	11.73 / 298	12.48 / 317	13.27 / 337	5.87 / 149	6.24 / 158	6.63 / 168	11.78 / 299	13.94 / 354	10.00 / 254	15.66 / 398	12.33 / 313	14.34 / 364	7.42 / 188		19.50 / 495
4 / 100	13.86 / 352	14.49 / 368	15.51 / 394	6.93 / 176	7.24 / 184	7.76 / 197	13.50 / 343	15.22 / 387	11.28 / 286	17.35 / 441	14.05 / 357	16.06 / 408	7.88 / 200	3.75 / 95	20.70 / 526
6 / 150	17.76 / 451	18.62 / 473	20.0 / 508	8.88 / 225	9.31 / 236	10.0 / 254	12.99 / 330	16.64 / 423	12.70 / 323	17.93 / 455	13.54 / 344	15.55 / 395	9.81 / 249		22.80 / 579

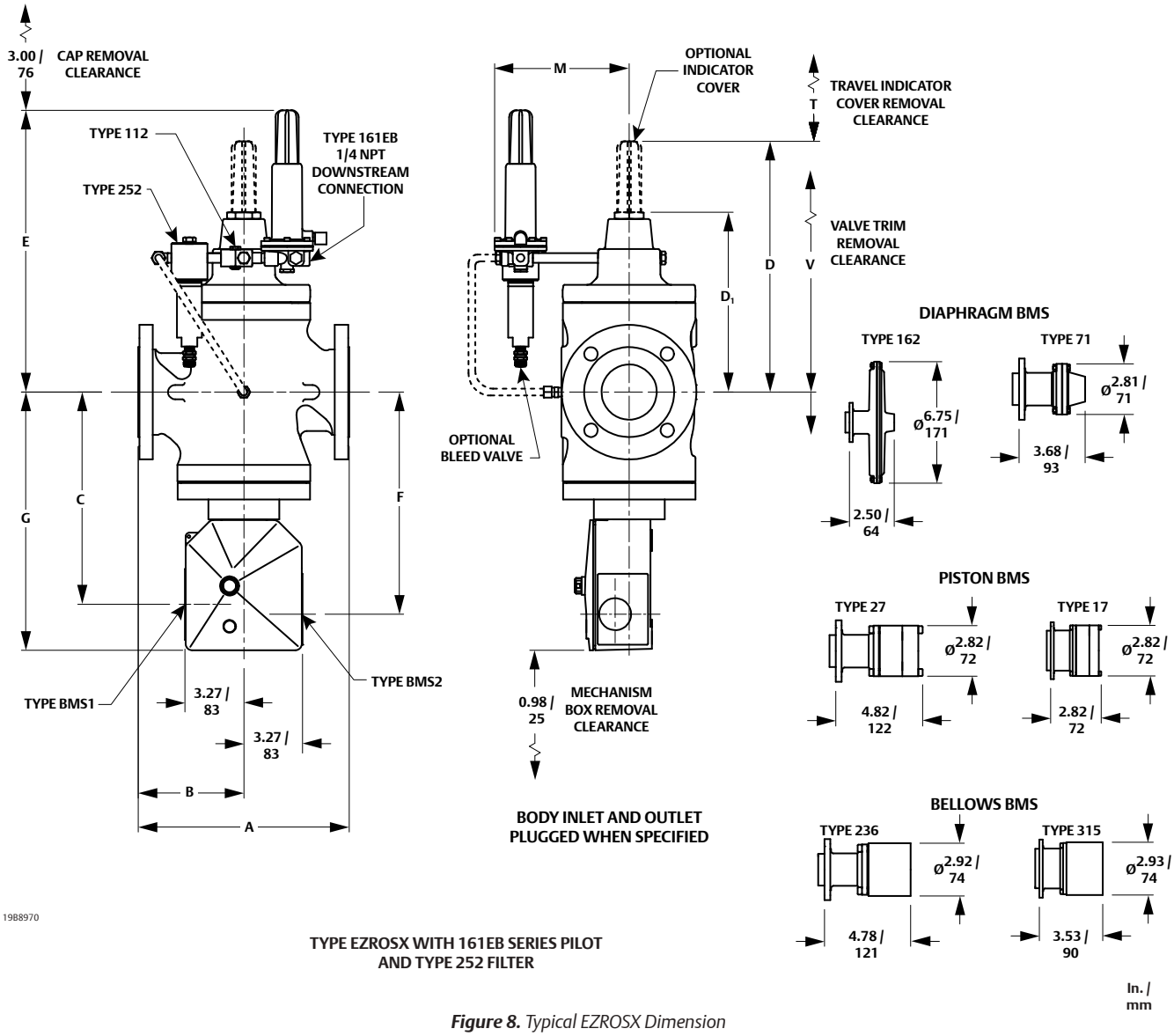
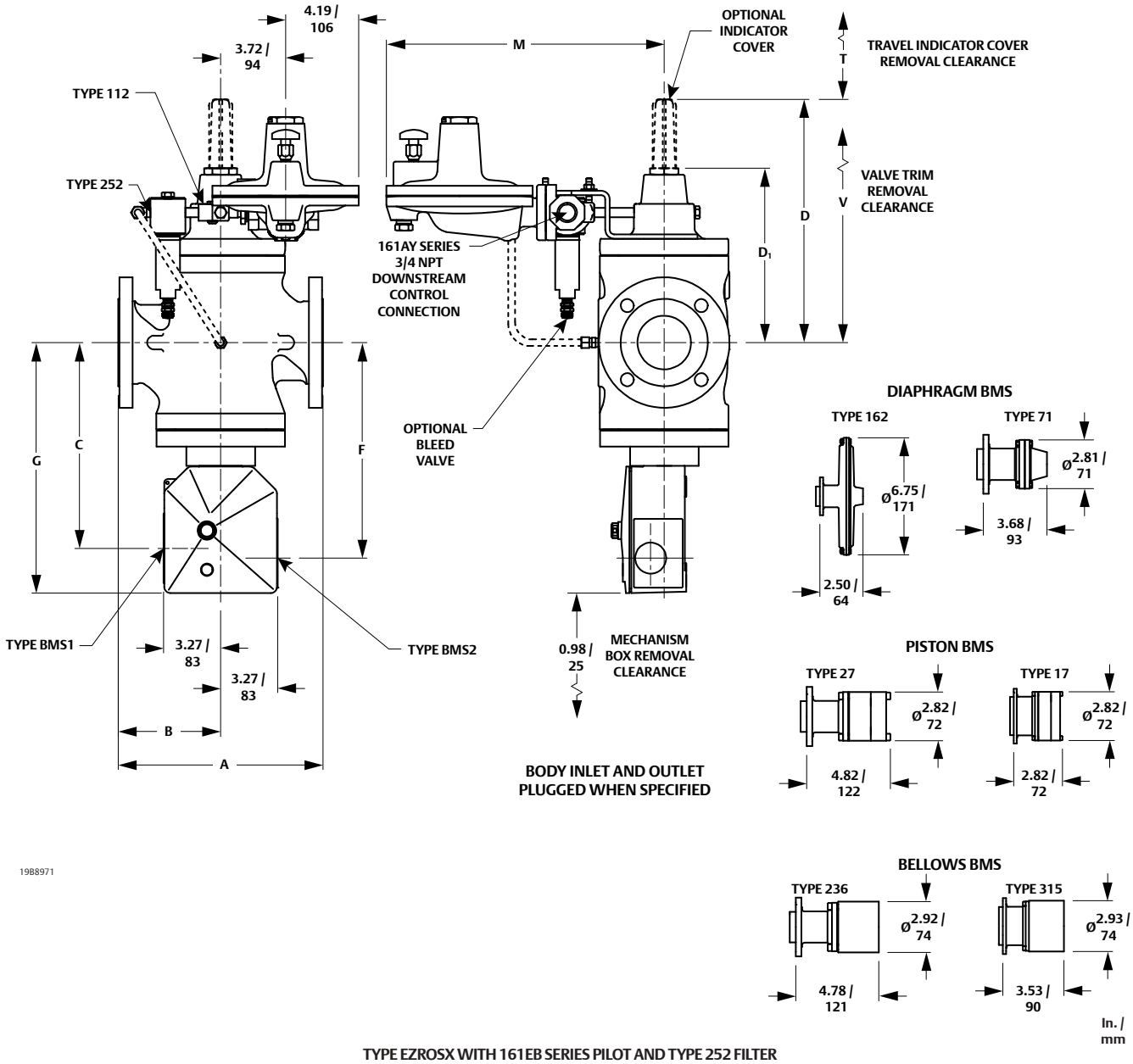


Figure 8. *Typical EZROSX Dimension*

Table 24. Approximate Weights Including 161EB, 161AY and PRX Series Pilot and Restrictor[1][2]

BODY SIZE		CAST IRON MAIN VALVE BODY						WCC OR LCC STEEL MAIN VALVE BODY							
		NPT		CL125 FF		CL250 RF		NPT, SWE or BWE		CL150 RF		CL300 RF		CL600 RF	
In.	DN	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
1, 1-1/4 x 1	25, 32 x 25	----		----		----		22	10	24	11	28	13	32	15
2, 2 x 1	50, 50 x 25	52	24	50	23	59	27	51	23	54	24	58	26	65	29
3	80	----		89	40	106	48	103	47	107	49	110	50	123	56
4	100			140	64	155	70	139	63	145	66	159	72	192	87
6 x 4	150 x 100			----		----		270	122	280	127	292	132	394	179
8 x 4	200 x 100							390	177	461	209	515	234	600	272
6	150			205	93	225	102	200	91	210	95	235	107	350	159
8 x 6	200 x 150			----		----		600	272	571	259	625	284	680	308
12 x 6	300 x 150							1160	526	994	451	1102	500	1590	721
8	200							----		635	288	685	310	790	358

1. Add 15 lbs / 7 kg to get the weight with a 161AY Series pilot.
2. Add 5 lbs / 2 kg to get the weight of PRX Series pilot.



TYPE EZROSX WITH 161EB SERIES PILOT AND TYPE 252 FILTER

Figure 8. *Typical EZROSX Dimension (continued)*

Ordering Guide

Type (Select One)

- ☐ EZR
- ☐ EZROSX (with slam shut)

Body Size (Select One)

- ☐ 1-In. / DN 25 (Available in steel only)***
- ☐ 1-1/4 x 1-In. / DN 32 x 25 (Available in NPT steel only)***
- ☐ 2-In. / DN 50***
- ☐ 2 x 1-In. / DN 50 x 25***
- ☐ 3-In. / DN 80***
- ☐ 4-In. / DN 100***
- ☐ 6 x 4-In. / DN 150 x 100***
- ☐ 8 x 4-In. / DN 200 x 100***
- ☐ 6-In. / DN 150***
- ☐ 8 x 6-In. / DN 200 x 150***
- ☐ 12 x 6-In. / DN 300 x 150***
- ☐ 8-In. / DN 200***

Body Material and End Connection Style (Select One)

(8-In. / DN 200 size available only in LCC Steel CL150, CL300 or CL600 RF)

Cast Iron Body

- ☐ NPT - Available in 2 or 2 x 1 NPT only***
- ☐ CL125 FF***
- ☐ CL250 RF***

WCC or LCC Steel Body

- ☐ NPT - Available in 1, 1-1/4 x 1, 2 x 1 or 2 NPT only***
- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ CL600 RF***
- ☐ SWE - Available in 1, 2 x 1 or 2 SWE only*
- ☐ BWE 40**
- ☐ BWE 80*
- ☐ PN 16/25/40*_____ specify

Main Valve Diaphragm Material (Select One)

- ☐ 17E68 Nitrile (NBR); (low temperature capable) (Not available on 6 or 8-In. / DN 150 or 200 sizes)***
- ☐ 17E97 Nitrile (NBR); (high-pressure capable/ erosion resistant)***
- ☐ 17E88 Fluorocarbon (FKM); (high aromatic hydrocarbon resistant) (Not available on 8-In. / DN 200 size)**

Cage, Percent of Full Capacity (Select One)

- ☐ 100 percent **(standard)***
- ☐ 60 percent (Not available on 8-In. / DN 200 size)***
- ☐ 30 percent (Not available on 8-In. / DN 200 size)***

Main Valve O-ring Material (Select One)

- ☐ Nitrile (NBR) **(standard)***
- ☐ Fluorocarbon (FKM)**

Travel Indicator (Select One)

- ☐ No **(standard)***
- ☐ Yes***

Inlet Strainer (Optional)

- ☐ No **(standard)***
- ☐ Yes***

Main Valve Main Spring (See Table 13 for Maximum Inlet Rating) (Select One)

1, 1-1/4 x 1 or 2 x 1-In. / DN 25, 32 x 25 or 50 x 25 Main Valve

- ☐ Light Blue***
- ☐ Black***
- ☐ Black with white stripe***
- ☐ Red Stripe***

2-In. / DN 50 Main Valve

- ☐ Yellow***
- ☐ Green***
- ☐ Red***
- ☐ Purple

3-In. / DN 80 Main Valve

- ☐ Yellow***
- ☐ Light Blue***
- ☐ Black***

4, 6 x 4 or 8 x 4-In. / DN 100, 150 x 100 or 200 x 100 Main Valve

- ☐ Yellow***
- ☐ Green***
- ☐ Red***

6, 8 x 6 and 12 x 6-In. / DN 150, 200 x 150 and 300 x 150 Main Valve

- ☐ Yellow***
- ☐ Green***
- ☐ Red***

8-In. / DN 200 Main Valve

- ☐ Yellow***
- ☐ Green***
- ☐ Red***

Inlet Body Tap (Select One)

- ☐ Inlet body tap only **(standard)***
- ☐ Inlet body tap with pre-piped pilot supply***
- ☐ Inlet/outlet body taps only***
- ☐ Inlet/outlet body taps with pre-piped pilot supply and pilot bleed***

- continued -

Ordering Guide (continued)

Pilot O-ring Material (Select One)

- ☐ Nitrile (NBR) **(standard)*****
- ☐ Fluorocarbon (FKM)***

Pilot Valve Plug Material (Select One)

- ☐ Nitrile (NBR) **(standard)*****
- ☐ Fluorocarbon (FKM)***

Pilot Mounting (Select One)

- ☐ Standard***
- ☐ Quick Disconnect Union**

Pilot Diaphragm Material (Select One)

- ☐ Nitrile (NBR) **(standard)*****
- ☐ Fluorocarbon (FKM)**

Pilot Type and Outlet Pressure Range (Select One)

Type 161AY

- ☐ 6 to 15 In. w.c. / 15 to 37 mbar, Olive Drab***
- ☐ 0.5 to 1.2 psig / 34 to 83 mbar, Yellow***
- ☐ 1.2 to 2.5 psig / 83 mbar to 0.17 bar, Light Green***
- ☐ 2.5 to 4.5 psig / 0.17 to 0.31 bar, Light Blue***
- ☐ 4.5 to 7 psig / 0.31 to 0.48 bar, Black***

Type 161AYM

- ☐ 6 to 15 In. w.c. / 15 to 37 mbar, Olive Drab***
- ☐ 0.5 to 1.2 psig / 34 to 83 mbar, Yellow***
- ☐ 1.2 to 2.5 psig / 83 mbar to 0.17 bar, Light Green***
- ☐ 2.5 to 4.5 psig / 0.17 to 0.31 bar, Light Blue***
- ☐ 4.5 to 7 psig / 0.31 to 0.48 bar, Black***

Type 161EB

- ☐ 5 to 15 psig / 0.34 to 1.0 bar, White***
- ☐ 10 to 40 psig / 0.69 to 2.8 bar, Yellow***
- ☐ 30 to 75 psig / 2.1 to 5.2 bar, Black***
- ☐ 70 to 140 psig / 4.8 to 9.7 bar, Green***
- ☐ 130 to 200 psig / 9.0 to 13.8 bar, Blue***
- ☐ 30 to 300 psig / 2.1 to 20.7 bar, Green (intermediate reduction pilot on the Type EZR worker / monitor systems)***
- ☐ 200 to 350 psig / 13.8 to 24.1 bar, Red***

- continued -

Pilot Type and Outlet Pressure Range (Select One) (continued)

Type 161EBM

- ☐ 5 to 15 psig / 0.34 to 1.0 bar, White***
- ☐ 10 to 40 psig / 0.69 to 2.8 bar, Yellow***
- ☐ 30 to 75 psig / 2.1 to 5.2 bar, Black***
- ☐ 70 to 140 psig / 4.8 to 9.7 bar, Green***
- ☐ 130 to 200 psig / 9.0 to 13.8 bar, Blue***
- ☐ 30 to 300 psig / 2.1 to 20.7 bar, Green***
- ☐ 200 to 350 psig / 13.8 to 24.1 bar, Red***

Type PRX120/125

- ☐ 14.5 to 26 psig / 1.00 to 1.8 bar, Yellow***
- ☐ 23 to 44 psig / 1.6 to 3.0 bar, Green***
- ☐ 41 to 80 psig / 2.8 to 5.5 bar, Blue***
- ☐ 73 to 123 psig / 5.0 to 8.5 bar, Black***
- ☐ 116 to 210 psig / 8.0 to 14.5 bar, Silver***
- ☐ 203 to 334 psig / 14.0 to 23.0 bar, Gold***
- ☐ 319 to 435 psig / 22.0 to 30.0 bar, Aluminum***

Type PRX120/125 - AP

- ☐ 435 to 1000 psig / 30.0 to 69.0 bar, Clear***

Type 252 Pilot Supply Filter (Optional)

Material	Length	Drain Valve
☐ Stainless Steel***	☐ Standard***	☐ Yes***
☐ Aluminum**	☐ Extended**	☐ No**

Conversion Trim Package (Optional, Not available for 8-In. / DN 200 size)

- ☐ Yes, send one conversion trim package. (If ordering replacement trim package for change-out of existing E-body to a Type EZR, be sure to mark selection of the following items on this page: body size, diaphragm material, inlet strainer option and travel indicator option desired.)

Main Valve Replacement Parts Kit (Optional)

- ☐ Yes, send one diaphragm cartridge and O-rings kit to match this order.
- ☐ Yes, send one diaphragm and O-rings kit to match this order.

Pilot Replacement Parts Kit (Optional)

- ☐ Yes, send one replacement kit to match this order.

Wireless Position Monitor Mounting Kit (Optional)

- ☐ Yes, send one mounting kit for mounting the Topworx™ 4310 or the Fisher™ 4320 wireless position monitor (requires Travel Indicator option).

Ordering Guide (continued)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired?	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Most soft-seated regulators will maintain the pressure within reasonable limits down to zero flow. Therefore, a regulator sized for a high flow rate will usually have a turndown ratio sufficient to handle pilot-light loads during off cycles.

Type EZR Relief

Relief Valve or Backpressure Regulator

Introduction

The Type EZR pilot-operated, pressure relief valve or backpressure regulator is typically used in city gate and district stations as a relief valve for overpressure protection or in commercial and industrial applications as a backpressure regulator. The Type EZR provides smooth, quiet operation, tight shutoff and long life, even in dirty service. Its internally actuated metal plug eliminates disadvantages associated with boot-style relief valves and backpressure regulators. The specially engineered flow path deflects debris, protecting the seat from damage and erosion. The Type EZR relief valve or backpressure regulator can be converted to a pressure reducing regulator simply by changing to a pressure reducing piloting system (see Bulletin 71.2:EZR).

Body Sizes and End Connection Styles

See Table 4

Flow Coefficients

See Table 7

IEC Sizing Coefficients

See Table 8

Pressure Registration

External through upstream control line

Temperature Capabilities

See Table 13

Maximum Relief (Inlet) Pressure

See Table 9

Set Pressure Range

20 to 1160 psig / 1.4 to 80.0 bar
in eleven ranges
See Tables 5, 10 and 11

Minimum and Maximum Differential Pressures

See Tables 6 and 9

Options

- Pre-piped Pilot Supply and Pilot Bleed
- Travel Indicator
- Inlet Strainer
- Type 252 Pilot Supply Filter
- Trim Package
- Quick Disconnect Union in Pilot Mounting

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Tight Shutoff**
- **Robust Construction**
- **Quiet Operation**
- **Internally Actuated**
- **Debris Protection**
- **Easy In-Line Maintenance**
- **Fast Pilot Reseat**



Figure 1. *Type EZR Relief Valve or Backpressure Regulator with Type 6358B Pilot*

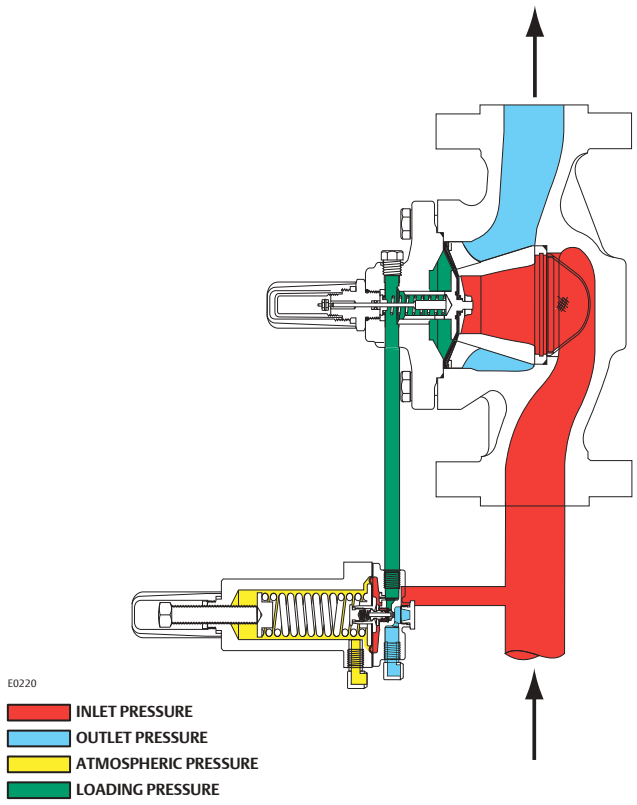


Figure 2. *Type EZR with Type 6358EB Relief Pilot Operational Schematic*

Type EZR Relief

Relief Valve or Backpressure Regulator

FISHER

Table 1. Main Valve Construction Material	
BODY	Cast iron, WCC Steel or LCC steel
BONNET	LF2 Steel
CAGE	15-5 Stainless steel
SPRING	Zinc-plated steel or 17-7 Stainless steel
TOP PLUG	17-4 Stainless steel
BOTTOM PLUG	416 Stainless steel
INLET STRAINER	316 Stainless steel
DIAPHRAGM AND O-RING	Nitrile (NBR) or Fluorocarbon (FKM)
FLANGED LOCKNUT	Alloy-plated Steel
BACK-UP RING	Polytetrafluoroethylene (PTFE)
UPPER SPRING SEAT	416 Stainless steel
INDICATOR STEM	303 Stainless steel
INDICATOR FITTING	416 Stainless steel
TRAVEL INDICATOR PLUG	416 Stainless steel

Table 2. 6358 Series Pilot Construction Material									
BODY	SPRING CASE	BODY PLUG	CONTROL SPRING AND SPRING SEAT	VALVE PLUG	ADJUSTING SCREW	STEM GUIDE	DIAPHRAGM AND O-RING	DIAPHRAGM LIMITER	LOWER SPRING SEAT
CF8M Stainless steel	CF8M Stainless steel	303 Stainless steel	Zinc-plated steel	Nitrile (NBR) or Fluorocarbon (FKM) with Stainless steel stem	Zinc-plated steel	Stainless steel	Nitrile (NBR) or Fluorocarbon (FKM)	Stainless steel (Type 6358EB only)	Thermoplastic (Types 63EB and 63EBH only)

Table 3. PRX Series Pilot			
BODY	TRIM	ELASTOMER	DISK MATERIAL
Steel, ASTM 105	Stainless steel	Nitrile (NBR) or Fluorocarbon (FKM)	Polyurethane (PU) or Fluorocarbon (FKM)

Table 4. Main Valve Body Sizes, End Connection Styles and Body Ratings					
MAIN VALVE BODY SIZE		MAIN VALVE BODY MATERIAL	END CONNECTION STYLE(1)	STRUCTURAL DESIGN RATING(2)	
In.	DN			psig	bar
2, 3, 4 and 6	50, 80, 100 and 150	Cast iron	NPT (2 in. only)	400	27.6
			CL125 FF	200	13.8
			CL250 RF	500	34.5
1, 2, 3, 4, 6 and 8	25, 50, 80, 100, 150 and 200	WCC Steel	NPT or SWE (1 and 2 in. only)	1500	103
			CL150 RF	290	20.0
			CL300 RF	750	51.7
			CL600 RF or BWE	1500	103

1. Ratings and end connections for other than ASME standard can usually be provided. Contact your local Sales Office for assistance.
2. See Tables 5, 6, 9, 10, 11 and 13 for additional pressure rating.

Table 5. Set Pressure Ranges, Pilot Pressure Ratings and Pilot Information(1)												
PILOT TYPE	RELIEF SET PRESSURE RANGE		PILOT CONTROL INFORMATION									
			Part Number	Color	Wire Diameter		Free Length		Maximum Operating Pressure		Maximum Emergency Pressure	
	psig	bar			In.	mm	In.	mm	psig	bar	psig	bar
6358 or 6358B	20 to 40 35 to 125(3)	1.4 to 2.8 2.4 to 8.6(3)	1E392527022 1K748527202(3)	Yellow Red	0.148 0.187	3.76 4.75	2.00 2.19	50.8 55.6	150	10.3	150	10.3
6358EB	75 to 140 130 to 200 180 to 350	5.2 to 9.7 9.0 to 13.8 12.4 to 24.1	17B1261X012 17B1263X012 17B1264X012	Green Blue Red	0.225 0.262 0.294	5.72 6.65 7.47	3.70 3.85 4.22	94.0 97.8 107	650	44.8	750	51.7
6358EBH	250 to 450 400 to 600(2)	17.2 to 31.0 27.6 to 41.4(2)	17B1263X012 17B1264X012	Blue Red	0.262 0.294	6.65 7.47	3.85 4.22	97.8 107				
PRX/182	29 to 116 73 to 290 217 to 609	2.0 to 8.0 5.0 to 20.0 15.0 to 42.0	GD25522X012 GD25520X012 GD25519X012	Black Gold Red	0.157 0.197 0.236	3.99 5.00 5.99	2.16 2.01 2.01	54.9 51.1 51.1	609	42.0	1480	102
PRX/182-AP	435 to 1160	30.0 to 80.0	GD27379X012	Clear	0.335	8.51	3.94	100	1160	80.0	1480	102

1. See the Main Valve Body Sizes, End Connections, Structural Design Ratings tables and the Main Valve Diaphragm and Spring Pressure Ratings table for additional pressure ratings.
2. Fluorocarbon (FKM) diaphragms are limited to 450 psig / 31.0 bar.
3. Regulator minimum differential pressure is approximately equal to minimum setpoint.

EMERSON. Process Management

Table 6. Main Valve Minimum Differential Pressures[1]

MAIN VALVE BODY SIZE		MAIN SPRING PART NUMBER AND COLOR	DIAPHRAGM MATERIAL	MINIMUM DIFFERENTIAL, PERCENT OF CAGE CAPACITY											
				For 90% Capacity						For 100% Capacity					
				100% Trim		60% Trim		30% Trim		100% Trim		60% Trim		30% Trim	
In.	DN			psid	bar d	psid	bar d	psid	bar d	psid	bar d	psid	bar d	psid	bar d
1	25	19B2400X012, Light Blue	17E68 and 17E88	24	1.7	29	2.0	31	2.1	24	1.7	31	2.1	40	2.8
		GE12727X012, Black	17E97	35	2.4	38	2.6	42	2.9	35	2.4	39	2.7	52	3.6
			17E68 and 17E88	30	2.1	35	2.4	39	2.7	30	2.1	36	2.5	52	3.6
		19B2401X012, Black with white stripe[3]	17E88 and 17E97	43	3.0	50	3.4	56	3.9	43	3.0	53	3.7	68	4.7
2	50	19B0951X012, Yellow[2]	17E68 and 17E88	12	0.83	15	1.0	15	1.0	12	0.83	25	1.7	20	1.4
		18B2126X012, Green	17E97	24	1.7	25	1.7	26	1.8	24	1.7	30	2.1	37	2.5
			17E68 and 17E88	18	1.2	20	1.4	22	1.5	19	1.3	26	1.8	28	1.9
		18B5955X012, Red[3] GE05504X012, Purple[3]	17E88 and 17E97	29	2.0	29	2.0	31	2.1	31	2.1	35	2.4	43	3.0
3	80	T14184T0012, Yellow[2]	17E68 and 17E88	16	1.1	19	1.3	24	1.7	23	1.6	23	1.6	29	2.0
		19B0781X012, Light Blue	17E97	23	1.6	23	1.6	23	1.6	23	1.6	23	1.6	25	1.7
			17E68 and 17E88	21	1.4	22	1.5	28	1.9	28	1.9	28	1.9	33	2.3
		19B0782X012, Black[3]	17E88 and 17E97	32	2.2	33	2.3	43	3.0	38	2.6	38	2.6	50	3.4
4	100	T14184T0012, Yellow[2]	17E68 and 17E88	10	0.69	12	0.83	14	0.97	25	1.7	25	1.7	25	1.7
		18B8501X012, Green	17E97	16	1.1	17	1.2	21	1.4	34	2.3	34	2.3	34	2.3
			17E68 and 17E88	16	1.1	17	1.2	20	1.4	30	2.1	30	2.1	30	2.1
		18B8502X012, Red[3]	17E88 and 17E97	21	1.4	24	1.7	26	1.8	40	2.8	40	2.8	40	2.8
6	150	19B0364X012, Yellow[2]	17E97	10	0.69	11	0.76	14	0.97	12	0.83	16	1.1	16	1.1
			17E88	10	0.69	13	0.90	13	0.90	12	0.83	21	1.4	21	1.4
		19B0366X012, Green	17E97	14	0.97	22	1.5	22	1.5	19	1.3	29	2.0	29	2.0
			17E88	17	1.2	21	1.4	21	1.4	20	1.4	36	2.5	36	2.5
		19B0365X012, Red[3]	17E88 and 17E97	23	1.6	29	2.0	29	2.0	30	2.1	41	2.8	41	2.8
8	200	GE09393X012, Yellow[2]	17E97	16	1.1	----	----	----	----	19	1.3	----	----	----	----
		GE09396X012, Green	17E97	20	1.4	----	----	----	----	23	1.6	----	----	----	----
		GE09397X012, Red[3]	17E97	26	1.8	----	----	----	----	30	2.1	----	----	----	----

1. See Table 4 for structural design ratings, Table 5 for pilot ratings and Table 9 for maximum pressure ratings.
2. The yellow springs is only recommended for inlet pressures under 100 psig / 6.9 bar.
3. The red, black, purple and black with white stripe springs are only recommended for applications where the maximum inlet pressure can exceed 500 psig / 34.5 bar.

Table 7. Main Valve Regulating Flow Coefficient

MAIN VALVE BODY SIZE		CAGE STYLE, PERCENT OF CAPACITY	LINE SIZE EQUALS BODY SIZE PIPING						2:1 LINE SIZE TO BODY SIZE PIPING					
			With Inlet Strainer			Without Inlet Strainer			With Inlet Strainer			Without Inlet Strainer		
In.	DN		C_g	C_v	C_1	C_g	C_v	C_1	C_g	C_v	C_1	C_g	C_v	C_1
1	25	100% 60% 30%	494 290 145	14.8 10.1 5.0	33.4 28.7 29.0	494 282 141	15.3 9.8 4.9	32.4 28.9 28.7	481 286 144	14.4 9.9 5.0	33.4 28.9 28.6	478 275 139	14.6 9.5 4.9	32.7 28.9 28.5
2	50	100% 60% 30%	1890 1040 570	50.8 35.6 21.4	37.2 29.2 26.6	1970 1050 570	54.6 36.3 21.4	36.1 28.9 26.6	1800 1020 560	50.4 35.9 21.5	35.7 28.4 26.0	1840 1020 560	53.0 35.9 21.5	34.7 28.4 26.0
3	80	100% 60% 30%	3550 2000 980	91.4 70.3 38.0	38.8 28.5 25.8	3720 2000 980	99.9 70.3 38.0	37.2 28.5 25.8	3390 1970 970	90.6 67.5 36.9	37.4 29.2 26.3	3510 1970 970	97.1 68.3 36.9	36.1 28.8 26.3
4	100	100% 60% 30%	5690 3360 1710	147 124 66.5	38.7 27.1 25.7	5830 3360 1710	154 124 66.5	37.9 27.1 25.7	5540 3300 1690	145 122 66.3	38.2 27.0 25.5	5640 3300 1690	151 121 66.8	37.4 27.3 25.3
6	150	100% 60% 30%	11,600 7120 3560	325 239 135	35.7 29.8 26.4	12,000 7200 3560	337 241 134	35.6 29.9 26.6	11,200 7150 3570	314 240 135	35.7 29.8 26.4	11,700 7230 3590	329 242 135	35.6 29.9 26.6
8	200	100%	19,700	505	39	20,100	517	38.9	19,500	503	38.8	19,700	509	38.7

Table 8. IEC Sizing Coefficient[1]

BODY SIZE		X_T	F_D	F_L
In.	DN			
1	25	0.706	0.06	0.94
2	50	0.875	0.09	0.96
3	80	0.952	0.09	0.97
4	100	0.947	0.09	0.92
6	150	0.806	0.09	0.91
8	200	0.96	0.10	0.89

1. Coefficients for 100% of capacity cage style.

Table 9. Main Valve Maximum Pressure Ratings, Diaphragm Selection Information and Main Spring Selection[1]

BODY SIZE		DIAPHRAGM MATERIAL	MAXIMUM OPERATING INLET PRESSURE[4]		MAXIMUM OPERATING DIFFERENTIAL PRESSURE[4]		MAXIMUM EMERGENCY INLET AND DIFFERENTIAL PRESSURE		MAIN SPRING COLOR	DIAPHRAGM STYLE
In.	DN		psig	bar	psid	bar d	psid	bar d		
1	25	17E68 Nitrile (NBR) Low temperature	100	6.9	100	6.9	100	6.9	Light Blue	130
			460	31.7	400	27.6	460	31.7	Black	
		17E97 Nitrile (NBR) High-pressure and/or erosion resistance	500	34.5	500	34.5	1050	72.4	Black	
			1050	72.4	800	55.2	1050	72.4	Black with White Stripe[2]	
		17E88 Fluorocarbon (FKM) High aromatic hydrocarbon content resistance	100	6.9	100	6.9	100	6.9	Light Blue	
			500	34.5	500	34.5[3]	750	51.7	Black	
			750	51.7	500	34.5[3]	750	51.7	Black with White Stripe[2]	
2	50	17E68 Nitrile (NBR) Low temperature	100	6.9	100	6.9	100	6.9	Yellow	
			460	31.7	400	27.6	460	31.7	Green	
		17E97 Nitrile (NBR) High-pressure and/or erosion resistance	500	34.5	500	34.5	1050	72.4	Green	
			1050	72.4	800	55.2	1050	72.4	Red or Purple[2]	
		17E88 Fluorocarbon (FKM) High aromatic hydrocarbon content resistance	100	6.9	100	6.9	100	6.9	Yellow	
			500	34.5	500	34.5[3]	750	51.7	Green	
			750	51.7	500	34.5[3]	750	51.7	Red or Purple[2]	
3	80	17E68 Nitrile (NBR) Low temperature	100	6.9	100	6.9	100	6.9	Yellow	
			360	24.8	300	20.7	500	34.5	Light Blue	
		17E97 Nitrile (NBR) High-pressure and/or erosion resistance	500	34.5	500	34.5	1050	72.4	Light Blue	
			1050	72.4	800	55.2	1050	72.4	Black[2]	
		17E88 Fluorocarbon (FKM) High aromatic hydrocarbon content resistance	100	6.9	100	6.9	100	6.9	Yellow	
			500	34.5	500	34.5[3]	750	51.7	Light Blue	
			750	51.7	500	34.5[3]	750	51.7	Black[2]	
4	100	17E68 Nitrile (NBR) Low temperature	100	6.9	100	6.9	100	6.9	Yellow	
			360	24.8	300	20.7	500	34.5	Green	
		17E97 Nitrile (NBR) High-pressure and/or erosion resistance	500	34.5	500	34.5	1050	72.4	Green	
			1050	72.4	800	55.2	1050	72.4	Red[2]	
		17E88 Fluorocarbon (FKM) High aromatic hydrocarbon content resistance	100	6.9	100	6.9	100	6.9	Yellow	
			500	34.5	500	34.5[3]	750	51.7	Green	
			750	51.7	500	34.5[3]	750	51.7	Red[2]	
6	150	17E97 Nitrile (NBR) High-pressure and/or erosion resistance	100	6.9	100	6.9	100	6.9	Yellow	
			500	34.5	500	34.5	1050	72.4	Green	
			1050	72.4	800	55.2	1050	72.4	Red[2]	
		17E88 Fluorocarbon (FKM) High aromatic hydrocarbon content resistance	100	6.9	100	6.9	100	6.9	Yellow	
			500	34.5	500	34.5[3]	750	51.7	Green	
			750	51.7	500	34.5[3]	750	51.7	Red[2]	
8	200	17E97 Nitrile (NBR) High-pressure and/or erosion resistance	100	6.9	100	6.9	100	6.9	Yellow	
			500	34.5	500	34.5	1050	72.4	Green	
			1050	72.4	800	55.2	1050	72.4	Red[2]	

1. See Table 4 for main valve structural design ratings and Table 5 for pilot ratings.
2. The red or purple, black and black with white stripe springs are recommended for applications where the maximum inlet pressures can exceed 500 psig / 34.5 bar.
3. For differential pressures above 400 psig / 27.6 bar d diaphragm temperatures are limited to 150°F / 66°C.
4. These are recommendations that provide the best regulator performance for a typical application. Please contact your local Sales Office for further information if a deviation from the standard recommendations are required.

Table 10. Pilot Information for 6358 Series Pilot

PILOT TYPE	SET PRESSURE RANGE[5], SPRING PART NUMBER AND COLOR	MAIN VALVE SPRING COLOR	SET PRESSURE[1]		BUILD-UP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE[2]		BUILD-UP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE[3]		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESEAT PILOT	
			psig	bar	psig	bar	psig	bar	psig	bar
6358	20 to 40 psig / 1.4 to 2.8 bar 1E392527022 Yellow	Green, Light Blue or Yellow	20	1.4	1.0	69 mbar	2.0	0.14	5.0	0.34
		Green, Light Blue or Yellow	25	1.7	1.0	69 mbar	2.0	0.14	5.0	0.34
		Green, Light Blue or Yellow	30	2.1	1.0	69 mbar	2.0	0.14	5.0	0.34
		Green, Light Blue or Yellow	40	2.8	1.0	69 mbar	2.0	0.14	5.0	0.34
	35 to 125 psig / 2.4 to 8.6 bar[5] 1K748527202 Red	Green, Light Blue or Yellow	40	2.8	1.4	0.10	2.5	0.17	5.0	0.34
		Green, Light Blue or Yellow	60	4.1	1.4	0.10	2.5	0.17	5.0	0.34
		Green, Light Blue or Yellow	80	5.5	1.5	0.10	2.8	0.19	5.0	0.34
		Green or Light Blue	100	6.9	1.6	0.11	3.0	0.21	5.0	0.34
		Green or Light Blue	125	8.6	1.6	0.11	3.0	0.21	5.0	0.34
6358B	20 to 40 psig / 1.4 to 2.8 bar 1E392527022 Yellow	Green, Light Blue or Yellow	20	1.4	1.0	69 mbar	2.0	0.14	1.0	0.07
		Green, Light Blue or Yellow	25	1.7	1.0	69 mbar	2.0	0.14	1.0	0.07
		Green, Light Blue or Yellow	30	2.1	1.0	69 mbar	2.0	0.14	1.0	0.07
		Green, Light Blue or Yellow	40	2.8	1.0	69 mbar	2.0	0.14	1.0	0.07
	35 to 125 psig / 2.4 to 8.6 bar[5] 1K748527202 Red	Green, Light Blue or Yellow	40	2.8	1.4	0.10	2.5	0.17	1.0	0.07
		Green, Light Blue or Yellow	60	4.1	1.4	0.10	2.5	0.17	1.0	0.07
		Green, Light Blue or Yellow	80	5.5	1.5	0.10	2.8	0.19	1.0	0.07
		Green or Light Blue	100	6.9	1.6	0.11	3.0	0.21	1.0	0.07
		Green or Light Blue	125	8.6	1.6	0.11	3.0	0.21	1.0	0.07
6358EB	75 to 140 psig / 5.2 to 9.7 bar 17B1261X012 Green	Green, Light Blue or Yellow	75	5.2	1.7	0.12	3.0	0.21	2.0	0.14
		Green or Light Blue	100	6.9	1.7	0.12	3.0	0.21	2.0	0.14
		Green or Light Blue	125	8.6	2.1	0.15	3.5	0.24	2.0	0.14
		Green or Light Blue	140	9.7	2.4	0.17	4.0	0.28	2.0	0.14
	130 to 200 psig / 9.0 to 13.8 bar 17B1263X012 Blue	Green or Light Blue	140	9.7	3.0	0.21	5.0	0.34	3.0	0.21
		Green or Light Blue	150	10.3	3.5	0.24	5.5	0.38	3.0	0.21
		Green or Light Blue	175	12.1	4.5	0.31	6.5	0.45	3.0	0.21
		Green or Light Blue	200	13.8	5.0	0.34	7.5	0.52	3.0	0.21
	180 to 350 psig / 12.4 to 24.1 bar 17B1264X012 Red	Green or Light Blue	200	13.8	5.0	0.34	8.0	0.55	3.0	0.21
		Green or Light Blue	225	15.5	5.0	0.34	8.0	0.55	3.0	0.21
		Green or Light Blue	250	17.2	5.0	0.34	8.5	0.59	3.0	0.21
		Green or Light Blue	275	19.0	5.5	0.38	8.5	0.59	3.0	0.21
		Green or Light Blue	300	20.7	5.5	0.38	8.5	0.59	3.0	0.21
		Green or Light Blue	325	22.4	5.5	0.38	9.0	0.62	3.0	0.21
		Green or Light Blue	350	24.1	5.5	0.38	9.0	0.62	3.0	0.21
6358EBH	250 to 450 psig / 17.2 to 31.0 bar[4] 17B1263X012 Blue	Green or Light Blue	350	24.1	6.0	0.41	9.5	0.66	6.0	0.41
		Green or Light Blue	375	25.9	6.0	0.41	9.5	0.66	6.0	0.41
		Green or Light Blue	400	27.6	6.5	0.45	10.0	0.69	6.0	0.41
		Green or Light Blue	425	29.3	7.0	0.48	10.5	0.72	6.0	0.41
		Green or Light Blue	450	31.0	7.5	0.52	11.0	0.76	6.0	0.41
	400 to 600 psig / 27.6 to 41.4 bar[4] 17B1264X012 Red	Green or Light Blue	450	31.0	7.5	0.52	11.5	0.79	6.0	0.41
		Red or Black	500	34.5	8.0	0.55	12.0	0.83	6.0	0.41
		Red or Black	550	37.9	8.5	0.59	13.0	0.90	6.0	0.41
		Red or Black	600	41.4	9.0	0.62	14.0	0.97	6.0	0.41

1. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
2. Crack point pressure of the main valve or the inlet pressure build-up over the set pressure at which the main valve starts audible flow.
3. Inlet pressure build-up over the set pressure for the main valve to achieve wide-open flow capacity.
4. The maximum operating pressure for Fluorocarbon (FKM) pilot diaphragms is limited to 450 psig / 31.0 bar.
5. Regulator minimum differential pressure is approximately equal to minimum setpoint.

Table 11. Pilot Information for PRX Series Pilot

PILOT TYPE	SET PRESSURE CONTROL RANGE, SPRING PART NUMBER AND COLOR	MAIN VALVE SPRING COLOR	SET PRESSURE[1]		BUILD-UP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE[2]		BUILD-UP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE[3]		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESEAT PILOT	
			psig	bar	psig	bar	psig	bar	psig	bar
PRX/182	29 to 116 psig / 2.0 to 8.0 bar GD25522X012 Black	Green or Light Blue	30	2.1	1.9	0.13	3.3	0.23	1.4	0.10
			60	4.1	2.2	0.15	3.6	0.25		
			80	5.5	2.2	0.15	4.0	0.27		
			100	6.9	2.4	0.17	4.2	0.29		
	73 to 290 psig / 5.0 to 20.0 bar GD25520X012 Gold	Green or Light Blue	75	5.2	2.5	0.17	4.1	0.28	1.6	0.11
			100	6.9	3.0	0.21	5.7	0.40		
			150	10.3	3.7	0.26	7.7	0.53		
			200	13.8	4.0	0.27	7.9	0.55		
			250	17.2	4.1	0.28	9.1	0.63		
	217 to 609 psig / 15.0 to 42.0 bar GD25519X012 Red	Green or Light Blue	225	15.5	4.1	0.28	10.4	0.72	2.1	0.14
			300	20.7	4.3	0.29	12.6	0.87		
			400	27.6	4.4	0.30	14.4	0.99		
			450	31.0	4.4	0.30	16.7	1.15		
PRX/182-AP	435 to 1160 psig / 30.0 to 80.0 bar GD27379X012 Clear	Green or Light Blue	450	31.0	5.2	0.36	17.9	1.2	3.1	0.21
		Red or Black	500	34.5	5.6	0.39	18.1	1.2	3.1	0.21
			600	41.4	5.5	0.38	19.9	1.4		
			1050	72.4	7.8	0.54	25.0	1.7		

1. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
2. Crack point pressure of the main valve of the inlet pressure build-up over the set pressure at which the main valve starts audible flow.
3. Inlet pressure build-up over the set pressure for the main valve to achieve wide-open flow capacity.

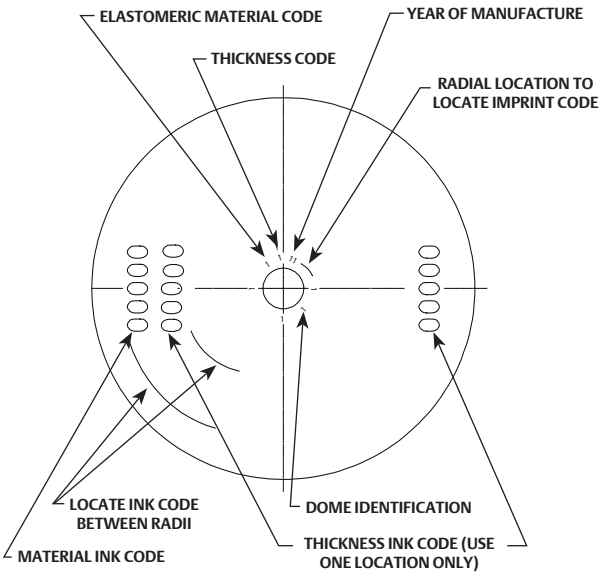


Figure 3. *Diaphragm Markings*

Table 12. Diaphragm Imprint Codes

THICKNESS		MATERIAL		DIAPHRAGM MATERIAL
Imprint	Ink Code	Imprint	Ink Code	
2	130	2	17E68	17E68 - Nitrile (NBR) (low temperature)
		4	17E88	17E88 - Fluorocarbon (FKM) (high aromatic hydrocarbon content resistance)
		5	17E97	17E97 - Nitrile (NBR) (high-pressure and/or erosion resistance)

Table 13. Diaphragm Temperature Capabilities, Erosion Resistance and Chemical Compatibility

	17E68 NITRILE (NBR)	17E97[3] NITRILE (NBR)	17E88 FLUOROCARBON (FKM)
Gas Temperature (for lower temperatures contact your local Sales Office)	-20 to 150°F / -29 to 66°C	0 to 150°F / -18 to 66°C	0 to 260°F / -18 to 127°C[1]
General Applications	Best for cold temperatures.	Best for high pressure conditions, i.e. transmission service or high pressure industrial service. It is also the best for abrasive or erosive service applications.	Best for natural gas having aromatic hydrocarbons. It is also the best for high temperature applications.
Heavy Particle Erosion	Fair	Excellent	Good
Natural Gas With:			
Up to 3% aromatic hydrocarbon content[2]	Good	Excellent	Excellent
3 to 15% aromatic hydrocarbon content[2]	Poor	Good	Excellent
15 to 50% aromatic hydrocarbon content[2]	Not recommended	Poor	Excellent
Up to 3% H_2S (hydrogen sulfide or sour gas)	Good	Good	Good
Up to 3% ketone	Fair	Fair	Fair
Up to 10% alcohol	Good	Good	Fair
Up to 3% synthetic lube	Fair	Fair	Good

1. For differential pressures above 400 psid / 27.6 bar d diaphragm temperature is limited to 150°F / 66°C.
2. The aromatic hydrocarbon content is based on percent volume.
3. The 6 in. / DN 150, 17E97 diaphragm will perform in gas temperatures as low as -20°F / -29°C.

Table 14. Capacities for Type 6358 Pilot

SET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	SET PRESSURE[1]		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS WITH 2:1 LINE SIZE TO BODY SIZE PIPING AND WITHOUT INLET STRAINER											
			1 in. / DN 25		2 in. / DN 50		3 in. / DN 80		4 in. / DN 100		6 in. / DN 150		8 in. / DN 200	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
20 to 40 psig / 1.4 to 2.8 bar 1E392527022 Yellow	20	1.4	24	0.6	87	2.3	166	4.4	267	7.2	496	13.3	864	23.2
	25	1.7	27	0.7	99	2.7	189	5.1	303	8.1	576	15.4	1000	26.8
	30	2.1	31	0.8	111	3.0	211	5.7	340	9.1	563	15.1	1133	30.4
	40	2.8	38	1.0	135	3.6	257	6.9	413	11.1	806	21.6	1396	37.4
35 to 125 psig / 2.4 to 8.6 bar 1K748527202 Red	40	2.8	38	1.0	140	3.8	267	7.2	429	11.5	806	21.6	1409	37.8
	60	4.1	52	1.4	183	4.9	350	9.4	562	15.1	1102	29.5	1926	51.7
	80	5.5	67	1.8	231	6.2	441	11.8	709	19.0	1392	37.3	2447	65.6
	100	6.9	81	2.2	279	7.5	533	14.3	856	22.9	1677	44.9	2964	79.5
	125	8.6	99	2.7	339	9.1	646	17.3	1038	27.8	2029	54.4	3602	96.6
75 to 140 psig / 5.2 to 9.7 bar 17B1261X012 Green	75	5.2	63	1.7	220	5.9	420	11.3	674	18.1	1320	35.4	2324	62.3
	100	6.9	81	2.2	279	7.5	533	14.3	856	22.9	1677	44.9	2964	79.5
	125	8.6	99	2.7	340	9.1	648	17.4	1042	27.9	2029	54.4	3615	96.9
	140	9.7	110	2.9	377	10.1	719	19.3	1155	31.0	2237	60.0	4010	107.5
130 to 200 psig / 9.0 to 13.8 bar 17B1263X012 Blue	140	9.7	110	2.9	379	10.2	723	19.4	1162	31.1	2237	60.0	4035	108.2
	150	10.3	117	3.1	404	10.8	771	20.7	1238	33.2	2375	63.7	4303	115.4
	175	12.1	136	3.6	466	12.5	888	23.8	1427	38.2	2716	72.8	4965	133.1
	200	13.8	154	4.1	527	14.1	1006	27.0	1617	43.3	3052	81.8	5627	105.9
180 to 350 psig / 12.4 to 24.1 bar 17B1264X012 Red	200	13.8	154	4.1	529	14.2	1008	27.0	1620	43.4	3052	81.8	5639	151.2
	225	15.5	173	4.6	588	15.8	1122	30.1	1802	48.3	3382	90.6	6275	168.3
	250	17.2	193	5.2	648	17.4	1237	33.2	1988	53.3	3708	99.4	6924	185.7
	275	19.0	212	5.7	708	19.0	1350	36.2	2170	58.2	4029	108	7560	202.7
	300	20.7	232	6.2	767	20.6	1463	39.2	2351	63.0	4345	116	8196	219.8
	325	22.4	252	6.8	828	22.2	1579	42.3	2537	68.0	4656	125	8844	237.1
	350	24.1	272	7.3	887	23.8	1692	45.3	2719	72.9	4962	133	9480	254.2
250 to 450 psig / 17.2 to 31.0 bar[2] 17B1263X012 Blue	350	24.1	272	7.3	888	23.8	1694	45.4	2732	73.2	4962	133	9492	254.5
	375	25.9	292	7.8	948	25.4	1808	48.5	2904	77.8	5263	141	10,128	271.6
	400	27.6	313	8.4	1008	27.0	1923	51.5	3090	82.8	5559	149	10,776	289.0
	425	29.3	334	9.0	1069	28.6	2038	54.6	3275	87.8	5850	157	11,424	306.3
	450	31.0	355	9.5	1129	30.3	2154	57.7	3461	92.8	6137	164	12,072	323.7
400 to 600 psig / 27.6 to 41.4 bar[2] 17B1264X012 Red	450	31.0	355	9.5	1130	30.3	2156	57.8	3465	92.9	6137	164	12,085	324.1
	500	34.5	398	10.7	1250	33.5	2385	63.9	3832	103	6695	179	13,369	358.5
	550	37.9	442	11.8	1371	36.7	2616	70.1	4203	113	7233	194	14,665	393.2
	600	41.4	487	13.1	1492	40.0	2847	76.3	4574	123	7752	208	15,961	428.0

1. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
2. The maximum operating pressure for Fluorocarbon (FKM) pilot diaphragms is limited to 450 psig / 31.0 bar.

Table 15. Capacities for Type PRX/182 Pilot

SET PRESSURE RANGE, SPRING PART NUMBER AND COLOR	SET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS WITH 2:1 LINE SIZE TO BODY SIZE PIPING WITHOUT INLET STRAIN											
			1 in. / DN 25		2 In. / DN 50		3 In. / DN 80		4 In. / DN 100		6 In. / DN 150		8 In. / DN 200	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
29 to 116 psig / 2.0 to 8.0 bar GD25522X012 Black	30	2.1	31	0.8	116	3.1	215	5.8	344	9.2	721	19.3	1189	31.9
	60	4.1	52	1.4	196	5.3	364	9.8	583	15.6	1207	32.3	2017	54.1
	80	5.5	65	1.7	247	6.6	461	12.4	738	19.8	1522	40.8	2554	68.4
	100	6.9	79	2.1	301	8.1	561	15.0	898	24.1	1847	49.5	3107	83.3
73 to 290 psig / 5.0 to 20.0 bar GD25519X012 Gold	75	5.2	62	1.6	238	6.4	442	11.8	709	19.0	1462	39.2	2451	65.7
	100	6.9	79	2.1	303	8.1	565	15.1	905	24.3	1861	49.9	3131	83.9
	150	10.3	113	3.0	431	11.6	806	21.6	1291	34.6	2646	70.9	4468	119.7
	200	13.8	146	3.9	561	15.0	1048	28.1	1679	45.0	3436	92.1	5811	155.7
	250	17.2	180	4.8	689	18.5	1289	34.5	2065	55.3	4221	113.1	1745	46.8
217 to 609 psig / 14.9 to 41.7 bar GD25519X012 Red	225	15.6	164	4.4	629	16.9	1177	31.5	1885	50.5	3855	103.3	6524	174.8
	300	20.7	214	5.7	819	21.9	1533	41.1	2455	65.8	5017	134.5	8498	227.7
	400	27.6	280	7.5	1071	28.7	2006	53.8	3213	86.1	6563	175.9	11,123	298.1
	450	31.0	313	8.4	1198	32.1	2244	60.1	3594	96.3	7339	196.7	12,440	333.4
435 to 1160 psig / 30.0 to 80.0 bar GD27379X012 Clear	450	31.0	313	8.4	1198	32.1	2244	60.1	3594	96.3	7339	196.7	12,440	333.4
	500	34.5	346	9.3	1324	35.5	2481	66.5	3973	106.5	8112	217.4	13,752	368.6
	600	41.4	411	11.0	1575	42.2	2953	79.1	4729	126.7	9654	258.7	16,371	438.7
	1050	72.4	707	18.9	2708	72.6	5078	136.1	8132	217.9	16,597	444.8	28,155	754.6

Table 16. Shipping Weight

BODY SIZE		APPROXIMATE SHIPPING WEIGHT													
		Cast Iron Main Valve Body						WCC or LCC Steel Main Valve Body							
		NPT		CL125 FF		CL250 RF		NPT, SWE or BWE		CL150 RF		CL300 RF		CL600 RF	
In.	DN	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
1	25	23	10	22	10	29	13	23	10	22	10	28	13	32	15
2	50	52	24	50	23	59	27	51	23	54	24	58	26	65	29
3	80	----		89	40	106	48	103	47	107	49	110	50	123	56
4	100	----		140	64	155	70	139	63	145	66	159	72	192	87
6	150	----		205	93	225	102	200	91	210	95	235	107	350	159
8	200	----		----	----	----	----	----	----	635	288	685	310	790	358

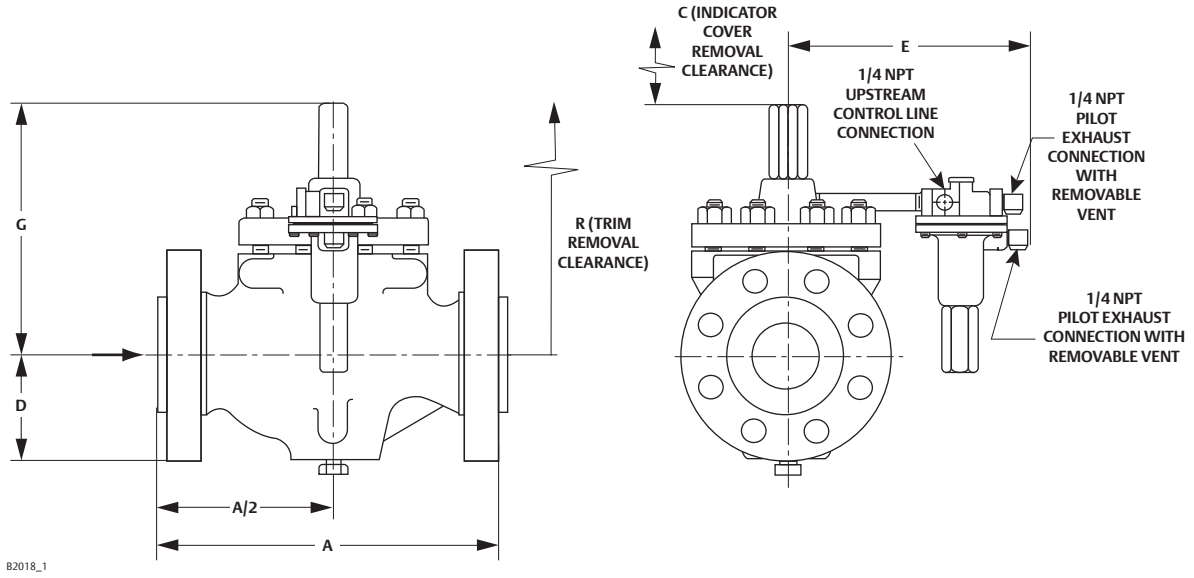


Figure 4. *Dimensions*

Table 17. Dimension

BODY SIZE		DIMENSION																			
		A								C		D (Maximum)		E 6358 SERIES		E PRX SERIES		G		R	
		SWE or NPT		CL125 FF or CL150 RF		CL250 or CL300 RF		CL600 RF or BWE													
In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1	25	8.25	210	7.25	184	7.75	197	8.25	210	2	51	2.38	60	7.44	189	6.54	166	8.65	220	9.87	251
2	50	11.25	286	10	254	10.50	267	11.25	286	2	51	3.06	78	7.44	189	11.13	283	9	229	11	279
3	80	----		11.75	298	12.5	317	13.25	337	3.75	95	3.81	97	8.19	208	13.6	334	13.3	338	5.9	150
4	100	----		13.9	353	14.5	368	15.5	394	3.75	95	5.06	129	8.45	215	14.53	369	14.7	373	20.7	526
6	150	----		17.8	452	18.6	472	20	508	3.8	97	5.5	140	10.88	276	16.49	419	15.2	386	32.8	833
8	200	----		21.9	558	22.4	570	24.0	610	4.5	114	8.25	210	15.6	397	15.44	392	20.6	522	38	965

Ordering Guide

Main Valve Body Size (Select One)

- ☐ 1 in. / DN 25*** (Available in steel only)
- ☐ 2 in. / DN 50***
- ☐ 3 in. / DN 80***
- ☐ 4 in. / DN 100***
- ☐ 6 in. / DN 150***
- ☐ 8 in. / DN 200***

Main Valve Body Material and End Connection Style (Select One)

Cast Iron Body

- ☐ NPT (Available in 2 in. body size only)***
- ☐ CL125 FF***
- ☐ CL250 RF***

WCC Steel Body

- ☐ NPT (Available in 1 and 2 in. body sizes only)***
- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ CL600 RF***
- ☐ SWE (Available in 1 and 2 in. body sizes only)*
- ☐ BWE 40*
- ☐ BWE 80*
- ☐ PN 16/25/40* specify _____

- continued -

Ordering Guide (continued)

Main Valve Diaphragm Material (Select One)

- ☐ 17E68 Nitrile (NBR) (low temperature)***
  (Not available on 6 or 8 in. / DN 150 or 200)
- ☐ 17E97 Nitrile (NBR) (high-pressure/erosion resistance)***
- ☐ 17E88 Fluorocarbon (FKM) (high aromatic hydrocarbons)***
  (Not available on 8 in. / DN 200)

Main Valve O-ring Material (Select One)

- ☐ Nitrile (NBR) **(standard)***
- ☐ Fluorocarbon (FKM)***

Main Valve Main Spring (Select One)

1in. / DN 25 Main Valve

- ☐ Light Blue, for inlet pressures under 100 psig / 6.9 bar***
- ☐ Black, for inlet pressures up to 500 psig / 34.5 bar***
- ☐ Black with White Stripe, for inlet pressures over 500 psig / 34.5 bar***

2 in. / DN 50 Main Valve

- ☐ Yellow, for inlet pressures under 100 psig / 6.9 bar***
- ☐ Green, for inlet pressures up to 500 psig / 34.5 bar***
- ☐ Red/Purple, for inlet pressures over 500 psig / 34.5 bar***

3 in. / DN 80 Main Valve

- ☐ Yellow, for inlet pressures under 100 psig / 6.9 bar***
- ☐ Light Blue, for inlet pressures up to 500 psig / 34.5 bar***
- ☐ Black, for inlet pressures over 500 psig / 34.5 bar***

4 in. / DN 100 Main Valve

- ☐ Yellow, for inlet pressures under 100 psig / 6.9 bar***
- ☐ Green, for inlet pressures up to 500 psig / 34.5 bar***
- ☐ Red, for inlet pressures over 500 psig / 34.5 bar***

6 in. / DN 150 Main Valve

- ☐ Yellow, for inlet pressures under 100 psig / 6.9 bar***
- ☐ Green, for inlet pressures up to 500 psig / 34.5 bar***
- ☐ Red, for inlet pressures over 500 psig / 34.5 bar***

8 in. / DN 200

- ☐ Yellow, for inlet pressures under 100 psig / 6.9 bar***
- ☐ Green, for inlet pressures up to 500 psig / 34.5 bar***
- ☐ Red, for inlet pressures over 500 psig / 34.5 bar***

Travel Indicator (Select One)

- ☐ No **(standard)***
- ☐ Yes***

Inlet Strainer (Select One)

- ☐ No **(standard)***
- ☐ Yes***

Inlet Body Tap (Select One)

- ☐ Inlet body tap only **(standard)***
- ☐ Inlet body tap with pre-piped pilot supply***
- ☐ Inlet or outlet body taps only***
- ☐ Inlet or outlet body taps with pre-piped pilot supply and pilot bleed***

Pilot Type and Set Pressure Range (Select One)

Type 6358

- ☐ 20 to 40 psig / 1.4 to 2.8 bar, Yellow***
- ☐ 35 to 125 psig / 2.4 to 8.6 bar, Red***

Type 6358B

- ☐ 20 to 40 psig / 1.4 to 2.8 bar, Yellow***
- ☐ 35 to 125 psig / 2.4 to 8.6 bar, Red***

Type 6358EB

- ☐ 75 to 140 psig / 5.2 to 9.7 bar, Green***
- ☐ 130 to 200 psig / 9.0 to 13.8 bar, Blue***
- ☐ 180 to 350 psig / 12.4 to 24.1 bar, Red***

Type 6358EBH

- ☐ 250 to 450 psig / 17.2 to 31.0 bar, Blue***
- ☐ 400 to 600 psig / 27.6 to 41.4 bar, Red***

Type PRX/182

- ☐ 29 to 116 psig / 2.0 to 8.0 bar, Black***
- ☐ 73 to 290 psig / 5.0 to 20.0 bar, Gold***
- ☐ 217 to 609 psig / 15.0 to 42.0 bar, Red ***

Type PRX/182-AP

- ☐ 435 to 1160 psig / 30.0 to 80.0 bar, Clear***

Pilot Diaphragm Material (Select One)

- ☐ Nitrile (NBR) **(standard)***
- ☐ Fluorocarbon (FKM)***

Pilot O-ring Material (Select One)

- ☐ Nitrile (NBR) **(standard)***
- ☐ Fluorocarbon (FKM)***

Pilot Valve Plug Material (Select One)

- ☐ Nitrile (NBR) **(standard)***
- ☐ Fluorocarbon (FKM)***

Pilot Mounting (Select One)

- ☐ **Standard***
- ☐ Quick Disconnect Union**

- continued -

Ordering Guide (continued)

Type 252 Pilot Supply Filter (Optional)

Material
- ☐ Stainless steel***
- ☐ Aluminum**

Length
- ☐ **Standard*****
- ☐ Extended**

Drain Valve
- ☐ Yes***
- ☐ No**

Trim Package (Optional)

☐ Yes, send one Type EZR trim package. (If ordering replacement trim package for change-out of existing E-body to a Type EZR, be sure to mark selection of the following items on this page: body size, diaphragm material, inlet strainer option and travel indicator option. If other components are required, they may be selected on this page.)

Main Valve Replacement Parts Kit (Optional)

☐ Yes, send one diaphragm cartridge and O-rings parts kit to match this order.
☐ Yes, send one diaphragm and O-rings parts kit to match this order.

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.

Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.

Pilot Replacement Parts Kit (Optional)

☐ Yes, send one replacement parts kit to match this order.

Wireless Position Monitor Mounting Kit (Optional)

☐ Yes, send one mounting kit for mounting the Topworx 4310 or the Fisher™ 4320 wireless position monitor (requires Travel Indicator option).

Specification Worksheet
Application
☐ Relief Valve ☐ Backpressure Regulator
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Keep vents open. Do not use small diameter, long vent lines. Use the rule of thumb of the next nominal pipe size every 10 feet / 3.1 m of vent line and 3 feet / 0.9 m of vent line for every elbow in the line.

Introduction

It is often necessary in regulating and metering stations to protect the valves, pressure regulators, meters and other equipment from foreign particles present in the gases or, particularly during the initial stages of operation, from debris in newly laid pipes. This is the job of the filter.

FA and FAG Series cartridge filters can be used with natural and manufactured gases, air, propane and other gases so long as they do not contain high percentages of benzol.

They come in several versions to meet all application demands. They have threaded connections for the mounting of the drain cock (supplied on request) and other accessories. Even special filters can be made upon request. Simply contact your local Sales Office.

Available Versions

FA Series: High pressure filters

FAG Series: Mid and low pressure filters

Maximum Allowable Pressure

FA Series: 1305 psig / 90 bar

FAG Series: 276 psig / 19 bar

See Table 1

Maximum Casing Pressure

FA Series: 1958 psig / 135 bar

FAG Series: 435 psig / 30 bar

See Table 1

Filtering Surface

FA Series:
387 to 13,019 in^2 / 0.25 to 8.4 m^2

FAG Series:
93 to 6510 in^2 / 0.06 to 4.2m^2

See Tables 22 to 25

Filtering Capability

197 µin / 5µm

Body Sizes

FA Series: 2, 2-1/2, 3, 4, 6, 8, 10, 12, 14 and 16 NPS / DN 50, 65, 80, 100, 150, 200, 250, 300, 350 and 400

FAG Series: 2, 2-1/2, 3, 4, 5, 6,8, 10 and 12 NPS / DN 50, 65, 80, 100, 125, 150, 200, 250 and 300

End Connection Styles

PN 16, CL150, CL300 and CL600

See Table 1

Operating Temperature

FA Series

Standard version:
14 to 212°F / -10 to 100°C
Low temperature version:
-4 to 212°F / -20 to 100°C

FAG Series

Standard version:
14 to 140°F / -10 to 60°C
Low temperature version:
-4 to 140°F / -20 to 60°C

Options

- Blind flange closure (FA Series)
- Closure flange lifting system (FA Series)
- Drain valve (FAG and FA Series)
- Local clogging indicator (FAG and FA Series)
- Remote clogging indicator (FAG and FA Series)
- Quick-opening version

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Versatility**
- **Wide Range of Applications**
- **Maximum Safety**
- **Easy Maintenance**
- **Axial and Right-Angle Connections**
- **Rated Pressures Up to 1305 psig / 90 bar**
- **Quick Opening Version Available on Request**
- **Capacity Up to 22,954,409 SCFH / 650,000 Sm^3/h**
- **197 µin. / 5 µm Filtering Capability**



Figure 1. *Type FA Cartridge Filter*



Figure 2. *Type FAG Cartridge Filter*

Table 1. FA and FAG Series Maximum Pressure and End Connection Style

TYPE	END CONNECTION STYLE	MAXIMUM ALLOWABLE PRESSURE		MAXIMUM CASING PRESSURE	
		psig	bar	psig	bar
FA Series					
FA/ and FA-11/	CL150	247	17	370	25.5
FA/ and FA-12/	CL300	435	30	653	45
FA-AP/ and FA-12-AP/	CL600	1305	90	1958	135
FAG Series					
FAG/ and FAG-A/	PN 16 or CL150	87	6	131	9
FAG-AP/ and FAG-A-AP/	CL150	276	19	435	30

Table 2. Types FA-11, FA-12, FA-12-AP, FA/10 and FA-AP/10 with 2 in. / DN 50 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	10,594	300	12,360	350	12,360	350	12,360	350	----	----	----	----	----	----	----	----
14.5	1	12,713	360	15,892	450	15,892	450	15,892	450	----	----	----	----	----	----	----	----
29.0	2	15,538	440	24,720	700	24,720	700	24,720	700	24,720	700	----	----	----	----	----	----
72.5	5	22,954	650	28,252	800	35,315	1000	44,143	1250	44,143	1250	44,143	1250	----	----	----	----
145	10	31,783	900	45,909	1300	70,629	2000	84,755	2400	88,286	2500	88,286	2500	88,286	2500	----	----
363	25	60,034	1700	70,629	2000	105,943	3000	127,132	3600	148,321	4200	176,572	5000	194,230	5500	194,230	5500
580	40	----	----	----	----	----	----	----	----	----	----	----	----	282,516	8000	317,830	9000
1015	70	----	----	----	----	----	----	----	----	----	----	----	----	423,774	12,000	529,717	15,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 3. Types FA-11, FA-12 and FA-12-AP with 2-1/2 in. / DN 65 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	10,594	300	15,538	440	21,189	600	21,189	600	----	----	----	----	----	----	----	----
14.5	1	12,713	360	19,423	550	28,252	800	28,252	800	----	----	----	----	----	----	----	----
29.0	2	15,538	440	24,720	700	35,314	1000	42,377	1200	42,377	1200	----	----	----	----	----	----
72.5	5	22,954	650	35,314	1000	49,440	1400	60,035	1700	70,629	2000	84,755	2400	----	----	----	----
145	10	31,783	900	45,909	1300	70,629	2000	84,755	2400	98,881	2800	113,006	3200	155,384	4400	----	----
363	25	45,909	1300	70,629	2000	105,943	3000	127,132	3600	148,321	4200	176,572	5000	226,013	6400	353,145	10,000
580	40	----	----	----	----	----	----	----	----	----	----	----	----	282,516	8000	423,774	12,000
1015	70	----	----	----	----	----	----	----	----	----	----	----	----	423,774	12,000	565,032	16,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 4. Types FA-11, FA-12, FA-12-AP, FA/15 and FA-AP/15 with 3 in. / DN 80 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	21,189	600	26,486	750	26,486	750	26,486	750	----	----	----	----	----	----	----	----
14.5	1	24,720	700	35,314	1000	35,314	1000	35,314	1000	----	----	----	----	----	----	----	----
29.0	2	28,252	800	45,909	1300	60,035	1700	60,035	1700	60,035	1700	----	----	----	----	----	----
72.5	5	42,377	1200	63,566	1800	91,818	2600	105,943	3000	105,943	3000	105,943	3000	----	----	----	----
145	10	60,035	1700	84,755	2400	127,132	3600	158,915	4500	176,572	5000	176,572	5000	176,572	5000	----	----
363	25	88,286	2500	141,258	4000	211,887	6000	247,201	7000	282,516	8000	353,145	10,000	423,774	12,000	459,088	13,000
580	40	----	----	----	----	----	----	----	----	----	----	----	----	565,032	16,000	741,604	21,000
1015	70	----	----	----	----	----	----	----	----	----	----	----	----	741,604	21,000	1,059,434	30,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 5. Types FA-11, FA-12, FA-12-AP, FA/20 and FA-AP/20 with 4 in. / DN 100 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	21,189	600	31,783	900	45,909	1300	45,909	1300	----	----	----	----	----	----	----	----
14.5	1	24,720	700	35,314	1000	52,972	1500	67,098	1900	----	----	----	----	----	----	----	----
29.0	2	28,252	800	45,909	1300	60,035	1700	77,692	2200	91,818	2600	----	----	----	----	----	----
72.5	5	42,377	1200	63,566	1800	91,818	2600	113,006	3200	123,601	3500	158,915	4500	----	----	----	----
145	10	60,035	1700	84,755	2400	127,132	3600	158,915	4500	176,572	5000	211,887	6000	282,516	8000	----	----
363	25	88,286	2500	141,258	4000	211,887	6000	247,201	7000	282,516	8000	353,145	10,000	423,774	12,000	618,003	17,500
580	40	----	----	----	----	----	----	----	----	----	----	----	----	565,032	16,000	741,604	21,000
1015	70	----	----	----	----	----	----	----	----	----	----	----	----	741,604	21,000	1,059,434	30,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 6. Types FA-11, FA-12, FA-12-AP, FA/30 and FA-AP/30 with 6 in. / DN 150 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	63,566	1800	98,881	2800	98,881	2800	98,881	2800	----	----	----	----	----	----	----	----
14.5	1	74,160	2100	113,006	3200	141,258	4000	141,258	4000	----	----	----	----	----	----	----	----
29.0	2	91,818	2600	141,258	4000	194,230	5500	194,230	5500	194,230	5500	----	----	----	----	----	----
72.5	5	105,943	3000	155,384	4400	282,516	8000	423,774	11,000	423,774	11,000	423,774	11,000	----	----	----	----
145	10	158,915	4500	229,544	6500	353,145	10,000	423,774	12,000	565,032	16,000	706,290	20,000	706,290	20,000	----	----
363	25	229,544	6500	353,145	10,000	494,403	14,000	635,661	18,000	706,290	20,000	918,176	26,000	1,236,007	35,000	1,624,466	46,000
580	40	----	----	----	----	----	----	----	----	----	----	----	----	1,483,208	42,000	2,189,498	62,000
1015	70	----	----	----	----	----	----	----	----	----	----	----	----	2,118,869	60,000	3,178,303	90,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 7. Types FA-11, FA-12, FA-12-AP, FA/40 and FA-AP/40 with 8 in. / DN 200 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	84,755	2400	127,132	3600	176,572	5000	176,572	5000	----	----	----	----	----	----	----	----
14.5	1	98,881	2800	152,912	4330	222,481	6300	229,544	6500	----	----	----	----	----	----	----	----
29.0	2	123,600	3500	194,230	5500	282,516	8000	353,145	10,000	353,145	10,000	----	----	----	----	----	----
72.5	5	176,572	5000	264,859	7500	423,774	11,000	529,717	15,000	706,290	20,000	706,290	20,000	----	----	----	----
145	10	247,201	7000	353,145	10,000	565,032	16,000	635,661	18,000	776,919	22,000	918,176	26,000	1,236,007	35,000	----	----
363	25	353,145	10,000	565,032	16,000	847,547	24,000	1,059,434	30,000	1,200,692	34,000	1,412,579	40,000	1,765,724	50,000	2,542,642	72,000
580	40	----	----	----	----	----	----	----	----	----	----	----	----	2,295,441	65,000	3,178,303	90,000
1015	70	----	----	----	----	----	----	----	----	----	----	----	----	3,178,303	90,000	4,414,309	125,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 8. Types FA-11, FA-12 and FA-12-AP with 10 in. / DN 250 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	158,915	4500	247,201	7000	282,516	8000	282,516	8000	----	----	----	----	----	----	----	----
14.5	1	194,230	5500	282,516	8000	353,145	10,000	353,145	10,000	----	----	----	----	----	----	----	----
29.0	2	229,544	6500	353,145	10,000	529,717	15,000	529,717	15,000	353,145	15,000	----	----	----	----	----	----
72.5	5	335,488	9500	494,403	14,000	706,290	20,000	1,059,434	30,000	706,290	30,000	706,290	30,000	----	----	----	----
145	10	459,088	13,000	706,290	20,000	1,059,434	30,000	1,271,321	36,000	1,412,579	40,000	1,589,151	45,000	1,942,296	55,000	----	----
363	25	706,290	20,000	1,059,434	30,000	1,589,151	45,000	1,624,466	46,000	2,260,126	64,000	2,683,900	76,000	3,178,303	90,000	4,590,882	130,000
580	40	----	----	----	----	----	----	----	----	----	----	----	----	4,237,737	120,000	6,180,033	175,000
1015	70	----	----	----	----	----	----	----	----	----	----	----	----	6,003,461	170,000	8,828,619	250,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 9. Types FA-11, FA-12, FA-12-AP, FA/50 and FA-AP/50 with 12 in. / DN 300 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	282,516	8000	406,117	11,500	406,117	11,500	406,117	11,500	----	----	----	----	----	----	----	----
14.5	1	317,830	9000	529,717	15,000	529,717	15,000	529,717	15,000	----	----	----	----	----	----	----	----
29.0	2	423,774	12,000	635,661	18,000	812,233	23,000	812,233	23,000	812,233	23,000	----	----	----	----	----	----
72.5	5	600,346	17,000	918,176	26,000	1,236,007	35,000	1,589,151	45,000	1,589,151	45,000	1,589,151	45,000	----	----	----	----
145	10	847,547	24,000	1,271,321	36,000	1,906,982	54,000	2,260,126	64,000	2,472,013	70,000	3,001,730	85,000	3,001,730	85,000	----	----
363	25	1,236,007	35,000	1,906,982	54,000	2,825,158	80,000	3,531,448	100,000	3,884,592	110,000	4,944,027	140,000	6,003,461	170,000	7,062,895	200,000
580	40	----	----	----	----	----	----	----	----	----	----	----	----	7,062,895	200,000	10,594,343	300,000
1015	70	----	----	----	----	----	----	----	----	----	----	----	----	10,594,343	300,000	12,360,066	350,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 10. Types FA-11, FA-12 and FA-12-AP with 14 in. / DN 350 Body Size Flow Capacity (Available on request)

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	282,516	8000	441,431	12,500	406,117	15,000	406,117	15,000	----	----	----	----	----	----	----	----
14.5	1	317,830	9000	529,717	15,000	706,290	20,000	706,290	20,000	----	----	----	----	----	----	----	----
29.0	2	423,774	12,000	635,661	18,000	882,862	25,000	882,862	25,000	882,862	25,000	----	----	----	----	----	----
72.5	5	600,346	17,000	918,176	26,000	1,236,007	35,000	1,765,724	50,000	2,118,869	60,000	2,118,869	60,000	----	----	----	----
145	10	847,547	24,000	1,271,321	36,000	1,906,982	54,000	2,260,126	64,000	2,472,013	70,000	3,178,303	90,000	3,884,592	110,000	----	----
363	25	1,236,007	35,000	1,906,982	54,000	2,825,158	80,000	3,531,448	100,000	3,884,592	110,000	4,944,027	140,000	6,003,461	170,000	8,475,474	240,000
580	40	----	----	----	----	----	----	----	----	----	----	----	----	7,062,895	200,000	10,594,343	300,000
1015	70	----	----	----	----	----	----	----	----	----	----	----	----	10,594,343	300,000	12,360,066	350,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 11. Types FA-11, FA-12 and FA-12-AP with 16 in. / DN 400 Body Size Flow Capacity (Available on request)

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	441,431	12,500	706,290	20,000	706,290	20,000	706,290	20,000	----	----	----	----	----	----	----	----
14.5	1	529,717	15,000	847,547	24,000	918,176	26,000	918,176	26,000	----	----	----	----	----	----	----	----
29.0	2	635,661	18,000	918,176	26,000	1,412,579	40,000	1,412,579	40,000	1,412,579	40,000	----	----	----	----	----	----
72.5	5	953,491	27,000	1,412,579	40,000	2,118,869	60,000	6,180,033	75,000	2,825,158	80,000	2,825,158	80,000	----	----	----	----
145	10	1,341,950	38,000	1,942,296	55,000	2,966,416	84,000	3,531,448	100,000	4,061,165	115,000	4,944,027	140,000	4,944,027	140,000	----	----
363	25	1,977,611	56,000	2,966,416	84,000	4,590,882	130,000	5,650,316	160,000	6,356,606	180,000	7,769,185	220,000	9,181,764	260,000	12,360,066	350,000
580	40	----	----	----	----	----	----	----	----	----	----	----	----	12,360,066	350,000	17,657,238	500,000
1015	70	----	----	----	----	----	----	----	----	----	----	----	----	17,657,238	500,000	22,954,409	650,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 12. Type 0.5 (FAG-A and FAG Series) with 2 in. / DN 50 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	2649	75	3885	110	4238	120	4238	120	----	----	----	----	----	----	----	----
14.5	1	3178	90	4944	140	6004	170	6004	170	----	----	----	----	----	----	----	----
29.0	2	3885	110	6004	170	8829	250	8829	250	8829	250	----	----	----	----	----	----
73	5	----	----	----	----	12,360	350	13,243	375	17,657	500	17,657	500	----	----	----	----
145	10	----	----	----	----	----	----	----	----	22,954	650	24,720	700	24,720	700	----	----
232	16	----	----	----	----	----	----	----	----	----	----	----	----	35,315	1000	35,315	1000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 13. Type 1 (FAG-A and FAG Series) with 2-1/2 in. / DN 65 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	5297	150	7769	220	12,007	340	14,126	400	----	----	----	----	----	----	----	----
14.5	1	6357	180	9888	280	14,126	400	15,892	450	----	----	----	----	----	----	----	----
29.0	2	7769	220	12,007	340	17,657	500	21,189	600	24,720	700	----	----	----	----	----	----
73	5	11,301	320	17,657	500	24,720	700	26,486	750	35,315	1000	42,377	1200	----	----	----	----
145	10	15,892	450	22,954	650	35,315	1000	42,377	1200	45,909	1300	56,503	1600	77,692	2200	----	----
232	16	19,423	550	28,252	800	42,377	1200	52,972	1500	60,035	1700	70,629	2000	97,115	2750	134,195	3800

Table 14. Type 1.5 (FAG-A and FAG Series) with 3 in. / DN 80 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	10,594	300	15,185	430	22,954	650	28,252	800	----	----	----	----	----	----	----	----
14.5	1	12,007	340	19,423	550	26,486	750	31,783	900	----	----	----	----	----	----	----	----
29.0	2	14,126	400	22,954	650	33,549	950	38,846	1100	45,909	1300	----	----	----	----	----	----
73	5	21,189	600	31,783	900	45,909	1300	56,503	1600	67,098	1900	77,692	2200	----	----	----	----
145	10	30,017	850	42,377	1200	63,566	1800	77,692	2200	88,286	2500	105,943	3000	132,429	3750	----	----
232	16	35,315	1000	49,440	1400	77,692	2200	98,881	2800	113,006	3200	141,258	4000	158,915	4500	211,887	6000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 15. Type 2 (FAG-A and FAG Series) with 4 in. / DN 100 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	21,189	600	31,783	900	45,909	1300	45,909	1300	----	----	----	----	----	----	----	----
14.5	1	24,720	700	38,846	1100	52,972	1500	60,035	1700	----	----	----	----	----	----	----	----
29.0	2	30,017	850	45,909	1300	67,098	1900	77,692	2200	77,692	2200	----	----	----	----	----	----
73	5	30,017	850	45,909	1300	97,115	2750	113,006	3200	132,429	3750	167,744	4750	----	----	----	----
145	10	42,377	1200	63,566	1800	105,943	3000	123,601	3500	176,572	5000	220,716	6250	300,173	8500	----	----
232	16	49,440	1400	77,692	2200	113,006	3200	141,258	4000	194,230	5500	229,544	6500	353,145	10,000	423,774	12,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 16. Type 2.5 (FAG-A and FAG Series) with 5 in. / DN 125 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	31,783	900	45,909	1300	70,629	2000	70,629	2000	----	----	----	----	----	----	----	----
14.5	1	35,315	1000	56,503	1600	97,115	2750	97,115	2750	----	----	----	----	----	----	----	----
29.0	2	44,143	1250	70,629	2000	98,881	2800	105,943	3000	123,601	3500	----	----	----	----	----	----
73	5	52,972	1500	77,692	2200	141,258	4000	176,572	5000	194,230	5500	211,887	6000	----	----	----	----
145	10	77,692	2200	113,006	3200	176,572	5000	211,887	6000	264,859	7500	300,173	8500	353,145	10,000	----	----
232	16	88,286	2500	141,258	4000	211,887	6000	247,201	7000	282,516	8000	353,145	10,000	423,774	12,000	635,661	18,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 17. Type 3 (FAG-A and FAG Series) with 6 in. / DN 150 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	56,503	1600	88,286	2500	105,943	3000	105,943	3000	----	----	----	----	----	----	----	----
14.5	1	67,098	1900	105,943	3000	132,429	3750	132,429	3750	----	----	----	----	----	----	----	----
29.0	2	88,286	2500	141,258	4000	158,915	4500	167,744	4750	194,230	5500	----	----	----	----	----	----
73	5	105,943	3000	158,915	4500	264,859	7500	317,830	9000	353,145	10,000	388,459	11,000	----	----	----	----
145	10	123,601	3500	183,635	5200	282,516	8000	353,145	10,000	423,774	12,000	529,717	15,000	635,661	18,000	----	----
232	16	141,258	4000	229,544	6500	317,830	9000	423,774	12,000	459,088	13,000	565,032	16,000	776,919	22,000	1,094,749	31,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 18. Type 3.5 (FAG-A and FAG Series) with 6 in. / DN 150 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	67,098	1900	98,881	2800	123,601	3500	123,601	3500	----	----	----	----	----	----	----	----
14.5	1	77,692	2200	123,601	3500	141,258	4000	141,258	4000	----	----	----	----	----	----	----	----
29.0	2	97,115	2750	150,087	4250	211,887	6000	211,887	6000	211,887	6000	----	----	----	----	----	----
73	5	141,258	4000	211,887	6000	317,830	9000	353,145	10,000	406,117	11,500	423,774	12,000	----	----	----	----
145	10	194,230	5500	282,516	8000	459,088	13,000	529,717	15,000	600,346	17,000	706,290	20,000	776,919	22,000	----	----
232	16	211,887	6500	353,145	10,000	529,717	15,000	635,661	18,000	776,919	22,000	918,176	26,000	1,094,749	31,000	1,094,749	31,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.43 ft/s / 30 m/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 19. Type 4 (FAG-A and FAG Series) with 8 in. / DN 200 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	79,458	2250	120,069	3400	176,572	5000	176,572	5000	----	----	----	----	----	----	----	----
14.5	1	88,286	2500	141,258	4000	194,230	5500	247,201	7000	----	----	----	----	----	----	----	----
29.0	2	105,943	3000	176,572	5000	247,201	7000	317,830	9000	353,145	10,000	----	----	----	----	----	----
73	5	158,915	4500	247,201	7000	353,145	10,000	441,431	12,500	529,717	15,000	618,003	17,500	----	----	----	----
145	10	229,544	6500	353,145	10,000	529,717	15,000	635,661	18,000	688,632	19,500	776,919	22,000	1,059,434	30,000	----	----
232	16	282,516	8000	423,774	12,000	635,661	18,000	776,919	22,000	882,862	25,000	1,094,749	31,000	1,236,007	35,000	1,765,724	50,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.42 ft/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 20. Type 5 (FAG-A and FAG Series) with 10 in. / DN 250 Body Size Flow Capacity

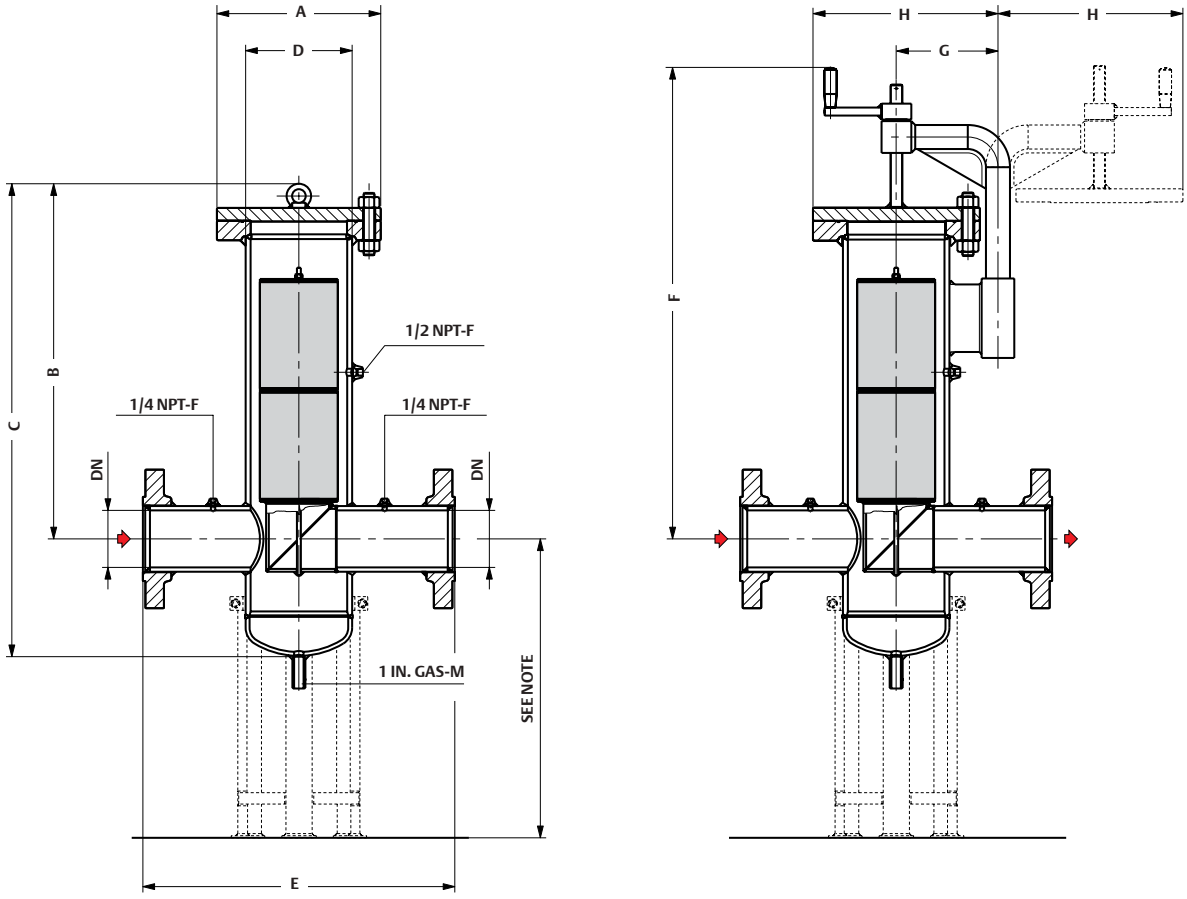
Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	123,601	3500	194,230	5500	282,516	8000	282,516	8000	----	----	----	----	----	----	----	----
14.5	1	132,429	3750	247,201	7000	388,459	11,000	388,459	11,000	----	----	----	----	----	----	----	----
29.0	2	229,544	6500	300,173	8500	441,431	12,500	565,032	16,000	565,032	16,000	----	----	----	----	----	----
73	5	300,173	8500	459,088	13,000	618,003	17,500	741,604	21,000	918,176	26,000	1,130,063	32,000	----	----	----	----
145	10	423,774	12,000	635,661	18,000	953,491	27,000	1,130,063	32,000	1,236,007	35,000	1,412,579	40,000	2,012,925	57,000	----	----
232	16	494,403	14,000	776,919	22,000	1,130,063	32,000	1,412,579	40,000	1,589,151	45,000	1,942,296	55,000	2,295,441	65,000	3,178,303	90,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.42 ft/s) in the filter's tubes. It is recommended that these values not be exceeded.

Table 21. Type 6 (FAG-A and FAG Series) with 12 in. / DN 300 Body Size Flow Capacity

Inlet Pressure (pu)		Pressure Loss (Δp) in psig / mbar															
		0.15 / 10		0.36 / 25		0.73 / 50		1.09 / 75		1.45 / 100		2.18 / 150		3.63 / 250		7.25 / 500	
psig	bar	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h	SCFH	Stm³/h
7.3	0.5	211,887	6000	317,830	9000	388,459	11,000	406,117	11,500	----	----	----	----	----	----	----	----
14.5	1	247,201	7000	353,145	10,000	529,717	15,000	529,717	15,000	----	----	----	----	----	----	----	----
29.0	2	282,516	8000	459,088	13,000	670,975	19,000	812,233	23,000	812,233	23,000	----	----	----	----	----	----
73	5	476,745	13,500	706,290	20,000	882,862	25,000	1,059,434	30,000	1,236,007	35,000	1,589,151	45,000	----	----	----	----
145	10	670,975	19,000	988,805	28,000	1,483,208	42,000	1,695,095	48,000	1,765,724	50,000	2,118,869	60,000	3,001,730	85,000	----	----
232	16	776,919	22,000	1,236,007	35,000	1,765,724	50,000	2,189,498	62,000	2,472,013	70,000	3,001,730	85,000	3,178,303	90,000	4,590,882	130,000

- In the grey-marked areas, capacity is restricted by gas speed (max 98.42 ft/s) in the filter's tubes. It is recommended that these values not be exceeded.



STANDARD FLANGED OPENING SYSTEM

FLANGED OPENING SYSTEM WITH DAVIT LIFTING SYSTEM

Figure 3. *FA-11, FA-12 and FA-12-AP Series Dimensions*

Table 22. FA-11, FA-12 and FA-12-AP Series (Flanged Opening) Dimension and Weight

BODY SIZE		DIMENSION																VOLUME		FILTERING SURFACE		CARTRIDGE		WEIGHT			
		A		B		C		D		E		F		G		H								FA/11		FA/12	
In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	gal	L	in²	m²	Type	Qty	LB	kg	LB	kg
2	50	8.86	225	18.50	470	25.98	660	5.56	141.3	17.72	450	----	----	----	----	----	----	2.25	8.5	387.48	0.250	G 1		77	35	97	44
2-1/2	65	10.24	260	20.08	510	28.15	715	6.63	168.3	19.69	500	----	----	----	----	----	----	3.83	14.5					88	40	110	50
3	80	11.81	300	23.39	594	33.66	855	7.64	194	23.62	600	----	----	----	----	----	----	6.08	23	712.96	0.460	G 1.5		101	46	176	80
4	100	11.81	300	23.39	594	33.66	855	7.64	194	23.62	600	----	----	----	----	----	----	6.47	24.5					110	50	207	94
4	100S	14.96	380	28.74	730	40.55	1030	8.63	219.1	27.56	700	----	----	----	----	----	----	8.45	32	1456.9	0.940	G 2	2	----	----	375	170
6	150	16.14	410	36.22	920	51.57	1310	10.75	273	31.50	800	47.24	1200	10.04	255	18.50	470	21.13	80	2247.4	1.450	G 2.5		419	190	661	300
8	200	18.90	480	40.39	1026	53.54	1360	14.02	356	35.43	900	52.20	1326	11.81	300	21.26	540	34.35	130	2944.8	1.900	G 3		573	260	882	400
10	250	22.44	570	44.88	1140	61.14	1553	16.00	406.4	39.37	1000	58.15	1477	13.19	335	24.80	630	49.93	189	4494.7	2.900	G 4		992	450	1521	690
12	300	25.98	660	56.54	1436	77.95	1980	20.00	508	47.24	1200	66.34	1685	15.24	387	28.62	727	103	390	7129.6	4.600	G 5		1433	650	2160	980
14	350																			7129.6	4.600	G 5					
16	400																			13,019	8.40	G 6					

- Available on request.
Note: Starting from 6 in. / DN 150 the filters are supplied with support (recommended height 31.5 in. / 800 mm, other heights are available for different installations).

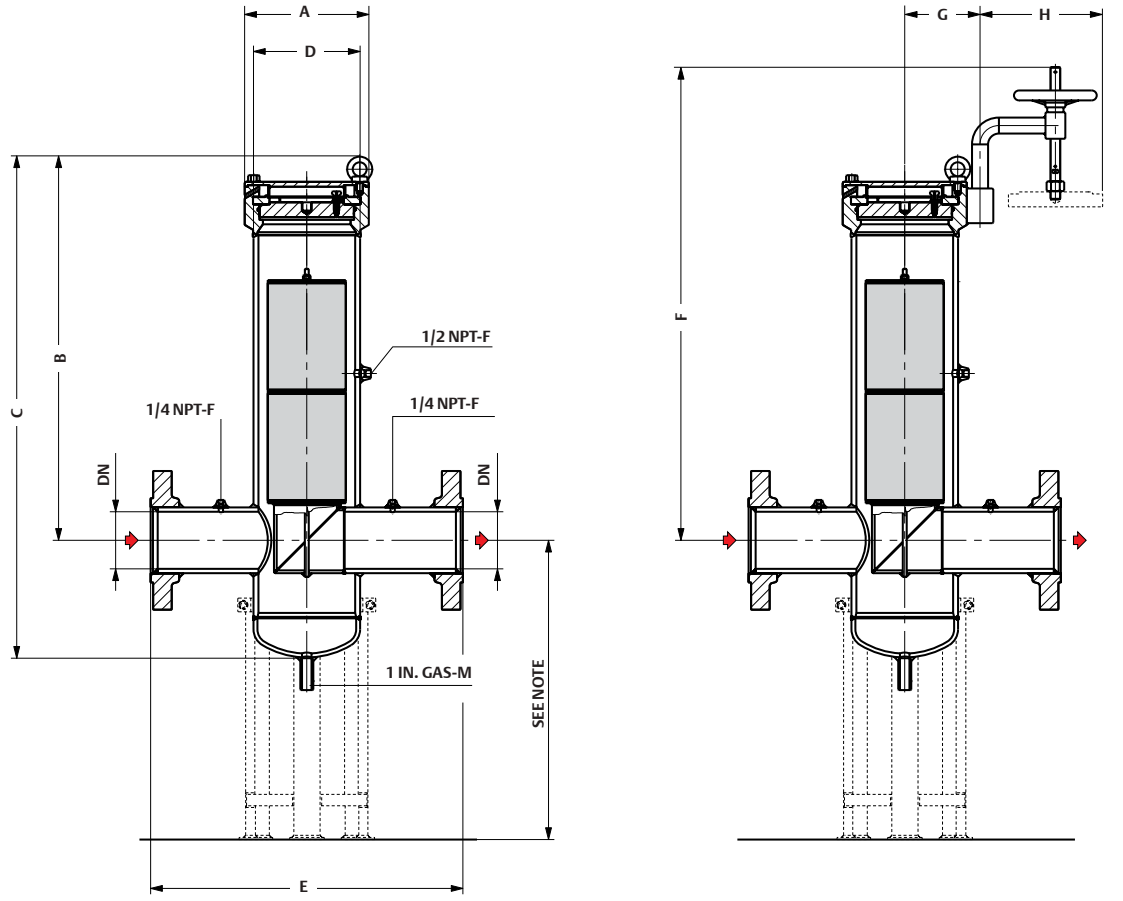


Figure 4. *FA and FA-AP Series Dimensions*

Table 23. FA and FA-AP Series (Quick Opening) Dimension and Weight

TYPE	BODY SIZE		DIMENSION																VOLUME		FILTERING SURFACE		CARTRIDGE		WEIGHT			
			A		B		C		D		E		F		G		H								Standard		Davit	
	In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	gal	L	in²	m²	Type	Qty	LB	kg	LB	kg
FA/10	2	50	6.61	168	22.72	577	29.06	738	5.55	141	17.72	450	----	----	----	----	----	----	1.98	7.5	387.48	0.250	G 1		97	44	----	----
FA/15	3	80	7.64	194	29.02	737	36.73	933	6.61	168	19.69	500	----	----	----	----	----	----	3.70	14	712.96	0.460	G 1.5		176	80	----	----
FA/20	4	100	10.63	270	35.12	892	45.12	1146	8.62	219	23.62	600	----	----	----	----	----	----	9.51	36	1456.9	0.940	G 2		308	140	----	----
FA/25	5	125	11.81	300	37.32	948	50.20	1275	10.75	273	29.53	750	----	----	----	----	----	----	15.59	59	2247.4	1.450	G 2.5	2	569	258	----	----
FA/30	6	150	14.76	375	41.38	1051	55.16	1401	12.76	324	31.50	800	55.24	1403	8.94	227	14.57	370	24.83	94	2944.8	1.900	G 3		----	----	926	420
FA/40	8	200	18.11	460	51.65	1312	68.58	1742	15.98	406	39.37	1000	65.08	1653	10.63	270	17.60	447	47.29	179	4494.7	2.900	G 4		----	----	1312	595
FA/50	12	300	22.24	565	60.87	1546	80.55	2046	20.00	508	43.31	1100	78.31	1989	12.68	322	21.18	538	87.19	330	7129.6	4.600	G 5		----	----	2657	1205

Note: Starting from Type FA/25 the filters are supplied with support (recommended height 31.5 in. / 800 mm, other heights are available for different installations).

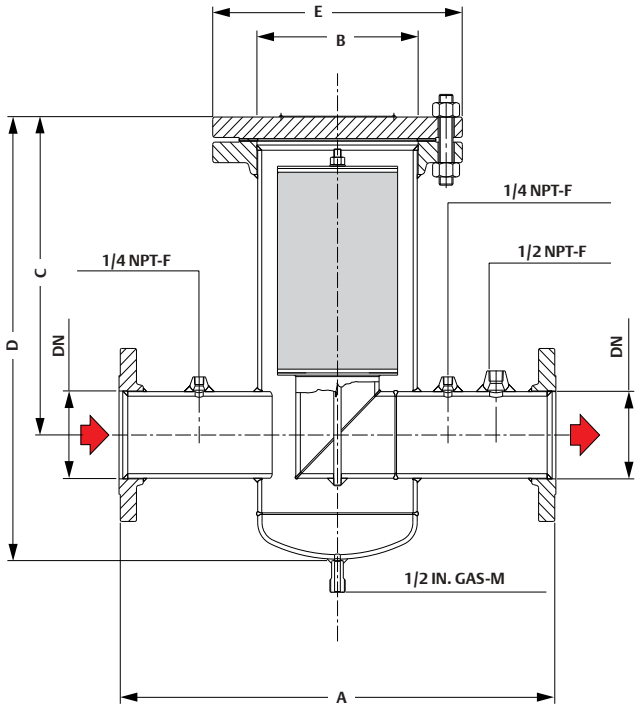


Figure 5. *FAG-A and FAG-A-AP Series Dimensions*

Table 24. FAG-A and FAG-A-AP Series Dimension and Weight

TYPE	BODY SIZE		DIMENSION										VOLUME		FILTERING SURFACE		CARTRIDGE		WEIGHT	
			A		B		C		D		E									
	In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	gal	L	in²	m²	Type	Qty	LB	kg
0.5	2	50	17.72	450	4.50	114.3	8.43	214	13.50	343	8.27	210	0.95	3.6	92.99	0.06	G 0.5	1	50.71	23
0.5-AP							8.58	218	13.35	339	9.00	228.6	0.92	3.5					55.12	25
1	2-1/2	65	17.72	450	5.56	141.3	10.47	266	16.30	414	9.45	240	1.59	6	193.7	0.125	G 1		66.14	30
1-AP							10.75	273	16.54	420	10.00	254							88.18	40
1.5	3	80	23.62	600	6.63	168.3	13.74	349	20.98	533	10.43	265	3.17	12	356.5	0.23	G 1.5		88.18	40
1.5-AP							14.13	359	21.34	542	11.00	279.4							88.18	40
2	4	100	23.62	600	8.63	219.1	16.85	428	24.33	618	12.60	320	5.02	19	728.5	0.47	G 2		141.10	64
2-AP							16.54	420	24.69	627	13.50	342.9	6.08	23					176.37	80
2.5	5	125	31.50	800	10.75	273	17.87	454	27.32	694	14.76	375	11.10	42	1123.7	0.725	G 2.5		205.03	93
2.5-AP							17.87	454	27.32	694	16.00	406.4	10.57	40					302.03	137
3	6	150	35.43	900	12.75	323.8	19.49	495	30.59	777	17.32	440	17.44	66	1472.4	0.95	G 3		286.60	130
3-AP							19.88	505	30.98	787	19.00	482.6	16.91	64					421.08	191
3.5	6	150	35.43	900	16.00	406.4	17.32	440	29.92	760	21.26	540	23.78	90	1472.4	0.95	G 3.5		451.95	205
3.5-AP							18.11	460	30.71	780	23.43	595	24.31	92					568.79	258
4	8	200	39.37	1000	16.00	406.4	25.51	648	39.29	998	21.26	540	34.87	132	2247.4	1.45	G 4		502.65	228
4-AP							26.46	672	40.24	1022	23.43	595	34.61	131					701.07	318
5	10	250	47.24	1200	20.00	508	29.02	737	46.50	1181	25.39	645	64.99	246	3564.8	2.30	G 5		749.57	340
5-AP							29.21	742	46.38	1178	27.56	700	63.94	242					1069.24	485
6	12	300	47.24	1200	24.02	610	36.42	925	53.07	1348	29.53	750	103.83	393	6509.6	4.20	G 6		1102.31	500
6-AP							36.42	925	53.07	1348	29.53	750	101.98	386					1421.98	645

Note: Filters can be ordered with smaller DN (nominal diameters) than those listed in the table and with greater A length.

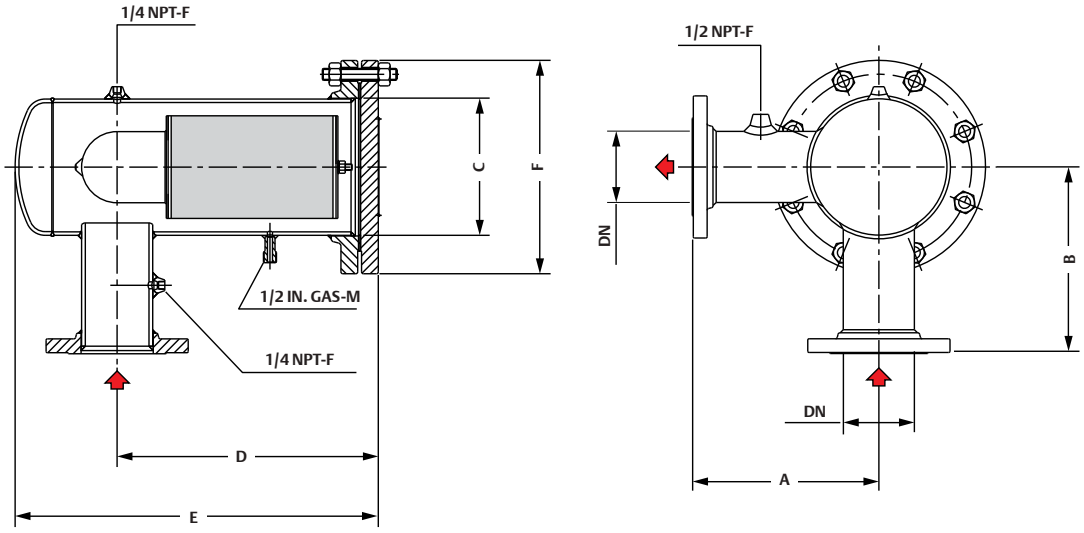


Figure 6. *FAG and FAG-AP Series Dimensions*

Table 25. FAG and FAG-AP Series Dimension and Weight

TYPE	BODY SIZE		DIMENSION												VOLUME		FILTERING SURFACE		CARTRIDGE		WEIGHT	
			A		B		C		D		E		F									
	In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	gal	L	in²	m²	Type	Qty	LB	kg
0.5	2	50	8.86	225	8.86	225	4.50	114.3	8.43	214	13.50	343	8.27	210	0.95	3.6	92.99	0.06	G 0.5	1	50.71	23
0.5-AP									8.58	218	13.35	339	9.00	228.6	0.92	3.5					55.12	25
1	2-1/2	65	8.86	225	8.86	225	5.56	141.3	10.47	266	16.30	414	9.45	240	1.59	6	193.7	0.125	G 1		66.14	30
1-AP									10.75	273	16.54	420	10.00	254							88.18	40
1.5	3	80	11.81	300	11.81	300	6.63	168.3	13.74	349	20.98	533	10.43	265	3.17	12	356.5	0.23	G 1.5		88.18	40
1.5-AP									14.13	359	21.34	542	11.00	279.4							88.18	40
2	4	100	11.81	300	11.81	300	8.63	219.1	16.85	428	24.33	618	12.60	320	5.02	19	728.5	0.47	G 2		141.10	64
2-AP									16.54	420	24.69	627	13.50	342.9	6.08	23					176.37	80
2.5	5	125	15.75	400	15.75	400	10.75	273	17.87	454	27.32	694	14.76	375	11.10	42	1123.7	0.725	G 2.5		205.03	93
2.5-AP									17.87	454	27.32	694	16.00	406.4	10.57	40					302.03	137
3	6	150	17.72	450	17.72	450	12.75	323.8	19.49	495	30.59	777	17.32	440	17.44	66	1472.4	0.95	G 3		286.60	130
3-AP									19.88	505	30.98	787	19.00	482.6	16.91	64					421.08	191
3.5	6	150	17.72	450	17.72	450	16.00	406.4	17.32	440	29.92	760	21.26	540	23.78	90	1472.4	0.95	G 3.5		451.95	205
3.5-AP									18.11	460	30.71	780	23.43	595	24.31	92					568.79	258
4	8	200	19.69	500	19.69	500	16.00	406.4	25.51	648	39.29	998	21.26	540	34.87	132	2247.4	1.45	G 4		502.65	228
4-AP									26.46	672	40.24	1022	23.43	595	34.61	131					701.07	318
5	10	250	23.62	600	23.62	600	20.00	508	29.02	737	46.50	1181	25.39	645	64.99	246	3564.8	2.30	G 5		749.57	340
5-AP									29.21	742	46.38	1178	27.56	700	63.94	242					1069.24	485
6	12	300	23.62	600	23.62	600	24.02	610	36.42	925	53.07	1348	29.53	750	103.83	393	6509.6	4.20	G 6		1102.31	500
6-AP									36.42	925	53.07	1348	29.53	750	101.98	386					1421.98	645

Note: Filters can be ordered with smaller DN (nominal diameters) than those listed in the table and with greater A and B lengths.

Ordering Guide

Type (Select One)

- ☐ FA/
- ☐ FA-AP/
- ☐ FA-11/
- ☐ FA-12/
- ☐ FA-12-AP/
- ☐ FAG/
- ☐ FAG-A/
- ☐ FAG-AP/
- ☐ FAG-A-AP/

Body Size (Select One)

- ☐ 2 NPS / DN 50***
- ☐ 2-1/2 NPS / DN 65***
- ☐ 3 NPS / DN 80***
- ☐ 4 NPS / DN 100***
- ☐ 5 NPS / DN 125, FAG Series Only***
- ☐ 6 NPS / DN 150***
- ☐ 8 NPS / DN 200***
- ☐ 10 NPS / DN 250***
- ☐ 12 NPS / DN 300***
- ☐ 14 NPS / DN 350, FA Series only***
- ☐ 16 NPS / DN 400, FA Series only***

End Connection Styles (Select One)

FAG Series

- ☐ PN 16***
- ☐ CL150***

FA Series

- ☐ CL150***
- ☐ CL300***
- ☐ CL600***

Operating Temperature (Select One)

- ☐ Standard***
- ☐ Low Temperature**

Inlet/Outlet Pressure Required

_____ please specify

Options (Select all that apply)

- ☐ Blind Flange Closure - FA Series only***
- ☐ Closure Flange Lifting System - FA Series only***
- ☐ Drain Valve***
- ☐ Local Clogging Indicator***
- ☐ Remote Clogging Indicator***

Special Requirements (Optional)

_____
_____

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Regulator Tip:

Four easy ways to find the products you need . . .
1. Section headers at the top of each page are grouped by application of product (i.e., Natural Gas).
2. The Product Index at the back of this Application Guide contains a detailed list of products arranged by type and application.
3. If you know the application and product number, turn to the Application Map of that section and locate the Section Outline which indexes all of the products found in that section.
4. Look for the product type number in the Quick Reference Chart in the Table of Contents.

FL Series
Pressure Reducing Regulators

TARTARINI™

Introduction

The FL Series regulators are accurate pilot-operated, pressure-balanced, soft-seated regulators designed for high pressure transmission/city gate, large capacity distribution systems and power plant feeds. The FL Series provides smooth, quiet operation, tight shutoff and long service life. The regulator uses a main valve actuator, a Type PRX pressure reducing pilot and a Type SA/2 pilot supply pressure regulator or a Type PS compact pressure reducing pilot.

This regulator's superior performance is due to the amplifying effect of the pilot and two-path control system. Outlet pressure changes act quickly on the actuator diaphragm to provide fast response to system change.

Available Configurations

Type FL[1]: Regulator for medium to high outlet pressures
Type FL-BP: Type FL for lower operating pressures
Type MFL: Type FL regulator and monitor in one unit for overpressure protection
Type MFL-BP: Type MFL for lower operating pressures
Type BFL: Regulator with built-in shutoff valve
Type BFL-BP: Type BFL for lower operating pressures

Body Sizes

Same Inlet and Outlet:
NPS 1[1], 1-1/2, 2[1], 2-1/2, 3[1], 4[1], 6[1][2], 8[1][3] and 10[1][3]/DN 25[1], 40, 50[1], 65, 80[1], 100[1], 150[1][2], 200[1][3] and 250[1][3]
Different Inlet and Outlet with Type SRS Silencer:
NPS 1 x 4[1], 1-1/2 x 6, 2 x 6[1], 2-1/2 x 8, 3 x 10[1], 4 x 10[1], 6 x 12[1][4] and 8 x 16[1] / DN 25 x 100[1], 40 x 150, 50 x 150[1], 65 x 200, 80 x 250[1], 100 x 250[1], 150 x 300[1][4] and 200 x 400[1]

Main Valve End Connection Style and Pressure Ratings

Type FL-BP Configurations
CL150 RF/PN 16/25: 363 psig / 25.0 bar
Type FL Configurations
CL300 RF: 740 psig / 51.0 bar
CL600 RF: 1480 psig / 102 bar

1. North American market is limited to Type FL only.
2. NPS 6 / DN 150 Types FL and FL-BP only.
3. NPS 8 and 10 / DN 200 and 250 Type FL only.
4. NPS 6 x 12 / DN 150 x 300 Types FL and FL-BP only.
5. Low-temperature version is temperature capability of Type FL in North America.

Maximum Allowable Pressure

Type FL-BP Configurations
Up to 363 psig / 25.0 bar
Type FL Configurations
Up to 1480 psig / 102 bar

Minimum Operating Differential Pressure

Type FL-BP Configurations
2.9 psid / 0.20 bar d
Type FL Configurations
Start Open: 7.3 psid / 0.50 bar d
Full Open: 14.5 psid / 1.00 bar d

Outlet Pressure Ranges

See Tables 3 and 4

Flow Coefficients

See Table 2

Temperature Capabilities

Standard version:
Working: 14 to 140°F / -10 to 60°C
Low-Temperature Version[5]:
Working: -20 to 140°F / -29 to 60°C

Accuracy Class

Up to ± 1%

Approximate Weights (Including Pilot)

See Tables 5 and 6

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- Control Accuracy
- High Capacity
- Versatility
- Control Accuracy
- Easy In-Line Maintenance
- Easy Startup
- No Atmospheric Bleed
- Tight Shutoff
- Quiet Operation
- In-Service Travel Indicator
- Full strength diaphragm



TYPE FL WITH PRX SERIES PILOT

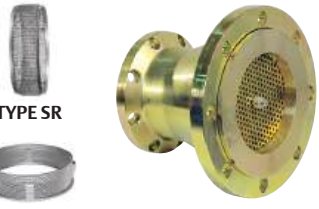


TYPE MFL REGULATOR AND MONITOR



TYPE BFL REGULATOR WITH SHUTOFF VALVE

Figure 1. *FL Series Regulators*



TYPE SR

E0822

TYPE SR II

TYPE SRS

Figure 2. *Noise Abatement Construction*

EMERSON
Process Management

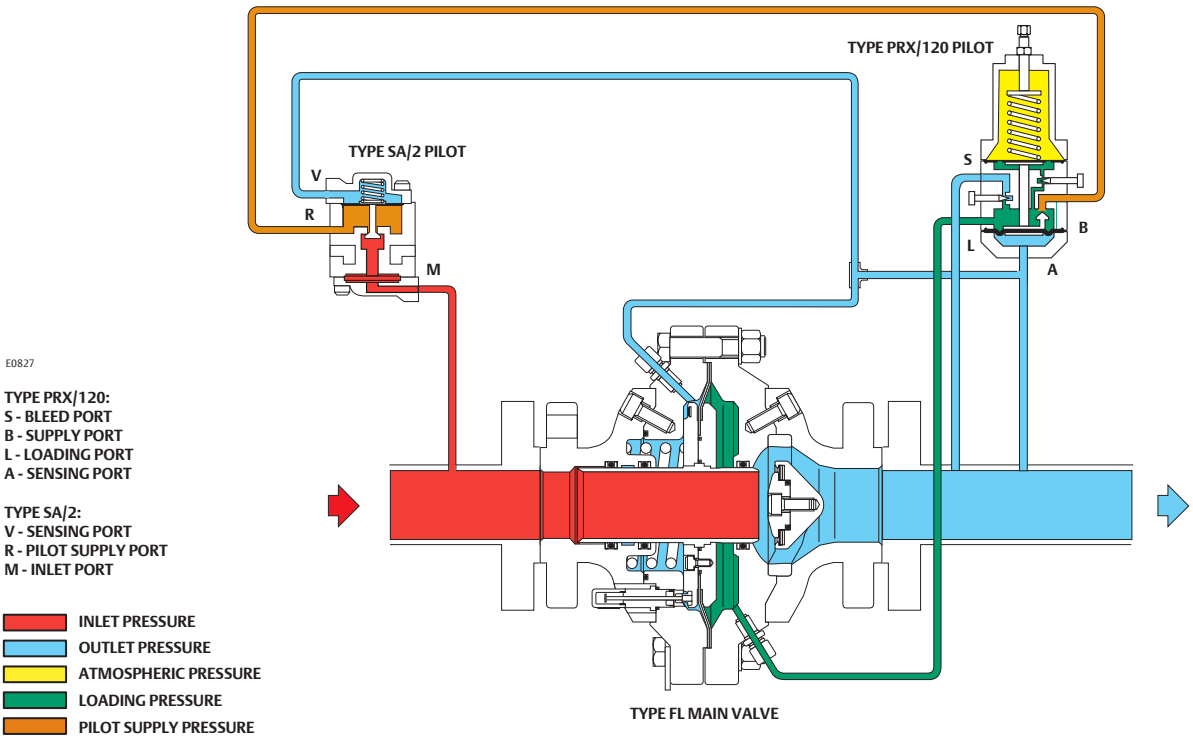


Figure 3. *Type FL Operational Schematic*

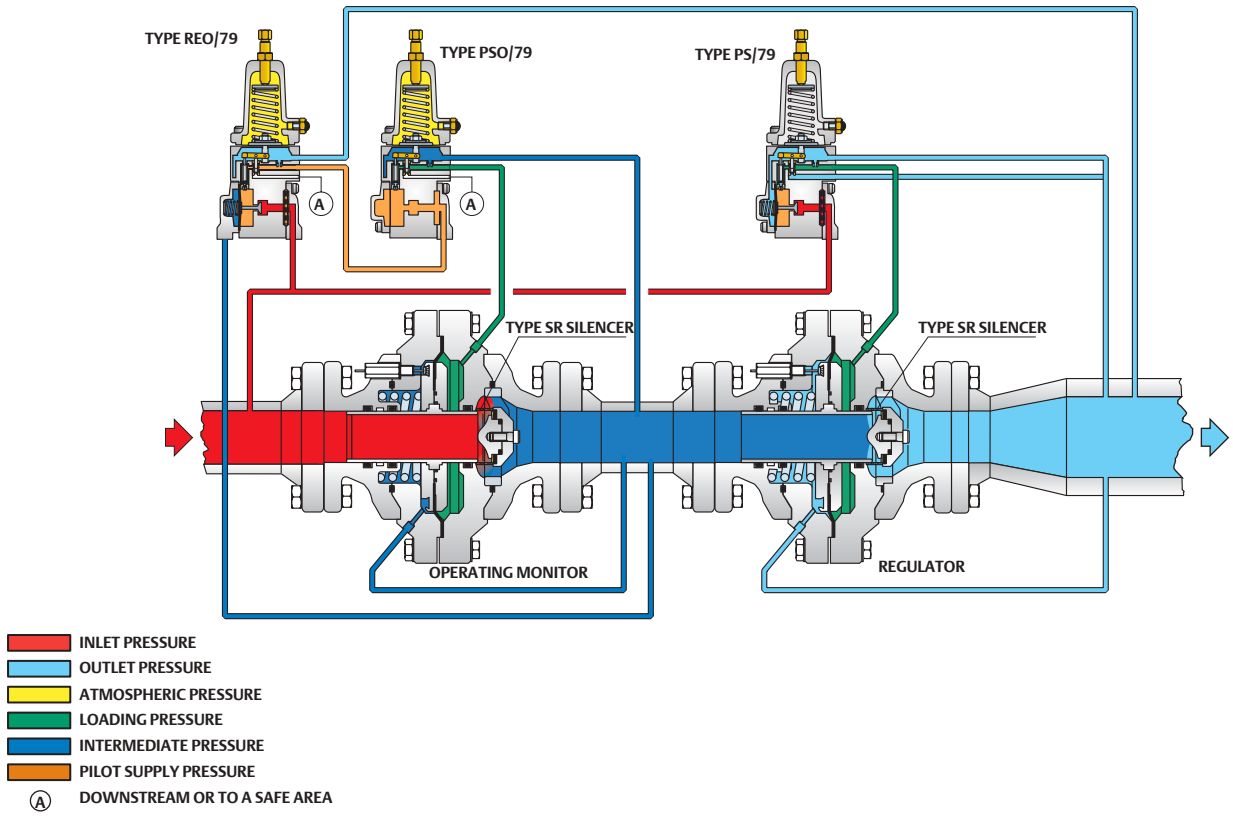


Figure 4. *Working (Operating) Monitor Operational Schematic*

Table 1. Main Valve Construction Materials

MAIN BODY, FLANGE, SLEEVE, DISK HOLDER AND DIAPHRAGM PLATE	DIAPHRAGM	DISK	O-RING
Steel	Nitrile (NBR) with PVC Coating	Nitrile (NBR), Fluorocarbon (FKM) or Polyurethane (PU)	Nitrile (NBR) or Fluorocarbon (FKM)

Table 2. Flow Coefficients[1]

BODY SIZE			TYPE NUMBER										
NPS	DN	COEFFICIENT	FL-BP* FL*	FL-BP-SR* FL-SR*	FL-SRII[2]	FL-BP-SRS FL-SR/SRS	FL-SRII/SRS	MFL-BP* MFL*	MFL-BP-SR* MFL-SR*	MFL-BP-SRS MFL-SRS	BFL-BP* BFL*	BFL-BP-SR* BFL-SR*	BFL-BP-SRS BFL-SRS
1	25	C_g	590	580	540	570	530	440	430	400	430	420	370
		C_v	18.4	17.3	16.0	15.6	14.3	14.7	14.3	12.5	14.3	14	11.6
		C_1	32.1	33.4	33.5	36.6	37.1	30	30	32	30	30	32
1-1/2	40	C_g	1400	1350	----	1200	----	1130	1100	1020	1130	1110	970
		C_v	50	48.2		40		39	37.9	32.9	39	38.3	31.3
		C_1	28	28		30		29	29	31	29	29	31
2	50	C_g	2300	2200	2000	1900	1700	1850	1800	1600	1850	1800	1530
		C_v	70.6	65.3	59.8	48.9	44.8	66.1	64.3	53.3	66.1	64.3	51
		C_1	32.6	33.7	33.4	38.9	38.0	28	28	30	28	28	30
2-1/2	65	C_g	3500	3350	----	2900	----	2800	2700	2450	2850	2750	2360
		C_v	121	116		93.5		93.3	90	76.6	95	91.7	73.8
		C_1	29	29		31		30	30	32	30	30	32
3	80	C_g	5200	5000	4400	4000	3500	4100	4000	3550	4150	4050	3390
		C_v	161.9	151.7	138	111.7	101.6	137	133	111	138	135	106
		C_1	32.1	33	30	35.8	34.4	30	30	32	30	30	32
4	100	C_g	8000	7400	6500	6200	5400	6800	6600	5800	6900	6700	5490
		C_v	249.3	226.5	196.5	164.7	142.9	243	236	193	246	239	183
		C_1	32.1	32.7	32.9	37.7	37.8	28	28	30	28	28	30
6	150	C_g	20,300	17,800	16,200	14,000	12,700	----	----	----	----	----	----
		C_v	735.8	597.5	480.7	436.3	351.0						
		C_1	27.6	29.8	31.7	32.1	36.2						
8	200	C_g	30,900	----	25,335	----	20,100	----	----	----	----	----	----
		C_v	1080.4		784		515.0						
		C_1	28.6		32.3		39.0						
10	250	C_g	52,100	----	42,500	----	----	----	----	----	----	----	----
		C_v	1615.4		1197.9								
		C_1	32.3		35.5								

1. Flow coefficients (regulating) shown apply only to regulators with line size equals body size.
2. Type SRII Silencer is applicable only for Type FL.
*Values valid also for widened outlet version.

Table 3. Outlet Pressure Ranges of Regulator or Monitor Pilots

TYPE	USE	OUTLET PRESSURE RANGE		ALLOWABLE PRESSURE		BODY AND COVER MATERIAL
		psig	bar	psig	bar	
PS/79-1[1]	Regulator or Monitor	0.15 to 7.3	0.01 to 0.50	363	25.0	Aluminum
PS/79-2[1]	Regulator or Monitor	7.3 to 44	0.50 to 3.0			
PS/79[1]	Regulator or Monitor	7.3 to 580	0.50 to 40.0	1450	100	Steel
PSO/79[1]	Operating Monitor - Regulator					
REO/79[1]	Operating Monitor - Monitor					
PS/80[1]	Regulator or Monitor	22 to 580	1.5 to 40.0	1450	100	Steel
PSO/80[1]	Operating Monitor - Regulator					
REO/80[1]	Operating Monitor - Monitor					
PRX/120[2]	Regulator or Monitor	14.5 to 26 23 to 44 41 to 80 73 to 123 116 to 210 203 to 334 319 to 435	1.00 to 1.8 1.6 to 3.0 2.8 to 5.5 5.0 to 8.5 8.0 to 14.5 14.0 to 23.0 22.0 to 30.0	1450	100	Steel
PRX/125[2]	Monitor					
PRX-AP/120[2]	Regulator or Monitor	435 to 1160	30.0 to 80.0	1450	100	Steel
PRX-AP/125[2]	Monitor					

1. All PS Series pilots are supplied with a filter (5-micron filtering degree) and built-in pressure stabilizer, with the exception of Types PSO/79 and PSO/80.
2. The Type SA/2 pressure pre-reducer must be used with PRX Series pilots.

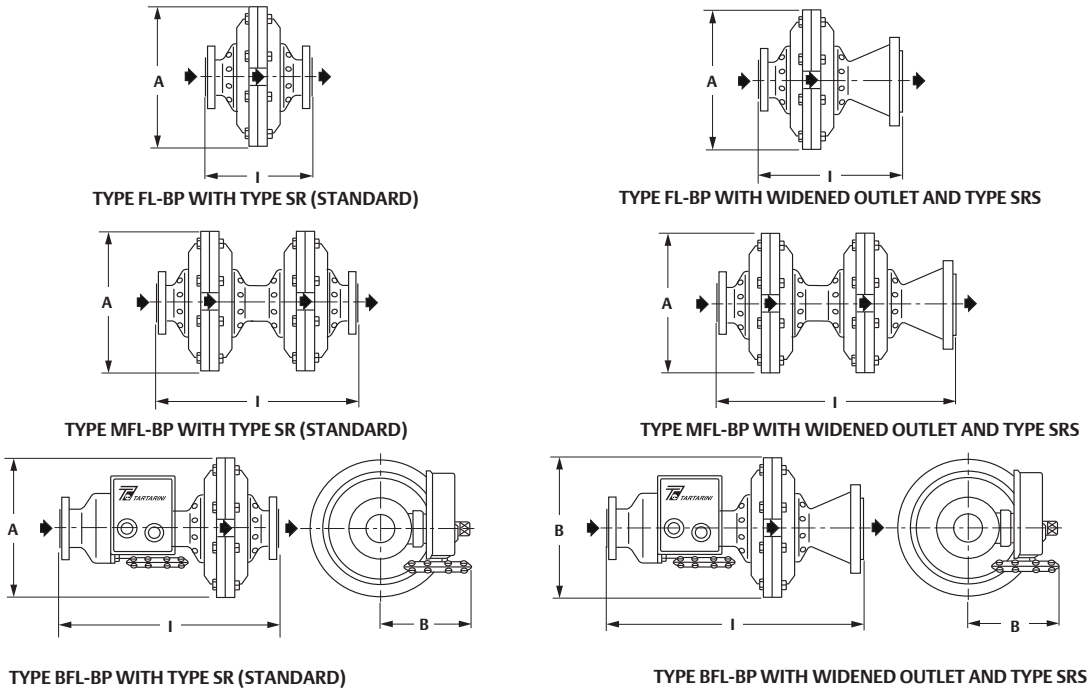


Figure 5. *Dimensions for Type FL-BP Configurations*

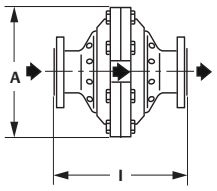
Table 4. Outlet Pressure Ranges of Shutoff Device Pilots of Type BFL/BFL-BP

TYPE	SERVOMOTOR BODY RESISTANCE		OVERPRESSURE SET RANGE: W_{ho}				UNDERPRESSURE SET RANGE: W_{hu}			
			Minimum		Maximum		Minimum		Maximum	
	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
OS/80X-BP	73	5.0	0.44	0.03	29	2.00	0.15	0.01	8.7	0.60
OS/80X-BPA-D	290	20.0	0.44	0.03	29	2.00	0.15	0.01	8.7	0.60
OS/80X-MPA-D	1450	100	7.3	0.50	73	5.00	3.6	0.25	58	4.0
OS/80X-APA-D	1450	100	29	2.00	145	10.0	4.4	0.30	102	7.0
OS/84X	1450	100	73	5.00	595	41.0	58	4.0	232	16.0
OS/88X	1450	100	261	18.0	1160	80.0	116	8.0	1015	70.0
OS/80X-PN(1)	1450	100	7.3	0.50	580	40.0	7.3	0.50	580	40.0
OS/84X-PN(1)	1450	100	435	30.0	1160	80.0	435	30.0	1160	80.0

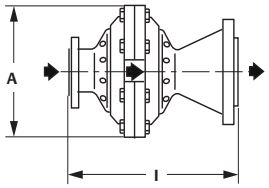
1. The following pilots are used with BFL Series regulator with built-in shutoff device.

Table 5. Dimensions and Shipping Weights for Type FL-BP Configurations

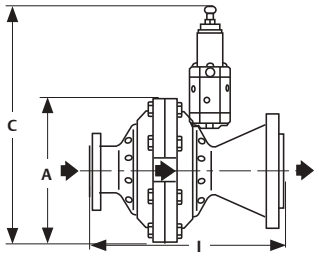
BODY SIZE		DIMENSION										APPROXIMATE SHIPPING WEIGHT					
		Standard and with Type SR															
		l (Face-to-Face)						A		B		PN 16/25 or CL150 RF					
		PN 16/25 or CL150 RF										Type FL-BP		Type MFL-BP		Type BFL-BP	
		Type FL-BP		Type MFL-BP		Type BFL-BP											
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	lb	kg	lb	kg	lb	kg
1	25	7.2	184	14.2	360	14.0	355	11.2	285	7.8	199	53	24	106	48	84	38
1-1/2	40	8.7	222	16.7	424	16.1	410	12.0	306	8.1	206	82	37	170	77	110	50
2	50	10.0	254	20.1	510	19.1	485	13.2	335	8.4	213	106	48	214	97	132	60
2-1/2	65	10.9	276	21.3	542	20.9	530	14.6	370	8.9	227	150	68	309	140	220	100
3	80	11.7	298	22.2	564	22.0	560	15.7	400	9.6	245	183	83	370	168	291	132
4	100	13.9	352	26.6	675	26.4	670	17.7	450	10.6	269	231	105	527	239	434	197
6	150	17.8	451	----		----		23.2	590	----		562	255	----		----	
		Widened Outlet and With Type SRS															
1 x 4	25 x 100	11.4	290	18.3	466	18.2	461	11.2	285	7.8	199	66	30	119	54	97	44
1-1/2 x 6	40 x 150	13.8	350	21.7	552	21.2	538	12.0	306	8.1	206	104	47	192	87	132	60
2 x 6	50 x 150	15.0	380	25.0	636	24.1	611	13.2	335	8.4	213	128	58	236	107	154	70
2-1/2 x 8	65 x 200	16.5	420	27.0	686	26.5	674	14.6	370	8.9	227	198	90	357	162	269	122
3 x 10	80 x 250	18.5	470	29.0	736	28.8	732	15.7	400	9.6	245	282	128	470	213	390	177
4 x 10	100 x 250	20.7	525	33.4	848	33.2	843	17.7	450	10.6	269	331	150	626	284	534	242
6 x 12	150 x 300	24.8	630	----		----		23.2	590	----		838	380	----		----	



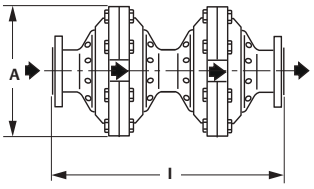
TYPE FL WITH TYPE SR (STANDARD)



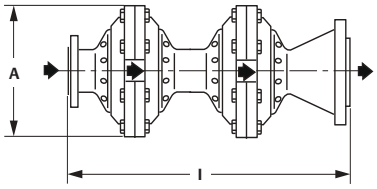
TYPE FL WITH WIDENED OUTLET AND TYPE SRS



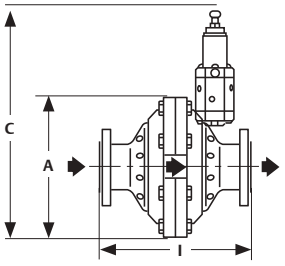
TYPE FL WITH TYPE SRS AND TYPE PRX PILOT



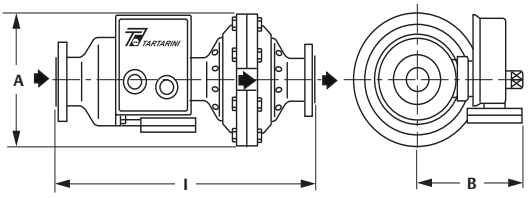
TYPE MFL WITH TYPE SR (STANDARD)



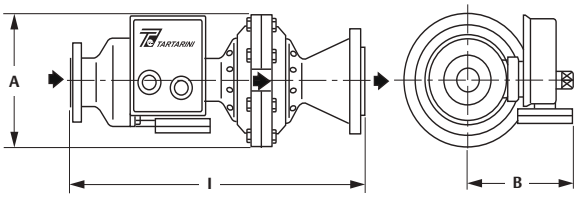
TYPE MFL WITH WIDENED OUTLET AND TYPE SRS



TYPE MFL WITH TYPE PRX PILOT



TYPE BFL WITH TYPE SR (STANDARD)



TYPE BFL WITH WIDENED OUTLET AND TYPE SRS

Figure 6. *Dimensions for Type FL Configurations*

Table 6. Dimensions and Shipping Weights for Type FL Configurations

BODY SIZE		DIMENSION												APPROXIMATE SHIPPING WEIGHT					
		Standard and with Type SR/SRII																	
		l (Face-to-Face)						A		B		C		CL300 or CL600 RF					
		CL300 or CL600 RF												Type FL		Type MFL		Type BFL	
		Type FL		Type MFL		Type BFL													
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	lb	kg	lb	kg	lb	kg
1	25	8.3	210	15.2	385	15.4	390	8.9	225	7.8	199	17.1	430	68	31	161	73	108	49
1-1/2	40	9.9	251	17.7	450	17.5	445	10.4	265	8.1	206	----		103	47	212	96	157	71
2	50	11.3	286	21.1	535	20.3	515	11.3	287	8.4	213	19.5	490	132	60	249	113	198	90
2-1/2	65	12.2	311	22.6	574	22.0	560	14.0	355	8.9	227	----		194	88	384	174	284	129
3	80	13.3	337	23.6	600	23.6	600	15.7	400	9.6	245	23.4	590	326	148	653	296	459	208
4	100	15.5	394	28.3	720	28.0	710	18.9	480	10.6	269	26.8	680	443	201	803	364	655	297
6	150	20.0	508	----		----		24.0	610	----		33.9	860	1058	480	----		----	
8 (CL300)	200 (CL300)	22.4	569	----		----		25.7	653	----		39.5	1000	1367	620	----		----	
8 (CL600)	200 (CL600)	24.0	610																
10 (CL300)	250 (CL300)	27.8	708	----		----		30.9	785	----		43.3	1100	2623	1190	----		----	
10 (CL600)	250 (CL600)	29.6	752																
		Widened outlet and With Type SRS																	
1x4	25 x 100	11.9	300	18.7	475	18.9	480	8.9	225	7.8	199	17.1	430	99	45	192	87	139	63
1-1/2x6	40 x 150	14.6	370	22.4	569	22.2	564	10.4	265	8.1	206	----		163	74	271	123	216	98
2x6	50 x 150	15.7	400	25.6	649	24.8	629	11.3	287	8.4	213	19.5	490	192	87	309	140	258	117
2-1/2x8	65 x 200	17.3	440	27.7	703	27.1	689	14.0	355	8.9	227	----		297	135	485	220	388	176
3x10	80 x 250	19.7	500	30.0	763	30.0	763	15.7	400	9.6	245	23.4	590	514	233	838	380	646	293
4x10	100 x 250	20.7	525	33.5	851	33.1	841	18.9	480	10.6	269	26.8	680	631	286	992	450	842	382
6x12	150 x 300	26.0	660	----		----		24.0	610	----		33.9	860	1367	620	----		----	
8x16 (CL300)	200 x 400 (CL300)	28.4	722	----		----		25.7	653	----		39.5	1000	1984	900	----		----	
8x16 (CL600)	200 x 400 (CL600)	29.5	750																

Ordering Guide

Type (Select One)

- ☐ FL
- ☐ FL-BP
- ☐ MFL
- ☐ MFL-BP
- ☐ BFL
- ☐ BFL-BP

Body Size (Select One)

Same Inlet and Outlet

- ☐ NPS 1 / DN 25**
- ☐ NPS 1-1/2 / DN 40**
- ☐ NPS 2 / DN 50**
- ☐ NPS 2-1/2 / DN 65**
- ☐ NPS 3 / DN 80**
- ☐ NPS 4 / DN 100**
- ☐ NPS 6 / DN 150 - Types FL-BP and FL only**
- ☐ NPS 8 / DN 200 - Type FL only**
- ☐ NPS 10 / DN 250 - Type FL only**

Different Inlet and Outlet (with Type SRS Silencer)

- ☐ NPS 1 x 4 / DN 25 x 100**
- ☐ NPS 1-1/2 x 6 / DN 40 x 150**
- ☐ NPS 2 x 6 / DN 50 x 150**
- ☐ NPS 2-1/2 x 8 / DN 65 x 200**
- ☐ NPS 3 x 10 / DN 80 x 250**
- ☐ NPS 4 x 10 / DN 100 x 250**
- ☐ NPS 6 x 12 / DN 150 x 300 - Types FL and FL-BP only**
- ☐ NPS 8 x 16 / DN 200 x 400 - Type FL only**

Silencer - For Clean Gas Only (Select One)

- ☐ Type SR**
- ☐ Type SRII**
- ☐ Type SR/SRS**
- ☐ Type SRII/SRS**
- ☐ None

Outlet Flange Spacer (Optional)

- ☐ Yes**
- ☐ No

End Connection Style (Select One)

Type FL-BP Configuration

- ☐ PN 16**
- ☐ PN 25**
- ☐ CL150 RF**

Type FL Configuration

- ☐ CL300 RF**
- ☐ CL600 RF**

O-ring Material (Select One)

- ☐ Nitrile (NBR)**
- ☐ Fluorocarbon (FKM)**

Disk Material (Select One)

- ☐ Nitrile (NBR)**
- ☐ Fluorocarbon (FKM)**
- ☐ Polyurethane (PU)**

Valve Disk (Select One)

- ☐ Polyurethane (PU)**
- ☐ Fluorocarbon (FKM)**

Pilot Diaphragm (Select One)

- ☐ Nitrile (NBR)**
- ☐ Fluorocarbon (FKM)**

Type SA/2 O-ring and Diaphragm Material (Select One)

- ☐ Nitrile (NBR)**
- ☐ Fluorocarbon (FKM)**

Working Temperature Range (Select One)

- ☐ Standard Version: 14 to 140°F / -10 to 60°C**
- ☐ Low Temperature Version: -20 to 140°F / -29 to 60°C**

Pilot Type (Select One - See Table 3)

- ☐ PS/79**
- ☐ PS/79-1**
- ☐ PS/79-2**
- ☐ PSO/79**
- ☐ REO/79**
- ☐ PS/80**
- ☐ PSO/80**
- ☐ REO/80**
- ☐ PRX/120**
- ☐ PRX125**
- ☐ PRX-AP/120**
- ☐ PRX-AP/125**

- continued -

Ordering Guide (continued)

Setpoint (Fill in - See Table 3 or 4)

Regulator Outlet Pressure: _____
Built-in Monitor Outlet Pressure: _____
Built-in Safety Shutoff Device Minimum Pressure: _____
Built-in Safety Shutoff Device Maximum Pressure: _____

Monitor Booster Valve Type (Select One)

☐ V/31-1**
☐ PRX/131**
☐ PRX-AP/131**

PED Certificate (Mandatory Only for CE Market)

☐ Yes**

Replacement Parts Kit (Optional)

☐ Yes, send one replacement parts kit to match this order.

Installation (Select One)

Horizontal Flow
☐ Left to Right
☐ Right to Left
Vertical Flow
☐ Downward
☐ Upward

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

When installing a working monitor station, get as much volume between the two regulators as possible. This will give the upstream regulator more room to control intermediate pressure.

Introduction

FL Series relief valve or backpressure regulator is accurate, pilot-operated and designed for high-pressure transmission/city gate, large capacity distribution systems and power plant feeds. FL Series provides smooth, tight shutoff and long service life.

The relief valve or backpressure regulator utilizes a main valve actuator, a Type PRX/182 or PRX-AP/182 pilot. The regulator's superior performance is due to the amplifying effect of the pilot and two-path control system. Changes in inlet pressure act quickly on the actuator diaphragm to provide fast response to system change.

Available Construction:

Types FL and VS-FL: Medium to high pressure applications with Pilot Type PRX/182 or PRX/182-AP
Type VS-FL-BP: Low to medium pressure applications with Pilot Type PRX/182

Body Sizes

Types FL and VS-FL: NPS 1, 1-1/2, 2, 2-1/2, 3, 4, 6, 8 and 10 / DN 25, 40, 50, 65, 80, 100, 150, 200 and 250
Type VS-FL-BP: NPS 1, 1-1/2, 2, 2-1/2, 3, 4, and 6 / DN 25, 40, 50, 65, 80, 100 and 150

Main Valve End Connection Style and Pressure Ratings(1)

PN 16: 232 psig / 16 bar
CL150 RF: 290 psig / 20 bar
CL300 RF: 740 psig / 51.0 bar
CL600 RF: 1480 psig / 102 bar

Minimum Differential Pressure:

7.25 psid / 0.50 bar d

Accuracy Class

See Table 4

Set (Control) Pressure Ranges

See Table 1

Flow and Sizing Coefficients

See Table 5

Pilot Regulator Flow Coefficients

Type PRX Pilot: C_g: 10.5; C_v: 0.36; C_1: 29

Pilot Connections

1/4 NPT

Pressure Registration

External

Temperature Capabilities

Type FL:
Nitrile (NBR) or Fluorocarbon (FKM) Disk(2):
-4 to 140°F / -20 to 60°C
Nitrile (NBR) Disk(3):
-20 to 140°F / -29 to 60°C
Types VS-FL and VS-FL-BP
Standard Version:
14 to 140°F / -10 to 60°C
Low Temperature Version:
-4 to 140°F / -20 to 60°C

Approximate Weights (Including Pilot)

See Table 5

Construction Materials

Type FL Main Valve
Main Body and Flanges: Steel
Sleeve and Disk Holder: Steel
Diaphragm Plates: Steel
Diaphragm: Nitrile (NBR) with PVC coating
Disk O-rings: Nitrile (NBR) or Fluorocarbon (FKM)
Disk: Nitrile (NBR) or Fluorocarbon (FKM)
Type PRX Pilot
Body: Steel
Trim: Stainless Steel
Diaphragm: Nitrile (NBR) or Fluorocarbon (FKM)
Disk O-rings: Nitrile (NBR) or Fluorocarbon (FKM)
Disk: Polyurethane (PU) or Fluorocarbon (FKM)

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com



Figure 1. *Type FL Relief Valve or Backpressure Regulator*

Features

- **Control Accuracy**
- **Versatility**
- **Tight Shutoff**
- **Easy Startup**
- **High Capacity**
- **In-Service Travel Indicator**
- **Full Strength Diaphragm**
- **Modular Design**

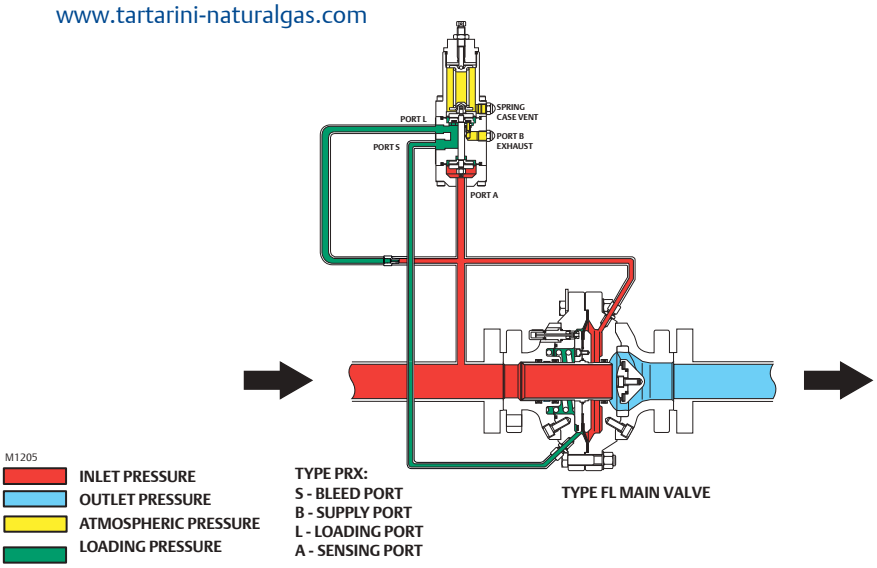


Figure 2. *Type FL Relief Valve or Backpressure Regulator Operational Schematic*

1. At average ambient temperature.
2. Type PRX Fluorocarbon (FKM) elastomer is limited to 0°F / -18°C.
3. Meets or exceeds ANSI/FCI 70-3 Class VI/VII leakage limits at maximum operating differential pressure.

Table 1. Type FL Relief Set Pressure Control

PILOT TYPE	RELIEF SET PRESSURE RANGE		PILOT CONTROL INFORMATION									
	psig	bar	Part Number	Color	Wire Diameter		Free Length		Maximum Operating Pressure		Maximum Emergency Pressure	
					In.	mm	In.	mm	psig	bar	psig	bar
PRX/182	29 to 116 73 to 290 217 to 609	2.0 to 8.0 5.0 to 20.0 15.0 to 42	M0255220X12 M0255200X12 M0255190X12	Black Gold Red	0.157 0.217 0.256	4.00 5.50 6.50	2.16 2.01 1.97	55.0 51.0 50.0	609	42.0	1480	102
PRX-AP/182	435 to 1160	30.0 to 80.0	M0273790X12	Clear	0.335	8.50	3.94	100	1160	80.0	1480	102

Table 2. Pilot Set Pressure Build-Up

PILOT TYPE	SET PRESSURE CONTROL RANGE, SPRING PART NUMBER AND COLOR	SET PRESSURE[1]		BUILD-UP OVER SET PRESSURE NEEDED TO BEGIN OPENING MAIN VALVE[2]		BUILD-UP OVER SET PRESSURE NEEDED TO FULLY OPEN MAIN VALVE[3]		PRESSURE DROP BELOW SET PRESSURE NEEDED TO RESEAT PILOT	
		psig	bar	psig	bar	psig	bar	psig	bar
PRX/182	29 to 116 psig / 2.0 to 8.0 bar M0255220X12 Black	30	2.1	1.2	0.08	2.8	0.19	1.0	0.69
		60	4.1	1.7	0.12	3.7	0.26	1.0	0.69
		80	5.5	1.9	0.13	4.0	0.28	1.0	0.69
		100	6.9	2.8	0.19	5.0	0.35	1.0	0.69
	73 to 290 psig / 5.0 to 20.0 bar M0255200X12 Gold	75	5.2	2.3	0.16	5.1	0.35	2.1	0.14
		100	6.9	2.5	0.17	5.9	0.41	2.1	0.14
		150	10.3	3.5	0.24	6.8	0.47	2.1	0.14
		200	13.8	4.0	0.28	8.0	0.55	2.1	0.14
		250	17.2	4.0	0.28	8.9	0.61	2.1	0.14
	217 to 609 psig / 14.9 to 41.7 bar M0255190X12 Red	225	15.5	4.0	0.28	10.2	0.70	2.7	0.19
		300	20.7	4.0	0.28	10.5	0.72	2.7	0.19
		400	27.6	4.1	0.28	10.7	0.74	2.7	0.19
		450	31.0	4.3	0.3	11.0	0.76	2.7	0.19
PRX-AP/182	435 to 1160 psig / 30.0 to 80.0 bar M0273790X12 Clear	450	31.0	4.3	0.3	11.0	0.76	3.3	0.23
		500	34.5	4.5	0.31	11.1	0.77	3.3	0.23
		600	41.4	5.1	0.35	11.1	0.77	3.3	0.23
		1050	72.4	5.1	0.35	11.1	0.77	3.3	0.23

1. Set pressure is defined as the pressure at which the pilot starts-to-discharge.
2. Crack point pressure of the main valve of the inlet pressure build-up over the set pressure at which the main valve starts audible flow.
3. Inlet pressure build-up over the set pressure for the main valve to achieve wide-open flow capacity.

Table 3. Type FL Flow and Sizing Coefficients

BODY SIZE, NPS / DN	LINE SIZE EQUALS BODY SIZE						2:1 LINE SIZE TO BODY SIZE RATIO					
	Regulating		C_1	IEC Sizing Coefficient			Regulating		C_1	IEC Sizing Coefficient		
	C_g	C_v		X_T	F_D	F_L	C_g	C_v		X_T	F_D	F_L
1 / 25	590	18.4	32.1	0.65	0.73	0.89	550	16.4	33.5	0.71	0.69	0.89
2 / 50	2300	70.6	32.6	0.67	0.69	0.89	2200	67.7	32.5	0.67	0.68	0.89
3 / 80	5200	161.9	32.1	0.69	0.70	0.89	4900	161.4	30.4	0.58	0.70	0.89
4 / 100	8000	249.3	32.1	0.65	0.65	0.89	7900	244.9	32.3	0.66	0.64	0.89
6 / 150	20,300	735.8	27.6	0.48	0.71	0.89	18,400	666.7	27.6	0.48	0.67	0.89
8 / 200	30,900	1080.4	28.6	0.52	0.66	0.89	30,600	1069.9	28.6	0.52	0.65	0.89
10 / 250	52,100	1615.4	32.3	0.66	0.69	0.89	51,500	1599.7	32.2	0.66	0.69	0.89

Table 4. Type FL Relief Capacities

SET PRESSURE RANGE, PILOT SPRING PART NUMBER AND COLOR	SET PRESSURE		CAPACITIES IN THOUSANDS OF SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
			NPS 1 / DN 25		NPS 2 / DN 50		NPS 3 / DN 80		NPS 4 / DN 100		NPS 6 / DN 150		NPS 8 / DN 200		NPS 10 / DN 250	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
29 to 116 psig / 2.0 to 8.0 M0255220X12 Black	30	2.1	37	1.0	147	3.9	331	8.9	503	13.5	1282	34.4	2011	53.9	3285	88.0
	60	4.1	62	1.7	243	6.5	547	14.7	830	22.2	2115	56.7	3320	89.0	5425	145
	80	5.5	78	2.1	306	8.2	688	18.4	1045	28.0	2663	71.4	4179	112	6830	183
	100	6.9	94	2.5	371	9.9	834	22.4	1267	34.0	3230	86.6	5069	136	8283	222
73 to 290 psig / 5.0 to 20.0 bar M0255200X12 Gold	75	5.2	75	2.0	294	7.9	661	17.7	1004	26.9	2558	68.6	4014	108	6560	176
	100	6.9	95	2.5	374	10.0	841	22.5	1277	34.2	3254	87.2	5107	137	8345	224
	150	10.3	135	3.6	531	14.2	1196	32.1	1816	48.7	4627	124	7262	195	11,867	318
	200	13.8	175	4.7	690	18.5	1553	41.6	2358	63.2	6009	161	9430	253	15,410	413
	250	17.2	215	5.8	848	22.7	1907	51.1	2896	77.6	7382	198	11,585	310	18,932	507
217 to 609 psig / 14.9 to 41.7 bar M0255190X12 Red	225	15.5	197	5.3	774	20.7	1742	46.7	2645	70.9	6743	181	10,582	284	17,292	463
	300	20.7	256	6.9	1008	27.0	2267	60.8	3443	92.3	8774	235	13,770	369	22,503	603
	400	27.6	335	9.0	1318	35.3	2966	79.5	4503	121	11,478	308	18,013	483	29,437	789
	450	31	375	10.1	1474	39.5	3316	88.9	5036	135	12,835	344	20,143	540	32,917	882
435 to 1160 psig / 30.0 to 80.0 bar M0273790X12 Clear	450	31	375	10.1	1474	39.5	3316	88.9	5036	135	12,835	344	20,143	540	32,917	882
	500	34.5	414	11.1	1629	43.7	3666	98.2	5566	149	14,187	380	22,265	597	36,384	975
	600	41.4	493	13.2	1939	52.0	4363	117	6625	178	16,885	453	26,499	710	43,304	1161
	1050	72.4	847	22.7	3333	89.3	7500	201	11,389	305	29,027	778	45,554	1221	74,442	1995

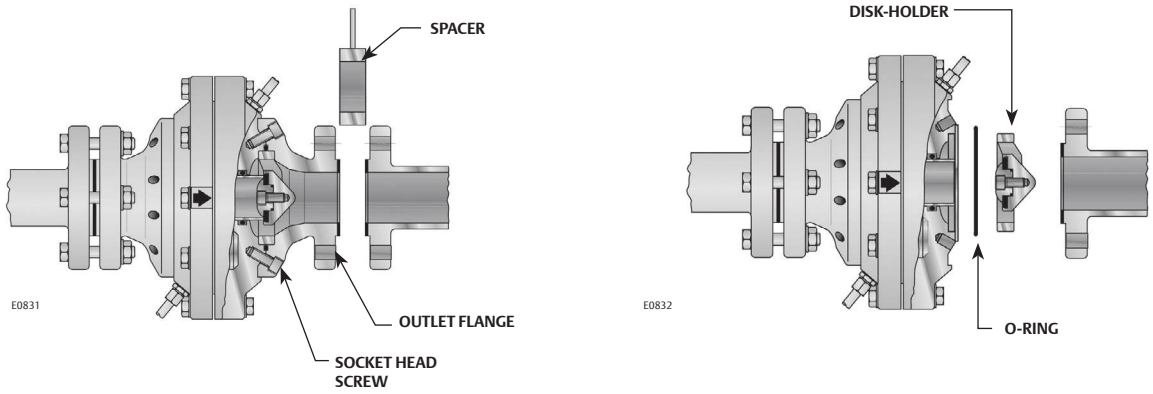


Figure 3. *Type FL Outlet Flange Spacer Installation*

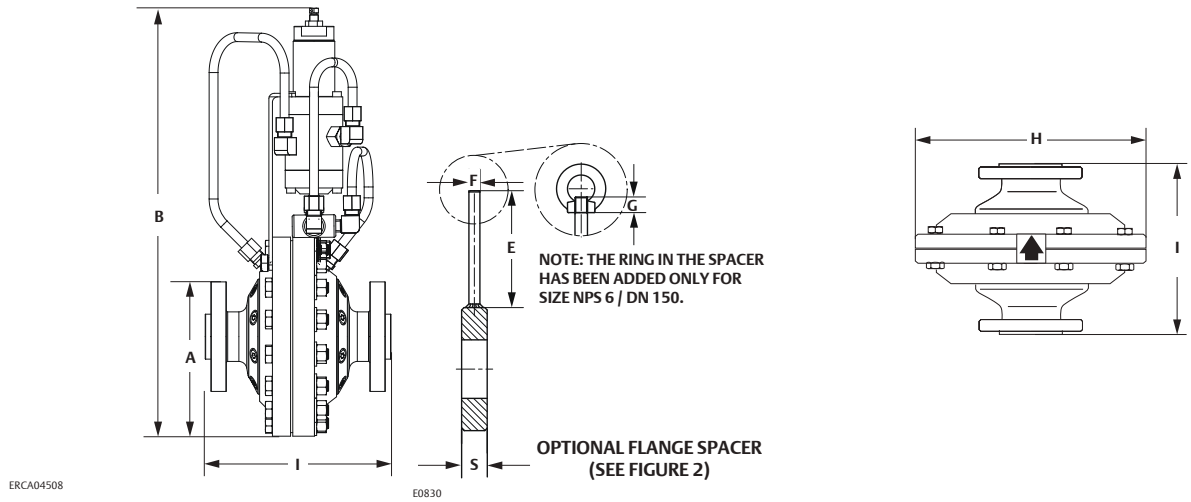


Figure 4. *Dimensions*

Table 5. Dimensions

BODY SIZE		DIMENSION, IN. / mm														APPROXIMATE WEIGHT, lbs / kg	
NPS	DN	(Face-to-Face / I) CL300 to CL600		A		B		E		F		G		S			
1	25	8.3	211	8.9	225	17.1	430	4.7	120	0.39	10	----		1.18	30	68	31
1-1/2	40	9.88	251	10.4	265	----	----	----	----	----	----	----		----	----	104	47
2	50	11.3	286	11.3	287	19.5	490	4.7	120	0.39	10	----		1.97	50	132	60
2-1/2	65	12.24	311	14.0	355	----	----	----	----	----	----	----		----	----	194	88
3	80	13.3	337	15.7	400	23.4	590	4.7	120	0.39	10	----		2.36	60	326	148
4	100	15.5	394	18.9	480	26.8	680	4.7	120	0.39	10	----		2.36	60	443	201
6	150	20.0	508	24.0	610	33.9	860	4.7	120	0.39	10	0.47	12	3.15	80	1058	480
8	200	CL300 22.4	569 CL600 24.0	610	25.7	653	39.5	1000	4.7	120	0.39	10	0.47	12	3.93	100	1367	620
10	250	CL300 27.8	708 CL600 29.6	752	30.9	785	43.3	1100	4.7	120	0.39	10	0.47	12	3.93	100	2623	1190

BODY SIZE		Face to Face - I		H				WEIGHT	
		PN 16 - CL150		PN 16 - CL150		CL300 - CL600		PN 16 - CL150 RF	
		Type VS-FL-BP		Type VS-FL-BP		Type VS-FL		Type VS-FL-BP	
NPS	DN	in. / mm						lbs / kg	
1	25	7.24	184	11.22	285	8.86	225	52.9	24
1-1/2	40	8.74	222	12.05	306	10.43	265	81.6	37
2	50	10.0	254	13.19	335	11.3	287	106	48
2-1/2	65	10.87	276	14.57	370	13.98	355	150	68
3	80	11.73	298	15.75	400	15.75	400	183	83
4	100	13.86	352	17.72	450	18.90	480	231	105
6	150	17.75	451	23.23	590	24.0	610	562	255
8[1]	200[1]	----	----	----	----	25.7	653	----	----
10	250	----	----	----	----	CL300 27.8	708 CL600 29.6	752	----	----

Ordering Guide

Type (Select One)
- ☐ FL or VS-FL
- ☐ VS-FL-BP

Type FL

Body Size (Select One)
- ☐ NPS 1 / DN 25**
- ☐ NPS 1-1/2 / DN 40**
- ☐ NPS 2 / DN 50**
- ☐ NPS 2-1/2 / DN 65**
- ☐ NPS 3 / DN 80**
- ☐ NPS 4 / DN 100**
- ☐ NPS 6 / DN 150**
- ☐ NPS 8 / DN 200**
- ☐ NPS 10 / DN 250**

End Connection Style (Select One)
- ☐ CL300 RF**
- ☐ CL600 RF**
- ☐ PN16 and CL150 RF**

O-ring Material (Select One)
- ☐ Nitrile (NBR) **
- ☐ Fluorocarbon (FKM)**

Disk Material (Select One)
- ☐ Nitrile (NBR) **(standard)*****
- ☐ Fluorocarbon (FKM)**

Pilot Type (Select One)
- ☐ PRX/182
- ☐ PRX-AP/182

Outlet Flange Spacer (Optional)
- ☐ Yes**
- ☐ No

Set Pressure Range (Select One)

Type PRX/182
- ☐ 29 to 116 psig / 2.00 to 8.00 bar, Black**
- ☐ 73 to 290 psig / 5.00 to 20.0 bar, Gold***
- ☐ 217 to 609 psig / 15.0 to 42.0 bar, Red**

Type PRX-AP/182
- ☐ 435 to 1160 / 30.0 to 80.0 bar, Clear**

Main Valve Mounting Position (Select One)
- ☐ Horizontal
- ☐ Vertical

Pilot Diaphragm (Select One)
- ☐ Nitrile (NBR) **(standard)*****
- ☐ Fluorocarbon (FKM)**

Pilot Disk (Select One)
- ☐ Polyurethane (PU) **(standard)****
- ☐ Fluorocarbon (FKM)**

Main Valve Replacement Parts Kit (Optional)
- ☐ Yes, send one replacement parts kit to match this order.

Main Valve Replacement Commission Kit (Optional)
- ☐ Yes, send one commission kit to match this order.

Pilot Valve Replacement Parts Kit (Optional)
- ☐ Yes, send one replacement parts kit to match this order.

- continued -

Ordering Guide (continued)

Inlet/Outlet Pressure Required
_____ please specify

Setpoint
_____ please specify

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
☐ Relief Valve ☐ Backpressure Regulator
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Adequate overpressure protection should be installed to protect the regulator from overpressure. Adequate overpressure protection should also be installed to protect all downstream equipment in the event of regulator failure.

FloBoss™ 103

Flow Manager

Introduction

The FloBoss™ 103 Flow Manager is a compact, single-run, self-contained flow computer that is a cost-effective replacement for the traditional paper chart recorders used in natural gas flow measurement. The FloBoss 103 gathers gas flow data electronically and provides an extensive audit trail for measured and calculated values, as well as events and alarms.

The FloBoss 103 virtually eliminates the lost and off-chart gas flow measurement problems inherent with chart recorders. The result is less lost and unaccounted gas and more revenue. Both static and differential pressure are measured to a reference accuracy of ±0.1 or ±0.075 percent. Gas flow is calculated for both volume and energy in accordance with the 1992 AGA3 flow and AGA8 super-compressibility equations, and the unit is compliant with API Chapter 21.1.

The FloBoss 103 is compact, so it can be mounted almost anywhere. The enclosure has a Class I, Division 1 rating without the solar panel and a Class I, Division 2 rating with the solar panel. Its extremely low power consumption lets it operate for up to 21 days on its built-in rechargeable batteries with no communications. A 2 or 5-watt (nominal) solar panel is all that's required to keep the batteries charged in most installations.

The FloBoss 103 also offers PID and logic/sequencing control at no extra cost. Options include six channels of I/O, RS-232 or dial-up communications, built-in spread-spectrum radio and MODBUS protocol.

Processor Information

32 bit, running at 3.68 MHz
Program Memory: 2 MB flash EPROM (programmable) for firmware and configuration
Data Memory: 512 KB SRAM
Boot Memory: 128 KB Flash EPROM

Time Functions

Clock: Real Time, Year/Month/Day and Hour/Minute/Second. Battery Backed

Clock Accuracy

± 5 seconds/year

Diagnostics

These conditions are monitored and alarmed: Pulse Interface Module and RTD point fail; battery, charger and internal voltages; internal temperature

Communications

Local Operator Interface: EIA-232 (RS-232C) format. Software configurable, 1200 to 19,200 bps rate selectable
COM1: EIA-485 (RS-485), software configurable, 1,200 to 19,200 bps rate selectable
COM2 (Host): EIA-232 (RS-232), EIA-485 (RS-485) or 2400 baud Dial-up Modem. EIA-232, EIA-485 or Modem requires optional communications card. For more information on the radio interface board, refer to Specification Sheet 5.3:RIB
Protocols: ROC or Modbus Slave or optional Modbus Host (ASCII or RTU) on any communications port

Power

Internal Batteries: Lead-acid. Rechargeable. Nominal 6.2 V dc, 2.5 Amp-hour. Battery life with no charging input and no communications: 3 weeks
External Power Charging Input: 8 to 28 V dc. Reverse Polarity Protection
Input Current: 10 to 15 mA nominal. 20 mA at 100% duty cycle (battery charging not included)

Solar Panel (Optional)

2-Watt Output: 9 V nominal
Size: 4.5 x 6.25-in. / 114 x 159 mm
5-Watt Output: 9 V nominal
Size: 8.75 x 9-in. / 222 x 229 mm

Weights

Aluminum: 14.5 lbs / 7 kg
Stainless Steel: 26.7 lbs / 12 kg

RTD Input

Quantity/Type: Single input for a 2 or 3-wire RTD element with alpha of 0.00385
Terminals: "RTD+" current source, "RTD+" signal positive input and "RTD RET" signal negative input
Sensing Range(1): -40 to 464°F / -40 to 240°C
Accuracy(1): ±0.64°F / ±0.2°C over sensing range (includes linearity, hysteresis, repeatability)



Figure 1. *FloBoss™ 103 with Solar Panel*

Ambient Temperature Effects per 50°F / 10°C: ±0.90°F / ±0.50°C for process temperatures from -40 to 464°F / -40 to 240°C
Filter: Band-pass hardware filter
Resolution: 15 bits
Sample Period: 1 second minimum

Dimensions

Enclosure: 6.3-in. H x 5.8-in. W x 8.5-in. D / 160 mm H x 147 mm W x 216 mm D, excludes mounting flange and sensor. Depth is farthest edge of end cap to farthest edge of other end cap
Pipestand Mounting: Mounts on a 2-in. / 51 mm pipe with U-bolt mounting kit (optional)

Features

- **Cost-Effective Alternative to Chart Recorders**
- **Low-Cost Data Management**
- **Better Gas Measurement**
- **Easier Installation**
- **More Reliable, Less Maintenance**
- **More Upgrade Paths**

1. The accuracy depends on the span calibrated for the sensing range of the RTD Input. The sensing range is the difference between the calibrated zero and calibrated span. The sensing range may be changed from the defaults during calibration. When the sensing range is less than or equal to 572°F / 300°C, the accuracy is 32.4°F / 0.2°C. When the sensing range is greater than 572°F / 300°C, the accuracy is 32.9°F / 0.5°C. Sensing range limits are -40° to 1472°F / -40 to 800°C.

EMERSON
Process Management

Enclosure

Housing and Cap: Die-cast aluminum alloy with iridite plating and paint. Optional investment cast stainless steel (CF8M) version available.

Environmental

Operating Temperature: -40 to 167°F / -40 to 75°C
LCD Display: -4 to 167°F / -20 to 75°C
Storage Temperature: -58 to 185°F / -50 to 85°C
Operating Humidity: 5 to 95%, non-condensing
Vibration: Meets SAMA PMC 31.1
Radiated/Conducted Transmissions: Meets requirements of IEC 61326 Electrical Equipment for Measurement, Control and Laboratory Use, Industrial Locations
Radiated Emissions: Meets FCC Part 15, Class A

Approvals

Evaluated per the following North American standards:
CAN/CSA-C22.2 No. 0-M91, CAN/CSA-C22.2 No. 94-M91, CSA-C22.2 No. 30-M1986, CSA-C22.2 No. 142-M1987, CSA-C22.2 No. 213-M1987, UL No 50 (11th Edition), UL No. 1203 (4th Edition), UL No. 1604 (3rd Edition), ANSI/UL No 508 (16th Edition), ANSI/ISA No. 12.12.01-2007 and ISA No. 12.27.01-2003.

Product Markings for Hazardous Locations:
Certified by CSA
Model W40106
Class I Division 1, Groups C and D, Explosion-proof
Type 4 enclosure
Model W40106
Class I, Division 2, Groups A, B, C and D Temperature Code T3
Non-incendive, Type 4 enclosure
Model W40112
Class 1, Division 2, Groups A, B, C and D Temperature Code T3
Non-incendive, ($T_{ambient}$ =75°C), Type 4 enclosure

ATEX Version
Evaluated per the following standards:
EN60079-0:2012 (Flameproof)
EN60079-1:2007 (Flameproof)
EN60079-15:2010 (Type N)
EN60079-0:2012 (Type N) IEC 60529

Certified by LCIE as Model W40116
Ex d IIB T5 Gb ($T_{ambient}$=75°C),
Ex nA IIC T3 Gc ($T_{ambient}$= 75°C), IP66

IECEx Version (Flame-proof and Type N)
Evaluated per the following standards:
IEC 60079-0:2011 Edition 6.0
IEC 60079-1: 2007 Edition 6.0
IEC 60079-15:2010 Edition 4
IEC 60529

Certified by IECEx as Model W40149
Ex d IIB T5 Gb ($T_{ambient}$=75°C)
Ex nA IIC T3 Gc ($T_{ambient}$=75°C), IP66

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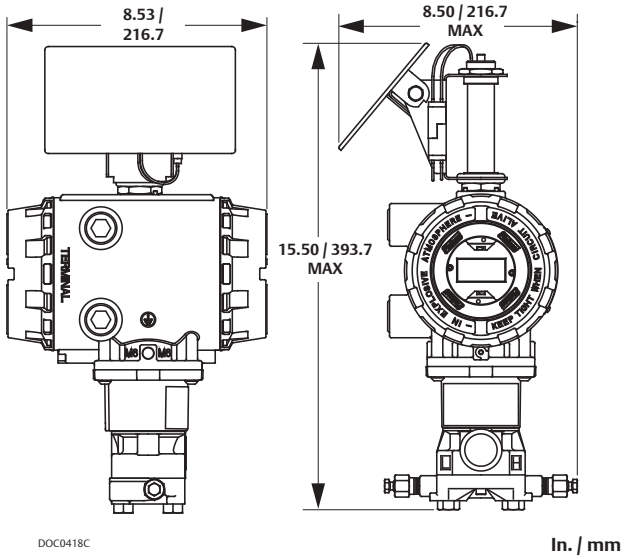


Figure 2. *FloBoss™ 103 with Solar Panel Dimension*

Dual-Variable Sensor (DVS) Specifications

Differential Pressure Input Range:
100:1 rangeability allowed
0 to 62.2 kPa / 0 to 250-in. w.c.
0 to 248.8 kPa / 0 to 1000-in. w.c.
Static Pressure Input Range:
Either Absolute or Gauge:
0 to 5516 kPa / 0 to 800 psia/psig
0 to 25,000 kPa / 0 to 3626 psia/psig
Reference Accuracy
DVS205P: ±0.075% of span for turndowns from 1:1 to 10:1 of URL
DVS205E: ±0.10% of span for turndowns from 1:1 to 10:1 of URL
Stability
±0.125% of URL for five years for ±50°F / 10°C ambient temperature changes
Process Connections
1/4-in. NPT on 2-1/8-in. / 54 mm centers, located on bottom of Coplanar™ flange
Construction
Standard: Transducer is all stainless steel construction with silicone fill fluid, 316L diaphragms and glass-filled Polytetrafluoroethylene (PTFE) O-rings. Coupling is A360 Aluminum with urethane coating.
Optional: Transducer includes Hastelloy® C-276 wetted parts (construction is NACE compliant per MR0103 and ISO15156/MR0175), inert fill fluid. Coupling is available in 316 stainless steel.

Ordering Guide

To order this product, contact your local Sales Office or log on to:
www.emersonprocess.com/regulators

FloBoss™ 104

Flow Manager

Introduction

The FloBoss 104 is a compact, high-performance flow computer that is cost effective for fiscal measurement. It performs API 21.1 compliant flow measurement when used with pulse-generating devices, such as rotary, turbine and ultrasonic meters. The FloBoss 104 shares its advanced technology platform with the FloBoss 103, its orifice metering twin.

The FloBoss 104 mounts directly to a rotary or turbine meter and easily handles the slow rotational speed of a rotary meter or the high-speed pulse trains generated by most turbine meters. When line pressure and temperature are measured along with the pulse train, the FloBoss 104 can provide high-accuracy flow measurement.

The FloBoss 104 offers much more, including PID and logic/sequencing control at no extra cost. Options include six channels of I/O, RS-232 or dial-up communications, built-in spread-spectrum radio and MODBUS protocol.

The sensor assembly and rotary meter interface of the FloBoss 104 achieves superior performance over mechanical or conventional electronic measurement technology because it:

- Generates 1000 pulses / revolution for high-resolution measurement
- Uses non-contact pulse sensing for outstanding reliability
- Has built-in pressure transducers to measure upstream and downstream pressure
- Provides bi-directional pulse detection and diagnostics for easy installation, setup and maintenance
- Eliminates gear trains that load down the metering device and cause inaccuracies

Processor Information

32 bit, running at 3.68 MHz
Program Memory: 2 MB flash ROM (programmable) for firmware and configuration
Data Memory: 512 KB RAM
Boot Memory: 128 KB Flash ROM

Time Functions

Clock: Real Time. Year/Month/Day and Hour/Minute/Second. Battery Backed. ±5 second/year accuracy

Diagnostics

These conditions are monitored and alarmed: Pulse Interface Module and RTD point fail; battery, charger and internal voltages; internal temperature

Communications

Local Operator Interface: EIA-232 (RS-232C), Software configurable, 1200 to 19,200 bps rate selectable

Com1: EIA-485 (RS-485), software configurable, 1200 to 19,200 bps rate selectable

Com2 (Host): EIA-232 (RS-232), EIA-485 (RS-485) or 2400 baud Dial-up Modem. EIA-232, EIA-485 or Modem requires optional communications card

Protocols: ROC or Modbus Slave or optional Modbus Host (ASCII or RTU) on all ports

Power

Internal Batteries: Lead-acid. Rechargeable. Nominal 6.2 V dc, 2.5 amp-hour. Battery life with no charging input and no communications: 1 week

External Power Charging Input: 8 to 28 V dc. Reverse Polarity Protection

Input Power: 10 to 15 mA nominal. 20 mA at 100% duty cycle (battery charging not included)

Enclosure

Housing and Cap: Die-cast aluminum alloy with iridite plating and paint

Solar Panel (Optional)

2 Watts Output: 9 V nominal
Size: 4.5 x 6.26-in. / 114 x 159 mm
5-Watt Output: 9 V nominal.
Size: 8.75 x 9-in. / 222 x 229 mm

Features

- **API / AGA Compliant Flow Measurement**
- **Local or Host Operation**
- **More Communication Choices**
- **Expandable I/O**
- **Built-in Control Capability**
- **Low Power Consumption**
- **Rugged Construction**



Figure 1. *FloBoss 104*

RTD Input

Quantity/Type: Single input for a 2 or 3-wire RTD element with alpha of 0.00385

Terminals: "RTD+" current source, "RTD+" signal positive input and "RTD RET" signal negative input

Sensing Range(1): -40 to 464°F / -40 to 240°C (default)

Accuracy(1): ±0.64°F (±0.2°C) over sensing range (includes linearity, hysteresis, repeatability)

Ambient Temperature Effects per 50°F /10°C: ±0.90°F / ±0.50°C) for process temperatures from -40 to 464°F / -40 to 240°C

Filter: Band-pass hardware filter

Resolution: 16 bits

Sample Period: 1 second minimum

Environmental

Operating Temperature: -40 to 167°F / -40° to 75°C

LCD Display: -4 to 167°F / -20° to 75°C

Storage Temperature: -58° to 185°F / -50 to 85°C

Operating Humidity: 5 to 95%, non-condensing

Vibration: Meets SAMA PMC 31.1

Radiated/Conducted Transmissions: Meets requirements of IEC 61326 Electrical Equipment for Measurement, Control and Laboratory Use and Industrial Locations

Radiated Emissions: Meets FCC Part 15, Class A

Dimensions

6.3-in. H x 5.8-in. W x 8.5-in. D / 160 mm H x 147 mm W x 216 mm D, excludes mounting flange and interface. Depth is farthest edge of end cap to farthest edge of other end cap.

Weight

9.5 lb / 4.3 kg approximate, with Pulse Interface Module

Approvals

Evaluated per following Approval Standards:
CAN/CSA-C22.2 No. 0-M91
CAN/CSA-C22.2 No. 94-M91
CSA-C22.2 No. 30-M1986
CSA-C22.2 No. 142-M1987
CSA-C22.2 No. 213-M1987
UL No 50 (11th Edition)
UL No. 1203 (4th Edition)
UL No. 1604 (3rd Edition)
ANSI/UL No 508 (16th Edition)
ANSI/ISA No. 12.12.01-2007 ISA No. 12.27.01-2003

Product Markings for Hazardous Locations Certified by CSA:

Model W40106: Class I, Division 1, Groups C and D Explosion-proof and Type 4 enclosure

Model W40106: Class I, Division 2, Groups A, B, C and D Temperature Code: *T3* and Type 4 enclosure

Model W40112: Class 1, Division 2, Groups A, B, C and D, Temperature Code T3, Non-incendive (T_{amb} =75°C) and Type 4 enclosure

Evaluated per following Approval Standard:
EN60079-0:2012 (Flameproof)
EN60079-1:2007 (Flameproof)
EN60079-15:2010 (Type N)
EN60079-0:2012 (Type N)
IEC 60529

Product Markings for Hazardous Locations Certified by LCIE:

Model W40116: Cert LCIE 03 ATEX 6221 X X/05, EX II 2 G, Ex d IIB T5 Gb (T_{amb} = 75°C), Type D or Flameproof (Zone 1) and IP66 enclosure

Model W40116: Cert LCIE 13 ATEX 1033 X, EX II 3 G, Ex nA IIC T3 Gc (T_{amb} = 75°C), Type N (Zone 2) and IP66 enclosure

Evaluated per following Approval Standard:
IEC 60079-0:2011 Edition 6.0
IEC 60079-1: 2007 Edition 6.0
IEC 60079-15:2010 Edition 4
IEC 60529

Product Markings for Hazardous Locations Certified by IECEx:

Model W40116: Cert LCIE 03 ATEX 6221 X X/05, EX II 2 G, Ex d IIB T5 Gb (T_{amb} = 75°C), Type D or Flameproof (Zone 1) and IP66 enclosure

Model W40116: Cert LCIE 13 ATEX 1033 X, EX II 3 G Ex nA IIC T3 Gc (T_{amb} = 75°C), Type N (Zone 2) and IP66 enclosure

Pressure Transducer Input

Range Options:
0 to 100 psi / 0 to 6.9 bar
0 to 300 psi / 0 to 20.7 bar
0 to 1000 psi / 0 to 69 bar

Accuracy: 0.35% of Span at -40 to 158°F / -40 to 70°C for all range options

Process Connections

1/4- 18 NPT, located on sides of interface

Construction

Interface Housing: 6061 Aluminum

Pressure Transducers: Stainless steel

Mounting Flange: 6061 Aluminum

Ordering Guide

To order this product, contact your local Sales Office or log on to:
www.emersonprocess.com/regulators

Regulator Tip:

Looking for a specific product? When you know the application and Type or Series of the product you need, you can use the Quick Product Index in the Table of Contents, the Section Outline in the Application Map of each section, or the Product Index at the back of this Application Guide to direct you to the page on which the product is described.

Type H120
Relief Valve

FISHER

Introduction

The Type H120 direct-operated relief valve registers directly on a spring-opposed poppet assembly which includes a Nitrile (NBR) disk. When the inlet pressure increases above the spring setting, the poppet and disk assembly is pushed away from the metal seat. Springs are available that provide various fixed relief pressures from 35 to 350 psig / 2.4 to 24.1 bar.

With this simple operation and wide spring setting selection, the Type H120 relief valve may be used where venting to atmosphere is acceptable, where the process gas is compatible with the Nitrile (NBR) disk, where its relief capacity is adequate, and where some pressure relieving tolerance is acceptable. Common applications include use on pneumatic control lines of air drills, jackhammers and other similar equipment and on high-pressure installations such as the side outlet of a Type 1301F regulator.

Inlet Connection Size and Style

1/4 NPT

Maximum Allowable Relief (Inlet) Pressure

420 psig / 29.0 bar

Fixed Relief Pressures

35 to 350 psig / 2.4 to 24.1 bar with nine fixed settings

See Table 2

Wide-Open Flow Coefficient

C_g: 0.80

IEC Sizing Coefficients

X_T: 0.78
F_D: 0.50
F_L: 0.89

Temperature Capabilities

-20 to 160°F / -29 to 71°C

Approximate Shipping Weight

0.25 lb / 0.11 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Space-Saving Construction**
- **Economical**
- **Durable**
- **Optional Protective Cap**



Figure 1. *Type H120 Relief Valve*

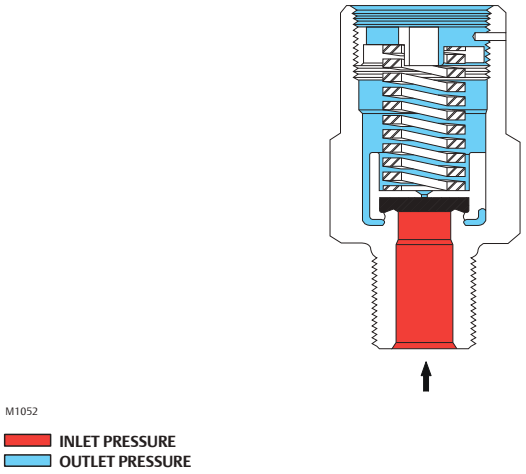


Figure 2. *Operational Schematic*

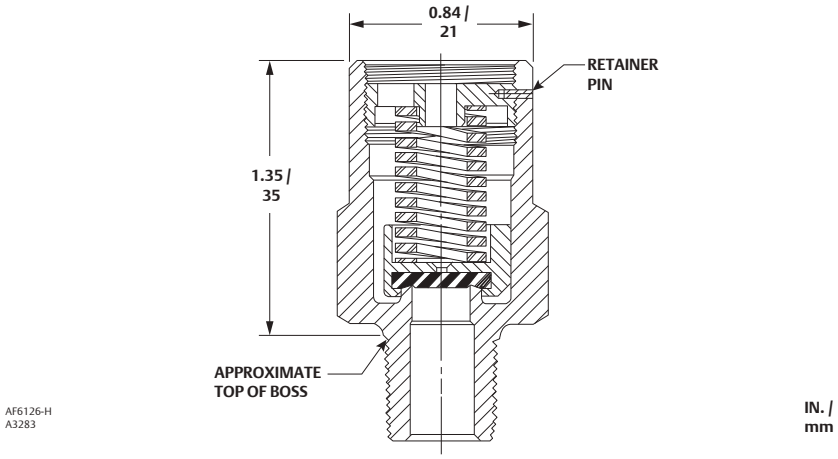


Figure 3. *Dimensions*

EMERSON. Process Management

Table 1. Construction Material		
BODY, POPPET AND SPRING RETAINER	DISK	SPRING AND RETAINER PIN
Brass and Stainless steel	Nitrile (NBR)	Steel and Stainless steel

Table 2. Relief Pressure and Capacities

FIXED RELIEF PRESSURE SETTING(1)		BUILD-UP OVER RELIEF PRESSURE SETTING		CAPACITY IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS(2)		SPRING PART NUMBER	SPRING COLOR CODE	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
psig	bar	psig	bar	SCFH	Nm³/h			in.	mm	in.	mm
35 60	2.4 4.1	25 25	1.7 1.7	6000 8175	161 219	T1217837022	Yellow	0.047	1.19	0.91	23.1
120	8.3	25	1.7	12,825	344	T12687T0012	Orange	0.051	1.30	0.94	23.9
150 175	10.3 12.1	30 35	2.1 2.4	14,890 17,400	399 466	T12688T0012	Brown	0.056	1.42	1.17	29.7
200 225 275 350	13.8 15.5 19.0 24.1	40 45 55 70	2.8 3.1 3.8 4.8	20,350 21,750 23,525 34,560	545 583 630 926	1F790837022	Black	0.062	1.58	1.13	28.7

1. This is the initial leak point, the point at which the relief valve begins to discharge.
2. To convert to equivalent capacities of other gases, multiply the table value by 0.775 for air or 0.789 for nitrogen.

Ordering Guide

Fixed Relief Pressure Setting (Select One)

- ☐ 35 psig / 2.4 bar***
- ☐ 60 psig / 4.1 bar***
- ☐ 120 psig / 8.3 bar***
- ☐ 150 psig / 10.3 bar***
- ☐ 175 psig / 12.1 bar***
- ☐ 200 psig / 13.8 bar***
- ☐ 225 psig / 15.5 bar***
- ☐ 275 psig / 19.0 bar**
- ☐ 350 psig / 24.1 bar**

Quantity

_____

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Regulator Tip:

Adequate overpressure protection should be installed to protect the regulator from overpressure. Adequate overpressure protection should also be installed to protect all downstream equipment in the event of regulator failure.

H200 Series
Relief Valves

FISHER

Introduction

The H200 Series Pop™ relief valves are direct-operated relief valves with preset and pinned spring retainers. The inlet pressure registers directly on a spring-opposed poppet assembly that includes a Nitrile (NBR) disk. When the inlet gas pressure increases above the spring setting, the poppet and disk assembly is pushed away from the orifice.

With this simple operation and wide spring setting selection, the H200 Series Pop relief valves may be used where venting to atmosphere is acceptable and where some pressure relieving tolerance is acceptable. Common applications include use on pneumatic control lines and farm tap installations.

Wide-Open Flow Coefficient

C_g: 405

Maximum Allowable Relief (Inlet) Pressure

400 psig / 27.6 bar

Fixed Relief Pressures

25 to 300 psig / 1.7 to 20.7 bar with 12 fixed settings
See Table 2

Available Configurations and End Connection Style

Type H202: 3/4 NPT
Type H203: 1 NPT

Approximate Shipping Weight

0.5 lb / 0.2 kg

Temperature Capabilities

-20 to 160°F / -29 to 71°C

Option

- Type P145 Raincap

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Space-Saving Construction**
- **Economical**
- **Durable**



W1929_1

Figure 1. *H200 Series Relief Valve*

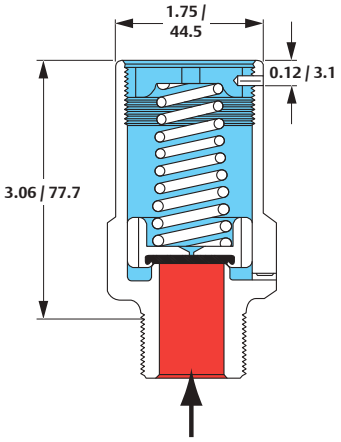


Figure 2. *Operational Schematic and Dimensions*

Table 1. Construction Material

BODY, POPPET AND SPRING RETAINER	DISK	SPRING
Brass	Nitrile (NBR)	302 Stainless steel

Table 2. Relief Set Pressures and Capacities

RELIEF SET PRESSURE(1)		SET PRESSURE PLUS BUILD-UP		CAPACITY OF 0.6 SPECIFIC GRAVITY NATURAL GAS(2)		RELIEF SETTING TOLERANCE	
psig	bar	psig	bar	SCFH	Nm³/h	psig	bar
25 50	1.7 3.4	50 75	3.4 5.2	34,200 47,400	916 1270	±5	±0.34
75 100 125	5.2 6.9 8.6	100 120 150	6.9 8.3 10.3	60,000 69,600 83,400	1608 1865 2235	±8	±0.55
150 175 200 225 250 275 300	10.3 12.1 13.8 15.5 17.2 19.0 20.7	180 210 240 270 300 330 360	12.4 14.5 16.5 18.6 20.7 22.7 24.8	100,500 117,600 132,000 150,000 165,000 180,000 195,000	2693 3152 3538 4020 4422 4824 5226	±15	±1.03

1. This is the initial leak point (the point at which the relief valve begins to discharge).
2. To convert to equivalent capacities of other gases, multiply the table values by 0.775 for air or 0.789 for nitrogen.

EMERSON
Process Management

Ordering Guide

Body Size and End Connection Style (Select One)

- ☐ 3/4 NPT***
- ☐ 1 NPT***

Fixed Relief Pressure Setting (Select One)

3/4 NPT

- ☐ 25 psig / 1.7 bar***
- ☐ 35 psig / 2.4 bar***
- ☐ 50 psig / 3.4 bar***
- ☐ 75 psig / 5.2 bar***
- ☐ 250 psig / 17.2 bar***

1 NPT

- ☐ 25 psig / 1.7 bar***
- ☐ 35 psig / 2.4 bar***
- ☐ 50 psig / 3.4 bar***
- ☐ 60 psig / 4.1 bar***
- ☐ 75 psig / 5.2 bar***
- ☐ 100 psig / 6.9 bar***
- ☐ 125 psig / 8.6 bar***
- ☐ 150 psig / 10.3 bar***
- ☐ 175 psig / 12.1 bar***
- ☐ 200 psig / 13.8 bar ***
- ☐ 250 psig / 17.2 bar***
- ☐ 300 psig / 20.7 bar***

Type P145 Raincap (Optional)

- ☐ Yes

Quantity (Specify)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.

Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.

Specification Worksheet
Application
☐ Relief Valve ☐ Backpressure Regulator
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

All regulators should be installed and used in accordance with federal, state and local codes and regulations.

Type HSR
Pressure Reducing Regulator

FISHER™

Introduction

The Type HSR direct-operated, spring-loaded regulators provide economical pressure reducing control in a variety of residential, commercial and industrial applications.

In addition, the Type HSR regulators have internal relief across the diaphragm to help minimize overpressure.

Body Sizes (Inlet x Outlet) and End Connection Styles

3/4, 3/4 x 1 or 1 NPT

All sizes are available in globe or angle body.

Allowable Inlet Pressures

Emergency: 150 psig / 10.3 bar

Maximum Operating Pressure: See Table 3

Allowable Outlet Pressures

Emergency (Casing): 25 psig / 1.7 bar

Maximum Operating Pressure to Avoid Internal Parts Damage: 3 psi / 0.21 bar differential above outlet pressure setting

Outlet Pressure Ranges

4 in. w.c. to 2.2 psig /
10 mbar to 0.15 bar in seven ranges
See Table 2

Flow and Sizing Coefficients

See Table 5

Internal Relief Performance

Approximate Internal Relief Start-To-Discharge Point: 6 to 12 in. w.c. / 15 to 30 mbar above outlet pressure setting (Applies to 6 to 8 in. w.c. / 15 to 20 mbar and 8 to 10 in. w.c. / 20 to 25 mbar springs only)

Relief Performance: See Figures 3 and 4

Temperature Capabilities

-20 to 160°F / -29 to 71°C

Pressure Registration

Internal

Spring Case Vent Connection

Standard: 1 NPT with removable screen

Optional: 3/4 NPT with removable screen

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Angle Bodies**
- **Globe Bodies**
- **Fixed Factor / PFM Accuracy**
- **Meets or Exceeds ANSI B109.4 / CGA 6.18 Requirements**
- **High Capacity Internal Relief**
- **Compact Design**
- **High Capacity**



P1275

Figure 1. *Type HSR Pressure Reducing Regulator*

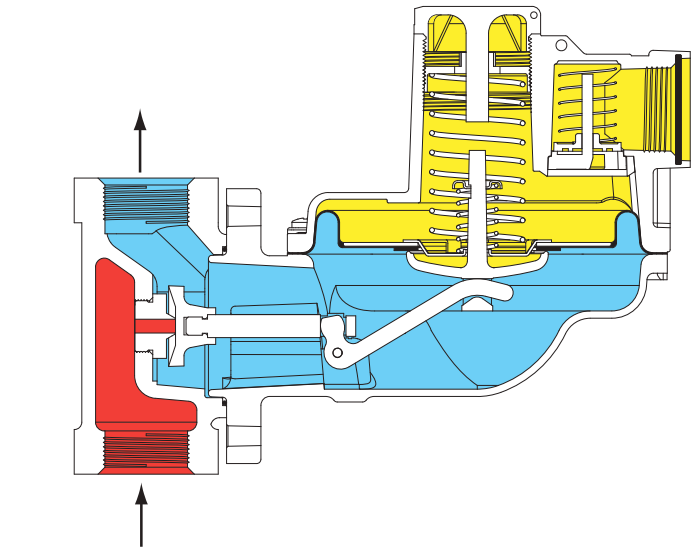


Figure 2. *Type HSR Pressure Regulator Operational Schematic*

EMERSON
Process Management

Table 1. Construction Material

BODY	BODY GASKET	CLOSING CAP	ADJUSTING SCREW	DIAPHRAGM CASE, SPRING CASE, ORIFICE AND VALVE SEAT	PUSHER POST OR RELIEF VALVE SEAT	DIAPHRAGM AND DISK	CONTROL SPRING	RELIEF VALVE SPRING AND RETAINER, VENT SCREEN AND LEVER PIN	SPRING SEAT, LEVER AND OTHER METAL PARTS	DIAPHRAGM PLATE
Cast iron	Nitrile (NBR)	ASA thermoplastic (provides UV-ray protection)	Delrin®	Aluminum	Delrin®	Nitrile (NBR)	Zinc-plated steel	Stainless steel	Plated steel	Aluminum

Table 2. Outlet Pressure Range

OUTLET PRESSURE RANGE		SPRING PART NUMBER	SPRING COLOR	CLOSING CAP	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
In. w.c.	mbar				In.	mm	In.	mm
4 to 6	10 to 15	T14398T0012	Orange	Black	0.062	1.58	3.40	86.4
6 to 8	15 to 20	T14399T0012	Yellow	Black	0.067	1.70	3.61	91.7
8 to 10	20 to 25	T14405T0012	Black	Black	0.067	1.70	3.71	94.2
10 to 12.5	25 to 31	T14400T0012	Silver	Black	0.072	1.83	4.10	104
12.5 to 20	31 to 50	T14401T0012	Gray	Black	0.080	2.03	3.60	91.4
20 to 35	50 to 87	T14402T0012	Pink	Black	0.093	2.36	3.52	89.4
1.25 to 2.2 psig	0.09 to 0.15 bar	T14403T0012	Light Blue	Red	0.105	2.67	3.66	93.0

Table 3. Maximum Operating Inlet Pressure

ORIFICE SIZE		MAXIMUM OPERATING INLET PRESSURE TO OBTAIN GOOD REGULATING PERFORMANCE	
In.	mm	psig	bar
1/8	3.2	125	8.6
3/16	4.8	100	6.9
1/4	6.4	60	4.1
3/8	9.5	30	2.1
1/2	13	20	1.4

Table 4. Lockup Performance During Normal Operation

ORIFICE SIZE		LOCKUP ABOVE SETPOINT		LOCKUP ABOVE SETPOINT	
In.	mm	In. w.c.	mbar	psi	mbar
1/8	3.2	1	2	0.15	10.3
3/16	4.8	1	2	0.15	10.3
1/4	6.4	2	5	0.15	10.3
3/8	9.5	2.5	6	0.15	10.3
1/2	12	3	7	0.15	10.3

Table 5. Flow and Sizing Coefficient

ORIFICE SIZE		WIDE-OPEN FOR RELIEF SIZING		C_1	IEC SIZING COEFFICIENT		
In.	mm	C_g	C_v		X_T	F_D	F_L
1/8	3.2	12.5	0.36	35	0.78	0.82	0.89
3/16	4.8	28.2	0.81			0.82	
1/4	6.4	50	1.43			0.82	
3/8	9.5	105	3.00			0.79	
1/2	13	185	5.29			0.79	

Delrin® is a mark owned by E.I. du Pont de Nemours and Co.

Table 6. 3/4 NPT Globe Body Capacities

OUTLET PRESSURE SETTING, SPRING RANGE, DROOP AND BOOST	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS									
			Orifice Size, In. / mm									
			1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
7 in. w.c. / 17 mbar 6 to 8 in. w.c. / 15 to 20 mbar 1 in. w.c. droop 2 in. w.c. boost	0.5	0.03	70	1.9	120	3.2	170	4.6	240	6.4	300	8.0
	1	0.07	100	2.7	180	4.8	240	6.4	340	9.1	430	11.5
	2	0.14	130	3.5	250	6.7	330	8.8	510	13.7	630	16.9
	3	0.21	170	4.6	340	9.1	420	11.3	680	18.2	770	20.6
	5	0.35	220	5.9	420	11.3	650	17.4	900	24.1	960	25.7
	10	0.69	330	8.8	730	19.6	1100	29.5	1310	35.1	1310	35.1
	15	1.0	430	11.5	1000	26.8	1380	37.0	1520	40.7	1520	40.7
	20	1.4	530	14.2	1200	32.2	1560	41.8	1620	43.4	1620	43.4
	30	2.1	680	18.2	1550	41.5	1840	49.3	1750	46.9		
	40	2.8	850	22.8	1900	50.9	1950	52.3				
	50	3.4	970	26.0	2200	59.0	2000	53.6				
	60	4.1	1150	30.8	2280	61.1	2100	56.3				
	80	5.5	1450	38.9	2350	63.0						
	100	6.9	1750	46.9	1900	50.9						
	125	8.6	2100	56.3								
11 in. w.c. / 27 mbar 10 to 12.5 in. w.c. / 25 to 31 mbar 1 in. w.c. droop 2 in. w.c. boost	1	0.07	80	2.1	150	4.0	200	5.4	240	6.4	330	8.8
	2	0.14	120	3.2	200	5.4	270	7.2	420	11.3	530	14.2
	3	0.21	150	4.0	250	6.7	350	9.4	530	14.2	680	18.2
	5	0.35	190	5.1	340	9.1	480	12.9	770	20.6	860	23.0
	10	0.69	290	7.8	550	14.7	910	24.4	1210	32.4	1210	32.4
	15	1.0	400	10.7	840	22.5	1210	32.4	1380	37.0	1380	37.0
	20	1.4	480	12.9	1140	30.6	1550	41.5	1590	42.6	1590	42.6
	30	2.1	670	18.0	1530	41.0	1830	49.0	1810	48.5		
	40	2.8	820	22.0	1970	52.8	1950	52.3				
	50	3.4	970	26.0	2150	57.6	1990	53.3				
	60	4.1	1120	30.0	2260	60.6	2050	54.9				
	80	5.5	1420	38.1	2390	64.1						
	100	6.9	1730	46.4	1950	52.3						
	125	8.6	2110	56.6								
14 in. w.c. / 35 mbar 12.5 to 20 in. w.c. / 31 to 50 mbar 2 in. w.c. droop 2 in. w.c. boost	1	0.07	80	2.1	140	3.8	190	5.1	290	7.8	330	8.8
	2	0.14	120	3.2	230	6.2	300	8.0	430	11.5	570	15.3
	3	0.21	160	4.3	290	7.8	360	9.6	580	15.5	730	19.6
	5	0.35	210	5.6	360	9.6	500	13.4	760	20.4	970	26.0
	10	0.69	320	8.6	570	15.3	890	23.9	1190	31.9	1290	34.6
	15	1.0	410	11.0	820	22.0	1210	32.4	1460	39.1	1560	41.8
	20	1.4	500	13.4	1050	28.1	1440	38.6	1660	44.5	1700	45.6
	30	2.1	670	18.0	1500	40.2	1790	48.0	1850	49.6		
	40	2.8	830	22.2	1830	49.0	2020	54.1				
	50	3.4	970	26.0	2100	56.3	2100	56.3				
	60	4.1	1140	30.6	2120	56.8	2180	58.4				
	80	5.5	1440	38.6	2220	59.5						
	100	6.9	1770	47.4	2250	60.3						
	125	8.6	2140	57.4								

- Gray areas indicate capacities limited by either droop or boost.
- Blank areas indicate where maximum operating inlet pressure is exceeded for a given orifice.

- continued -

Table 6. 3/4 NPT Globe Body Capacities (continued)

OUTLET PRESSURE SETTING, SPRING RANGE, DROOP AND BOOST	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS									
			Orifice Size, In. /mm									
			1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
28 in. w.c. / 70 mbar 20 to 35 in. w.c. / 50 to 87 mbar ± 1% ABS	2	0.14	120	3.2	250	6.7	310	8.3	420	11.3	570	15.3
	3	0.21	150	4.0	280	7.5	380	10.2	570	15.3	770	20.6
	5	0.35	220	5.9	380	10.2	550	14.7	830	22.2	1040	27.9
	10	0.69	330	8.8	600	16.1	890	23.9	1310	35.1	1570	42.1
	15	1.0	410	11.0	810	21.7	1220	32.7	1600	42.9	1860	49.9
	20	1.4	510	13.7	1020	27.3	1490	39.9	1790	48.0	2020	54.1
	30	2.1	660	17.7	1440	38.6	1820	48.8	2100	56.3		
	40	2.8	830	22.2	1800	48.2	2080	55.7				
	50	3.4	970	26.0	1980	53.1	2280	61.1				
	60	4.1	1130	30.3	2320	62.2	2380	63.8				
	80	5.5	1440	38.6	2400	64.3						
	100	6.9	1760	47.2	2500	67.0						
	125	8.6	2150	57.6								
28 in. w.c. / 70 mbar 20 to 35 in. w.c. / 50 to 87 mbar ± 2% ABS	2	0.14	150	4.0	310	8.3	470	12.6	710	19.0	930	24.9
	3	0.21	180	4.8	390	10.5	590	15.8	940	25.2	1230	33.0
	5	0.35	250	6.7	530	14.2	840	22.5	1290	34.6	1600	42.9
	10	0.69	360	9.7	810	21.7	1320	35.4	1890	50.7	2200	59.0
	15	1.0	430	11.5	1010	27.1	1650	44.2	2290	61.4	2530	67.8
	20	1.4	530	14.2	1200	32.2	1940	52.0	2490	66.7	2750	73.7
	30	2.1	670	18.0	1570	42.1	2430	65.1	2900	77.7		
	40	2.8	830	22.2	1920	51.5	2720	72.9				
	50	3.4	970	26.0	2280	61.1	2830	75.8				
	60	4.1	1130	30.3	2630	70.5	3050	81.7				
	80	5.5	1440	38.6	3050	81.7						
	100	6.9	1760	47.1	3150	84.4						
	125	8.6	2150	57.6								
2 psig / 0.14 bar 1.25 to 2.2 psig / 0.09 to 0.15 bar ± 1% ABS	3	0.21	120	3.2	190	5.1	250	6.7	330	8.8	450	12.1
	5	0.35	150	4.0	270	7.2	360	9.6	560	15.0	750	20.1
	10	0.69	250	6.7	430	11.5	620	16.6	1020	27.3	1340	35.9
	15	1.0	330	8.8	600	16.1	800	21.4	1350	36.2	1480	39.7
	20	1.4	410	11.0	740	19.8	1040	27.9	1540	41.3	1800	48.2
	30	2.1	560	15.0	1050	28.1	1450	38.9	1850	49.6		
	40	2.8	730	19.6	1320	35.4	1640	44.0				
	50	3.4	870	23.3	1620	43.4	1900	50.9				
	60	4.1	1030	27.6	1910	51.2	2140	57.4				
	80	5.5	1350	36.2	2090	56.0						
	100	6.9	1650	44.2	2180	58.4						
	125	8.6	2000	53.6								
2 psig / 0.14 bar 1.25 to 2.2 psig / 0.09 to 0.15 bar ± 2 % ABS	3	0.21	150	4.0	270	7.2	420	11.3	600	16.1	790	21.2
	5	0.35	210	5.6	420	11.3	620	16.6	960	25.7	1230	33.0
	10	0.69	340	9.1	700	18.8	1050	28.1	1430	38.3	1880	50.4
	15	1.0	440	11.8	940	25.2	1350	36.2	1880	50.4	2230	59.8
	20	1.4	520	13.9	1150	30.8	1620	43.4	2260	60.6	2540	68.1
	30	2.1	670	18.0	1540	41.3	2110	56.6	2520	67.5		
	40	2.8	830	22.2	1880	50.4	2430	65.1				
	50	3.4	970	26.0	2170	58.2	2640	70.8				
	60	4.1	1130	30.3	2460	65.9	2850	76.4				
	80	5.5	1450	38.9	2850	76.4						
	100	6.9	1750	46.9	3000	80.4						
	125	8.6	2100	56.3								

☐ - Blank areas indicate where maximum operating inlet pressure is exceeded for a given orifice.

Table 7. 1 NPT Globe Body Capacities

OUTLET PRESSURE SETTING, SPRING RANGE, DROOP AND BOOST	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS									
			Orifice Size, In. / mm									
			1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
7 in. w.c. / 17 mbar 6 to 8 in. w.c. / 15 to 20 mbar 1 in. w.c. droop 2 in. w.c. boost	0.5	0.03	70	1.9	120	3.2	170	4.7	240	6.4	300	8.0
	1	0.07	100	2.7	180	4.8	240	6.4	340	9.1	430	11.5
	2	0.14	130	3.5	250	6.7	330	8.8	510	13.7	630	16.9
	3	0.21	170	4.7	340	9.1	420	11.3	680	18.2	770	20.6
	5	0.35	220	5.9	420	11.3	650	17.4	960	25.7	1080	28.9
	10	0.69	330	8.8	730	19.6	1100	29.5	1310	35.1	1600	42.9
	15	1.0	430	11.5	1000	26.8	1440	38.6	1770	47.4	1800	48.2
	20	1.4	530	14.2	1200	32.2	1810	48.5	2100	56.3	1960	52.5
	30	2.1	680	18.2	1550	41.5	2100	56.3	2450	65.7		
	40	2.8	850	22.8	1900	50.9	2150	57.6				
	50	3.4	970	26.0	2200	59.0	2690	72.1				
	60	4.1	1150	30.8	2280	61.1	3010	80.7				
	80	5.5	1450	38.9	2350	63.0						
	100	6.9	1750	46.9	1900	50.9						
	125	8.6	2100	56.3								
11 in. w.c. / 27 mbar 10 to 12.5 in. w.c. / 25 to 31 mbar 1 in. w.c. droop 2 in. w.c. boost	1	0.07	80	2.1	150	4.0	200	5.4	240	6.4	330	8.8
	2	0.14	120	3.2	200	5.4	270	7.2	420	11.3	530	14.2
	3	0.21	150	4.0	250	6.7	350	9.4	530	14.2	680	18.2
	5	0.35	190	5.1	340	9.1	480	12.9	770	20.6	870	23.3
	10	0.69	290	7.8	550	14.7	910	24.4	1230	33.0	1350	36.2
	15	1.0	400	10.7	840	22.5	1290	34.6	1450	38.9	1630	43.7
	20	1.4	480	12.9	1140	30.6	1420	38.1	1650	44.2	1870	50.1
	30	2.1	670	18.0	1530	41.0	1680	45.0	2100	56.3		
	40	2.8	820	22.0	1970	52.8	1750	46.9				
	50	3.4	970	26.0	2150	57.6	1840	49.3				
	60	4.1	1120	30.0	2260	60.6	2130	57.1				
	80	5.5	1420	38.1	2390	64.1						
	100	6.9	1730	46.4	1950	52.3						
	125	8.6	2110	56.6								
14 in. w.c. / 35 mbar 12.5 to 20 in. w.c. / 31 to 50 mbar 2 in. w.c. droop 2 in. w.c. boost	1	0.07	80	2.1	140	3.7	190	5.1	290	7.8	330	8.8
	2	0.14	120	3.2	230	6.2	300	8.0	430	11.5	570	15.3
	3	0.21	160	4.3	290	7.8	360	9.7	580	15.5	730	19.6
	5	0.35	210	5.6	360	9.7	500	13.4	760	20.4	970	26.0
	10	0.69	320	8.6	570	15.3	890	23.9	1190	31.9	1530	41.0
	15	1.0	410	11.0	820	22.0	1210	32.4	1460	39.1	1780	47.7
	20	1.4	500	13.4	1050	28.1	1440	38.6	1660	44.5	1950	52.3
	30	2.1	670	18.0	1500	40.2	1790	48.0	2200	59.0		
	40	2.8	830	22.2	1830	49.0	2020	54.1				
	50	3.4	970	26.0	2100	56.3	2100	56.3				
	60	4.1	1140	30.6	2350	63.0	2180	58.4				
	80	5.5	1440	38.6	3000	80.4						
	100	6.9	1770	47.4	2550	68.3						
	125	8.6	2140	57.4								

- Gray areas indicate capacities limited by either droop or boost.
- Blank areas indicate where maximum operating inlet pressure is exceeded for a given orifice.

- continued -

Table 7. 1 NPT Globe Body Capacities (continued)

OUTLET PRESSURE SETTING, SPRING RANGE, DROOP AND BOOST	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS									
			Orifice Size, In. / mm									
			1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
28 in. w.c. / 70 mbar 20 to 35 in. w.c. / 50 to 87 mbar ± 1% ABS	2	0.14	120	3.2	250	6.7	310	8.3	420	11.3	570	15.3
	3	0.21	150	4.0	280	7.5	380	10.2	570	15.3	770	20.6
	5	0.35	220	5.9	380	10.2	550	14.7	830	22.2	1040	27.9
	10	0.69	330	8.8	600	16.1	890	23.9	1310	35.1	1570	42.1
	15	1.0	410	11.0	810	21.7	1220	32.7	1600	42.9	2000	53.6
	20	1.4	510	13.7	1020	27.3	1490	39.9	2000	53.6	2300	61.6
	30	2.1	660	17.7	1440	38.6	1820	48.8	2450	65.7		
	40	2.8	830	22.2	1800	48.2	2080	55.7				
	50	3.4	970	26.0	2120	56.8	2430	65.1				
	60	4.1	1130	30.3	2340	62.7	2800	75.0				
	80	5.5	1440	38.6	2800	75.0						
	100	6.9	1760	47.2	3100	83.1						
	125	8.6	2150	57.6								
28 in. w.c. / 70 mbar 20 to 35 in. w.c. / 50 to 87 mbar ± 2% ABS	2	0.14	150	4.0	310	8.3	470	12.6	710	19.0	970	26.0
	3	0.21	180	4.8	390	10.5	590	15.8	940	25.2	1290	34.6
	5	0.35	250	6.7	530	14.2	840	22.5	1380	37.0	1710	45.8
	10	0.69	360	9.7	810	21.7	1320	35.4	2060	55.2	2500	67.0
	15	1.0	430	11.5	1010	27.1	1750	46.9	2550	68.3	3030	81.2
	20	1.4	530	14.2	1200	32.2	2130	57.1	2930	78.5	3380	90.6
	30	2.1	670	18.0	1570	42.1	2790	74.8	2550	68.3		
	40	2.8	830	22.2	1920	51.5	3400	91.1				
	50	3.4	970	26.0	2280	61.1	3800	102				
	60	4.1	1130	30.3	2630	70.5	4050	109				
	80	5.5	1440	38.6	3330	89.2						
	100	6.9	1760	47.2	4050	109						
	125	8.6	2150	57.6								
2 psig / 0.14 bar 1.25 to 2.2 psig / 0.09 to 0.15 bar ± 1% ABS	3	0.21	120	3.2	190	5.1	250	6.7	330	8.8	450	12.1
	5	0.35	150	4.0	270	7.2	360	9.7	560	15.0	750	20.1
	10	0.69	250	6.7	430	11.5	620	16.6	1020	27.3	1340	35.9
	15	1.0	330	8.8	600	16.1	800	21.4	1350	36.2	1600	42.9
	20	1.4	410	11.0	740	19.8	1040	27.9	1580	42.3	2040	54.7
	30	2.1	560	15.0	1050	28.1	1350	36.2	1980	53.1		
	40	2.8	730	19.6	1320	35.4	1790	48.0				
	50	3.4	870	23.3	1620	43.4	1960	52.5				
	60	4.1	1030	27.6	1910	51.2	2140	57.4				
	80	5.5	1350	36.2	2350	63.0						
	100	6.9	1650	44.2	2600	69.7						
	125	8.6	2000	53.6								
2 psig / 0.14 bar 1.25 to 2.2 psig / 0.09 to 0.15 bar ± 2 % ABS	3	0.21	150	4.0	270	7.2	420	11.3	600	16.1	790	21.2
	5	0.35	210	5.6	420	11.3	620	16.6	960	25.7	1230	33.0
	10	0.69	340	9.1	700	18.8	1050	28.1	1650	44.2	2000	53.6
	15	1.0	440	11.8	940	25.2	1450	38.9	2130	57.1	2580	69.1
	20	1.4	520	13.9	1150	30.8	1750	46.9	2600	69.7	2980	79.9
	30	2.1	670	18.0	1540	41.3	2290	61.4	3180	85.2		
	40	2.8	830	22.2	1880	50.4	2740	73.4				
	50	3.4	970	26.0	2220	59.5	2310	61.9				
	60	4.1	1130	30.3	2600	69.7	3600	96.5				
	80	5.5	1450	38.9	3340	89.5						
	100	6.9	1750	46.9	4000	107						
	125	8.6	2100	56.3								

- Gray areas indicate capacities limited by either droop or boost.
- Blank areas indicate where maximum operating inlet pressure is exceeded for a given orifice.

Table 8. 3/4 NPT Angle Body Capacities

OUTLET PRESSURE SETTING, SPRING RANGE, DROOP AND BOOST	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS									
			Orifice Size, In. / mm									
			1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
7 in. w.c. / 17 mbar 6 to 8 in. w.c. / 15 to 20 mbar 1 in. w.c. droop 2 in. w.c. boost	0.5	0.03	70	1.9	120	3.2	170	4.6	240	6.4	300	8.0
	1	0.07	100	2.7	180	4.8	240	6.4	340	9.1	430	11.5
	2	0.14	130	3.5	250	6.7	330	8.8	510	13.7	630	16.9
	3	0.21	170	4.6	340	9.1	420	11.3	680	18.2	770	20.6
	5	0.35	220	5.9	420	11.3	650	17.4	900	24.1	960	25.7
	10	0.69	330	8.8	730	19.6	1100	29.5	1310	35.1	1310	35.1
	15	1.0	430	11.5	1000	26.8	1380	37.0	1520	40.7	1520	40.7
	20	1.4	530	14.2	1200	32.2	1560	41.8	1620	43.4	1620	43.4
	30	2.1	680	18.2	1550	41.5	1840	49.3	1750	46.9		
	40	2.8	850	22.8	1900	50.9	1950	52.3				
	50	3.4	970	26.0	2200	59.0	2000	53.6				
	60	4.1	1150	30.8	2280	61.1	2100	56.3				
	80	5.5	1450	38.9	2350	63.0						
	100	6.9	1750	46.9	1900	50.9						
	125	8.6	2100	56.3								
11 in. w.c. / 27 mbar 10 to 12.5 in. w.c. / 25 to 31 mbar 1 in. w.c. droop 2 in. w.c. boost	1	0.07	80	2.1	150	4.0	200	5.4	240	6.4	330	8.8
	2	0.14	120	3.2	200	5.4	270	7.2	420	11.3	530	14.2
	3	0.21	150	4.0	250	6.7	350	9.4	530	14.2	680	18.2
	5	0.35	190	5.1	340	9.1	480	12.9	770	20.6	860	23.1
	10	0.69	290	7.8	550	14.7	910	24.4	1210	32.4	1210	32.4
	15	1.0	400	10.7	840	22.5	1210	32.4	1380	37.0	1380	37.0
	20	1.4	480	12.9	1140	30.6	1550	41.5	1590	42.6	1590	42.6
	30	2.1	670	18.0	1530	41.0	1830	49.0	1780	47.7		
	40	2.8	820	22.0	1970	52.8	1950	52.3				
	50	3.4	970	26.0	2150	57.6	1990	53.3				
	60	4.1	1120	30.0	2260	60.6	2050	54.9				
	80	5.5	1420	38.0	2390	64.1						
	100	6.9	1730	46.4	1950	52.3						
	125	8.6	2110	56.6								
14 in. w.c. / 35 mbar 12.5 to 20 in. w.c. / 31 to 50 mbar 2 in. w.c. droop 2 in. w.c. boost	1	0.07	80	2.1	140	3.8	190	5.1	290	7.8	330	8.8
	2	0.14	120	3.2	230	6.2	300	8.0	430	11.5	570	15.3
	3	0.21	160	4.3	290	7.8	360	9.7	580	15.5	730	19.6
	5	0.35	210	5.6	360	9.7	500	13.4	760	20.4	970	26.0
	10	0.69	320	8.6	570	15.3	890	23.9	1190	31.9	1290	34.6
	15	1.0	410	11.0	820	22.0	1210	32.4	1460	39.1	1560	41.8
	20	1.4	500	13.4	1050	28.1	1440	38.6	1660	44.5	1700	45.6
	30	2.1	670	18.0	1500	40.2	1790	48.0	1850	49.6		
	40	2.8	830	22.2	1830	49.0	2020	54.1				
	50	3.4	970	26.0	2100	56.3	2100	56.3				
	60	4.1	1140	30.6	2120	56.8	2180	58.4				
	80	5.5	1440	38.6	2220	59.5						
	100	6.9	1770	47.4	2250	60.3						
	125	8.6	2140	57.4								

- Gray areas indicate capacities limited by either droop or boost.
- Blank areas indicate where maximum operating inlet pressure is exceeded for a given orifice.

- continued -

Table 8. 3/4 NPT Angle Body Capacities (continued)

OUTLET PRESSURE SETTING, SPRING RANGE, DROOP AND BOOST	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS									
			Orifice Size, In. / mm									
			1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
28 in. w.c. / 70 mbar 20 to 35 in. w.c. / 50 to 87 mbar ± 1% ABS	2	0.14	120	3.2	250	6.7	310	8.3	420	11.3	570	15.3
	3	0.21	150	4.0	280	7.5	380	10.2	570	15.3	770	20.6
	5	0.35	220	5.9	380	10.2	550	14.7	830	22.2	1040	27.9
	10	0.69	330	8.8	600	16.1	890	23.9	1310	35.1	1570	42.1
	15	1.0	410	11.0	810	21.7	1220	32.7	1600	42.9	1860	49.9
	20	1.4	510	13.7	1020	27.3	1490	39.9	1790	48.0	2020	54.1
	30	2.1	660	17.7	1440	38.6	1820	48.8	2100	56.3		
	40	2.8	830	22.2	1800	48.2	2080	55.7				
	50	3.4	970	26.0	1980	53.1	2280	61.1				
	60	4.1	1130	30.3	2320	62.2	2380	63.8				
	80	5.5	1440	38.6	2400	64.3						
	100	6.9	1760	47.2	2500	67.0						
	125	8.6	2150	57.6								
28 in. w.c. / 70 mbar 20 to 35 in. w.c. / 50 to 87 mbar ± 2% ABS	2	0.14	150	4.0	310	8.3	470	12.6	710	19.0	930	24.9
	3	0.21	180	4.8	390	10.5	590	15.8	940	25.2	1230	33.0
	5	0.35	250	6.7	530	14.2	840	22.5	1290	34.6	1600	42.9
	10	0.69	360	9.7	810	21.7	1320	35.4	1890	50.7	2200	59.0
	15	1.0	430	11.5	1010	27.1	1650	44.2	2290	61.4	2530	67.8
	20	1.4	530	14.2	1200	32.2	1940	52.0	2490	66.7	2750	73.7
	30	2.1	670	18.0	1570	42.1	2430	65.1	2900	77.7		
	40	2.8	830	22.2	1920	51.5	2720	72.9				
	50	3.4	970	26.0	2280	61.1	2830	75.8				
	60	4.1	1130	30.3	2630	70.5	3050	81.7				
	80	5.5	1440	38.6	3050	81.7						
	100	6.9	1760	47.2	3150	84.4						
	125	8.6	2150	57.6								
2 psig / 0.14 bar 1.25 to 2.2 psig / 0.09 to 0.15 bar ± 1% ABS	3	0.21	120	3.2	190	5.1	250	6.7	330	8.8	450	12.1
	5	0.35	150	4.0	270	7.2	360	9.7	560	15.0	750	20.1
	10	0.69	250	6.7	430	11.5	620	16.6	1020	27.3	1340	35.9
	15	1.0	330	8.8	600	16.1	800	21.4	1350	36.2	1480	39.7
	20	1.4	410	11.0	740	19.8	1040	27.9	1540	41.3	1800	48.2
	30	2.1	560	15.0	1050	28.1	1450	38.9	1850	49.6		
	40	2.8	730	19.6	1320	35.4	1640	44.0				
	50	3.4	870	23.3	1620	43.4	1900	50.9				
	60	4.1	1030	27.6	1910	51.2	2140	57.4				
	80	5.5	1350	36.2	2090	56.0						
	100	6.9	1650	44.2	2180	58.4						
	125	8.6	2000	53.6								
2 psig / 0.14 bar 1.25 to 2.2 psig / 0.09 to 0.15 bar ± 2 % ABS	3	0.21	150	4.0	270	7.2	420	11.3	600	16.1	790	21.2
	5	0.35	210	5.6	420	11.3	620	16.6	960	25.7	1230	32.9
	10	0.69	340	9.1	700	18.8	1050	28.1	1430	38.3	1880	50.4
	15	1.0	440	11.8	940	25.2	1350	36.2	1880	50.4	2230	59.8
	20	1.4	520	13.9	1150	30.8	1620	43.4	2260	60.6	2540	68.1
	30	2.1	670	18.0	1540	41.3	2110	56.6	2520	67.5		
	40	2.8	830	22.2	1880	50.4	2430	65.1				
	50	3.4	970	26.0	2170	58.2	2640	70.8				
	60	4.1	1130	30.3	2460	65.9	2850	76.4				
	80	5.5	1450	38.9	2850	76.4						
	100	6.9	1750	46.9	3000	80.4						
	125	8.6	2100	56.3								

☐ - Blank areas indicate where maximum operating inlet pressure is exceeded for a given orifice.

Table 9. 1 NPT Angle Body Capacities

OUTLET PRESSURE SETTING, SPRING RANGE, DROOP AND BOOST	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS									
			Orifice Size, In. / mm									
			1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
7 in. w.c. / 17 mbar 6 to 8 in. w.c. / 15 to 20 mbar 1 in. w.c. droop 2 in. w.c. boost	0.5	0.03	70	1.9	120	3.2	170	4.6	240	6.4	300	8.0
	1	0.07	100	2.7	180	4.8	240	6.4	340	9.1	430	11.5
	2	0.14	130	3.5	250	6.7	330	8.8	510	13.7	630	16.9
	3	0.21	170	4.6	340	9.1	420	11.3	680	18.2	860	23.1
	5	0.35	220	5.9	420	11.3	650	17.4	1030	27.6	1130	30.3
	10	0.69	330	8.8	730	19.6	1100	29.5	1560	41.8	1520	40.7
	15	1.0	430	11.5	1000	26.8	1560	41.8	1830	49.0	1820	48.8
	20	1.4	530	14.2	1200	32.2	2220	59.5	2270	60.8	2370	63.5
	30	2.1	680	18.2	1550	41.5	2880	77.2	2770	74.2		
	40	2.8	850	22.8	1900	50.9	3550	95.1				
	50	3.4	970	26.0	2200	59.0	4000	107				
	60	4.1	1150	30.8	2280	61.1	4200	113				
	80	5.5	1450	38.9	2350	63.0						
	100	6.9	1750	46.9	1900	50.9						
	125	8.6	2100	56.3								
11 in. w.c. / 27 mbar 10 to 12.5 in. w.c. / 25 to 31 mbar 1 in. w.c. droop 2 in. w.c. boost	1	0.07	80	2.1	150	4.0	200	5.4	240	6.4	330	8.8
	2	0.14	120	3.2	200	5.4	270	7.2	420	11.3	530	14.2
	3	0.21	150	4.0	250	6.7	350	9.4	530	14.2	680	18.2
	5	0.35	190	5.1	340	9.1	480	12.9	770	20.6	970	26.0
	10	0.69	290	7.8	550	14.7	1050	28.1	1230	33.0	1430	38.3
	15	1.0	400	10.7	840	22.5	1470	39.4	1750	46.9	1760	47.2
	20	1.4	480	12.9	1140	30.6	1920	51.5	2230	59.8	2450	65.7
	30	2.1	670	18.0	1530	41.0	2430	65.1	2900	77.7		
	40	2.8	820	22.0	1970	52.8	2870	76.9				
	50	3.4	970	26.0	2150	57.6	3420	91.7				
	60	4.1	1120	30.0	2260	60.6	3750	101				
	80	5.5	1420	38.1	2390	64.0						
	100	6.9	1730	46.4	1950	52.3						
	125	8.6	2110	56.6								
14 in. w.c. / 35 mbar 12.5 to 20 in. w.c. / 31 to 50 mbar 2 in. w.c. droop 2 in. w.c. boost	1	0.07	80	2.1	140	3.8	190	5.1	290	7.8	330	8.8
	2	0.14	120	3.2	230	6.2	300	8.0	430	11.5	570	15.3
	3	0.21	160	4.3	290	7.8	360	9.7	580	15.5	730	19.6
	5	0.35	210	5.6	360	9.7	500	13.4	760	20.4	1000	26.8
	10	0.69	320	8.6	570	15.3	890	23.9	1290	34.6	1480	39.7
	15	1.0	410	11.0	820	22.0	1210	32.4	1570	42.1	1760	47.2
	20	1.4	500	13.4	1050	28.1	1510	40.5	1800	48.2	2400	64.3
	30	2.1	670	18.0	1500	40.2	1980	53.1	2430	65.1		
	40	2.8	830	22.2	1880	50.4	2250	60.3				
	50	3.4	970	26.0	2190	58.7	2570	68.9				
	60	4.1	1140	30.6	2450	65.7	3400	91.1				
	80	5.5	1440	38.6	3390	90.9						
	100	6.9	1770	47.4	2600	69.7						
	125	8.6	2140	57.4								

- Gray areas indicate capacities limited by either droop or boost.
- Blank areas indicate where maximum operating inlet pressure is exceeded for a given orifice.

- continued -

Table 9. 1 NPT Angle Body Capacities (continued)

OUTLET PRESSURE SETTING, SPRING RANGE, DROOP AND BOOST	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS									
			Orifice Size, In. / mm									
			1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13	
	psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
28 in. w.c. / 70 mbar 20 to 35 in. w.c. / 50 to 87 mbar ± 1% ABS	2	0.14	120	3.2	250	6.7	310	8.3	420	11.3	570	15.3
	3	0.21	150	4.0	280	7.5	380	10.2	570	15.3	770	20.6
	5	0.35	220	5.9	380	10.2	550	14.7	830	22.2	1150	30.8
	10	0.69	330	8.8	600	16.1	890	23.9	1310	35.1	1700	45.6
	15	1.0	410	11.0	810	21.7	1220	32.7	1720	46.1	2200	59.0
	20	1.4	510	13.7	1020	27.3	1490	39.9	2100	56.3	2500	67.0
	30	2.1	660	17.7	1440	38.6	2120	56.8	2650	71.0		
	40	2.8	830	22.2	1800	48.2	2500	67.0				
	50	3.4	970	26.0	2120	56.8	2900	77.7				
	60	4.1	1130	30.3	2340	62.7	3350	89.8				
	80	5.5	1440	38.6	2800	75.0						
	100	6.9	1760	47.2	3100	83.1						
	125	8.6	2150	57.6								
28 in. w.c. / 70 mbar 20 to 35 in. w.c. / 50 to 87 mbar ± 2% ABS	2	0.14	150	4.0	310	8.3	470	12.6	710	19.0	1030	27.6
	3	0.21	180	4.8	390	10.5	590	15.8	940	25.2	1380	37.0
	5	0.35	250	6.7	530	14.2	840	22.5	1380	37.0	1850	49.6
	10	0.69	360	9.7	810	21.7	1320	35.3	2170	58.2	2650	71.0
	15	1.0	430	11.5	1010	27.1	1750	46.9	2800	75.0	3250	87.1
	20	1.4	530	14.2	1200	32.2	2130	57.1	3300	88.4	3650	97.8
	30	2.1	670	18.0	1570	42.1	2790	74.8	4000	107		
	40	2.8	830	22.2	1920	51.5	3550	95.1				
	50	3.4	970	26.0	2280	61.1	4150	111				
	60	4.1	1130	30.3	2630	70.5	4800	129				
	80	5.5	1440	38.6	3330	89.2						
	100	6.9	1760	47.2	4050	109						
	125	8.6	2150	57.6								
2 psig / 0.14 bar 1.25 to 2.2 psig / 0.09 to 0.15 bar ± 1% ABS	3	0.21	120	3.2	190	5.1	250	6.7	330	8.8	450	12.1
	5	0.35	150	4.0	270	7.2	360	9.7	560	15.0	750	20.1
	10	0.69	250	6.7	430	11.5	620	16.6	1020	27.3	1340	35.9
	15	1.0	330	8.8	600	16.1	800	21.4	1350	36.2	1600	42.9
	20	1.4	410	11.0	740	19.8	1040	27.9	1700	45.6	2040	54.7
	30	2.1	560	15.0	1050	28.1	1650	44.2	2240	60.0		
	40	2.8	730	19.6	1320	35.4	1920	51.5				
	50	3.4	870	23.3	1620	43.4	2130	57.1				
	60	4.1	1030	27.6	1910	51.2	2500	67.0				
	80	5.5	1350	36.2	2350	63.0						
	100	6.9	1650	44.2	2600	69.7						
	125	8.6	2000	53.6								
2 psig / 0.14 bar 1.25 to 2.2 psig / 0.09 to 0.15 bar ± 2 % ABS	3	0.21	150	4.0	270	7.2	420	11.3	600	16.1	790	21.2
	5	0.35	210	5.6	420	11.3	620	16.6	960	25.7	1320	35.4
	10	0.69	340	9.1	700	18.8	1050	28.1	1650	44.2	2150	57.6
	15	1.0	440	11.8	940	25.2	1450	38.9	2230	59.8	2720	72.9
	20	1.4	520	13.9	1150	30.8	1750	46.9	2730	73.2	3240	86.8
	30	2.1	670	18.0	1540	41.3	2470	66.2	3520	94.3		
	40	2.8	830	22.2	1880	50.4	2930	78.5				
	50	3.4	970	26.0	2220	59.5	3600	96.5				
	60	4.1	1130	30.3	2600	69.7	4200	113				
	80	5.5	1450	38.9	3340	89.5						
	100	6.9	1750	46.9	4000	107						
	125	8.6	2100	56.3								

☐ - Blank areas indicate where maximum operating inlet pressure is exceeded for a given orifice.

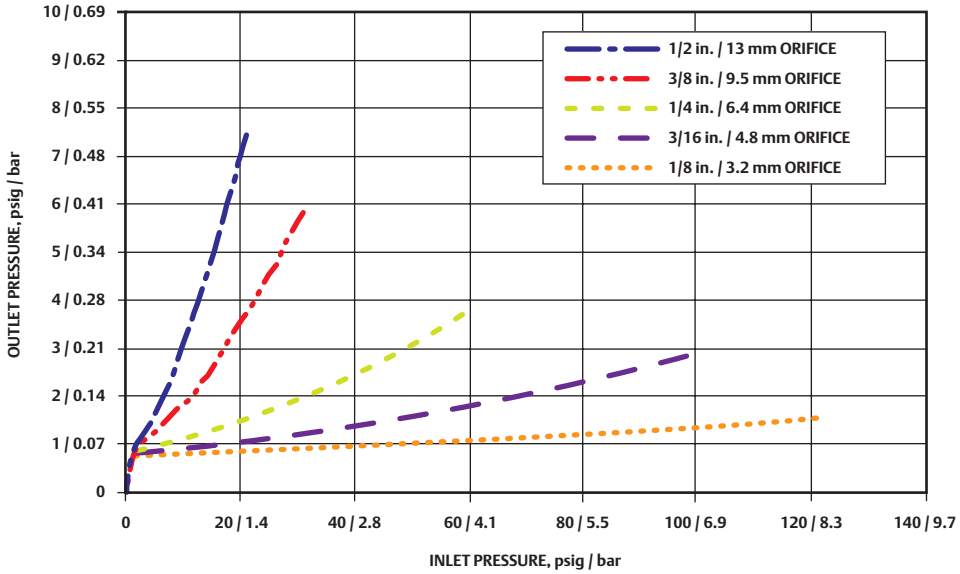


Figure 3. *7 in. w.c. / 17 mbar Setpoint Relief Curves (with Lever Disconnected, No Vent Piping and 3/4 or 1 NPT Vent)*

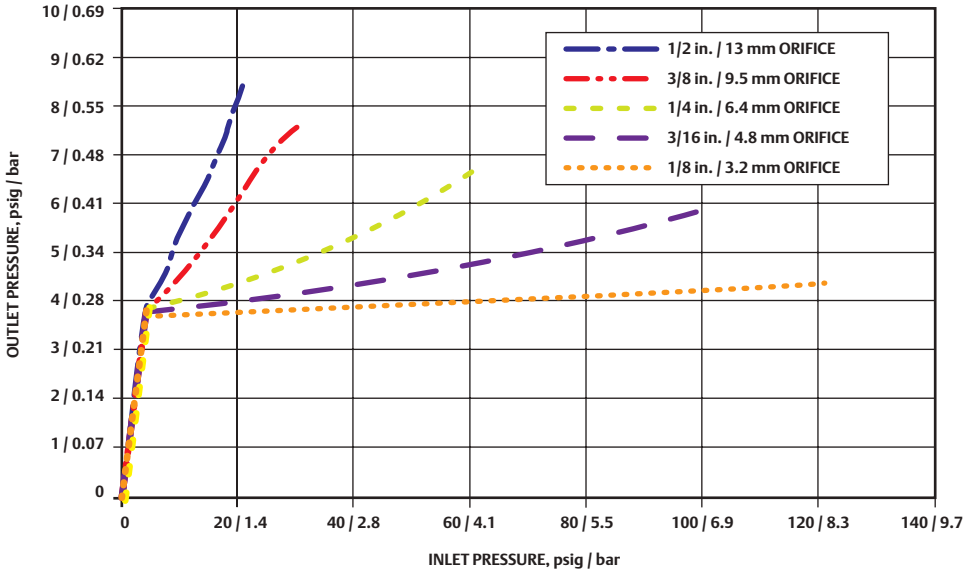


Figure 4. *2 psig / 0.14 bar Setpoint Relief Curves (with Lever Disconnected, No Vent Piping and 3/4 or 1 NPT Vent)*

Table 10. Relief Performance(1)

ORIFICE SIZE		MAXIMUM ALLOWABLE INLET PRESSURE IF OUTLET PRESSURE IS HELD AT OR BELOW 2 psig / 0.14 bar	
In.	mm	psig	bar
1/8 3/16	3.2 4.8	125 65	8.6 4.5
1/4 3/8 1/2	6.4 9.5 13	30 10 7	2.1 0.69 0.48

1. The relief performance testing is in accordance with ANSI B109.4 and CSA 6.18 with the regulator set at 7 in. w.c. / 17 mbar stem linkage disconnected and vented directly to atmosphere using the 3/4 or 1 NPT vent.

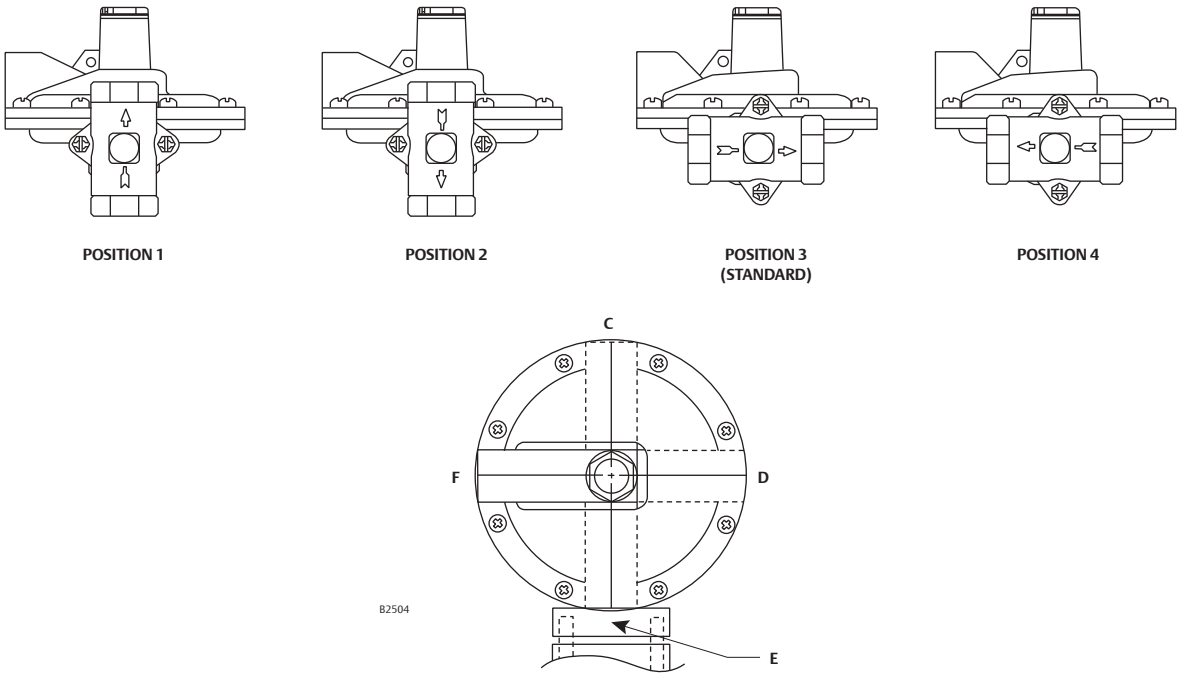
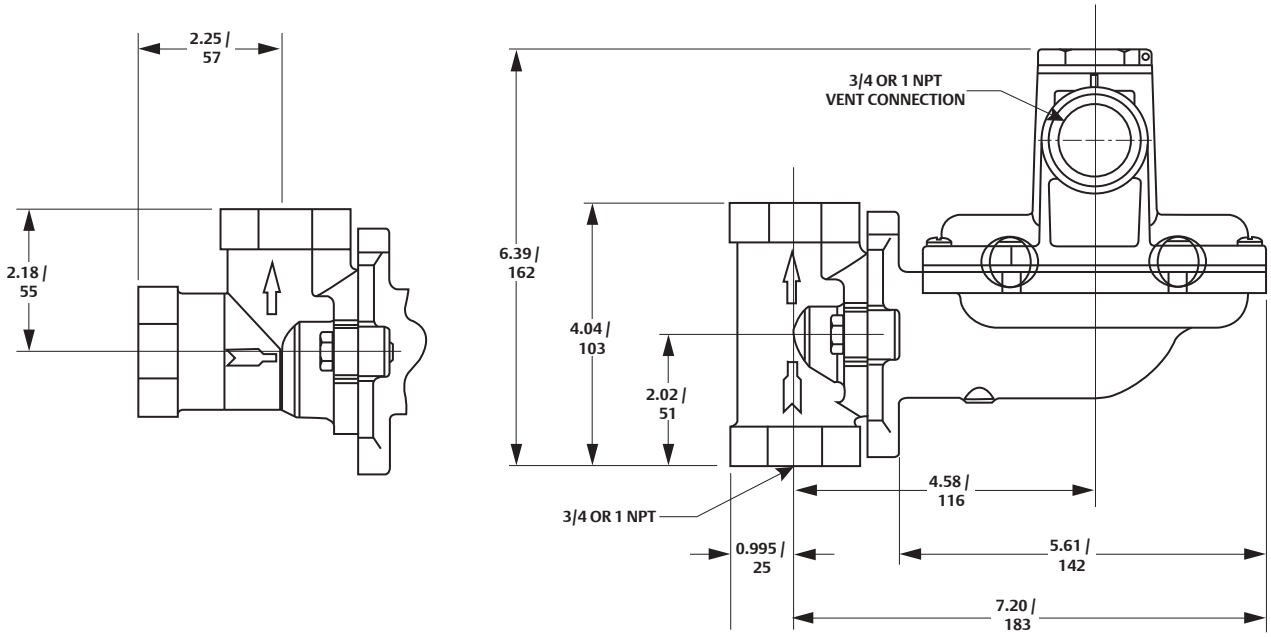


Figure 5. *Regulator Body and Spring Case Vent Locations (Body Position is with Regard to the Outlet)*



NOTE: THE STANDARD BODY ORIENTATION FOR THE ANGLE BODY IS WITH THE BODY OUTLET ROTATED 90° TOWARD THE READER. COMPARED TO FIGURE 5, THE OUTLET OF THE ANGLE BODY WILL POINT IN THE SAME DIRECTION AS POSITION "3" OF A GLOBE BODY.

IN. / mm

Figure 6. *Dimensions*

Ordering Guide

Body Type, Size and End Connection Style (Select One)	
Globe	**Angle**
☐ 3/4 NPT***	☐ 3/4 NPT***
☐ 3/4 x 1 NPT***	☐ 3/4 x 1 NPT***
☐ 1 NPT***	☐ 1 NPT***

Outlet Pressure Range (Select One)
☐ 4 to 6 in. w.c. / 10 to 15 mbar, Orange***
☐ 6 to 8 in. w.c. / 15 to 20 mbar, Yellow***
☐ 8 to 10 in. w.c. / 20 to 25 mbar, Black***
☐ 10 to 12.5 in. w.c. / 25 to 31 mbar, Silver***
☐ 12.5 to 20 in. w.c. / 31 to 50 mbar, Gray***
☐ 20 to 35 in. w.c. / 50 to 87 mbar, Pink***
☐ 1.25 to 2.2 psig / 0.09 to 0.15 bar, Light Blue***

Orifice Size (Select One)
☐ 1/8 in. / 3.2 mm***
☐ 3/16 in. / 4.8 mm***
☐ 1/4 in. / 6.3 mm***
☐ 3/8 in. / 9.5 mm***
☐ 1/2 in. / 13 mm***

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Body Orientation (Select One)	
Globe	**Angle**
☐ Position 1***	☐ Position 1***
☐ Position 2***	☐ Position 2***
☐ Position 3 **(standard)*****	☐ Position 3 **(standard)*****
☐ Position 4***	☐ Position 4***

Vent Size (Select One)
☐ 3/4 NPT***
☐ 1 NPT***

Vent Orientation (Select One)	
Globe	**Angle**
☐ Position C***	☐ Position C***
☐ Position D***	☐ Position D***
☐ Position E***	☐ Position E **(standard)*****
☐ Position F **(standard)*****	☐ Position F***

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Does the application require overpressure protection?
☐ Yes, which is preferred? ☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No
Pressure
Maximum Inlet Pressure (P_{1max}):
Minimum Inlet Pressure (P_{1min}):
Downstream Pressure Setting(s) (P_2):
Maximum Flow (Q_{max}):
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Do not oversize regulators. Pick the smallest orifice size or regulator that will work. Keep in mind when sizing a station that most restricted trims that do not reduce the main port size do not help with improved low flow control.

Introduction

The M Series spring-loaded regulators are ideal for applications requiring sudden changes in capacity or where gas shutoff is solenoid-controlled as with domestic or industrial burners. These regulators can be used with natural, manufactured, propane, other gases and air so long as they are filtered and do not contain high percentages of benzol.

Available Configurations

See Table 1

Body Sizes and End Connection Styles

See Table 2

Flow Capacities

See Tables 5 through 40

MN and MF Series

Allowable Pressure:
Body: Up to 290 psig / Up to 20.0 bar
Actuator: 58 psig / 4.0 bar

Highest Operating Pressure:
43.5 psig / 3.0 bar

Permissible Inlet Pressure:
Standard Version NPS 1 through 2 / DN 25 through 50: 145 psig / 10.0 bar
Standard Version NPS 2-1/2 through 4 / DN 65 through 100: 72.5 psig / 5.0 bar
PST, AP and APA Versions: 284 psig / 19.6 bar(1)

Set Range:
Standard Version: 0.15 to 7.25 psig / 0.01 to 0.50 bar
PST Version: 3.63 to 7.25 psig / 0.25 to 0.5 bar
AP Version: 7.25 to 14.5 psig / 0.50 to 1.00 bar
APA Version: 14.5 to 43.5 psig / 1.00 to 3.0 bar
BP Version(2): 0.29 to 1.16 psig / 0.02 to 0.08 bar

Accuracy Class

Up to ±5%

Lockup Pressure Class

Up to 10%

Class of Lockup Pressure Zone

Up to 10%

Shut-off Device Independent Pneumatic Control

Accuracy Class: ±5%

Response Time: ≤ 1 second

Temperature Capabilities

Standard Version:
Working: 14 to 140°F / -10 to 60°C

Low Temperature Version:
Working: -4 to 140°F / -20 to 60°C

Options

Built-in Type SR Silencer

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

1. At average ambient temperature.
2. BP version is available only for the NPS 3 and 4 / DN 80 and 100.



Figure 1. *MN Series Regulator*



Figure 2. *MF Series Regulator*

Features

- **Counterbalanced Valve**
- **Overpressure and Underpressure Slam-Shut Valve**
- **Full Seal at Zero Flow**
- **Ease of Maintenance**
- **Fail Open Regulator**
- **Wide Pressure Regulation Range**



Figure 3. *MF Series Cross-Sectional View*

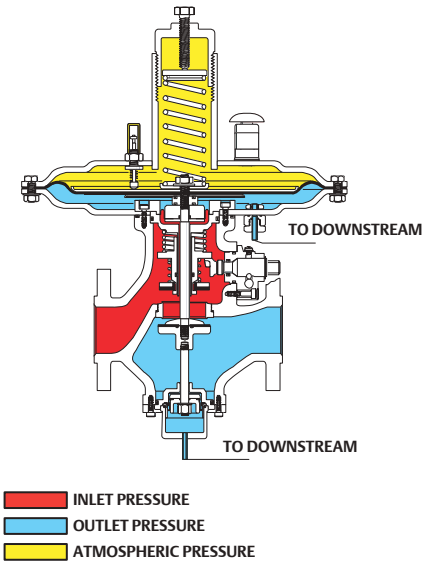


Figure 4. *MBF-M Series Operational Schematic*

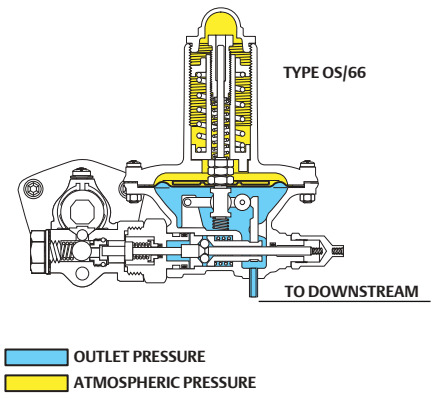


Figure 5. *Type OS/66 Shut-off Device Operational Schematic*

Table 1. Available Configuration

CONFIGURATION	TYPE							
	MN				MF			
	Standard	AP	APA	PST	Standard	AP	APA	PST
Regulator	MN	MN-AP	MN-APA	MN-PST	MF	MF-AP	MF-APA	MF-PST
Regulator with Shut-off	MBN	MBN-AP	MBN-APA	MBN-PST	MBF	MBF-AP	MBF-APA	MBF-PST
Monitor with Shut-off	MBN-M	MBN-M-AP	MBN-M-APA	MBN-M-PST	MBF-M	MBF-M-AP	MBF-M-APA	MBF-M-PST

Table 2. Body Size and End Connection Style

SERIES	BODY SIZE		END CONNECTION
	NPS	DN	
MN	1 X 2-1/2	25 X 65	PN 16, CL150 RF
	1-1/2 X 3	40 X 80	
	2 X 4	50 X 100	
	2-1/2 X 4	65 X 100	
	3 X 6	80 X 150	
	4 X 8	100 X 200	
MF	1	25	
	1-1/2	40	
	2	50	
	3	80	
	4	100	

Table 3. Construction Material

BODY	FLANGE AND COVER	DIAPHRAGM	PAD
Steel	Steel	Fabric Nitrile (NBR) and Polyvinyl Chloride (PVC)/Nitrile (NBR)	Nitrile (NBR)

Table 4. Set Range of Safety Shut-Off Device Pilot

TYPE	SERVOMOTOR BODY RESISTANCE		OVERPRESSURE SET RANGE				UNDERPRESSURE SET RANGE			
			Minimum		Maximum		Minimum		Maximum	
	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
OS/66	87	6.0	0.32	0.02	8.7	0.60	0.10	7 mbar	6.53	0.45
OS/66-AP			2.9	0.20	73	5.0	1.45	0.10	36	2.5

Table 5. MN Series Capacities for NPS 1 / DN 25 Body, Standard Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS																	
		Inlet Pressure, psig / bar																	
		0.73 / 0.05		2.90 / 0.20		5.80 / 0.40		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	2119	60.0	6003	170	8829	250	10,947	310	14,126	400	21,189	600	33,549	950	33,549	950	----	
0.73	0.05	----		5650	160	8475	240	10,594	300										
1.45	0.10			4944	140	8122	230							37,080	1050	37,080	1050		
3.63	0.25			----		5650	160	9182	260	13,420	380					42,377	1200	42,377	1200
7.25	0.50					----		5650	160	12,360	350					49,440	1400	49,440	1400

▭ - Capacities for PST version.

Table 6. MN Series Capacities for NPS 1 / DN 25 Body, AP Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
		Inlet Pressure, psig / bar											
		8.70 / 0.60		14.5 / 1.00		29.0 / 2.00		72.5 / 5.00		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
7.25	0.50	5650	160	12,360	350	21,189	600	37,080	1050	49,440	1400	49,440	1400
8.70	0.60	----		11,301	320					52,972	1500	52,972	1500
10.2	0.70			10,241	290	20,836	590			56,503	1600	56,503	1600
11.6	0.80			8829	250	20,482	580			60,035	1700	60,035	1700
14.5	1.00			----		19,776	560			70,629	2000	67,098	1900

Table 7. MN Series Capacities for NPS 1 / DN 25 Body, APA Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
		Inlet Pressure, psig / bar							
		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
14.5	1.00	19,776	560	37,080	1050	70,629	2000	67,098	1900
21.8	1.5	15,892	450					77,692	2200
29.0	2.0	----							
36.3	2.5								
43.5	3.0			35,314	1000				

Table 8. MN Series Capacities for NPS 1-1/2 / DN 40 Body, Standard Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS																	
		Inlet Pressure, psig / bar																	
		0.73 / 0.05		2.90 / 0.20		5.80 / 0.40		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	5297	150	12,007	340	16,598	470	20,482	580										
0.73	0.05			11,301	320	15,892	450	19,776	560	25,073	710	37,080	1050	63,566	1800	63,566	1800	----	
1.45	0.10	----		9535	270	15,185	430	19,070	540					65,332	1850	65,332	1850		
3.63	0.25			----		12,360	350	18,010	510	24,720	700			74,160	2100	74,160	2100	74,160	2100
7.25	0.50					----		11,301	320	22,601	640	35,314	1000			88,286	2500	88,286	2500

- Capacities for PST version.

Table 9. MN Series Capacities for NPS 1-1/2 / DN 40 Body, AP Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
		Inlet Pressure, psig / bar											
		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
7.25	0.50	11,301	320	22,601	640					88,286	2500	88,286	2500
8.70	0.60			21,189	600	35,314	1000			91,818	2600	91,818	2600
10.2	0.70			19,423	550			74,160	2100	98,881	2800	98,881	2800
11.6	0.80	----		16,245	460	34,608	980			102,412	2900	102,412	2900
14.5	1.00			----		33,549	950			109,475	3100	109,475	3100

Table 10. MN Series Capacities for NPS 1-1/2 / DN 40 Body, APA Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
		Inlet Pressure, psig / bar							
		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
14.5	1.00	33,549	950	74,160	2100	109,475	3100	109,475	3100
21.8	1.5	29,664	840					127,132	3600
29.0	2.0	----		72,395	2050	137,726	3900		
36.3	2.5							148,321	4200
43.5	3.0			63,566	1800				

Table 11. MN Series Capacities for NPS 2 / DN 50 Body, Standard Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS																	
		Inlet Pressure, psig / bar																	
		0.73 / 0.05		2.90 / 0.20		5.80 / 0.40		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	7063	200	16,951	480	23,308	660	28,252	800					91,818	2600	91,818	2600		
0.73	0.05			15,892	450	22,954	650	27,898	790	35,314	1000	51,206	1450	93,583	2650	93,583	2650	----	
1.45	0.10	----		13,773	390	22,248	630	27,545	780					97,115	2750	97,115	2750		
3.63	0.25			----		17,304	490	25,426	720					100,646	2850	109,475	3100	109,475	3100
7.25	0.50					----		15,892	450	32,842	930					141,258	4000	141,258	4000

- Capacities for PST version.

Table 12. MN Series Capacities for NPS 2 / DN 50 Body, AP Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS Inlet Pressure, psig / bar											
		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
7.25	0.50	15,892	450	32,842	930	51,206	1450	100,646	2850	141,258	4000	141,258	4000
8.70	0.60	----		31,077	880					148,321	4200	148,321	4200
10.2	0.70			28,252	800					162,447	4600	162,447	4600
11.6	0.80			24,014	680					173,041	4900	173,041	4900
14.5	1.00			----		49,440	1400			190,698	5400	187,167	5300

Table 13. MN Series Capacities for NPS 2 / DN 50 Body, APA Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS Inlet Pressure, psig / bar							
		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
14.5	1.00	49,440	1400	100,646	2850	190,698	5400	187,167	5300
21.8	1.5	42,377	1200					208,355	5900
29.0	2.0	----							
36.3	2.5								
43.5	3.0			98,881	2800				

Table 14. MN Series Capacities for NPS 2-1/2 / DN 65 Body, Standard Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS Inlet Pressure, psig / bar																	
		0.73 / 0.05		2.90 / 0.20		5.80 / 0.40		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	10,594	300	25,426	720	35,314	1000	44,143	1250	56,503	1600	84,755	2400	155,384	4400	----		----	
0.73	0.05	----		23,661	670									158,915	4500				
1.45	0.10			19,776	560	33,902	960							167,744	4750				
3.63	0.25			----		28,252	800	40,612	1150					173,041	4900	190,698	5400	190,698	5400
7.25	0.50					----		25,780	730	52,972	1500					229,544	6500	229,544	6500

▭ - Capacities for PST version.

Table 15. MN Series Capacities for NPS 2-1/2 / DN 65 Body, AP Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS Inlet Pressure, psig / bar											
		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
7.25	0.50	25,780	730	52,972	1500	84,755	2400	173,041	4900	229,544	6500	229,544	6500
8.70	0.60	----		49,440	1400					243,670	6900	243,670	6900
10.2	0.70			45,909	1300					261,327	7400	261,327	7400
11.6	0.80			38,846	1100					275,453	7800	275,453	7800
14.5	1.00			----		82,989	2350			307,236	8700	307,236	8700

Table 16. MN Series Capacities for NPS 2-1/2 / DN 65 Body, APA Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS Inlet Pressure, psig / bar							
		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
14.5	1.00	82,989	2350	173,041	4900	307,236	8700	307,236	8700
21.8	1.5	70,629	2000			314,299	8900	339,019	9600
29.0	2.0	----						342,550	9700
36.3	2.5			171,275	4850				
43.5	3.0			169,509	4800				

Table 17. MN Series Capacities for NPS 3 / DN 80 Body, Standard Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS																	
		Inlet Pressure, psig / bar																	
		0.73 / 0.05		2.90 / 0.20		5.80 / 0.40		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	16,598	470	38,846	1100	52,972	1500	63,566	1800	81,223	2300	120,069	3400	243,670	6900	----		----	
0.73	0.05	----		35,314	1000														
1.45	0.10			31,077	880	51,206	1450												
3.63	0.25			----		40,612	1150	58,269	1650							423,774	12,000	423,774	12,000
7.25	0.50					----		35,314	1000	75,926	2150					444,962	12,600	487,340	13,800

▭ - Capacities for PST version.

Table 18. MN Series Capacities for NPS 3 / DN 80 Body, AP Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
		Inlet Pressure, psig / bar											
		8.70 / 0.60		14.5 / 1.00		29.0 / 2.00		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
7.25	0.50	35,314	1000	75,926	2150	120,069	3400	243,670	6900	444,962	12,600	487,340	13,800
8.70	0.60	----		70,629	2000								
10.2	0.70			65,332	1850								
11.6	0.80			52,972	1500								
14.5	1.00			----									

Table 19. MN Series Capacities for NPS 3 / DN 80 Body, APA Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
		Inlet Pressure, psig / bar							
		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
14.5	1.00	120,069	3400	243,670	6900	444,962	12,600	487,340	13,800
21.8	1.5	100,646	2850						
29.0	2.0	----							
36.3	2.5								
43.5	3.0			240,138	6800				

Table 20. MN Series Capacities for NPS 4 / DN 100 Body, Standard Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS																	
		Inlet Pressure, psig / bar																	
		0.73 / 0.05		2.9 / 0.20		5.80 / 0.40		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	25,780	730	60,035	1700	82,989	2350	98,881	2800	125,366	3550	187,167	5300	370,802	10,500	----		----	
0.73	0.05	----		56,503	1600	81,223	2300												
1.45	0.10			47,675	1350	77,692	2200	97,115	2750										
3.63	0.25			----		61,800	1750	90,052	2550	123,601	3500					678,038	19,200	741,604	21,000
7.25	0.50					----		56,503	1600	116,538	3300								

▭ - Capacities for PST version.

Table 21. MN Series Capacities for NPS 4 / DN 100 Body, AP Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
		Inlet Pressure, psig / bar											
		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
7.25	0.50	56,503	1600	116,538	3300	187,167	5300	370,802	10,500	678,038	19,200	741,604	21,000
8.70	0.60	----		109,475	3100								
10.2	0.70			100,646	2850								
11.6	0.80			84,755	2400								
14.5	1.00			----		183,635	5200						

Table 22. MN Series Capacities for NPS 4 / DN 100 Body, APA Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
		Inlet Pressure, psig / bar							
		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
14.5	1.00	183,635	5200	370,802	10,500	678,038	19,200	741,604	21,000
21.8	1.5	155,384	4400						
29.0	2.0	----							
36.3	2.5								
43.5	3.0								

Table 23. MF Series Capacities for NPS 1 / DN 25 Body, Standard Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS																	
		Inlet Pressure, psig / bar																	
		0.73 / 0.05		2.90 / 0.20		5.80 / 0.40		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	2119	60	6003	170	8829	250	9888	280	9888	280	9888	280	9888	280	9888	280	----	
0.73	0.05	----		5650	160	8475	240	10,241	290	10,241	290	10,241	290	10,241	290	10,241	290		
1.45	0.10			4944	140	8122	230	10,594	300	10,594	300	10,594	300	10,594	300	10,594	300		
3.63	0.25			----		5650	160	9182	260	12,007	340	12,007	340	12,007	340	12,007	340	12,007	340
7.25	0.50					----		5650	160	12,360	350	14,126	400	14,126	400	14,126	400	14,126	400

▭ - Capacities for PST version.

Table 24. MF Series Capacities for NPS 1 / DN 25 Body, AP Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
		Inlet Pressure, psig / bar											
		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
7.25	0.50	5650	160	12,360	350	14,126	400	14,126	400	14,126	400	14,126	400
8.70	0.60	----		11,301	320	15,538	440	15,538	440	15,538	440	15,538	440
10.2	0.70			10,241	290	15,185	430	15,185	430	15,185	430	15,185	430
11.6	0.80			8829	250	17,657	500	17,657	500	17,657	500	17,657	500
14.5	1.00			----		19,776	560	19,776	560	19,776	560	19,776	560

Table 25. MF Series Capacities for NPS 1 / DN 25 Body, APA Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
		Inlet Pressure, psig / bar							
		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
14.5	1.00	19,070	540	22,601	640	22,601	640	22,601	640
21.8	1.5	15,892	450	24,014	680	24,014	680	24,014	680
29.0	2.0	----		28,252	800	28,252	800	28,252	800
36.3	2.5			33,549	950	33,549	950	33,549	950
43.5	3.0			35,314	1000	35,314	1000	35,314	1000

Table 26. MF Series Capacities for NPS 1-1/2 / DN 40 Body, Standard Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS																	
		Inlet Pressure, psig / bar																	
		0.73 / 0.05		2.90 / 0.20		5.80 / 0.40		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	5297	150	12,007	340	16,598	470	20,482	580			25,073	710	25,073	710	25,073	710		
0.73	0.05			11,301	320	15,892	450	19,776	560	25,073	710	25,426	720	25,426	720	25,426	720	----	
1.45	0.10	----		9535	270	15,185	430	19,070	540			28,252	800	28,252	800	28,252	800		
3.63	0.25			----		12,360	350	18,010	510	24,720	700	30,724	870	30,724	870	30,724	870	30,724	870
7.25	0.50					----		11,301	320	22,601	640	35,314	1000	35,314	1000	35,314	1000	35,314	1000

▭ - Capacities for PST version.

Table 27. MF Series Capacities for NPS 1-1/2 / DN 40 Body, AP Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
		Inlet Pressure, psig / bar											
		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
7.25	0.50	11,301	320	22,601	640	35,314	1000	35,314	1000	35,314	1000	35,314	1000
8.70	0.60	----		21,189	600			38,846	1100	38,846	1100	38,846	1100
10.2	0.70			19,423	550			42,377	1200	42,377	1200	42,377	1200
11.6	0.80			16,245	460	34,608	980	45,909	1300	45,909	1300	45,909	1300
14.5	1.00			----		33,549	950	47,675	1350	47,675	1350	47,675	1350

Table 28. MF Series Capacities for NPS 1-1/2 / DN 40 Body, APA Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
		Inlet Pressure, psig / bar							
		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
14.5	1.00	33,549	950	47,675	1350	47,675	1350	47,675	1350
21.8	1.5	29,664	840	74,160	2100	63,566	1800	63,566	1800
29.0	2.0	----		72,395	2050	77,692	2200	77,692	2200
36.3	2.5			63,566	1800	84,755	2400	84,755	2400
43.5	3.0					98,881	2800	98,881	2800

Table 29. MF Series Capacities for NPS 2 / DN 50 Body, Standard Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS																	
		Inlet Pressure, psig / bar																	
		0.73 / 0.05		2.90 / 0.20		5.80 / 0.40		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	7063	200	16,951	480	23,308	660	28,252	800	35,314	1000	38,846	1100	38,846	1100	38,846	1100	----	
0.73	0.05	----		15,892	450	22,954	650	27,898	790										
1.45	0.10			13,773	390	22,248	630	27,545	780			42,377	1200	42,377	1200	42,377	1200		
3.63	0.25			----		17,304	490	25,426	720			47,675	1350	47,675	1350	47,675	1350	47,675	1350
7.25	0.50					----		15,892	450	32,842	930	51,206	1450	56,503	1600	56,503	1600	56,503	1600

- Capacities for PST version.

Table 30. MF Series Capacities for NPS 2 / DN 50 Body, AP Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
		Inlet Pressure, psig / bar											
		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
7.25	0.50	15,892	450	32,842	930	51,206	1450	56,503	1600	56,503	1600	56,503	1600
8.70	0.60	----		31,077	880			60,035	1700	60,035	1700	60,035	1700
10.2	0.70			28,252	800			63,566	1800	63,566	1800	63,566	1800
11.6	0.80			24,014	680			67,098	1900	67,098	1900	67,098	1900
14.5	1.00			----		49,440	1400	75,926	2150	75,926	2150	75,926	2150

Table 31. MF Series Capacities for NPS 2 / DN 50 Body, APA Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
		Inlet Pressure, psig / bar							
		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
14.5	1.00	49,440	1400	75,926	2150	75,926	2150	75,926	2150
21.8	1.5	42,377	1200	95,349	2700	95,349	2700	95,349	2700
29.0	2.0	----		100,646	2850	113,006	3200	113,006	3200
36.3	2.5					134,195	3800	134,195	3800
43.5	3.0			98,881	2800	151,852	4300	151,852	4300

Table 32. MF Series Capacities for NPS 3 / DN 80 Body, Standard Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS																	
		Inlet Pressure, psig / bar																	
		0.73 / 0.05		2.90 / 0.20		5.80 / 0.40		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	16,598	470	38,846	1100	52,972	1500	63,566	1800	81,223	2300	98,881	2800	98,881	2800	----		----	
0.73	0.05	----		35,314	1000							102,412	2900	102,412	2900				
1.45	0.10			31,077	880	51,206	1450					107,709	3050	107,709	3050				
3.63	0.25			----		40,612	1150	58,269	1650			120,069	3400	123,601	3500	123,601	3500	123,601	3500
7.25	0.50					----		35,314	1000	75,926	2150			146,555	4150	146,555	4150	146,555	4150

▭ - Capacities for PST version.

Table 33. MF Series Capacities for NPS 3 / DN 80 Body, AP Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
		Inlet Pressure, psig / bar											
		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
7.25	0.50	35,314	1000	75,926	2150	120,069	3400	146,555	4150	146,555	4150	146,555	4150
8.70	0.60	----		70,629	2000			157,149	4450	157,149	4450	157,149	4450
10.2	0.70			65,332	1850			165,978	4700	165,978	4700	165,978	4700
11.6	0.80			52,972	1500			176,572	5000	176,572	5000	176,572	5000
14.5	1.00			----				194,230	5500	194,230	5500	194,230	5500

Table 34. MF Series Capacities for NPS 3 / DN 80 Body, APA Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
		Inlet Pressure, psig / bar							
		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
14.5	1.00	120,069	3400	194,230	5500	194,230	5500	194,230	5500
21.8	1.5	100,646	2850	243,670	6900	243,670	6900	243,670	6900
29.0	2.0	----				293,110	8300	293,110	8300
36.3	2.5					342,550	9700	342,550	9700
43.5	3.0			240,138	6800	395,522	11,200	395,522	11,200

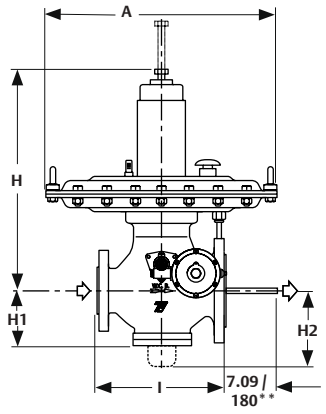
Table 35. MF Series Capacities for NPS 4 / DN 100 Body, Standard Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS																	
		Inlet Pressure, psig / bar																	
		0.73 / 0.05		2.90 / 0.20		5.80 / 0.40		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	25,780	730	60,035	1700	82,989	2350	98,881	2800	125,366	3550	155,384	4400	155,384	4400	----		----	
0.73	0.05	----		56,503	1600	81,223	2300					158,915	4500	158,915	4500				
1.45	0.10			47,675	1350	77,692	2200	97,115	2750			169,509	4800	169,509	4800				
3.63	0.25			----		61,800	1750	90,052	2550	123,601	3500	187,167	5300	190,698	5400	190,698	5400	190,698	5400
7.25	0.50					----		56,503	1600	116,538	3300			229,544	6500	229,544	6500	229,544	6500

▭ - Capacities for PST version.

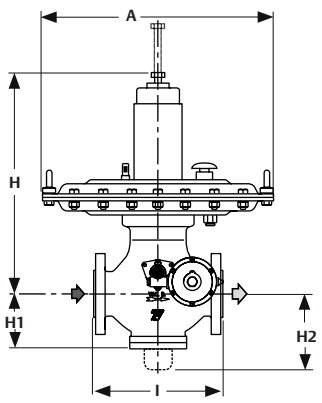
Table 36. MF Series Capacities for NPS 4 / DN 100 Body, AP Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
		Inlet Pressure, psig / bar											
		8.70 / 0.60		14.5 / 1.00		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
7.25	0.50	56,503	1600	116,538	3300	187,167	5300	229,544	6500	229,544	6500	229,544	6500
8.70	0.60	----		109,475	3100			247,201	7000	247,201	7000	247,201	7000
10.2	0.70			100,646	2850			261,327	7400	261,327	7400	261,327	7400
11.6	0.80			84,755	2400			275,453	7800	275,453	7800	275,453	7800
14.5	1.00			----		183,635	5200	307,236	8700	307,236	8700	307,236	8700



**ONLY APPLICABLE FOR MODELS WITH INTERNAL IMPULSE CONNECTION: NPS 1, 1-1/2, 2 AND 2-1/2 / DN 25, 40, 50 AND 65

MN, MBN AND MBN-M SERIES



MF, MBF AND MBF-M SERIES

IN. / mm

Figure 6. *Dimensions*

Table 37. MF Series Capacities for NPS 4 / DN 100 Body, APA Version

OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
		Inlet Pressure, psig / bar							
		29.0 / 2.0		72.5 / 5.0		145 / 10.0		160 to 276 / 11.0 to 19.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
14.5	1.00	183,635	5200	307,236	8700	307,236	8700	307,236	8700
21.8	1.5	155,384	4400	370,802	10,500	384,928	10,900	384,928	10,900
29.0	2.0	----				459,088	13,000	459,088	13,000
36.3	2.5					540,311	15,300	540,311	15,300
43.5	3.0					618,003	17,500	618,003	17,500

Table 38. Overall Dimension and Approximate Shipping Weight

BODY SIZE		DIMENSION												APPROXIMATE SHIPPING WEIGHT					
		I		A				H		H1		H2 Monitor Version							
				Standard or PST		AP APA													
MN, MBN and MBN-M Series														MN Series		MBN Series		MBN-M Series	
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	lbs	kg	lbs	kg	lbs	kg
1 x 2-1/2	25 x 65	7.24	184	14.96	380	14.96	380	19.69	500	3.74	95	5.51	140	68.34	31	72.8	33	81.57	37
1-1/2 x 3	40 X 80	8.74	222	19.69	500	14.96	380	22.84	580	3.94	100	6.30	160	117	53	121	55	130	59
2 x 4	50 X 100	10	254	19.69	500	14.96	380	23.62	600	4.72	120	6.69	170	130	59	137	62	148	67
2-1/2 x 4	65 X 100	10.87	276	19.69	500	14.96	380	24.41	620	5.20	132	7.87	200	137	62	146	66	159	72
3 x 6	80 X 150	11.73	298	19.69	500	14.96	380	25.59	650	5.71	145	8.47	215	176	80	185	84	198	90
				24.41(1)	620(1)														
4 x 8	100 X 200	13.86	352	19.69	500	19.69	500	25.98	660	7.09	180	10.43	265	276	125	287	130	309	140
				24.41(1)	620(1)														
MF, MBF and MBF-M Series														MF Series		MBF Series		MBF-M Series	
NPS	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	lbs	kg	lbs	kg	lbs	kg
1	25	7.24	184	14.96	380	14.96	380	19.69	500	3.74	95	5.51	140	59.52	27	63.93	29	72.75	33
1-1/2	40	8.74	222	19.69	500	14.96	380	22.84	580	3.94	100	6.30	160	110	50	115	52	123	56
2	50	10	254	19.69	500	14.96	380	23.62	600	4.72	120	7.09	180	121	55	130	59	141	64
3	80	11.73	298	19.69	500	14.96	380	25.59	650	5.71	145	8.47	215	161	73	170	77	183	83
				24.41(1)	620(1)														
4	100	13.86	352	19.69	500	19.69	500	25.98	660	7.09	180	10.43	265	243	110	254	115	276	125
				24.41(1)	620(1)														

1. For outlet pressure from 8 to 32 in. w.c. / 20 to 80 mbar only.

Ordering Guide

Body Sizes and End Connection Styles (Select One)

MN Series Widened Outlet Flanges Configuration

- ☐ NPS 1 x 2-1/2 / DN 25 x 65***
- ☐ NPS 1-1/2 x 3 / DN 40 x 80***
- ☐ NPS 2 x 4 / DN 50 x 100***
- ☐ NPS 2-1/2 x 4 / DN 65 x 100***
- ☐ NPS 3 x 6 / DN 80 x 150***
- ☐ NPS 4 x 8 / DN 100 x 200***

MF Series Same Inlet/Outlet Flanges Configuration

- ☐ NPS 1 / DN 25***
- ☐ NPS 1-1/2 / DN 40***
- ☐ NPS 2 / DN 50***
- ☐ NPS 3 / DN 80***
- ☐ NPS 4 / DN 100***

End Connection Style (Select One)

☐ PN 16 ☐ CL150 RF

Elastomer Part (Select One)

☐ Nitrile (NBR)***

Working Temperature Range (Select One)

☐ Standard Version: 14 to 140°F / -10 to 60°C***
☐ Low Temperature Version: -4 to 140°F / -20 to 60°C**

Built-In Monitor (Optional)

☐ Yes

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Built-In Shut-off Device (Optional)

☐ Type OS/66

Built-In Type SR Silencer - For Clean Gas Only (Optional)

☐ Yes

Setpoint (Fill in - see Table 4)

Regulator Outlet Pressure: _____
Built-in Monitor Outlet Pressure:_____
Built-in Safety Shut-off Device Minimum Pressure: _____
Built-in Safety Shut-off Device Maximum Pressure: _____

PED Certificate (Mandatory Only for CE Market)

☐ Yes**

Installation (Select One)

Horizontal Flow ☐ Left to Right ☐ Right to Left

Replacement Parts Kit (Optional)

☐ Yes, please send one parts kit to match this order.

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired?	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Make control line connections in a straight run of pipe about 10 pipe diameters downstream of any area of turbulence, such as elbows, pipe swages or block valves.

Introduction

The Underground Module was designed in order to avoid environmental impact due to both traditional cabinet installations and masonry structures.

With this solution it is possible to reduce the noise pollution and environmental impact and to obtain protection against impacts and damages due to vandalism or accidental acts.

The module is made up of two main parts:

- The metal underground container
- The gas control unit

The metal container is not pressurized and is provided with connections suitable to be welded directly to the inlet and outlet piping.

The gas control unit is completely placed inside the metal container and consists of a regulating line complete with by-pass assembled with standard version equipments. The gas control unit is easily accessible for maintenance or replacement purposes.

Permissible Inlet Pressure

MIF Series: 276 psig / 19.0 bar
MIC Series: 87 psig / 6.0 bar
MIR Series: 87 psig / 6.0 bar

Design Temperature

MIF, MIC and MIR Series:
14 to 140°F / -10 to 60°C

Minimum Operating Differential Pressure

MIF, MIC and MIR Series:
4.35 psid / 0.30 bar d

Accuracy Class

MIF, MIC and MIR Series: Up to 2.5%

Lockup Pressure Class

MIF, MIC and MIR Series: Up to 10%

Available Models

In order to offer a very versatile product, we have designed three series of underground modules available in different models according to the flow rate required:

MIF Series: This series is composed of Types MI-F/40 and MI-F/65, employs pilot-operated pressure regulators, Type MLF-BP and slam-shut valve Type BM5.

Inlet and outlet valves, together with the regulating line system by-pass and the relief valve, are placed inside the container.

All control devices (gauges-pilots-differential gauge) are placed on the container cover inside.

Metal container cover opens by means of a stress reducing unit.

To remove the gas control unit, a built-in hydraulic lifting system is available, for system maintenance no extra lifting is required.

MIC Series: This series is composed of Types MIC/25, MIC/50 and MIC/80, employs pilot-operated pressure regulators and Cronos Series with regulator monitor and slam-shut functions.

Inlet and outlet valves, together with the regulating line system by-pass and the relief valve, are placed inside the container.

MIR Series: This series is composed of Type MIR/65, employs spring-loaded pressure regulators, Type MBN and slam-shut valve Type BM5.

Inlet and outlet valves, together with the relief valve, are placed inside the container.

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Only Ventilation Ducts Installed Above-Ground**
- **Environmental Impact Reduction**
- **Noise Pollution Reduction**
- **Protection Against Impacts and Damages**
- **Reduced Administrative Installation Procedures**



Figure 1. *MIF Series*



Figure 2. *MIC Series*



Figure 3. *MIR Series*

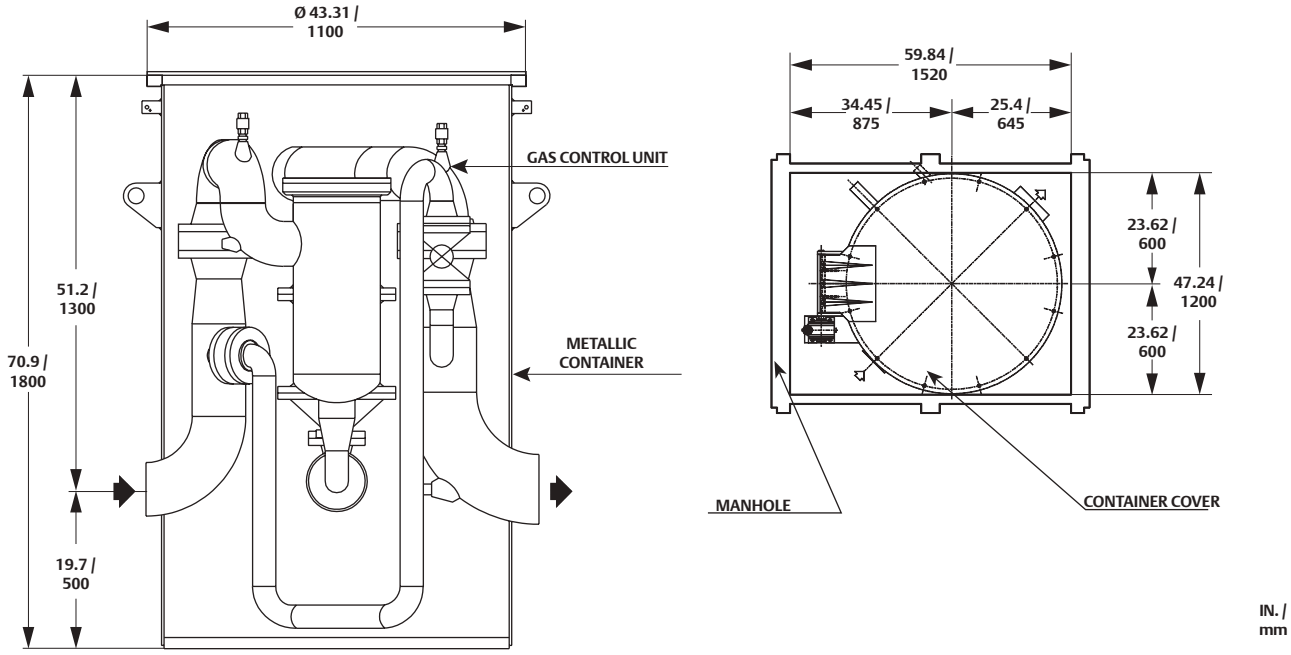


Figure 4. *MIF Series Overall Dimensions*

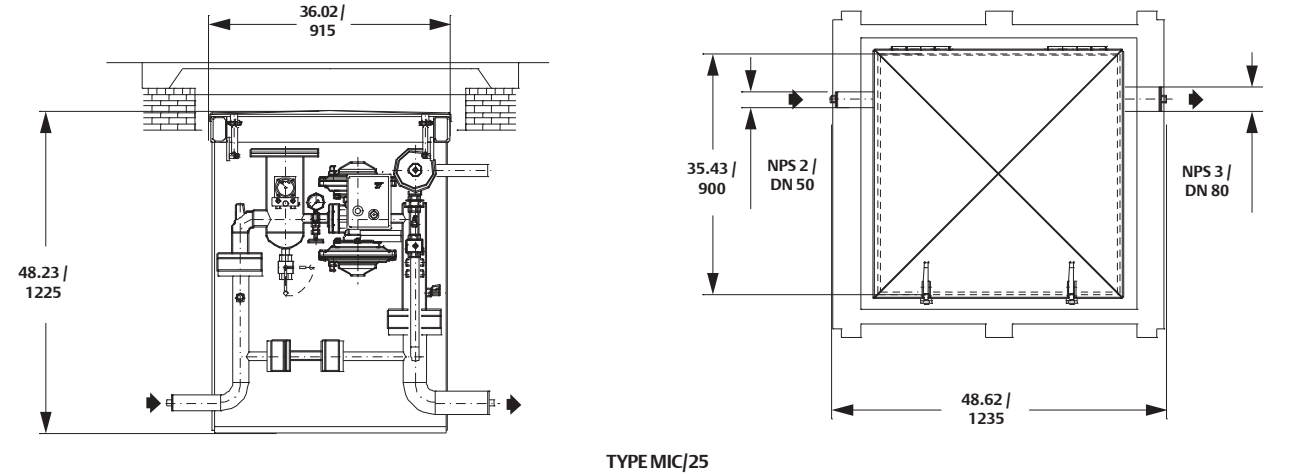
Table 1. MIF Series Construction Feature

PART NAME	TYPE MIF/40	TYPE MIF/65
Inlet Pipe	NPS 6 / DN 150	NPS 6 / DN 150
Inlet Valve	NPS 5 / DN 125	NPS 5 / DN 125
Filter Cartridge	G 2.5	G 2.5
Slam-Shut Valve	Type BM5/ NPS 1-1/2 / DN 40	Type BM5/ NPS 2-1/2 / DN 65
Monitor Regulator	Type MFL-BP/ NPS 1-1/2 x 3 / DN 40 x 80	Type MFL-BP/ NPS 2-1/2 x 6 / DN 65 x 150
Outlet Valve	NPS 6 / DN 150	NPS 6 / DN 150
Outlet Pipe	NPS 8 / DN 200	NPS 8 / DN 200
By-Pass	NPS 2-1/2 / DN 65	NPS 2-1/2 / DN 65
Relief Valve	NPS 1 / DN 25	NPS 1 / DN 25

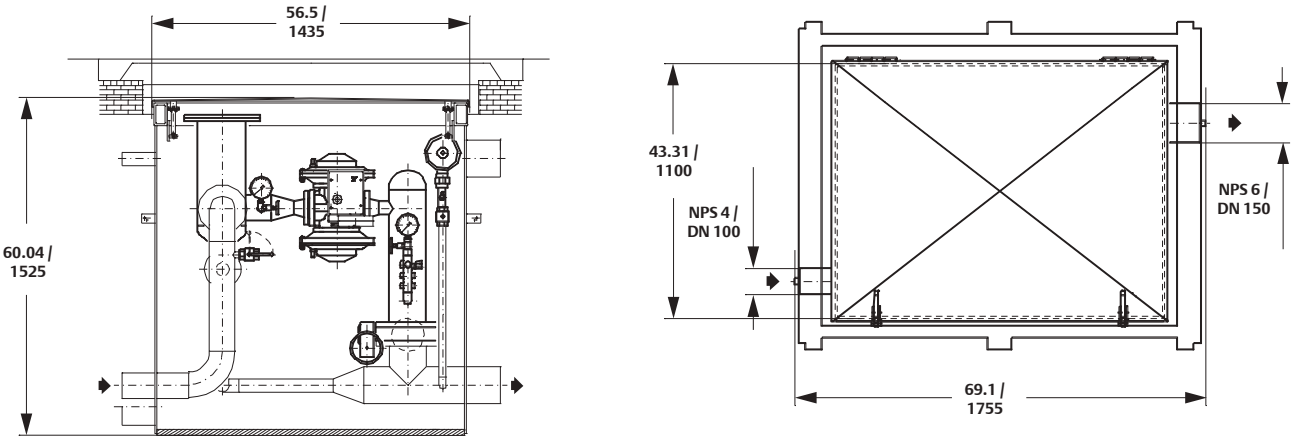
Table 2. MIF Series Flow Rate

OUTLET PRESSURE		FLOW RATE											
		Inlet Pressure, psig / bar											
		Type MIF/40						Type MIF/65					
		7.25 / 0.50		21.8 / 1.5		72.5 / 5.0		72.5 / 5.0		21.8 / 1.5		72.5 / 5.0	
psig	bar	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h	SCFH	Sm³/h
0.29	0.02	21,189	600	42,377	1200	102,412	2900	52,972	1500	102,412	2900	102,412	2900
2.18	0.15	21,189	600	42,377	1200	102,412	2900	49,440	1400	105,943	3000	105,943	3000
14.5	1.00	----		30,017	850	102,412	2900	----		77,692	2200	197,761	5600
43.5	3.0	----		----		90,051	2550	----		----		211,887	6000

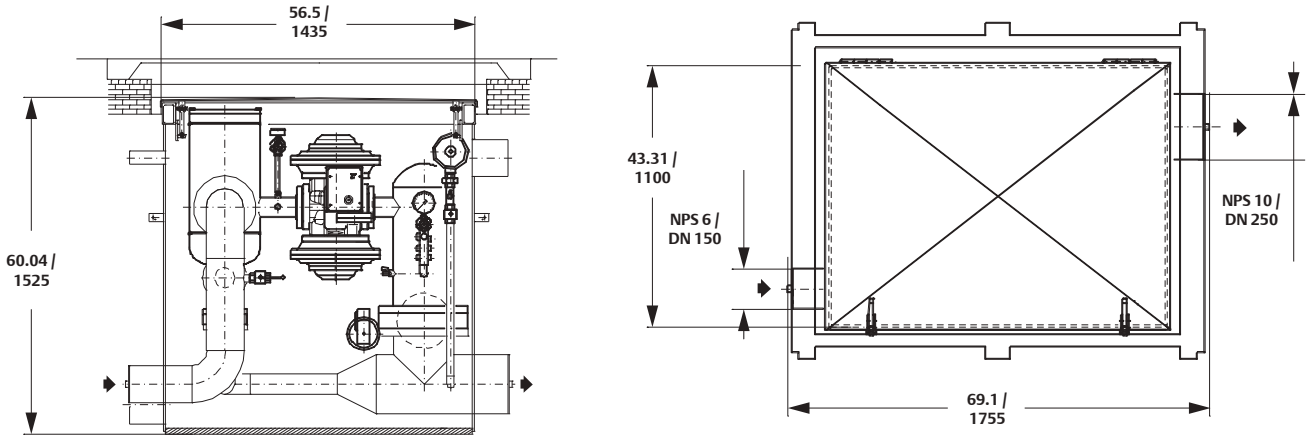
Note: For different flow rate please contact your local Sales Office.



TYPE MIC/25



TYPE MIC/50



TYPE MIC/80

Figure 5. *MIC Series Overall Dimensions*

Table 3. MIC Series Construction Feature

PART NAME	TYPE MIC/25	TYPE MIC/50	TYPE MIC/80
Inlet Pipe	NPS 2 / DN 50	NPS 4 / DN 100	NPS 6 / DN 150
Inlet Valve	NPS	NPS 4 / DN 100	NPS 6 / DN 150
Filter Cartridge	G 1	G 2	G 3
Monitor Regulator and Slam-Shut	Type Cronos CCB/ NPS 1 / DN 25	Type Cronos CCB/ NPS 2 / DN 50	Type Cronos CCB/ NPS 3 / DN 80
Outlet Valve	NPS 3 / DN 80	NPS 6 / DN 150	NPS 10 / DN 250
Outlet Pipe	NPS 3 / DN 80	NPS 6 / DN 150	NPS 10 / DN 250
By-Pass(1)	NPS 1 / DN 25	NPS 2 / DN 50	NPS 3 / DN 80
Relief Valve	NPS 1 / DN 25	NPS 1 / DN 25	NPS 1 / DN 25

1. Second reducing line available upon request.

Table 4. MIC Series Flow Rate

OUTLET PRESSURE		FLOW RATE																	
		Inlet Pressure, psig / bar																	
		Type MIC/25						Type MIC/50						Type MIC/80					
		7.25 / 0.5		21.8 / 1.5		72.5 / 5.0		7.25 / 0.5		21.8 / 1.5		72.5 / 5.0		7.25 / 0.5		21.8 / 1.5		72.5 / 5.0	
psig	**bar**	**SCFH**	**Sm³/h**	**SCFH**	**Sm³/h**	**SCFH**	**Sm³/h**	**SCFH**	**Sm³/h**	**SCFH**	**Sm³/h**	**SCFH**	**Sm³/h**	**SCFH**	**Sm³/h**	**SCFH**	**Sm³/h**	**SCFH**	**Sm³/h**
0.29	0.02	12,184	345	13,773	390	13,773	390	45,909	1300	45,909	1300	45,909	1300	102,412	2900	132,429	3750	132,429	3750
2.18	0.15	11,301	320	14,656	415	14,656	415	45,909	1300	50,500	1430	50,500	1430	102,412	2900	139,845	3960	139,845	3960
14.5	1.00	----		15,892	450	24,720	700	----		60,035	1700	91,818	2600	----		144,790	4100	206,590	5850
43.5	3.0	----		----		24,720	700	----		----		97,115	2750	----		----		264,859	7500

Note: For different flow rate please contact your local Sales Office.

Table 5. MIR Series Construction Feature

PART NAME	TYPE MIR/65
Inlet Pipe	NPS 5 / DN 125
Inlet Valve	NPS 5 / DN 125
Filter Cartridge	G 2.5
Slam-Shut Valve	Type BM5/NPS 2-1/2 / DN 65
Regulator	Type MBN/NPS 2-1/2 x 4 / DN 65 x 100
Outlet Valve	NPS 6 / DN 150
Outlet Pipe	NPS 6 / DN 150
Relief Valve	NPS 1 / DN 25

Table 6. MIR Series Flow Rate

OUTLET PRESSURE		FLOW RATE					
		Inlet Pressure, psig / bar					
		Type MIR/65					
		7.25 / 0.50		21.8 / 1.5		72.5 / 5.0	
psig	**bar**	**SCFH**	**Sm³/h**	**SCFH**	**Sm³/h**	**SCFH**	**Sm³/h**
0.29	0.02	49,440	1400	56,503	1600	56,503	1600
2.18	0.15	45,909	1300	60,035	1700	60,035	1700
14.5	1.00	----		70,629	2000	113,006	3200
43.5	3.0	----		----		141,258	4000

Note: For different flow rate please contact your local Sales Office.

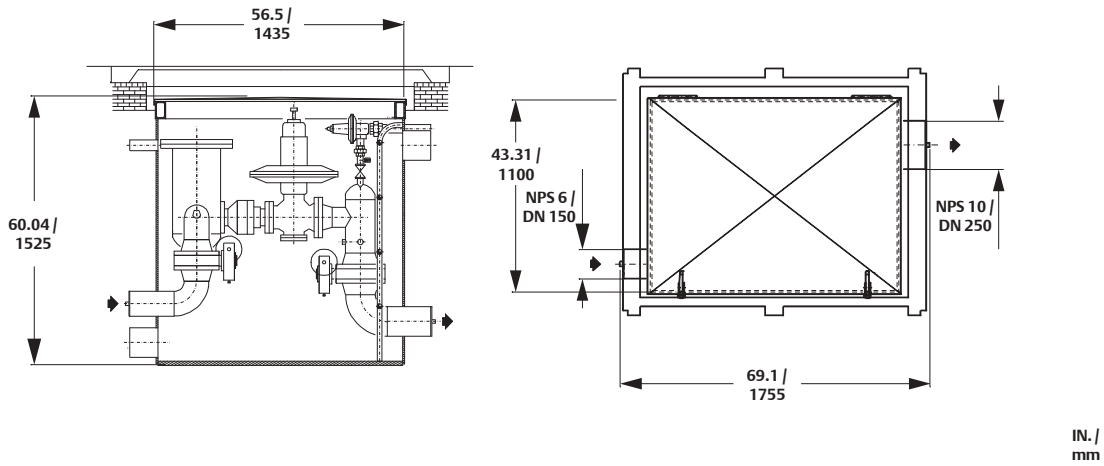


Figure 6. *MIR Series Overall Dimensions*

Ordering Guide

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Regulator Tip:

If you don't see what you're looking for in this Application Guide. . . ask us about it.
Space in this Application Guide does not always permit us to list all of the options or products available to you. If you don't see the product you're looking for, just pick up the phone and ask your local Sales Office to help you find the item you need. To locate your local Sales Office, log on to www.emersonprocess.com/regulators.

OL Series
Absorption Odorizing System

TARTARINI

Introduction

Absorption-type odorizing systems are employed in small and middle-sized stations with flow rates up to 3,531,000 SCFH / 100,000 Sm^3/h. However, they are used as stand-by and emergency systems in all injection-type odorizing installations. For the proper operation, it is necessary to reach a differential pressure, preferably by means of a Type VFA-MRO (refer to VFA Series pages) valve.

Type

OL-25: Volume: 6.60 gallons / 25 liters
OL-50: Volume: 13.2 gallons / 50 liters
OL-100: Volume: 26.4 gallons / 100 liters
OL-150: Volume: 39.6 gallons / 150 liters
OL-250: Volume: 66.0 gallons / 250 liters
OL-300: Volume: 79.3 gallons / 300 liters
OL-1000: Volume: 264 gallons / 1000 liters

Flanged Connections

- PN 6, PN 16 - CL150 (BP Version)
- CL600 (AP Version)

Maximum Allowable Pressure

Up to 1305 psig / 90.0 bar

Allowable Temperature

Minimum: -4°F / -20°C
Maximum: 140°F / 60°C

Configurations

Tank and Valves:
- Carbon steel
- Stainless steel

Level Indicator:
- Vertical
- Diagonal
- Magnetic for Remote Control

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com



Figure 1. *OL Series Absorption Odorizing System*

Features

- **Direct Reading Level Gauge**
- **Regulating, Shutoff and Filling Valves**

Ordering Guide

Type (Select One)
- ☐ OL-25***
- ☐ OL-50***
- ☐ OL-100***
- ☐ OL-150***
- ☐ OL-250***
- ☐ OL-300***
- ☐ OL-1000***

Flange Rating (Select One)
- ☐ PN 6***
- ☐ PN 16***
- ☐ CL150***
- ☐ CL600***

Elastomer Part (Select One)
- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)**

Material (Select One)
- ☐ Carbon steel***
- ☐ Stainless steel ***

Option (Select One)
- ☐ Vertical level indicator***
- ☐ Diagonal level indicator**

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

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www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

EMERSON
Process Management

Introduction

The Type OSE slam-shut valve is used to totally and rapidly cut the gas flow when the pipeline pressure exceeds the set pressure or when the pipeline pressure drops below the set pressure. The Type OSE consists of a valve, water-tight mechanism box (Type BM1 or BM2) and either one or two modular sensing elements called manometric devices (Type BMS1 or BMS2).

A double stage mechanism detects any pressure variances. Detection is the first stage and the mechanism will only trip when the pipeline pressure reaches the set pressure. The second stage is the power stage; once tripped, the closing spring causes the valve plug to slam shut and remain closed until the valve is manually reset.

Body Sizes and End Connection Styles

See Table 4

Flow Capacities

See Table 5

Flow and IEC Sizing Coefficients

See Table 1

Maximum Inlet Pressure

1470 psig / 101 bar or maximum body rating, whichever is lower

Maximum Set Pressure

1470 psig / 101 bar or maximum body rating, whichever is lower

Maximum Flow Pressure Differential

See Table 3

Set Pressure Ranges

4.02 in. w.c. to 1470 psig /
10 mbar to 101 bar
See Table 6

Vent Connection

1/4 NPT

Pressure Registration

External

Temperature Capabilities

-20 to 150°F / -29 to 66°C

Approximate Shipping Weights

NPS 1 through 6 / DN 25 through 150:
See Table 8
NPS 8 and 10 / DN 200 and 250:
See Table 9

Options

- Explosion-proof limit switch
- Non-explosion-proof limit switch
- Solenoid
- Additional manometric device for extra pressure sensing

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.francel.com

Features

- **Positive Shutoff**
- **Overpressure and Underpressure Protection**
- **Two-Stage Tripping Mechanism**
- **Internal Bypass Valve for NPS 1 through 6 / DN 25 through 150 and External for NPS 8 and 10 / DN 200 and 250 Body Sizes**
- **High Accuracy**
- **Water Tight**
- **Easy In-Line Maintenance**



Figure 1. *Type OSE Slam-Shut Valve*

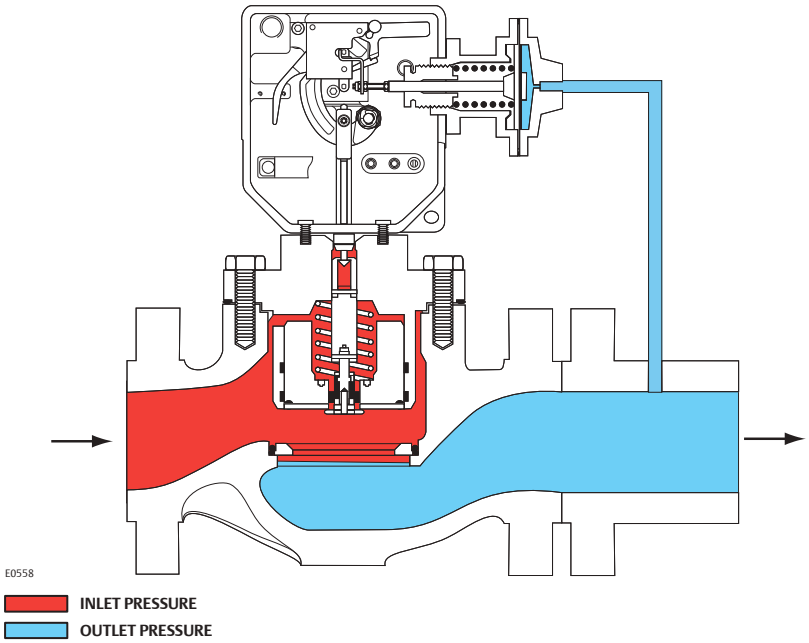


Figure 2. *Type OSE Slam-Shut Valve Operational Schematic*

Table 1. Flow and IEC Sizing Coefficient

BODY SIZE		PORT DIAMETER		FLOW COEFFICIENT			BYPASS FLOW COEFFICIENT		IEC SIZING COEFFICIENT		
NPS	DN	In.	mm	C_g	C_v	C_1	C_g	C_1	X_T	F_D	F_L
1	25	1.18	30	505	14.4	35	25.7	35	0.775	1.0	0.89
2	50	2.00	51	2210	60.6	35			0.775	1.0	0.89
3	80	3.15	80	4670	141	33			0.689	1.0	0.89
4	100	3.94	100	7860	244	32			0.648	1.0	0.89
6	150	5.91	150	14,850	454	33			0.648	1.0	0.89
8	200	7.87	200	28,830	833	34.6	133	32.8	0.580	1.0	0.89
10	250	9.84	250	42,180	1188	35.5			0.797	1.0	0.89

Table 2. Construction Material

BODY	BONNET	VALVE PLUG AND SEAT RING	O-RING AND DIAPHRAGM	BELLOW AND PISTON	MECHANISM BOX
WCC Steel or Cast Iron	Steel	Stainless steel	Nitrile (NBR)	316 Stainless steel	Aluminum

Table 3. Maximum Flowing Pressure Differential

BODY SIZE		MAXIMUM FLOWING PRESSURE DIFFERENCE	
NPS	DN	psi	bar
1	25	360	24.8
2	50	360	24.8
3	80	360	24.8
4	100	150	10.3
6	150	85	5.9
8	200	119	8.2
10	250	67	4.6

Table 4. Main Valve Body Size, End Connection Style and Body Pressure Rating

MAIN VALVE BODY SIZE		MAIN VALVE BODY MATERIAL	END CONNECTION STYLE[1]	STRUCTURAL DESIGN RATING[2]	
NPS	DN			psig	bar
1 2 3 4 6	25 50 80 100 150	Cast Iron	1 and 2 NPT only	500	34.5
			CL125 FF Flanged	200	13.8
			CL250 RF Flanged	500	34.5
1 2 3 4 6 8 10	25 50 80 100 150 200 250	WCC Steel	1 and 2 NPT only	1500	103
			CL150 RF Flanged	290	20.0
			CL300 RF Flanged	750	51.7
			CL600 RF Flanged	1500	103

1. Ratings and end connections for other than ASME standard can usually be provided. Contact your local Sales Office for assistance.
2. See Table 6 for additional pressure ratings.

Table 5. Capacities

INLET PRESSURE		PRESSURE DROP		CAPACITIES IN THOUSANDS OF SCFH / Nm^3/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
				Body Size											
psig	bar	psi	bar	NPS 1 / DN 25		NPS 2 / DN 50		NPS 3 / DN 80		NPS 4 / DN 100		NPS 6 / DN 150		NPS 8 / DN 200		NPS 10 / DN 250	
				SCFH	Nm^3/h	SCFH	Nm^3/h	SCFH	Nm^3/h	SCFH	Nm^3/h	SCFH	Nm^3/h	SCFH	Nm^3/h	SCFH	Nm^3/h
10	0.69	5	0.34	11.1	0.3	46.6	1.2	103	2.8	173	4.6	344	9.2	644	17.2	923	24.7
50	3.5			19.2	0.5	80.4	2.1	178	4.8	325	8.7	597	16.0	1111	29.8	1587	42.5
100	6.9			26.0	0.7	109	2.9	240	6.4	441	11.8	810	21.7	1504	40.3	2147	57.4
200	13.8			36.0	1.0	150	4.0	332	8.9	611	16.4	1121	30.0	2079	55.7	2966	79.4
300	20.7			43.7	1.2	182	4.9	404	10.8	743	19.9	1365	36.6	2526	67.7	3603	96.6
400	27.6	5	0.34	50.3	1.3	210	5.6	465	12.5	855	22.9	1567	42.0	2905	77.8	4144	111
500	34.5			56.1	1.5	234	6.3	518	13.9	954	25.6	1748	46.8	3240	86.8	4621	124
600	41.4			61.3	1.6	256	6.9	567	15.2	1040	27.9	1912	51.2	3544	95.0	5054	135
800	55.2			70.7	1.9	295	7.9	654	17.5	1203	32.2	2204	59.1	4084	109	5824	156
1000	69.0			78.9	2.1	330	8.8	730	19.6	1343	36.0	2462	66.0	4560	122	6503	174
50	3.5	20	1.4	34.2	0.9	143	3.8	329	8.8	565	15.1	1047	28.1	1937	51.9	2834	75.9
100	6.9			48.8	1.3	204	5.5	473	12.7	817	21.9	1506	40.4	2756	73.9	4032	108
200	13.8			69.5	1.9	290	7.8	678	18.2	1173	31.4	2157	57.8	3922	105	5737	154
300	20.7			85.4	2.3	357	9.6	835	22.4	1446	38.8	2655	71.2	4815	129	7045	189
400	27.6	20	1.4	98.8	2.6	413	11.1	966	25.9	1675	44.9	3074	82.4	5568	149	8146	218
600	41.4			121	3.2	506	13.6	1187	31.8	2058	55.2	3775	101	6830	183	9992	268
800	55.2			140	3.7	585	15.7	1372	36.8	2380	63.8	4365	117	7892	212	11,547	309
1000	69.0			156	4.2	655	17.6	1536	41.2	2664	71.4	4884	131	8828	237	12,916	346

Table 6. Set Pressure Range and Manometric Device Specification

SPRING RANGE		SPRING COLOR	SPRING PART NUMBER	MAXIMUM SENSING INLET PRESSURE		MANOMETRIC SENSING DEVICE TYPE	MANOMETRIC SENSING DEVICE STYLE	SETPOINT TOLERANCE(1)		MAXIMUM DIFFERENCE BETWEEN OVERPRESSURE AND UNDERPRESSURE(2)	
psig	bar			psig	bar			psig	bar	psig	bar
4.02 to 14.1 in. w.c.	10 to 35 mbar	Purple	T14232T0012	74	5.1	162	Diaphragm	0.058	0.004	0.145	0.010
9.97 to 33.2 in. w.c.	25 to 83 mbar	Orange	T14233T0012					0.073	0.005	0.363	0.025
18 in. w.c. to 2.0 psig	45 mbar to 0.14 bar	Red	T14234T0012					0.145	0.010	0.725	0.05
1.0 to 3.5	0.07 to 0.24	Yellow	T14235T0012					0.203	0.014	0.870	0.06
1.7 to 5.6	0.12 to 0.39	Green	T14236T0012					0.261	0.018	2.18	0.15
2 to 11	0.14 to 0.76	Gray	T14238T0012					0.725	0.05	5.08	0.35
4 to 19	0.28 to 1.3	Brown	T14239T0012					1.16	0.08	8.70	0.60
7 to 33	0.48 to 2.3	Black	T14240T0012					2.47	0.17	16.0	1.1
15 to 75	1.0 to 5.2	Blue	T14237T0012	235	16.2	71		5.08	0.35	36.3	2.5
31 to 161	2.1 to 11.1	Brown	T14239T0012					10.2	0.70	79.8	5.5
59 to 235	4.1 to 16.2	Black	T14240T0012					23.2	1.6	145	10.0
235 to 323	16.2 to 22.3	Brown	T14239T0012	1470	101	27	Piston	43.5	3.0	Requires use of a Types BMS1 and BMS2	
323 to 588	22.3 to 40.5	Black	T14240T0012					94.3	6.5		
588 to 808	40.5 to 55.7	Brown	T14239T0012	1470	101	17		102	7.0		
808 to 1470	55.7 to 101	Black	T14240T0012					174	12.0		
81 to 323	5.6 to 22.3	Brown	T14239T0012	514	35.4	236	Bellows	14.5	1.00	145	10.0
122 to 514	8.4 to 35.4	Black	T14240T0012					36.3	2.50	290	20.0
257 to 1058	17.7 to 72.9	Gray	T14238T0012	1058	72.9	315		72.5	5.0	479	33.0

1. Minimum suggested difference between slam-shut set pressure and normal operating pressure of the system.
2. Maximum difference between overpressure and underpressure when using one manometric device (Type BMS1) with tripping hook. For underpressure and overpressure points greater than this maximum number, use a second manometric device (Type BMS2) for underpressure protection.

Table 7. Application and Construction Guide

APPLICATION	MECHANISM BOX REQUIRED		MANOMETRIC SENSING DEVICE REQUIRED	
	Type BM1	Type BM2	Type BMS1	Type BMS2
Overpressure Shutoff (OPSO)	Yes	No	Yes	No
Underpressure Shutoff (UPSO)	Yes	No	Yes	No
Overpressure Shutoff (OPSO) and Underpressure Shutoff (UPSO)	Yes	No	Yes(1)	No
Overpressure Shutoff (OPSO) and Underpressure Shutoff (UPSO)	No	Yes	Yes(2)	Yes
Overpressure Shutoff (OPSO), Overpressure Shutoff and Underpressure Shutoff (OPSO/UPSO)	No	Yes	Yes(2)	Yes(1)

1. When using one Type BMS1 or BMS2 for both overpressure and underpressure shutoff, make sure that the difference between set pressures falls below the maximum range shown in Table 6.
2. When using Types BMS1 and BMS2, the Type BMS1 can only be used for high trip.

Table 8. NPS 1 through 6 / DN 25 through 150 Body Size and End Connection Dimension

BODY SIZE		DIMENSION							
		A							
NPS	DN	NPT		CL125 FF or CL150 RF		CL250 RF or CL300 RF		CL600 RF	
		In.	mm	In.	mm	In.	mm	In.	mm
1	25	8.25	209	7.25	184	7.75	197	8.3	211
2	50	11.3	287	10.0	254	10.5	267	11.3	287
3	80	----	----	11.8	300	12.5	317	13.3	338
4	100	----	----	13.9	353	14.5	368	15.5	394
6	150	----	----	17.8	452	18.6	472	20.0	508

- continued -

Table 8. NPS 1 through 6 / DN 25 through 150 Body Size and End Connection Dimension (continued)

BODY SIZE		DIMENSION										APPROXIMATE SHIPPING WEIGHT	
		B				C		D					
NPS	DN	CL150 RF		CL300 RF or CL600 RF		CL150 RF, CL300 RF or CL600 RF		CL150 RF		CL300 RF or CL600 RF			
		In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	LB	kg
1	25	2.2	56	2.5	63	12.6	320	4.6	117	4.9	124	36	16
2	50	3.0	76	3.3	84	13.2	335	6.0	152	6.5	165	70	32
3	80	3.7	94	4.1	104	14.2	361	7.5	190	8.3	211	121	55
4	100	4.5	114	5.0	127	16.0	406	9.0	229	10.0	254	216	98
6	150	5.5	140	6.6	168	16.2	411	14.0	356	14.0	356	445	202

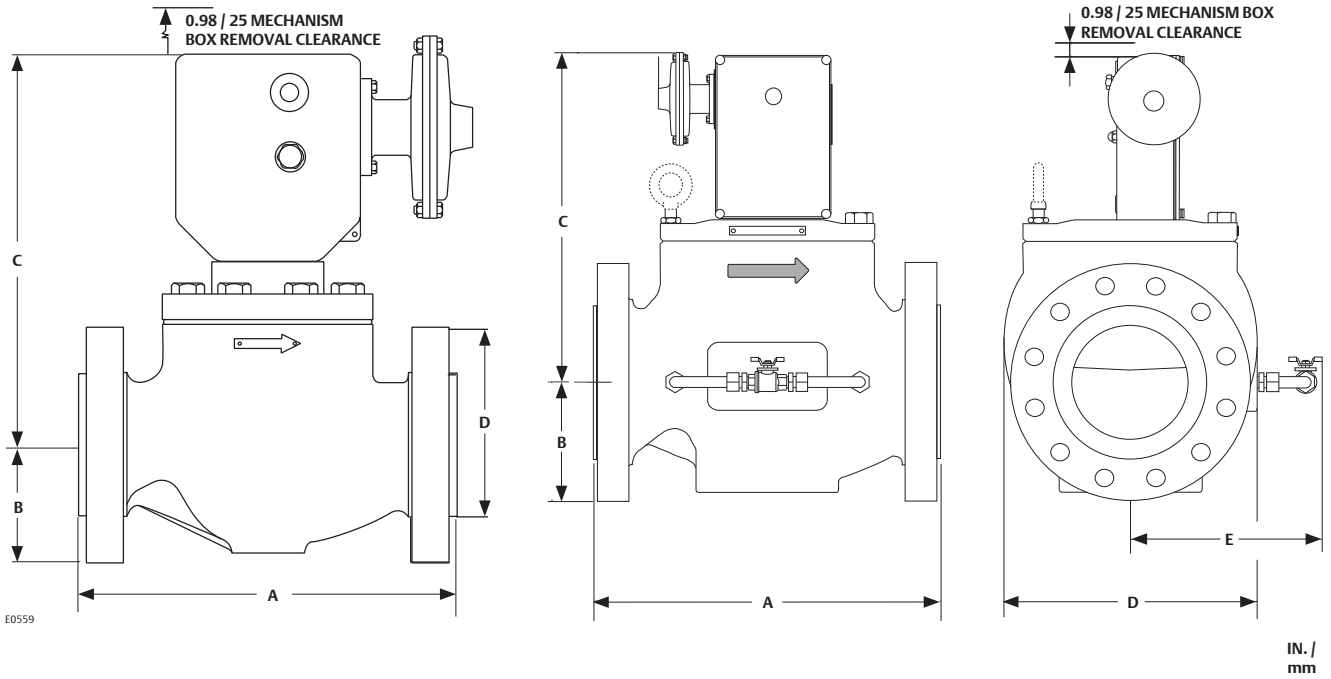


Figure 3. *Type OSE Dimensions*

Table 9. NPS 8 and 10 / DN 200 and 250 Body Size and End Connection Dimension

BODY SIZE		DIMENSION																		APPROXIMATE SHIPPING WEIGHT	
		A						B						C		D		E			
NPS	DN	CL150 RF		CL300 RF		CL600 RF		CL150 RF		CL300 RF		CL600 RF		CL150 RF, CL300 RF or CL600 RF		CL150 RF, CL300 RF or CL600 RF		CL150 RF, CL300 RF or CL600 RF			
		In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	LB	kg
8	200	21.4	543	22.4	569	24.0	610	6.8	173	7.5	190	8.2	208	22.8	579	17.6	447	13.2	335	785	356
10	250	26.5	673	27.9	709	29.6	752	8.0	203	8.7	221	10.0	254	26.3	668	19.6	498	14.3	363	1272	577

Ordering Guide

Body Size (Select One)

- ☐ NPS 1 / DN 25***
- ☐ NPS 2 / DN 50***
- ☐ NPS 3 / DN 80***
- ☐ NPS 4 / DN 100***
- ☐ NPS 6 / DN 150***
- ☐ NPS 8 / DN 200 (WCC Steel only)**
- ☐ NPS 10 / DN 250 (WCC Steel only)**

Body Material and End Connection Style (Select One)

Cast Iron Body

- ☐ 1 and 2 NPT only***
- ☐ CL125 FF** (NPS 1 to 6 / DN 25 to 150 only)
- ☐ CL250 RF** (NPS 1 to 6 / DN 25 to 150 only)

WCC Steel Body

- ☐ 1 and 2 NPT only***
- ☐ CL150 RF***
- ☐ CL300 RF**
- ☐ CL600 RF**

Slam-Shut Trip Pressure Setting (Select One)

- ☐ **Overpressure Protection Only (OPSO)**
  Supply setpoint required
- ☐ **Underpressure Protection Only (UPSO)**
  Supply setpoint required
- ☐ **Overpressure Protection and Underpressure Protection (OPSO/UPSO)**
  Supply overpressure setpoint required
  Supply underpressure setpoint required
- ☐ **Overpressure Protection (OPSO), Overpressure Protection and Underpressure Protection (OPSO/UPSO)**
  OPSO
  Supply overpressure setpoint required
  OPSO/UPSO
  Supply overpressure setpoint required
  Supply underpressure setpoint required

Ordering Guide (continued)

Explosion-Proof Limit Switch (Optional)

☐ Yes* *

Non-Explosion Proof Limit Switch (Optional)

☐ Yes* *

Solenoid (Optional)

☐ Yes* *

Manual Push Button Trigger Switch (Optional)

☐ Yes* *

Additional Manometric Device (For Extra Pressure Sensing) (Optional)

☐ Yes* *

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Use control lines of equal or greater size than the control tap on the regulator. If a long control line is required, make it bigger. A rule of thumb is to use the next nominal pipe size for every 20 feet / 6.1 m of control line. Small control lines cause a delayed response of the regulator, leading to increased chance of instability. 3/8-inch / 9.5 mm OD tubing is the minimum recommended control line size.

P590 Series
Filter

FISHER

Introduction

P590 Series filters are designed to remove dirt, scale or other solid substances from gases just upstream from pilot supply lines for air or gas pressure regulators.

The filter elements in all P590 Series filters are readily accessible and easily cleaned.

Filtering densities

The phenolic resin impregnated cellulose filter elements of these units are capable of removing all particles larger than 40 microns, 0.0016-inch / 0.04 mm in diameter.

Sizing Coefficient

The gas sizing coefficient (C_g) for all two filter elements at 75% clogged is in a range from 15 to 20.

Body Size and End Connection Style

Connections: 1/4 NPT
Length: 3.25-inch / 83 mm

Approximate Weight

2 lbs / 1 kg

Maximum Working Pressure

Type P594-1 with Brass body:
1400 psig / 96.5 bar
Type P593-1 with Aluminum body:
600 psig / 41.4 bar

Filer Types and Materials

Type P593-1:
Body: Aluminum
Filter Element: Cellulose
Type P594-1:
Body: Brass
Filter Element: Cellulose

Ordering Information

To receive the fastest order processing, please specify type number and (for Type P593-1 only) the NACE option (NACE International standard MR0175-2003).

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Compact Design**
- **Install in any Position**
- **Economical**



Figure 1. *Type P594-1*

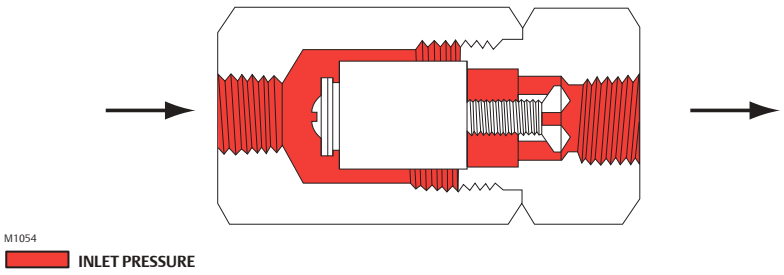


Figure 2. *Type P594-1 Schematics*

Ordering Guide

To order this product, supply your local Sales Office with the type number and quantity

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

EMERSON
Process Management

Introduction

The R Series spring-loaded regulators provide pressure reducing control for domestic and industrial use, such as burners, furnaces, boilers and other installations requiring proper regulation and quick response time. These regulators can be used with non-corrosive gases, such as natural gas, compressed air and nitrogen.

The R Series regulators achieve high accuracy and flow rates even with low inlet pressure and strong inlet pressure variations.

Types R/70, R/71, R/72, R/72-FS, R/73, R/74 and R/75

Allowable Inlet Pressure

87 psig / 6.0 bar

Inlet Pressure Range

1.45 to 87 psig / 0.10 to 6.0 bar(1)

Set Range

0.22 to 1.02 psig / 15 to 70 mbar

Accuracy Class

Up to ±5%

Lockup Pressure Class

Up to 10%

Types R/70-AP, R/71-AP, R/72-AP, R/72-FS-AP, R/73-AP, R/74-AP and R/75-AP

Allowable Inlet Pressure

145 psig / 10.0 bar

Inlet Pressure Range

1.45 to 145 psig / 0.10 to 10.0 bar(1)

Set Range

1.02 to 4.35 psig / 70 to 300 mbar

Accuracy Class

Up to ±5%

Lockup Pressure Class

Up to 10%

Built-In Slam-Shut Valve

Overpressure Set Range:
0.44 to 5.5 psig / 30 to 380 mbar

Underpressure Set Range:
0.12 to 2.25 psig / 8 to 155 mbar

Response time: ≤ 1 s

Connections

Types R/70 and R/70-AP:
G 3/4-in. x G 1-1/4-in.
UNI ISO 228/1- right angle
(3/4-in. soft seal x 1-1/4-in. Gas)

Types R/71 and R/71-AP:
G 3/4-in. x G 1-1/4-in.
UNI ISO 228/1 - right angle
(3/4-in. metallic seal x 1-1/4-in. Gas)

Types R/72 and R/72-AP:
G 1-in. UNI ISO 228/1 - axial flow
(1-in. Gas)

Types R/72-FS, R/72-FS-AP:
1-in. / DN 25, PN 16 - axial flow

Types R73, R/73-AP:
G 1-1/4-in. UNI ISO 228/1 - axial flow
(1-1/4-in. Gas)

Types R/74 and R/74-AP:
G 3/4-in. x G 1-1/4-in.
UNI ISO 228/1 - axial flow
(3/4-in. soft seal x 1-1/4-in. Gas)

Types R/75 and R/75-AP:
G 3/4-in. x G 1-in.
UNI ISO 228/1 - axial flow
(3/4-in. soft seal x 1-in. Gas)

Operating Temperature

Working: -4 to 140°F / -20 to 60°C

Ambient: -22 to 140°F / -30 to 60°C

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

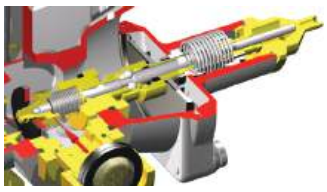
www.tartarini-naturalgas.com

Features

- **Two-Stage Regulation**
- **Built-In Relief Valve (Optional)**
- **Overpressure and Underpressure Slam-Shut Valve**
- **Manual Reset**
- **Built-In Filter with 0.02-in. / 0.5 mm Filtering Capacity**



Figure 1. *R Series Pressure Regulator*



SLAM-SHUT DETAIL

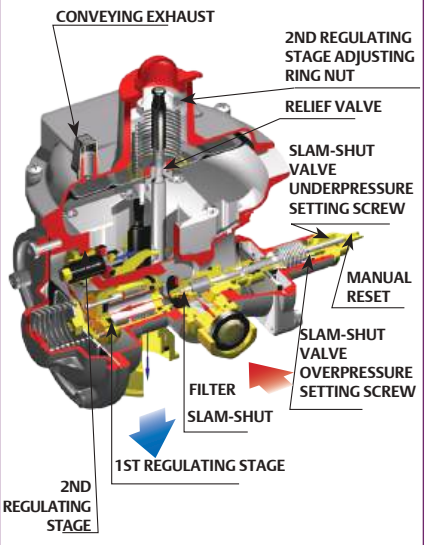


Figure 2. *R Series Regulator Cut Away with Slam-Shut Detail*

1. According to the standards enacted.

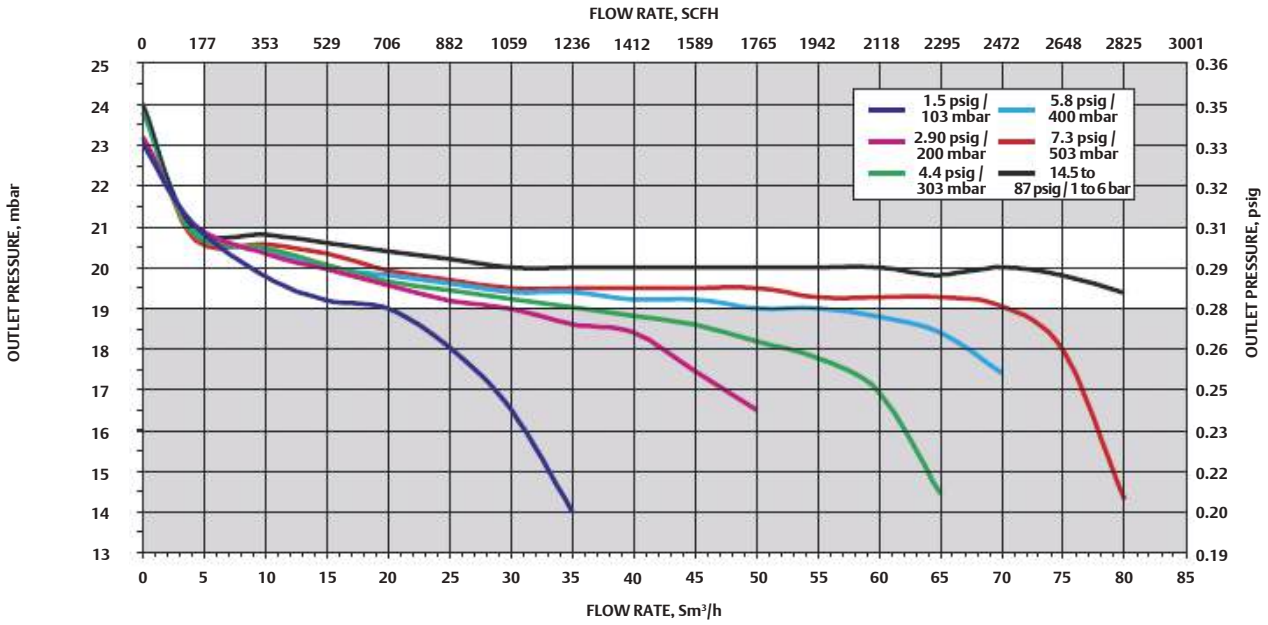


Figure 3. *0.29 psig / 20 mbar Set Characteristic Curves*

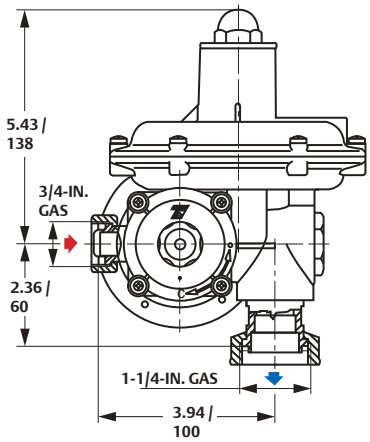
Table 1. Construction Materials

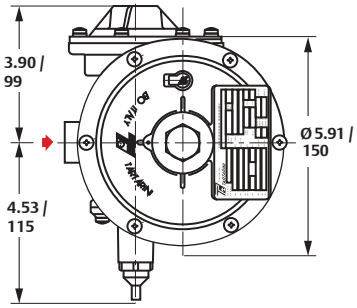
BODY	1ST AND 2ND STAGE COVER	SLAM-SHUT VALVE COVER	CONNECTION	SEAL	SLAM-SHUT VALVE DIAPHRAGM	1ST AND 2ND STAGE DIAPHRAGM
Die-cast Aluminum	Die-cast Aluminum	Die-cast Zama	Brass	Nitrile (NBR) Rubber	Nitrile (NBR) Rubber	Clothed Nitrile (NBR) Rubber

Table 2. Capacities

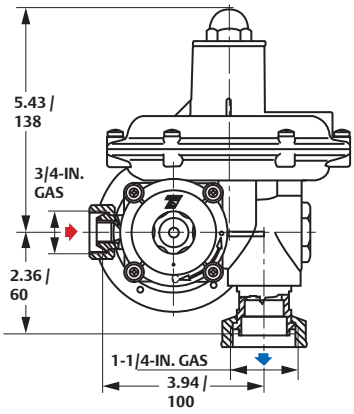
OUTLET PRESSURE		CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS							
		Inlet Pressure, psig / bar							
psig	bar	1.45 / 0.10	2.90 / 0.20	4.35 / 0.30	5.80 / 0.40	7.25 / 0.50	10.9 / 0.75	14.5 to 87 / 1 to 6	14.5 to 145 / 1 to 10
0.22	0.01	882 / 25.0	1236 / 35.0	1765 / 50.0	2118 / 60.0	2472 / 70.0	2472 / 70.0	2648 / 75.0	----
0.29	0.02	882 / 25.0	1236 / 35.0	1765 / 50.0	2118 / 60.0	2472 / 70.0	2472 / 70.0	2648 / 75.0	----
0.44	0.03	882 / 25.0	1059 / 30.0	1589 / 45.0	1942 / 55.0	2472 / 70.0	2472 / 70.0	2648 / 75.0	----
0.58	0.04	882 / 25.0	1059 / 30.0	1412 / 40.0	1765 / 50.0	2295 / 65.0	2472 / 70.0	2472 / 70.0	----
0.73	0.05	706 / 20.0	1059 / 30.0	1412 / 40.0	1765 / 50.0	2295 / 65.0	2472 / 70.0	2472 / 70.0	----
0.87	0.06	529 / 15.0	1059 / 30.0	1412 / 40.0	1765 / 50.0	2118 / 60.0	2118 / 60.0	2295 / 65.0	----
1.02	0.07	529 / 15.0	1059 / 30.0	1412 / 40.0	1589 / 45.0	1942 / 55.0	2118 / 60.0	2118 / 60.0	----
0.87	0.06	706 / 20.0	1059 / 30.0	1412 / 40.0	1589 / 45.0	1942 / 55.0	2472 / 70.0	----	3531 / 100
1.02	0.07	706 / 20.0	1059 / 30.0	1412 / 40.0	1589 / 45.0	1942 / 55.0	2472 / 70.0	----	3531 / 100
1.16	0.08	706 / 20.0	1059 / 30.0	1236 / 35.0	1589 / 45.0	1942 / 55.0	2472 / 70.0	----	3354 / 95.0
1.03	0.71	706 / 20.0	1059 / 30.0	1236 / 35.0	1589 / 45.0	1765 / 50.0	2472 / 70.0	----	3178 / 90.0
1.45	0.10	----	706 / 20.0	1059 / 30.0	1236 / 35.0	1589 / 45.0	2295 / 65.0	----	2825 / 80.0
2.18	0.15	----	706 / 20.0	1059 / 30.0	1236 / 35.0	1589 / 45.0	2118 / 60.0	----	2648 / 75.0
2.90	0.20	----	----	882 / 25.0	1059 / 30.0	1412 / 40.0	1765 / 50.0	----	2472 / 70.0
3.63	0.25	----	----	706 / 20.0	1059 / 30.0	1412 / 40.0	1765 / 50.0	----	2118 / 60.0
4.35	0.30	----	----	----	882 / 25.0	1059 / 30.0	1589 / 45.0	----	2118 / 60.0

Types R/70, R/71, R/72, R/72-FS, R/73, R/74 and R/75
Types R/70-AP, R/71-AP, R/72-AP, R/72-FS-AP, R/73-AP, R/74-AP and R/75-AP

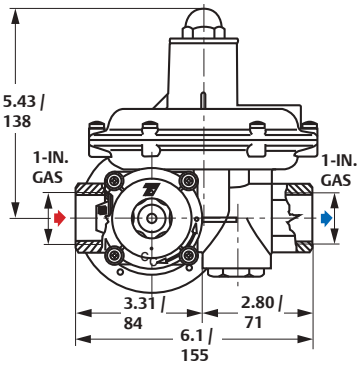




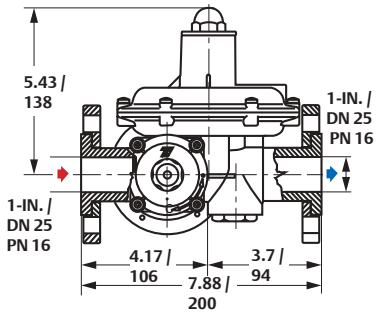
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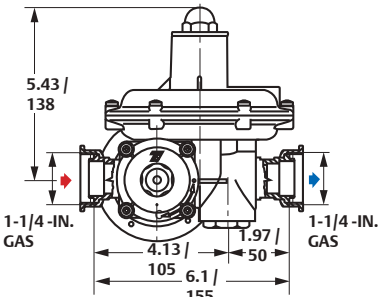
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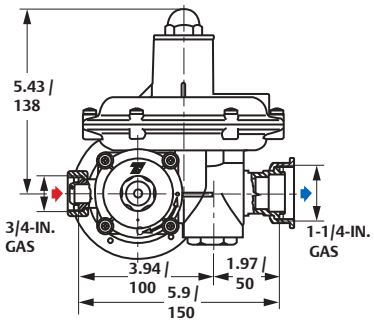
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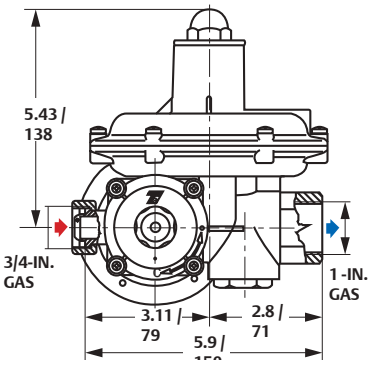
TYPE R/72-FS OR R/72-FS-AP



TYPE R/73 OR R/73-AP



TYPE R/74 OR R/74-AP



TYPE R/75 OR R/75-AP

In. /
mm

Figure 4. *Dimensions*

Ordering Guide

Type (Select One)

- ☐ R/70 or R/70-AP* * *
- ☐ R/71 or R/71-AP* * *
- ☐ R/72 or R/72-AP* * *
- ☐ R/72-FS or R/72-FS-AP* * *
- ☐ R/73 or R/73-AP* * *
- ☐ R/74 or R/74-AP* * *
- ☐ R/75 or R/75-AP* * *

Inlet Pressure

_____ please specify

Outlet Pressure

_____ please specify

Special Requirements (Optional)

_____

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired?	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Downstream pressure always changes to some extent when inlet pressure changes.

Introduction

Type R622 direct-operated, spring-loaded regulators provide economical pressure reducing control in a variety of residential, commercial and industrial applications. These regulators can be used with natural, manufactured or propane gas and have the same inlet and outlet pressure capabilities.

In addition, Type R622 regulators have internal relief across the diaphragm to help minimize overpressure. Any outlet pressure above the start-to-discharge point of the nonadjustable relief valve spring moves the diaphragm off of the relief valve seat, allowing excess pressure to bleed out through the screened spring case vent.

Body Size and End Connection Style

1/2 NPT (inlet and outlet)

Maximum Allowable Inlet Pressure

Operating: 125 psig / 8.6 bar
Emergency: 125 psig / 8.6 bar
Except 1.8 to 2.2 in. w.c. / 4 to 5 mbar spring range which has operating and emergency pressures of 60 psig / 4.1 bar

Relief Performance

See Figure 3

Outlet Pressure Ranges

See Table 2

Maximum Allowable Outlet (Casing) Pressure

Operating to Avoid Internal Parts Damage: 3 psid / 0.21 bar d above outlet pressure setting
Emergency: 20 psi / 1.4 bar

Flow Capacities

See Table 3

Orifice Size

1/8 in. / 3.2 mm

Flow Coefficients

Wide-Open C_g for Relief Sizing: 12.5
Wide-Open C_v for Relief Sizing: 0.36
C_1: 35

IEC Sizing Coefficients

X_T: 0.78
F_D: 0.82
F_L: 0.89

Pressure Registration

Internal

Temperature Capabilities

-20 to 160°F / -29 to 71°C

Approximate Shipping Weight

2.35 lbs / 1 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Compact Design**
- **High Capacity**
- **Protective Inlet Screen**
- **Internal Relief**
- **Light Weight**
- **Inlet and Outlet Pressure Gauge Taps**



Figure 1. *Type R622 Pressure Reducing Regulator*

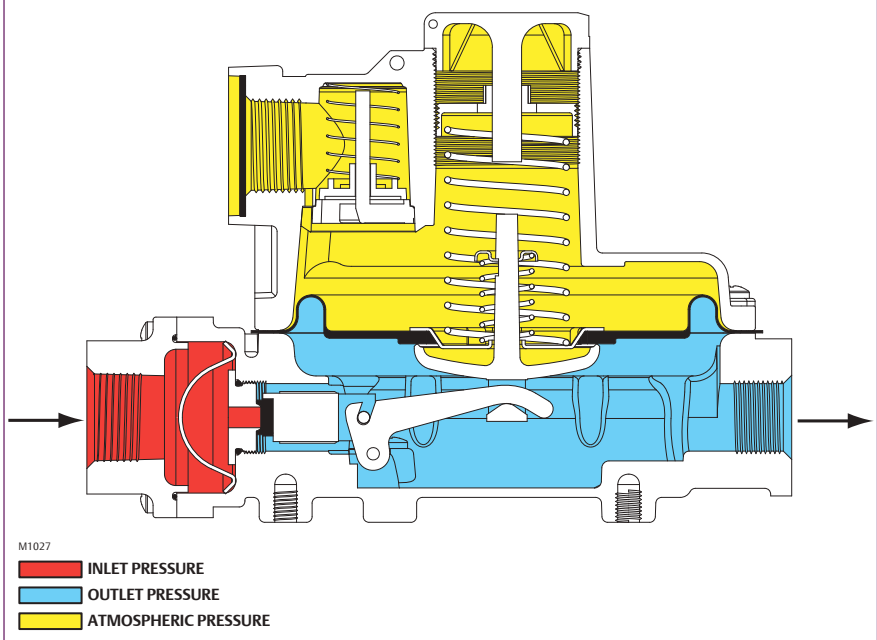
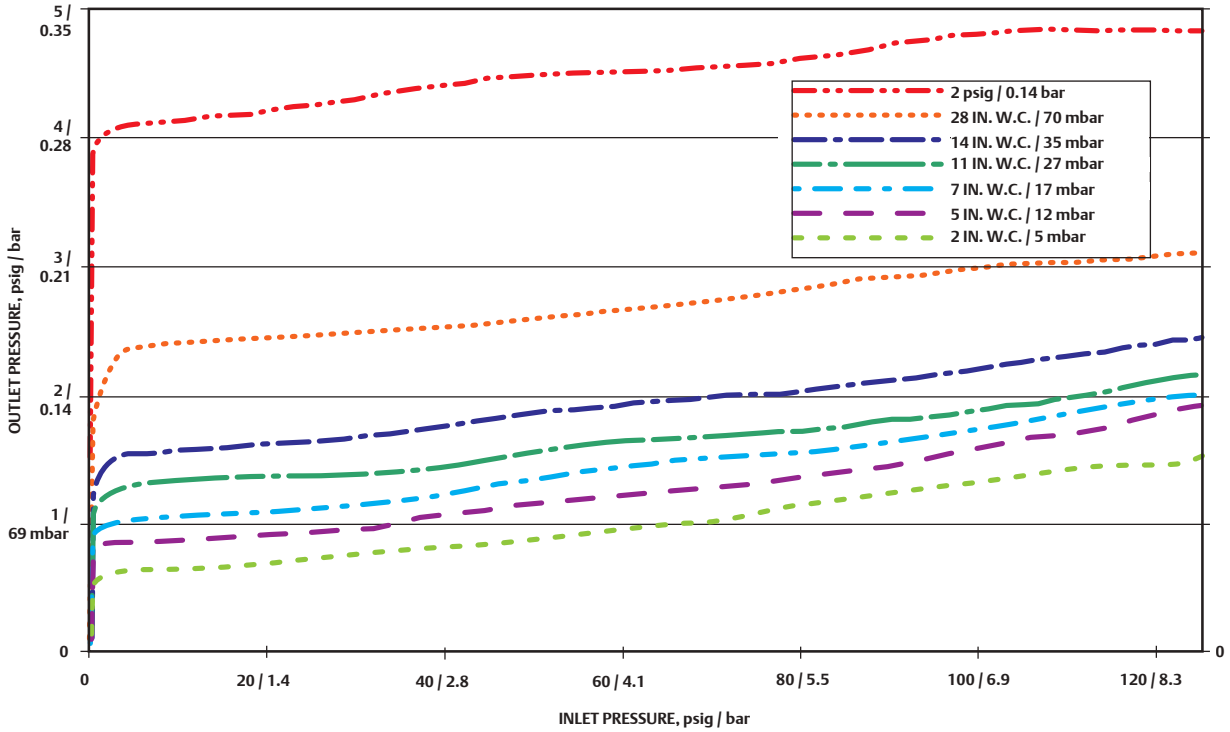


Figure 2. *Type R622 Operational Schematic*



NOTE: TESTED UNDER THE FOLLOWING CONDITIONS: 10 psig / 0.69 bar INLET PRESSURE, 7 IN. W.C. / 17 mbar OUTLET PRESSURE SETTING AND 50 SCFH / 1.3 Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS

Figure 3. *Industrial Relief Performance*

Table 1. Construction Material

PART NAME	MATERIAL
Body, Spring Case, Diaphragm Plate and Orifice	Aluminum
Diaphragm, Disk and O-ring	Nitrile (NBR)
Adjusting Screw and Pusher post	Delrin®
Closing Cap	ASA Thermoplastic (UV-Ray Resistant)
Control Spring	Zinc-plated steel
Machine Screw, Spring Seat and Lever	Zinc-plated steel
Valve Stem	Zinc
Relief Valve Spring, Relief Spring Retainer, Lever Pin and Vent Screen	Stainless steel

Table 2. Outlet Pressure Range

OUTLET PRESSURE RANGE		CONTROL SPRING PART NUMBER	CONTROL SPRING COLOR CODE	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
in. w.c.	mbar			In.	mm	In.	mm
1.8 to 2.2	4 to 5	T14453T0012	Purple	0.051	1.30	3.40	86.4
5 to 7	12 to 17	T14398T0012	Orange	0.062	1.58	3.40	86.4
6.5 to 9	16 to 22	T14399T0012	Yellow	0.067	1.70	3.61	91.7
9 to 13	22 to 32	T14400T0012	Silver	0.072	1.83	4.10	104
13 to 20	32 to 50	T14401T0012	Gray	0.080	2.03	3.60	91.4
16 to 35	40 to 87	T14402T0012	Pink	0.093	2.36	3.52	89.4
1 to 2.2 psig	69 to 152	T14403T0012	Light Blue	0.105	2.67	3.66	93.0

Delrin® is a mark owned by E.I. Du Pont de Nemours and Co.

Table 3. Typical Regulating Capacities in SCFH / Nm³/h of 0.6 Specific Gravity Natural Gas for Type R622 Regulator

OUTLET PRESSURE SETTING, CONTROL SPRING RANGE, SPRING PART NUMBER, COLOR CODE AND DROOP	INLET PRESSURE		1/2 NPT INLET AND OUTLET	
	psig	bar	SCFH	Nm³/h
Setting: 2 in. w.c. / 5 mbar Range: 1.8 to 2.2 in. w.c. / 4 to 5 mbar T14453T0012, Purple Droop: 1 in. w.c. / 2 mbar	5	0.35	287	7.7
	10	0.69	380	10.2
	25	1.7	451	12.1
	50	3.4	493	13.2
	60	4.1	506	13.6
Setting: 5 in. w.c. / 12 mbar Range: 5 to 7 in. w.c. / 12 to 17 mbar T14398T0012, Orange Droop: 1 in. w.c. / 2 mbar	5	0.35	271	7.3
	10	0.69	367	9.8
	25	1.7	468	12.5
	50	3.4	484	13.0
	60	4.1	428	11.5
	75	5.2	444	11.9
	100	6.9	536	14.4
	125	8.6	536	14.4
Setting: 7 in. w.c. / 17 mbar Range: 6.5 to 9 in. w.c. / 16 to 22 mbar T14399T0012, Yellow Droop: 1 in. w.c. / 2 mbar	5	0.35	246	6.6
	10	0.69	347	9.3
	25	1.7	451	12.1
	50	3.4	469	12.6
	60	4.1	477	12.8
	75	5.2	445	11.9
	100	6.9	507	13.6
	125	8.6	511	13.7
Setting: 11 in. w.c. / 27 mbar Range: 9 to 13 in. w.c. / 22 to 32 mbar T14400T0012, Silver Droop: 2 in. w.c. / 5 mbar	5	0.35	274	7.3
	10	0.69	401	10.7
	25	1.7	623	16.7
	50	3.4	708	19.0
	60	4.1	735	19.7
	75	5.2	676	18.1
	100	6.9	721	19.3
	125	8.6	738	19.8
Setting: 14 in. w.c. / 35 mbar Range: 13 to 20 in. w.c. / 32 to 50 mbar T14401T0012, Gray Droop: 2 in. w.c. / 5 mbar	5	0.35	246	6.6
	10	0.69	364	9.8
	25	1.7	551	14.8
	50	3.4	641	17.2
	60	4.1	661	17.7
	75	5.2	614	16.5
	100	6.9	677	18.1
	125	8.6	727	19.5
Setting: 1 psig / 69 mbar Range: 16 to 35 in. w.c. / 40 to 87 mbar T14402T0012, Pink Droop: 10%	5	0.35	174	4.7
	10	0.69	337	9.0
	25	1.7	533	14.3
	50	3.4	679	18.2
	60	4.1	708	19.0
	75	5.2	756	20.3
	100	6.9	762	20.4
	125	8.6	796	21.3
Setting: 2 psig / 0.14 bar Range: 1.2 to 2.2 psi / 83 to 152 mbar T14403T0012, Light Blue Droop: 10%	5	0.35	222	6.0
	10	0.69	381	10.2
	25	1.7	630	16.9
	50	3.4	923	24.7
	60	4.1	976	26.2
	75	5.2	1007	27.0
	100	6.9	1285	34.4
	125	8.6	1028	27.6

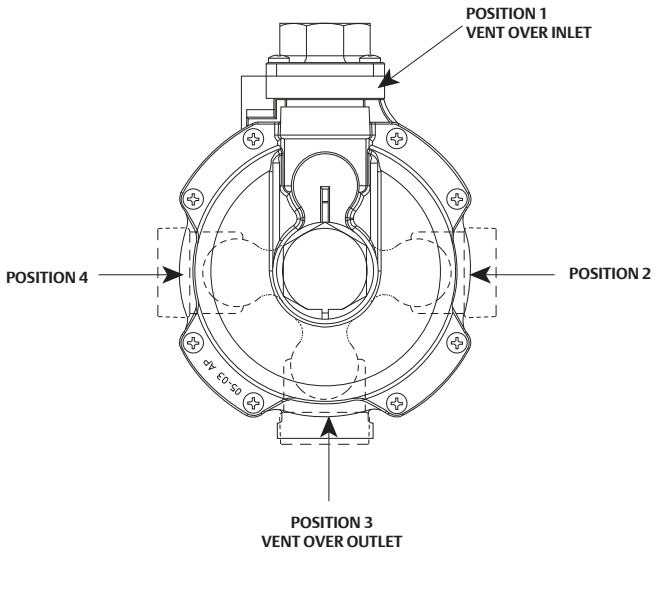


Figure 4. *Vent Position*

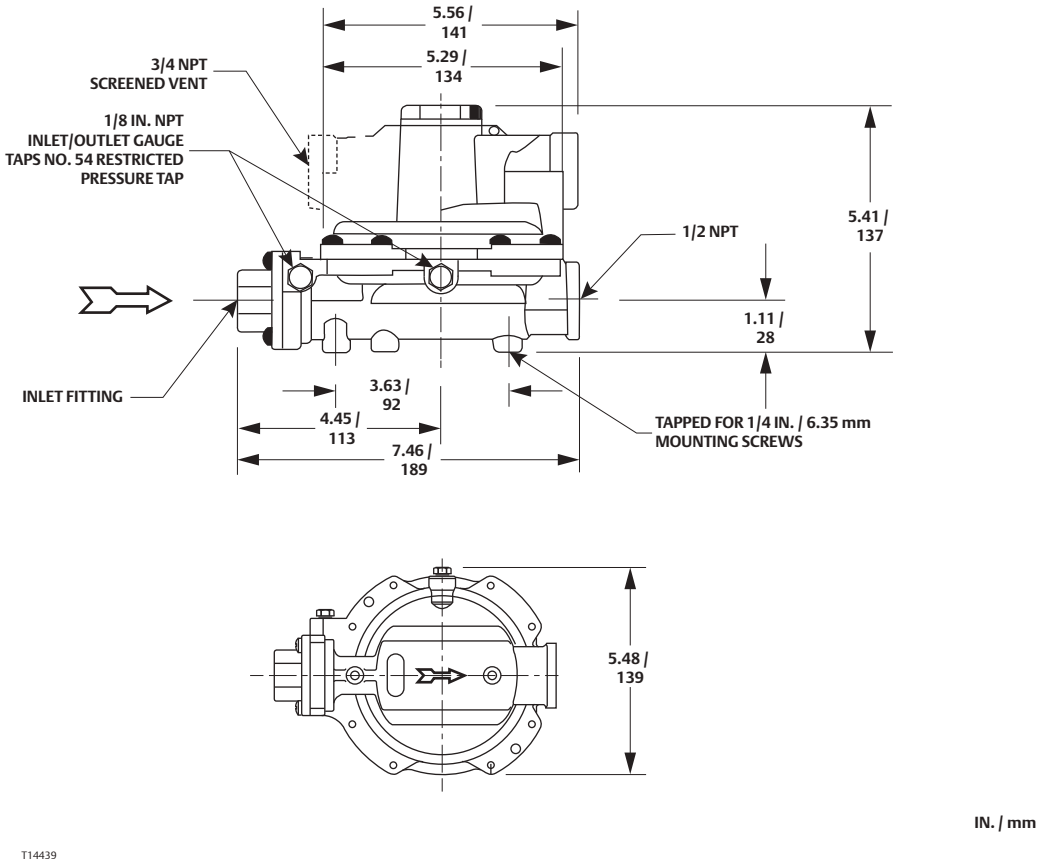


Figure 5. *Dimensions*

Ordering Guide

Outlet Pressure Range (Select One)

- ☐ 1.8 to 2.2 in. w.c. / 4 to 5 mbar, Purple***
- ☐ 5 to 7 in. w.c. / 12 to 17 mbar, Orange***
- ☐ 6.5 to 9 in. w.c. / 16 to 22 mbar, Yellow***
- ☐ 9 to 13 in. w.c. / 22 to 32 mbar, Silver***
- ☐ 13 to 20 in. w.c. / 32 to 50 mbar, Gray***
- ☐ 16 to 35 in. w.c. / 40 to 87 mbar, Pink***
- ☐ 1 to 2.2 psig / 69 to 152 mbar, Light Blue***

Vent Position (Select One)

- ☐ Position 1 (vent over inlet)***
- ☐ Position 2***
- ☐ Position 3 (vent over outlet)***
- ☐ Position 4***

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Keep vents open. Do not use small diameter, long vent lines. Use the rule of thumb of the next nominal pipe size every 10 feet / 3.1 m of vent line and 3 feet / 0.9 m of vent line for every elbow in the line.

REGAL 3 Series

Pressure Reducing Regulator

FRANCEL

Introduction

The REGAL 3 Series is a direct-operated, spring setpoint pressure regulator, used for supplying industries and commercial businesses.

As an option, it can be equipped with a slam-shut Type VSX2 or OS2 which permits the gas flow to be cut off rapidly and totally in the case of under or over outlet regulator pressure. As a standard feature for outlet pressure settings inferior or equal to 72.3-in. w.c. / 180 mbar, a relief valve is provided. On request, this relief valve may be disconnected and replaced by a dampener.

Upon request, for pressures 72.3 in. w.c. / 180 mbar >P2 <= 442 in. w.c. / 1100 mbar, the REGAL 3 Series can be equipped with a relief valve. This relief valve can be factory adjusted.

The REGAL 3 Series is in conformity with the Pressure Equipment Directive PED 97/23/CE and is classified in Category I.

Body Size and End Connection Styles

2 in. / DN 50 with NPT, PN 10/16, PN 20 or CL150 RF end connections

Maximum Flow Capacity

126,866 SCFH / 3400 Nm³/h

Maximum Inlet Pressure

145 psig / 10.0 bar

Maximum Outlet Pressure

PED Version: 21.8 psig / 1500 mbar

Non-PED Version: 43.5 psig / 3000 mbar

Outlet Pressure Range

PED Version: 3.2 in. w.c. to 21.8 psig / 8 to 1500 mbar

Non-PED Version: 29 to 43.5 psig / 2000 to 3000 mbar

Slam-Shut Pressure Ranges

See Table 4

Regulating Accuracy

AC10

Lockup Pressure Class

SG20

Pressure Registration

External

Internal Relief Setting

P1 + 1.3 psig / P1 + 90 mbar

Temperature Capabilities

-22 to 160°F / -30 to 71°C

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.francel.com

Features

- **Integral Slam-Shut Valve**
- **Installation Flexibility**
- **Ease of Installation**
- **Precise Flows**
- **Internal Relief**



Figure 1. *Type REGAL 3-VSX2 Pressure Reducing Regulator*



Figure 2. *Type REGAL 3-OS2 Pressure Reducing Regulator*

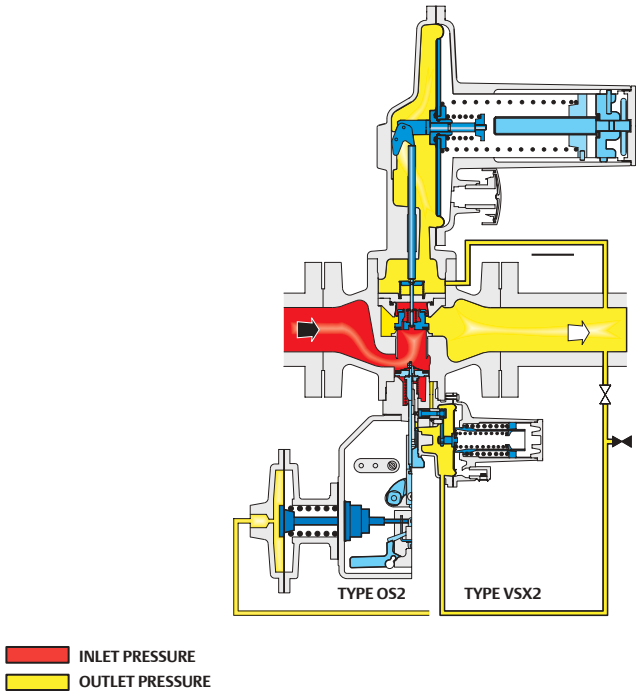


Figure 3. *REGAL 3 Series Operational Schematic*

EMERSON. Process Management

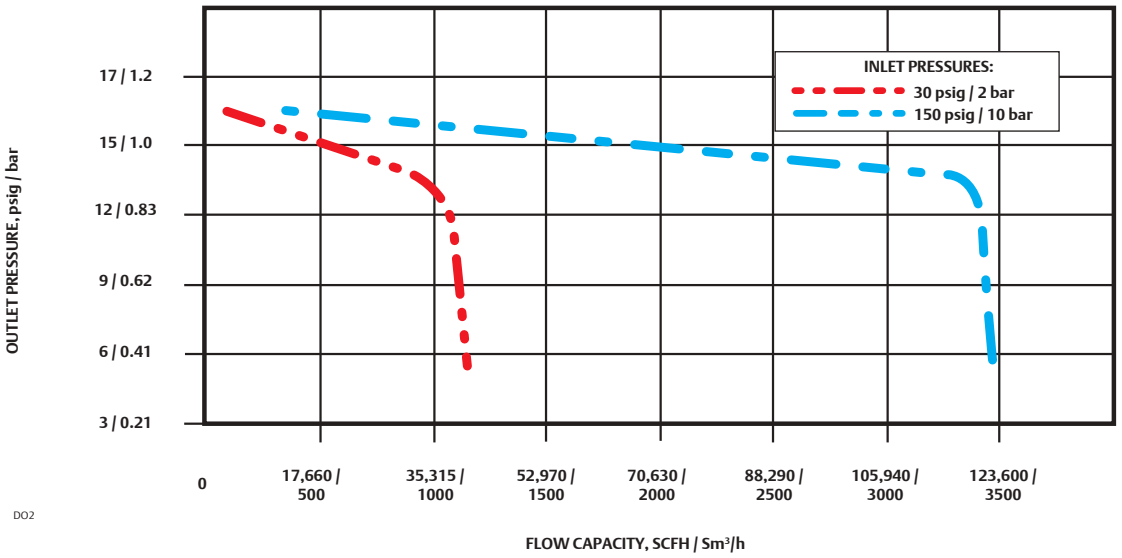


Figure 4. *Sizing Diagram*

Table 1. Regulator Construction Material

BODY	PLUG	PLUG DISK	ORIFICE	DIAPHRAGM	O-RING
Ductile iron	Aluminum	Nitrile (NBR)	Brass	Reinforced Nitrile (NBR)	Nitrile (NBR)

Table 2. Slam-Shut Valve Construction Material

BODY	PLUG	PLUG DISK	DIAPHRAGM	O-RING	RESET BUTTON
Aluminum	Aluminum	Nitrile (NBR)	Reinforced Nitrile (NBR)	Nitrile (NBR)	Brass

Table 3. Outlet Pressure Range

OUTLET PRESSURE RANGE		NOMINAL OUTLET PRESSURE		SPRING WIRE DIAMETER	
psig	bar	psig	bar	In.	mm
0.116 to 0.36	8 to 25	0.3	20	0.12	3.04
0.29 to 0.80	20 to 55	0.51	40	0.16	4.06
0.58 to 1.3	40 to 90	0.87	60	0.18	4.60
0.87 to 2.0	60 to 140	1.5	100	0.22	5.60
1.16 to 2.61	80 to 180	2.32	160	0.24	6.10
1.5 to 4.9	100 to 340	4.35	300	0.30	7.62
4.35 to 8.0	300 to 550	7.3	500	0.32	8.12
5.8 to 16	400 to 1100	15	1000	0.40	10.16
10.9 to 21.8	750 to 1500	21.8	1500	0.32	8.13

Table 4. Outlet Pressure Range of Shutoff Device Pilot

NOMINAL OUTLET PRESSURE		TYPE VSX2								TYPE OS2			
		Overpressure Range		Maximum Spring		Underpressure Range		Minimum Spring Diameter		Pressure Range		Spring Wire	
psig	mbar	psig	mbar	In.	mm	psig	mbar	In.	mm	psig	mbar	In.	mm
0.29	20	0.44 to 0.87	30 to 60	0.067	1.70	0.073 to 0.44	5 to 30	0.043	1.09	----	----	----	----
0.51	40	0.73 to 1.89	50 to 130	0.079	2.00	0.073 to 0.44	5 to 30	0.043	1.09	----	----	----	----
0.87	60	0.73 to 1.89	50 to 130	0.079	2.00	0.145 to 1.09	10 to 75	0.055	1.40	----	----	----	----
1.45	100	1.38 to 3.48	95 to 240	0.091	2.31	0.145 to 1.09	10 to 75	0.055	1.40	1.01 to 3.48	70 to 240	0.138	3.50
2.32	160	2.18 to 5.51	150 to 380	0.102	2.60	0.363 to 2.32	25 to 160	0.067	1.70	1.01 to 3.48	70 to 240	0.138	3.50
4.35	300	3.77 to 8.70	260 to 600	0.122	3.10	1.45 to 5.08	100 to 350	0.094	2.39	2.0 to 10.9	140 to 750	0.197	5.00
7.25	500	5.8 to 16.0	400 to 1100	0.138	3.50	1.45 to 7.25	100 to 500	0.094	2.39	2.0 to 10.9	140 to 750	0.197	5.00
14.5	1000	11.6 to 23.2	800 to 1600	0.161	4.09	1.45 to 10.9	100 to 750	0.126	3.20	6.53 to 33.36	450 to 2300	0.256	6.50
21.8	1500	16.0 to 29	1100 to 2000	0.122	3.10	7.3 to 16.0	500 to 1100	0.094	2.40	6.53 to 33.36	450 to 2300	0.256	6.50

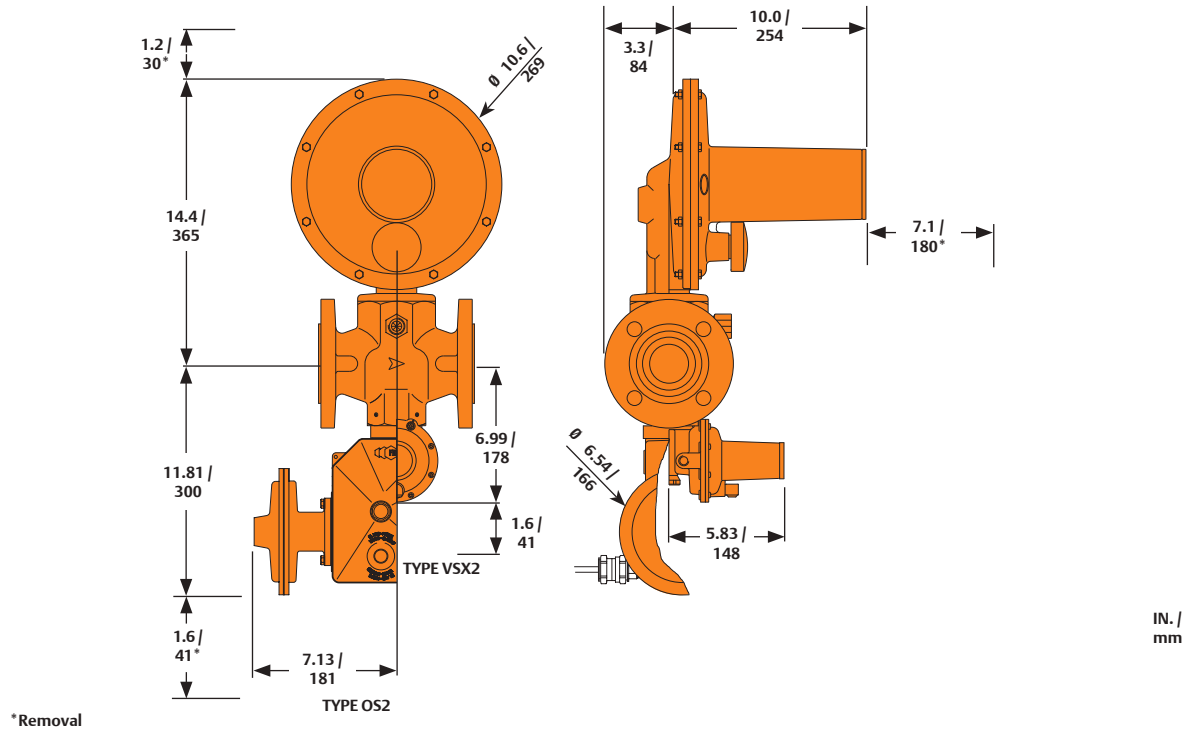


Figure 5. *Dimensions*

Table 5. Capacities at 10% Regulating Accuracy

INLET PRESSURE, psig / bar	CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Outlet Pressure, psig / mbar													
	0.29 / 20		0.51 / 35		0.87 / 60		1.5 / 100		4.35 / 300		7.3 / 500		15 / 1000	
	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
7.3 / 0.5	10,075	270	11,940	320	14,179	380	11,940	320	11,940	320	----	----	----	----
15 / 1.0	17,537	470	17,537	470	19,403	520	20,896	560	20,522	550	19,030	510	----	----
29 / 2.0	29,851	800	29,851	800	35,448	950	35,448	950	37,313	1000	37,313	1000	35,448	950
58 / 4.0	52,239	1400	54,104	1450	57,836	1550	61,567	1650	61,567	1650	65,299	1750	65,299	1750
116 / 8.0	87,687	2350	93,284	2500	104,478	2800	108,209	2900	108,209	2900	108,209	2900	108,209	2900
145 / 10	97,015	2600	108,209	2900	119,403	3200	119,403	3200	119,403	3200	126,866	3400	126,866	3400

Table 6. Capacities at 20% Regulating Accuracy

INLET PRESSURE, psig / bar	CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Outlet Pressure, psig / mbar													
	0.29 / 20		0.51 / 35		0.87 / 60		1.5 / 100		4.35 / 300		7.3 / 500		15 / 1000	
	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
7.3 / 0.5	17,910	480	17,910	480	17,910	480	17,910	480	15,672	420	----	----	----	----
15 / 1.0	26,866	720	26,866	720	26,866	720	26,866	720	25,373	680	23,507	630	----	----
29 / 2.0	44,776	1200	44,776	1200	44,776	1200	44,776	1200	44,776	1200	44,776	1200	39,179	1050
58 / 4.0	69,030	1850	69,030	1850	69,030	1850	67,164	1800	67,164	1800	65,299	1750	65,299	1750
116 / 8.0	104,478	2800	108,209	2900	108,209	2900	108,209	2900	108,209	2900	108,209	2900	108,209	2900
145 / 10	119,403	3200	126,866	3400	126,866	3400	126,866	3400	126,866	3400	126,866	3400	126,866	3400

Table 7. Shipping Weight

TYPE	APPROXIMATE SHIPPING WEIGHT, lb / kg
Type Regal 3 with Type VSX2 Slam-Shut Valve	41.4 / 19
Type Regal 3 with Type OS2 Slam-Shut Valve	52.9 / 24
Type Regal 3 without Slam-Shut Valve	39.7 / 18

Ordering Guide

End Connection Style (Select One)

- ☐ PN 10/16***
- ☐ PN 20/CL150 RF***
- ☐ NPT***

Outlet Pressure Range (Select One)

- ☐ 0.116 to 0.36 psig / 8 to 25 mbar
- ☐ 0.29 to 0.80 psig / 20 to 55 mbar
- ☐ 0.58 to 1.3 psig / 40 to 90 mbar
- ☐ 0.87 to 2.0 psig / 60 to 140 mbar
- ☐ 1.16 to 2.61 psig / 80 to 180 mbar
- ☐ 1.5 to 4.9 psig / 100 to 340 mbar
- ☐ 4.35 to 8.0 psig / 300 to 550 mbar
- ☐ 5.8 to 16 psig / 400 to 1100 mbar
- ☐ 10.9 to 21.8 psig / 750 to 1500 mbar

Slam-Shut Valve (Optional)

- ☐ Type VSX2
- ☐ Type OS2

Slam-Shut Valve Range

Type VSX2

Underpressure Range

- ☐ 0.073 to 0.44 psig / 5 to 30 mbar
- ☐ 0.145 to 1.09 psig / 10 to 75 mbar
- ☐ 0.363 to 2.32 psig / 25 to 160 mbar
- ☐ 1.45 to 5.08 psig / 100 to 350 mbar
- ☐ 1.45 to 7.25 psig / 100 to 500 mbar
- ☐ 1.45 to 10.9 psig / 100 to 750 mbar
- ☐ 7.3 to 16.0 psig / 500 to 1100 mbar

Overpressure Range

- ☐ 0.44 to 0.87 psig / 30 to 60 mbar
- ☐ 0.73 to 1.89 psig / 50 to 130 mbar
- ☐ 1.38 to 3.48 psig / 95 to 240 mbar
- ☐ 2.18 to 5.51 psig / 150 to 380 mbar
- ☐ 3.77 to 8.70 psig / 260 to 600 mbar
- ☐ 5.80 to 16.0 psig / 400 to 1100 mbar
- ☐ 11.6 to 23.2 psig / 800 to 1600 mbar
- ☐ 16.0 to 29 psig / 1100 to 2000 mbar

Type OS2

Pressure Range

- ☐ 1.01 to 3.48 psig / 70 to 240 mbar
- ☐ 2.0 to 10.9 psig / 140 to 750 mbar
- ☐ 6.53 to 33.36 psig / 450 to 2300 mbar

Slam-Shut (Optional)

- ☐ Explosion-Proof Switch (Type OS2 only)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Does the application require overpressure protection?
☐ Yes, which is preferred? ☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No
Pressure
Maximum Inlet Pressure (P_{1max}):
Minimum Inlet Pressure (P_{1min}):
Downstream Pressure Setting(s) (P_2):
Maximum Flow (Q_{max}):
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

ROC800 Series

Remote Operations Controllers

FISHER

Introduction

The ROC800 Series Remote Operations Controllers offer outstanding flexibility in meeting a wide range of field applications. They combine into one package the ruggedness, low power consumption and broad communications capabilities of an RTU (Remote Terminal Unit), the audit trails and historical data archival of a flow computer.

The ROC800 Series comes with a comprehensive applications package that addresses a wide range of metering and control needs. Gas flow calculations use AGA 3 for orifice metering, AGA 7 / (ISO 9951) for turbine metering, AGA 8 / (ISO 12213-2,3) for compressibility and are compliant with API Chapter 21. Up to 40 ft / 12 m runs can be measured. Comprehensive PID (Proportional, Integral and Derivative) loop control is configurable for up to 16 control loops and Function Sequence Table or FST control, lets users develop control strategies using logic, math, comparison, time-related, control-related, database and general command sets. Up to six FSTs can be implemented.

The optional DS800 Development Suite is a powerful programming tool that helps users create custom control strategies using any of six programming languages. Five are IEC 61131-3 graphical programming languages and include sequential function chart, functional block diagram, ladder diagram, structured text and instruction list. A graphical flow chart programming language is also provided. Programs developed using IEC 61131-3 are reusable on different platforms, eliminating the need for reprogramming.

The ROC800 Series interfaces to a wide variety of field devices using low-density I/O Modules that plug into expansion slots. With its optional high-speed Ethernet capability, users can effectively extend their company's local area network (LAN) to their fields. An Ethernet connection lets more data be transferred at a lower cost than with conventional communications methods. Ethernet also makes it possible to network the ROC800 Series, giving users tremendous I/O and control capabilities for large applications.

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **RTU and Flow Computer in One Package**
- **Fill-In-The-Blanks Configuration**
- **IEC61131-3 Compliant Programming**
- **Fast, Accurate Flow Calculations**
- **Distributed Architecture**
- **Rugged I/O Modules**
- **Sophisticated PID Loop Control**
- **Flexible Logic and Sequencing Control**
- **Communications Modules**

Processor

32-bit microprocessor based on the Motorola® MPC862 Quad Integrated Communications Controller (PowerQUICC™) PowerPC® processor running at 65 MHz

Processor Memory

Boot Flash: 256 KB for system initialization and diagnostics
Flash: 16 MB for firmware image
SRAM: 2 MB for Historical Data Logs and configuration
Synchronous DRAM: 32 MB for firmware execution and execution memory

I/O Modules

AC I/O-6: 6 channels: selectable as input or output
Analog Input-12: 4 channels: 12 bits of resolution
Analog Input-16: 4 channels: 16 bits of resolution
Analog Output: 4 channels
Advanced Pulse Input: 4 channels pulse, 2 prover
Discrete Input: 8 channels
Discrete Output: 5 channels
Digital Relay Output: 5 channels



Figure 1. *Series 2 ROC809 Remote Operations Controller*



Figure 2. *ROC800 Series Base Unit with 4 Expansion Racks*

HART Input/Output: 4 channels, each capable of communications with up to 5 HART devices (when in input multi-drop mode)
MVS I/O: Supports up to 6 sensors
Pulse Input: 2 channels; user-selectable high speed or low speed per channel
RTD Input: 2 channels

Communications Modules

EIA-232 (RS-232):
Type: Single. 57.6K bps maximum data rate
EIA-422/485 (RS-422/485):
Type: Single. 57.6K bps maximum data rate
Dial-Up Modem:
Type: Single. 57.6K bps maximum data rate

Communication Ports (on board)

EIA-232 (RS-232) PORT Type: Single. 57.6K bps maximum data rate
ETHERNET PORT Type: 10BASE-T twisted pair. IEEE multi-segment 10 MB/second baseband Ethernet
Maximum Segment: 100 m / 330 ft
LOI PORT Type: EIA-232D (RS-232D) Standard. 57.6K bps maximum data rate

Power Requirements

Series 2 Base System: (power module, backplane and CPU) typically draws 125 mA at 12 V dc (PM-12) or 121 mA at 24 V dc (PM-24)
PM-12 (12 V dc Nominal Module):
Recommended Voltage Range: 11.5 to 14.5 V dc
Maximum Voltage Range: 11.25 to 16 V dc
PM-24 (24 V dc Nominal Module):
Operating Input Range (+): 20 to 30 V dc

Battery Backup

User-replaceable
Type: Sanyo 3 V CR2430 lithium
Normal use life: 10 years while power is applied to unit
Backup life: 1 year minimum while maintaining RTC and SRAM data and no power is applied to unit
Shelf life: 10 years

Board Temperature Accuracy

1% typical, 2% maximum

Voltage Monitor Accuracy

Typical: 0.75%
Maximum: 1%

Time Functions

Clock Type: 32 KHz crystal oscillator with regulated supply, battery-backed. Year/Month/Day and Hour/Minute/Second, with Daylight Savings Time control
Clock Accuracy: 0.01%
Watchdog Timer: Hardware monitor expires after 3 seconds and resets the processor

Materials

Case: Acrylonitrile Butadiene Styrene (ABS) Plastic
Wire Channel Covers: Polypropylene Plastic
Modules: Thermoplastic Polyester, solvent resistant

Wiring

Size 12 to 22 American Wire Gauge (AWG) for terminal blocks

DIN Rails

Size: 35

Dimensions

9.5 in. H by 9.6 in. W by 6.85 in. D /
241 mm H by 244 mm W by 174 mm D,
allow an additional 0.75 in. / 19 mm for cables

Enclosure

US Government Patent: 6771513

Weight

3.65 lbs / 2 kg for housing, backplane and CPU
I/O Modules: Vary from 1.76 to 2.1 oz. / 49 to 60 g
Modem Module: 4 oz / 113.4 g
EIA-232 (RS-232) Module: 1.68 oz / 47.6 g
EIA-422/485 (RS-422/485) Module: 1.76 oz / 49.9 g
MVS Module: 2.16 oz / 61.2 g
12 V dc Power Input Module: 3.44 oz / 97.5 g
24 V dc Power Input Module: 4.24 oz / 120 g

Environmental

Operating Temperature: -40 to 167°F / -40 to 75°C
Storage Temperature: -40 to 185°F / -40 to 85°C
Relative Humidity: IEC68-2-3; 5-95% non-condensing
Vibration: IEC68-2-6; 0.15 mm or 20 m/sec^2
Mechanical Shock: IEC68-2-27; 11 mSec, sinusoidal 50 Gs non-operating, 15 Gs operating
Thermal Shock: IEC68-2-14; Air to air from -4 to 185°F / -20 to 85°C
Radiated/Conducted Immunity: Meets requirements of IEC 61326 Electrical Equipment for use in Industrial Locations
Radiated Emissions: Meets EN 55011 Class A; ICES-003:1997 Digital Apparatus; and FCC Part 15, Class A

Approvals

Evaluated per North American Standards: CSA C22.2 Nos. 142 and 213. CAN/CSA E79-0-02 and E79-15-02. UL 1604 – 3rd Edition. UL 508 – 17th Edition
Product Markings for Hazardous Locations: Class I, Division 2, Groups A, B, C and D, T4A. Class I, Zone 2, Group IIC, T4A. AEx nA IIC, T4A

Ordering Guide

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

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RP Series

Pressure Reducing Regulators

TARTARINI

Introduction

The RP Series regulators are direct-operated with non-balanced trim. Normally they are fitted with a built-in filter. Different constructions are available: Types RP/011, RP/022 and RP/033. All models can be fitted with a slam-shut valve.

Type

Types RP/011, RP/022 and RP/033: Without slam-shut valve

Types RP/011/66, RP/022/66 and RP/033/66: With slam-shut valve

Maximum Allowable Pressure

Body: 290 psig / 20.0 bar

Actuator: 58 psig / 4.0 bar

Maximum Inlet Pressure

290 psig / 20.0 bar

Inlet Pressure Range

3 to 290 psig / 0.21 to 20.0 bar

Set Pressure Range

Types RP/022 and RP/033: 1.45 to 58 psig / 0.10 to 4.0 bar

Type RP/011: 1.45 to 29 psig / 0.10 to 2.0 bar

Accuracy Class

Up to ±5%

Lock-up Pressure Class

Up to 10%

Built-in Slam-Shut Valve

Independent Pneumatic Control
Accuracy class: ±5%

Response time: ≤ 1 second

Orifice

1/2, 11/16 and 3/4 in. / 13, 17 and 19 mm

Threaded Connections

Type RP/011: Inlet x Outlet 1 x 1-1/4 in. BSP

Type RP/022: Inlet x Outlet 1-1/4 x 2 in. BSP

Type RP/033: Inlet x Outlet 2 x 3 in. BSP

Flanged Connections

RP Series/___-FS version
PN 16/25/40
CL150 RF, CL300 RF

Operating Temperature

Standard Version:
14 to 140°F / -10 to 60°C

Low Temperature Version:
-4 to 140°F / -20 to 60°C

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Overpressure and Underpressure Slam-Shut Valve**
- **Manual Reset**
- **Inlet and Outlet In-line**



TYPE RP/022



TYPE RP/033/66



TYPE RP/033/66-FS

Figure 1. *RP Series Spring-Loaded Regulators*

Table 1. Construction Material

COVER	BODY		DIAPHRAGM
	Types RP/011, RP/022 and RP/033	Types RP/022 and RP/033	
Die-cast Aluminum	Cast iron	Steel	Nitrile (NBR)

EMERSON. Process Management

Table 2. Type RP/011 at 5% Accuracy

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
	Inlet Pressure, psig / bar											
	4.4 / 0.30	5.8 / 0.40	7.3 / 0.50	8.7 / 0.60	10.2 / 0.70	11.6 / 0.80	14.5 / 1.00	18.1 / 1.3	21.8 / 1.5	26.1 / 1.8	29.0 / 2.0	43.5 / 3.0
2.9 / 0.20	706 / 20.0	1059 / 30.0	2119 / 60.0	2472 / 70.0	2825 / 80.0	3178 / 90.0	3708 / 105	4238 / 120	4767 / 135	5297 / 150	6180 / 175	7593 / 215
4.4 / 0.30	----	706 / 20.0	1766 / 50.0	2295 / 65.0	2649 / 75.0	3002 / 85.0	3531 / 100	4061 / 115	4591 / 130	5297 / 150	6180 / 175	6710 / 190
5.8 / 0.40	----	----	1413 / 40.0	1942 / 55.0	2295 / 65.0	2825 / 80.0	3355 / 95.0	3885 / 110	4414 / 125	5297 / 150	6180 / 175	6710 / 190
7.3 / 0.50	----	----	----	1413 / 40.0	1942 / 55.0	2472 / 70.0	3178 / 90.0	3708 / 105	4238 / 120	5121 / 145	6180 / 175	6710 / 190
8.7 / 0.60	----	----	----	----	1413 / 40.0	2119 / 60.0	3002 / 85.0	3531 / 100	4061 / 115	4944 / 140	5827 / 165	6710 / 190
10.2 / 0.70	----	----	----	----	----	1236 / 35.0	2119 / 60.0	2649 / 75.0	3178 / 90.0	3885 / 110	4238 / 120	5650 / 160
11.6 / 0.80	----	----	----	----	----	----	1766 / 50.0	2472 / 70.0	3002 / 85.0	3708 / 105	4061 / 115	5650 / 160
14.5 / 1.00	----	----	----	----	----	----	----	2119 / 60.0	2825 / 80.0	3531 / 100	3885 / 110	5650 / 160
21.8 / 1.5	----	----	----	----	----	----	----	----	----	2472 / 70.0	3178 / 90.0	5474 / 155
29.0 / 2.0	----	----	----	----	----	----	----	----	----	----	----	4944 / 140

- continued -

Table 2. Type RP/011 at 5% Accuracy (continued)

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Inlet Pressure, psig / bar													
	72.5 / 5.0	116 / 8.0	131 / 9.0	145 / 10.0	160 / 11.0	174 / 12.0	189 / 13.0	203 / 14.0	218 / 15.0	232 / 16.0	247 / 17.0	261 / 18.0	276 / 19.0	290 / 20.0
2.9 / 0.20	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215
4.4 / 0.30	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235
5.8 / 0.40	7239 / 205	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250
7.3 / 0.50	7239 / 205	7946 / 225	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251
8.7 / 0.60	7239 / 205	7946 / 225	8829 / 250	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285
10.2 / 0.70	8475 / 240	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300
11.6 / 0.80	8475 / 240	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320
14.5 / 1.00	8475 / 240	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360
21.8 / 1.5	8475 / 240	12,713 / 360	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450
29.0 / 2.0	8475 / 240	12,713 / 360	14,479 / 410	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530

- continued -

Table 3. Type RP/011 at 10% Accuracy

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
	Inlet Pressure, psig / bar											
	4.4 / 0.30	5.8 / 0.40	7.3 / 0.50	8.7 / 0.60	10.2 / 0.70	11.6 / 0.80	14.5 / 1.00	18.1 / 1.3	21.8 / 1.5	26.1 / 1.8	29.0 / 2.0	43.5 / 3.0
2.9 / 0.20	1059 / 30.0	1413 / 40.0	2472 / 70.0	2825 / 80.0	3178 / 90.0	3531 / 100	4061 / 115	4591 / 130	5297 / 150	6003 / 170	6886 / 195	7593 / 215
4.4 / 0.30	----	1059 / 30.0	2119 / 60.0	2649 / 75.0	3002 / 85.0	3355 / 95.0	3885 / 110	4414 / 125	5121 / 145	6003 / 170	6886 / 195	7416 / 210
5.8 / 0.40	----	----	1766 / 50.0	2295 / 65.0	2649 / 75.0	3178 / 90.0	3708 / 105	4238 / 120	4944 / 140	6003 / 170	6886 / 195	7416 / 210
7.3 / 0.50	----	----	----	1766 / 50.0	2295 / 65.0	2825 / 80.0	3531 / 100	4061 / 115	4767 / 135	5827 / 165	6886 / 195	7416 / 210
8.7 / 0.60	----	----	----	----	1766 / 50.0	2472 / 70.0	3355 / 95.0	3885 / 110	4591 / 130	5650 / 160	6533 / 185	7416 / 210
10.2 / 0.70	----	----	----	----	----	1766 / 50.0	2649 / 75.0	3355 / 95.0	4061 / 115	4767 / 135	5297 / 150	6886 / 195
11.6 / 0.80	----	----	----	----	----	----	2295 / 65.0	3178 / 90.0	3885 / 110	4591 / 130	5121 / 145	6886 / 195
14.5 / 1.00	----	----	----	----	----	----	----	2472 / 70.0	3531 / 100	4414 / 125	4944 / 140	6886 / 195
21.8 / 1.5	----	----	----	----	----	----	----	----	----	3355 / 95.0	4591 / 130	6710 / 190
29.0 / 2.0	----	----	----	----	----	----	----	----	----	----	----	6180 / 175

- continued -

Table 3. Type RP/011 at 10% Accuracy (continued)

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Inlet Pressure, psig / bar													
	72.5 / 5.0	116 / 8.0	131 / 9.0	145 / 10.0	160 / 11.0	174 / 12.0	189 / 13.0	203 / 14.0	218 / 15.0	232 / 16.0	247 / 17.0	261 / 18.0	276 / 19.0	290 / 20.0
2.9 / 0.20	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215	7593 / 215
4.4 / 0.30	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235	8299 / 235
5.8 / 0.40	8122 / 230	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250	8829 / 250
7.3 / 0.50	8122 / 230	8829 / 250	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251	8864 / 251
8.7 / 0.60	8122 / 230	8829 / 250	9888 / 280	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285	10,065 / 285
10.2 / 0.70	11,301 / 320	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300	10,594 / 300
11.6 / 0.80	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320	11,301 / 320
14.5 / 1.00	11,301 / 320	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360	12,713 / 360
21.8 / 1.5	11,301 / 320	15,538 / 440	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450
29.0 / 2.0	11,301 / 320	15,538 / 440	16,598 / 470	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530	18,717 / 530

- continued -

Table 4. Type RP/022 at 5% Accuracy

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Inlet Pressure, psig / bar													
	2.2 / 0.15	2.9 / 0.20	4.4 / 0.30	5.8 / 0.40	7.3 / 0.50	8.7 / 0.60	10.2 / 0.70	11.6 / 0.80	14.5 / 1.00	18.1 / 1.3	21.8 / 1.5	26.1 / 1.8	29.0 / 2.0	43.5 / 3.0
1.2 / 0.08	1766 / 50.0	2472 / 70.0	3355 / 95.0	3885 / 110	4944 / 140	5650 / 160	6180 / 175	6533 / 185	7063 / 200	7593 / 215	8475 / 240	9535 / 270	10,947 / 310	14,126 / 400
1.45 / 0.10	1589 / 45.0	2295 / 65.0	3178 / 90.0	3708 / 105	4767 / 135	5474 / 155	6003 / 170	6357 / 180	6886 / 195	7593 / 215	8475 / 240	9535 / 270	10,947 / 310	14,479 / 410
2.2 / 0.15	----	1589 / 45.0	2825 / 80.0	3531 / 100	4591 / 130	5297 / 150	5827 / 165	6180 / 175	6710 / 190	7416 / 210	8475 / 240	9535 / 270	10,947 / 310	15,362 / 435
2.9 / 0.20	----	----	2295 / 65.0	3355 / 95.0	4414 / 125	5121 / 145	5650 / 160	6003 / 170	6533 / 185	7239 / 205	8475 / 240	9535 / 270	10,947 / 310	13,420 / 380
4.4 / 0.30	----	----	----	2825 / 80.0	4061 / 115	4767 / 135	5297 / 150	5827 / 165	6357 / 180	7063 / 200	8122 / 230	9535 / 270	10,947 / 310	13,420 / 380
5.8 / 0.40	----	----	----	----	3178 / 90.0	4061 / 115	4944 / 140	5650 / 160	6180 / 175	6886 / 195	7946 / 225	9535 / 270	10,947 / 310	13,420 / 380
7.3 / 0.50	----	----	----	----	----	3178 / 90.0	4238 / 120	4944 / 140	6003 / 170	6710 / 190	7593 / 215	9182 / 260	10,947 / 310	13,420 / 380
8.7 / 0.60	----	----	----	----	----	----	3178 / 90.0	4238 / 120	5650 / 160	6357 / 180	7239 / 205	8829 / 250	10,947 / 310	13,420 / 380
10.2 / 0.70	----	----	----	----	----	----	----	1766 / 50.0	2825 / 80.0	3885 / 110	4591 / 130	5474 / 155	6003 / 170	8122 / 230
11.6 / 0.80	----	----	----	----	----	----	----	----	2472 / 70.0	3708 / 105	4591 / 130	5297 / 150	6003 / 170	8122 / 230
14.5 / 1.00	----	----	----	----	----	----	----	----	----	2825 / 80.0	4061 / 115	5121 / 145	5650 / 160	8122 / 230
21.8 / 1.5	----	----	----	----	----	----	----	----	----	----	----	3531 / 100	4591 / 130	7769 / 220
29.0 / 2.0	----	----	----	----	----	----	----	----	----	----	----	----	----	7063 / 200
43.5 / 3.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----
58.0 / 4.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----

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Table 4. Type RP/022 at 5% Accuracy (continued)

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Inlet Pressure, psig / bar													
	72.5 / 5.0	116 / 8.0	131 / 9.0	145 / 10.0	160 / 11.0	174 / 12.0	189 / 13.0	203 / 14.0	218 / 15.0	232 / 16.0	247 / 17.0	261 / 18.0	276 / 19.0	290 / 20.0
1.2 / 0.08	14,126 / 400	----	----	----	----	----	----	----	----	----	----	----	----	----
1.45 / 0.10	14,479 / 410	14,479 / 410	----	----	----	----	----	----	----	----	----	----	----	----
2.2 / 0.15	15,362 / 435	15,362 / 435	15,362 / 435	15,362 / 435	15,362 / 435	15,362 / 435	----	----	----	----	----	----	----	----
2.9 / 0.20	15,892 / 450	15,892 / 450	15,892 / 450	15,892/ 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	----	----	----	----
4.4 / 0.30	15,185 / 430	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490
5.8 / 0.40	15,185 / 430	16,951 / 480	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525
7.3 / 0.50	15,185 / 430	16,951 / 480	18,010 / 510	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565
8.7 / 0.60	15,185 / 430	16,951 / 480	18,010 / 510	19,423 / 550	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600
10.2 / 0.70	12,360 / 350	18,363 / 520	19,776 / 560	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640
11.6 / 0.80	12,360 / 350	18,363 / 520	20,482 / 580	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675
14.5 / 1.00	12,360 / 350	18,363 / 520	20,482 / 580	21,542 / 610	22,954 / 650	24,367 / 690	26,662 / 755	26,662 / 755	26,662 / 755	26,662 / 755	26,662 / 755	26,662 / 755	26,662 / 755	26,662 / 755
21.8 / 1.5	12,360 / 350	18,363 / 520	20,482 / 580	21,542 / 610	22,954 / 650	24,367 / 690	27,192 / 770	28,251 / 800	29,311 / 830	30,193 / 855	31,076 / 880	31,783 / 900	32,489 / 920	32,842 / 930
29.0 / 2.0	12,183 / 345	18,363 / 520	20,482 / 580	21,542 / 610	22,954 / 650	24,367 / 690	27,192 / 770	28,251 / 800	29,311 / 830	30,193 / 855	31,076 / 880	31,783 / 900	32,489 / 920	32,842 / 930
43.5 / 3.0	11,300 / 320	18,363 / 520	20,482 / 580	21,542 / 610	22,954 / 650	24,367 / 690	27,192 / 770	28,251 / 800	29,311 / 830	30,193 / 855	31,076 / 880	31,783 / 900	32,489 / 920	32,842 / 930
58.0 / 4.0	9182 / 260	18,363 / 520	20,482 / 580	21,542 / 610	22,954 / 650	24,367 / 690	27,192 / 770	28,251 / 800	29,311 / 830	30,193 / 855	31,076 / 880	31,783 / 900	32,489 / 920	32,842 / 930

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Table 5. Type RP/022 at 10% Accuracy

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Inlet Pressure, psig / bar													
	2.2 / 0.15	2.9 / 0.20	4.4 / 0.30	5.8 / 0.40	7.3 / 0.50	8.7 / 0.60	10.2 / 0.70	11.6 / 0.80	14.5 / 1.00	18.1 / 1.3	21.8 / 1.5	26.1 / 1.8	29.0 / 2.0	43.5 / 3.0
1.2 / 0.08	2119 / 60.0	2825 / 80.0	3708 / 105	4238 / 120	5297 / 150	6180 / 175	6710 / 190	7063 / 200	7593 / 215	8299 / 235	9182 / 260	10,241 / 290	11,654 / 330	14,302 / 405
1.45 / 0.10	1942 / 55.0	2649 / 75.0	3531 / 100	4061 / 115	5121 / 145	6003 / 170	6533 / 185	6886 / 195	7416 / 210	8299 / 235	9182 / 260	10,241 / 290	11,654 / 330	14,479 / 410
2.2 / 0.15	----	1942 / 55.0	3178 / 90.0	3885 / 110	4944 / 140	5827 / 165	6357 / 180	6710 / 190	7239 / 205	8122 / 230	9182 / 260	10,241 / 290	11,654 / 330	15,362 / 435
2.9 / 0.20	----	----	2649 / 75.0	3708 / 105	4767 / 135	5650 / 160	6180 / 175	6533 / 185	7063 / 200	7946 / 225	9182 / 260	10,241 / 290	11,654 / 330	14,832 / 420
4.4 / 0.30	----	----	----	3178 / 90.0	4414 / 125	5297 / 150	5827 / 165	6357 / 180	6886 / 195	7769 / 220	8829 / 250	10,241 / 290	11,654 / 330	14,832 / 420
5.8 / 0.40	----	----	----	----	3531 / 100	4591 / 130	5474 / 155	6180 / 175	6710 / 190	7593 / 215	8652 / 245	10,241 / 290	11,654 / 330	14,832 / 420
7.3 / 0.50	----	----	----	----	----	3708 / 105	4767 / 135	5474 / 155	6533 / 185	7416 / 210	8299 / 235	9888 / 280	11,654 / 330	14,832 / 420
8.7 / 0.60	----	----	----	----	----	----	3708 / 105	4767 / 135	6180 / 175	7063 / 200	7946 / 225	9535 / 270	11,300 / 320	14,832 / 420
10.2 / 0.70	----	----	----	----	----	----	----	2472 / 70.0	4591 / 130	5474 / 155	6710 / 190	8122 / 230	8829 / 250	10,594 / 300
11.6 / 0.80	----	----	----	----	----	----	----	----	4238 / 120	5297 / 150	7239 / 205	7769 / 220	8475 / 240	10,594 / 300
14.5 / 1.00	----	----	----	----	----	----	----	----	----	4767 / 135	6886 / 195	7593 / 215	8122 / 230	10,594 / 300
21.8 / 1.5	----	----	----	----	----	----	----	----	----	----	----	6180 / 175	7769 / 220	10,241 / 290
29.0 / 2.0	----	----	----	----	----	----	----	----	----	----	----	----	----	9358 / 265
43.5 / 3.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----
58.0 / 4.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----

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Table 5. Type RP/022 at 10% Accuracy (continued)

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Inlet Pressure, psig / bar													
	72.5 / 5.0	116 / 8.0	131 / 9.0	145 / 10.0	160 / 11.0	174 / 12.0	189 / 13.0	203 / 14.0	218 / 15.0	232 / 16.0	247 / 17.0	261 / 18.0	276 / 19.0	290 / 20.0
1.2 / 0.08	14,302 / 405	----	----	----	----	----	----	----	----	----	----	----	----	----
1.45 / 0.10	14,479 / 410	14,479 / 410	----	----	----	----	----	----	----	----	----	----	----	----
2.2 / 0.15	15,362 / 435	15,362 / 435	15,362 / 435	15,362 / 435	15,362 / 435	15,362 / 435	----	----	----	----	----	----	----	----
2.9 / 0.20	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	15,892 / 450	----	----	----	----
4.4 / 0.30	16,598 / 470	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490	17,304 / 490
5.8 / 0.40	16,598 / 470	18,363 / 520	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525	18,540 / 525
7.3 / 0.50	16,598 / 470	18,363 / 520	19,423 / 550	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565	19,952 / 565
8.7 / 0.60	16,598 / 470	18,363 / 520	19,423 / 550	20,836 / 590	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600	21,188 / 600
10.2 / 0.70	14,479 / 410	21,188 / 600	23,307 / 660	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640	22,601 / 640
11.6 / 0.80	14,479 / 410	21,188 / 600	23,307 / 660	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675	23,837 / 675
14.5 / 1.00	14,479 / 410	21,188 / 600	23,307 / 660	24,367 / 690	25,426 / 720	26,486 / 750	26,662 / 755	26,662 / 755	26,662 / 755	26,662 / 755	26,662 / 755	26,662 / 755	26,662 / 755	26,662 / 755
21.8 / 1.5	14,479 / 410	21,188 / 600	23,307 / 660	24,367 / 690	25,426 / 720	26,486 / 750	29,664 / 840	31,429 / 890	32,312 / 915	32,842 / 930	33,901 / 960	34,431 / 975	34,961 / 990	35,314 / 1000
29.0 / 2.0	14,302 / 405	21,188 / 600	23,307 / 660	24,367 / 690	25,426 / 720	26,486 / 750	29,664 / 840	31,429 / 890	32,312 / 915	32,842 / 930	33,901 / 960	34,431 / 975	34,961 / 990	35,314 / 1000
43.5 / 3.0	13,420 / 380	21,188 / 600	23,307 / 660	24,367 / 690	25,426 / 720	26,486 / 750	29,664 / 840	31,429 / 890	32,312 / 915	32,842 / 930	33,901 / 960	34,431 / 975	34,961 / 990	35,314 / 1000
58.0 / 4.0	11,300 / 320	21,188 / 600	23,307 / 660	24,367 / 690	25,426 / 720	26,486 / 750	29,664 / 840	31,429 / 890	32,312 / 915	32,842 / 930	33,901 / 960	34,431 / 975	34,961 / 990	35,314 / 1000

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Table 6. Type RP/033 at 5% Accuracy

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Inlet Pressure, psig / bar													
	2.2 / 0.15	2.9 / 0.20	4.4 / 0.30	5.8 / 0.40	7.3 / 0.50	8.7 / 0.60	10.2 / 0.70	11.6 / 0.80	14.5 / 1.00	18.1 / 1.3	21.8 / 1.5	26.1 / 1.8	29.0 / 2.0	43.5 / 3.0
1.2 / 0.08	2825 / 80.0	3708 / 105	5121 / 145	6180 / 175	7416 / 210	8299 / 235	9005 / 255	9888 / 280	11,654 / 330	13,066 / 370	14,479 / 410	16,244 / 460	21,188 / 600	25,426 / 720
1.45 / 0.10	2472 / 70.0	3531 / 100	4944 / 140	6003 / 170	7239 / 205	7946 / 225	8652 / 245	9535 / 270	11,300 / 320	12,713 / 360	14,302 / 405	16,068 / 455	21,188 / 600	25,426 / 720
2.2 / 0.15	----	2472 / 70.0	4238 / 120	5650 / 160	7063 / 200	7769 / 220	8475 / 240	9358 / 265	11,124 / 315	12,536 / 355	14,126 / 400	15,891 / 450	21,188 / 600	30,900 / 875
2.9 / 0.20	----	----	3708 / 105	5121 / 145	6710 / 190	7593 / 215	8299 / 235	9182 / 260	10,947 / 310	12,360 / 350	13,949 / 395	15,715 / 445	21,188 / 600	33,901 / 960
4.4 / 0.30	----	----	----	3708 / 105	5827 / 165	7063 / 200	8122 / 230	8829 / 250	10,771 / 305	12,183 / 345	13,772 / 390	15,538 / 440	21,188 / 600	28,251 / 800
5.8 / 0.40	----	----	----	----	4238 / 120	5827 / 165	7416 / 210	8475 / 240	10,418 / 295	12,007 / 340	13,596 / 385	15,362 / 435	21,188 / 600	28,251 / 800
7.3 / 0.50	----	----	----	----	----	4414 / 125	6357 / 180	7769 / 220	9888 / 280	11,830 / 335	13,420 / 380	15,185 / 430	21,188 / 600	28,251 / 800
8.7 / 0.60	----	----	----	----	----	----	4591 / 130	7063 / 200	9182 / 260	11,654 / 330	13,242 / 375	15,008 / 425	20,941 / 593	28,251 / 800
10.2 / 0.70	----	----	----	----	----	----	----	2825 / 80.0	4767 / 135	6357 / 180	7593 / 215	9535 / 270	10,064 / 285	13,596 / 385
11.6 / 0.80	----	----	----	----	----	----	----	----	4061 / 115	6003 / 170	7416 / 210	9358 / 265	9888 / 280	13,596 / 385
14.5 / 1.00	----	----	----	----	----	----	----	----	----	4767 / 135	6710 / 190	8299 / 235	9182 / 260	13,243 / 375
21.8 / 1.5	----	----	----	----	----	----	----	----	----	----	----	5827 / 165	7416 / 210	13,066 / 370
29.0 / 2.0	----	----	----	----	----	----	----	----	----	----	----	----	----	11,654 / 330
43.5 / 3.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----
58.0 / 4.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----

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Table 6. Type RP/033 at 5% Accuracy (continued)

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS Inlet Pressure, psig / bar													
	72.5 / 5.0	116 / 8.0	131 / 9.0	145 / 10.0	160 / 11.0	174 / 12.0	189 / 13.0	203 / 14.0	218 / 15.0	232 / 16.0	247 / 17.0	261 / 18.0	276 / 19.0	290 / 20.0
1.2 / 0.08	25,426 / 720	----	----	----	----	----	----	----	----	----	----	----	----	----
1.45 / 0.10	25,426 / 720	----	----	----	----	----	----	----	----	----	----	----	----	----
2.2 / 0.15	30,900 / 875	30,900 / 875	----	----	----	----	----	----	----	----	----	----	----	----
2.9/ 0.20	33,901 / 960	33,901 / 960	33,901 / 960	33,901 / 960	33,901 / 960	33,901 / 960	----	----	----	----	----	----	----	----
4.4 / 0.30	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	----	----	----
5.8 / 0.40	33,548 / 950	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	38,846 / 1100
7.3 / 0.50	33,548 / 950	42,024 / 1190	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250
8.7 / 0.60	33,548 / 950	42,024 / 1190	44,849 / 1270	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350
10.2 / 0.70	20,129 / 570	30,017 / 850	33,548 / 950	36,727 / 1040	40,258 / 1140	42,024 / 1190	43,790 / 1240	45,203 / 1280	46,438 / 1315	47,675 / 1350	48,380 / 1370	48,910 / 1385	49,440 / 1400	49,793 / 1410
11.6 / 0.80	20,129 / 570	30,017 / 850	33,548 / 950	36,727 / 1040	40,258 / 1140	42,024 / 1190	43,790 / 1240	45,203 / 1280	46,438 / 1315	47,675 / 1350	48,380 / 1370	48,910 / 1385	49,440 / 1400	49,793 / 1410
14.5 / 1.00	20,129 / 570	30,017 / 850	33,548 / 950	36,727 / 1040	40,258 / 1140	42,024 / 1190	43,790 / 1240	45,203 / 1280	46,438 / 1315	47,675 / 1350	48,380 / 1370	48,910 / 1385	49,440 / 1400	49,793 / 1410
21.8 / 1.5	20,129 / 570	30,017 / 850	33,548 / 950	36,727 / 1040	40,258 / 1140	42,024 / 1190	43,790 / 1240	45,203 / 1280	46,438 / 1315	47,675 / 1350	48,380 / 1370	48,910 / 1385	49,440 / 1400	49,793 / 1410
29.0 / 2.0	19,952 / 565	30,017 / 850	33,548 / 950	36,727 / 1040	40,258 / 1140	42,024 / 1190	43,790 / 1240	45,203 / 1280	46,438 / 1315	47,675 / 1350	48,380 / 1370	48,910 / 1385	49,440 / 1400	49,793 / 1410
43.5 / 3.0	18,540 / 525	30,017 / 850	33,548 / 950	36,727 / 1040	40,258 / 1140	42,024 / 1190	43,790 / 1240	45,203 / 1280	46,438 / 1315	47,675 / 1350	48,380 / 1370	48,910 / 1385	49,440 / 1400	49,793 / 1410
58.0 / 4.0	18,187 / 515	30,017 / 850	33,548 / 950	36,727 / 1040	40,258 / 1140	42,024 / 1190	43,790 / 1240	45,203 / 1280	46,438 / 1315	47,675 / 1350	48,380 / 1370	48,910 / 1385	49,440 / 1400	49,793 / 1410

- continued -

Table 7. Type RP/033 at 10% Accuracy

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS Inlet Pressure, psig / bar												
	2.2 / 0.15	2.9 / 0.20	4.4 / 0.30	5.8 / 0.40	7.3 / 0.50	8.7 / 0.60	10.2 / 0.70	11.6 / 0.80	14.5 / 1.00	18.1 / 1.3	21.8 / 1.5	26.1 / 1.8	29.0 / 2.0	43.5 / 3.0
1.2 / 0.08	3178 / 90.0	4061 / 115	5650 / 160	6710 / 190	8475 / 240	9005 / 255	10,064 / 285	10,947 / 310	12,713 / 360	14,126 / 400	16,245 / 460	18,010 / 510	22,954 / 650	26,839 / 760
1.45 / 0.10	2825 / 80.0	3885 / 110	5474 / 155	6533 / 185	7946 / 225	8652 / 245	9711 / 275	10,594 / 300	12,360 / 350	13,773 / 390	16,068 / 455	17,834 / 505	22,954 / 650	26,839 / 760
2.2 / 0.15	----	2825 / 80.0	4767 / 135	6180 / 175	7769 / 220	8475 / 240	9535 / 270	10,418 / 295	12,183 / 345	13,596 / 385	15,892 / 450	17,657 / 500	22,954 / 650	33,196 / 940
2.9 / 0.20	----	----	4238 / 120	5650 / 160	7416 / 210	8299 / 235	9358 / 265	10,241 / 290	12,007 / 340	13,420 / 380	15,715 / 445	17,481 / 495	22,954 / 650	37,080 / 1050
4.4 / 0.30	----	----	----	4238 / 120	6533 / 185	7769 / 220	9182 / 260	9888 / 280	11,830 / 335	13,243 / 375	15,538 / 440	17,304 / 490	22,954 / 650	30,370 / 860
5.8 / 0.40	----	----	----	----	4944 / 140	6357 / 180	8475 / 240	9535 / 270	11,477 / 325	13,006 / 370	15,362 / 435	17,128 / 485	22,954 / 650	30,370 / 860
7.3 / 0.50	----	----	----	----	----	4944 / 140	7416 / 210	8829 / 250	10,947 / 310	12,890 / 365	15,185 / 430	16,951 / 480	22,954 / 650	30,370 / 860
8.7 / 0.60	----	----	----	----	----	----	5650 / 160	8122 / 230	10,241 / 290	13,243 / 375	15,009 / 425	16,774 / 475	22,778 / 645	30,370 / 860
10.2 / 0.70	----	----	----	----	----	----	----	5650 / 160	7593 / 215	9182 / 260	10,418 / 295	12,360 / 350	12,890 / 365	16,421 / 465
11.6 / 0.80	----	----	----	----	----	----	----	----	6886 / 195	8829 / 250	10,241 / 290	12,183 / 345	12,713 / 360	16,421 / 465
14.5 / 1.00	----	----	----	----	----	----	----	----	----	7593 / 215	9535 / 270	11,124 / 315	12,007 / 340	16,068 / 455
21.8 / 1.5	----	----	----	----	----	----	----	----	----	----	----	8652 / 245	10,241 / 290	15,892 / 450
29.0 / 2.0	----	----	----	----	----	----	----	----	----	----	----	----	----	14,479 / 410
43.5 / 3.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----
58.0 / 4.0	----	----	----	----	----	----	----	----	----	----	----	----	----	----

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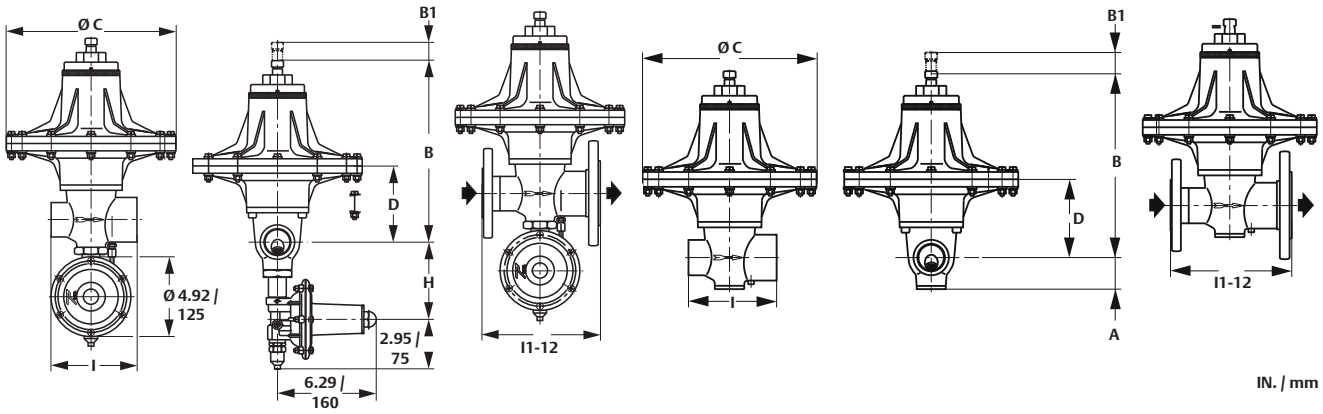


Figure 2. *RP Series Dimensions*

Table 7. Type RP/033 at 10% Accuracy (continued)

SET PRESSURE, psig / bar	CAPACITIES IN SCFH / Sm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS													
	Inlet Pressure, psig / bar													
	72.5 / 5.0	116 / 8.0	131 / 9.0	145 / 10.0	160 / 11.0	174 / 12.0	189 / 13.0	203 / 14.0	218 / 15.0	232 / 16.0	247 / 17.0	261 / 18.0	276 / 19.0	290 / 20.0
1.2 / 0.08	26,839 / 760	----	----	----	----	----	----	----	----	----	----	----	----	----
1.45 / 0.10	26,839 / 760	----	----	----	----	----	----	----	----	----	----	----	----	----
2.2 / 0.15	33,196 / 940	33,196 / 940	----	----	----	----	----	----	----	----	----	----	----	----
2.9 / 0.20	37,080 / 1050	37,080 / 1050	37,080 / 1050	37,080 / 1050	37,080 / 1050	37,080 / 1050	----	----	----	----	----	----	----	----
4.4 / 0.30	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	38,316 / 1085	----	----	----
5.8 / 0.40	35,314 / 1000	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	40,612 / 1150	38,846 / 1100
7.3 / 0.50	35,314 / 1000	43,790 / 1240	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250	44,143 / 1250
8.7 / 0.60	35,314 / 1000	43,790 / 1240	43,790 / 1240	46,968 / 1330	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350	47,675 / 1350
10.2 / 0.70	22,954 / 650	32,842 / 930	36,374 / 1030	43,084 / 1220	42,907 / 1215	45,203 / 1280	47,145 / 1335	48,734 / 1380	49,970 / 1415	51,206 / 1450	51,736 / 1465	52,619 / 1490	52,972 / 1500	53,325 / 1510
11.6 / 0.80	22,954 / 650	32,842 / 930	36,374 / 1030	43,084 / 1220	42,907 / 1215	45,203 / 1280	47,145 / 1335	48,734 / 1380	49,970 / 1415	51,206 / 1450	51,736 / 1465	52,619 / 1490	52,972 / 1500	53,325 / 1510
14.5 / 1.00	22,954 / 650	32,842 / 930	36,374 / 1030	43,084 / 1220	42,907 / 1215	45,203 / 1280	47,145 / 1335	48,734 / 1380	49,970 / 1415	51,206 / 1450	51,736 / 1465	52,619 / 1490	52,972 / 1500	53,325 / 1510
21.8 / 1.5	22,954 / 650	32,842 / 930	36,374 / 1030	43,084 / 1220	42,907 / 1215	45,203 / 1280	47,145 / 1335	48,734 / 1380	49,970 / 1415	51,206 / 1450	51,736 / 1465	52,619 / 1490	52,972 / 1500	53,325 / 1510
29.0 / 2.0	22,778 / 645	32,842 / 930	36,374 / 1030	43,084 / 1220	42,907 / 1215	45,203 / 1280	47,145 / 1335	48,734 / 1380	49,970 / 1415	51,206 / 1450	51,736 / 1465	52,619 / 1490	52,972 / 1500	53,325 / 1510
43.5 / 3.0	21,365 / 605	32,842 / 930	36,374 / 1030	43,084 / 1220	42,907 / 1215	45,203 / 1280	47,145 / 1335	48,734 / 1380	49,970 / 1415	51,206 / 1450	51,736 / 1465	52,619 / 1490	52,972 / 1500	53,325 / 1510
58.0 / 4.0	21,012 / 595	32,842 / 930	36,374 / 1030	43,084 / 1220	42,907 / 1215	45,203 / 1280	47,145 / 1335	48,734 / 1380	49,970 / 1415	51,206 / 1450	51,736 / 1465	52,619 / 1490	52,972 / 1500	53,325 / 1510

Table 8. Dimension and Shipping Weight

TYPE	INLET, IN. / DN	OUTLET, IN. / DN	DIMENSION, IN. / mm									APPROXIMATE SHIPPING WEIGHT, LBS / kg
			A	B	B1	C	D	I	I1[1]	I2[2]	H	
RP/011	1 / 25	1-1/4 / 32	1.97 / 50	11.02 / 280	4.72 / 120	8.11 / 206	4.02 / 102	5.32 / 135	7.28 / 185	7.68 / 195	----	14.3 / 6.5
RP/011/66	1 / 25	1-1/4 / 32	----	11.02 / 280	4.72 / 120	8.11 / 206	4.02 / 102	5.32 / 135	7.28 / 185	7.68 / 195	4.92 / 125	17.0 / 7.7
RP/022	1-1/4 / 32	2 / 50	1.97 / 50	11.81 / 300	4.72 / 120	10.47 / 266	4.17 / 106	5.32 / 135	7.28 / 185	7.87 / 200	----	23.1 / 11
RP/022/66	1-1/4 / 32	2 / 50	----	11.81 / 300	4.72 / 120	10.47 / 266	4.17 / 106	5.32 / 135	7.28 / 185	7.87 / 200	4.92 / 125	25.8 / 12
RP/033	2 / 50	3 / 80	2.76 / 70	11.81 / 300	4.72 / 120	10.47 / 266	4.72 / 120	6.30 / 160	9.06 / 230	10.63 / 270	----	28.7 / 13
RP/033/66	2 / 50	3 / 80	----	11.81 / 300	4.72 / 120	10.47 / 266	4.72 / 120	6.30 / 160	9.06 / 230	10.63 / 270	5.59 / 142	31.3 / 14

1. For PN 16/25/40 and CL150 RF Flanged connections.
2. For CL300 RF Flanged connection.

Ordering Guide

Type (Select One)

Without Slam-Shut valve

- ☐ RP/011 - 1 in. x 1-1/4 in. / DN 25 x DN 32***
- ☐ RP/022 - 1-1/4 in. x 2 in. / DN 32 x DN 50***
- ☐ RP/033 - 2-in. x 3 in. / DN 50 x DN 80***

With Slam-Shut valve

- ☐ RP/011/66 - 1 in. x 1-1/4 in. / DN 25 x DN 32***
- ☐ RP/022/66 - 1-1/4 in. x 2 in. / DN 32 x DN 50***
- ☐ RP/033/66 - 2 in. x 3 in. / DN 50 x DN 80***

End Connection Style (Select One)

- ☐ BSP***
- ☐ CL150 RF**
- ☐ CL300 RF*
- ☐ PN 16***
- ☐ PN 25**

Inlet Pressure (Please Specify)

Set Pressure (Please Specify)

Temperature (Select One)

- ☐ Standard Version***
- ☐ Low Temperature Version***

Special Requirements (Optional)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

Regulators with high flows and large pressure drops generate noise. Noise can wear parts which can cause failure and/or inaccurate control. Keep regulator noise below 110 dBA.

Type RPE
Electric Pilot Heater

FRANCEL

Introduction

The Type RPE is used for reheating gas supplying pressure reducing regulator pilots.

The Type RPE avoids the inconveniences caused by freezing which occur during large pressure drops.

There are two versions of the Type RPE:

Electrical Pilot Heater

The Type RPE (with a heating element) is installed with the thermometer in the vertical position and is affixed to the actuator bolts of the regulator.

A thermostat and power relay must be installed in a non-explosive risk zone.

Regulator Bottom Electrical Heater

This version is normally used for relief lines. The Type RPE is assembled with four screws to the bottom of the regulator.

The Type RPE can be installed in a hazardous atmosphere.

The Type RPE must be installed between the pilot filter and the pre-expansion relay.

The Type RPE is in conformity with the Directive for Equipment or Protective System intended for use in potentially explosive atmospheres 94/9/CE. It is classified under group II, Category 2.

Maximum Operating Pressure

Thermometer Pocket with Heating Element: 1450 psig / 100 bar

Temperature Measurement

Interchangeable Thermic Probe: 10 kΩ

Heater

2 Interchangeable Heating Cartridges:
280 W - 230 V
Connected in Series:
140 W

Temperature Regulation Range

Thermostat: -22 to 194°F / -30 to 90°C

Power Supply

Power Relay: I_{max} 2 A
U 250 V~

Protection

Thermostat: 2 A
Power Relay: 2 A

Pneumatic Connections

Inlet/Outlet: 1/4 NPT - tube 8/10

Electrical Connections

Electrical Type RPE Box:
Packing gland 3/4 NPT for cable snap-on
Electrical Wiring:
Customer

Weights

Heater:
3.1 pounds / 1.4 kg
Heater with Heating Element:
9.9 pounds / 4.5 kg

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.francel.com

Features

- **Robust**
- **Protection in Case of High Overpressure**
- **Large Range of Utilization**



Figure 1. *Type RPE Electric Pilot Heater*

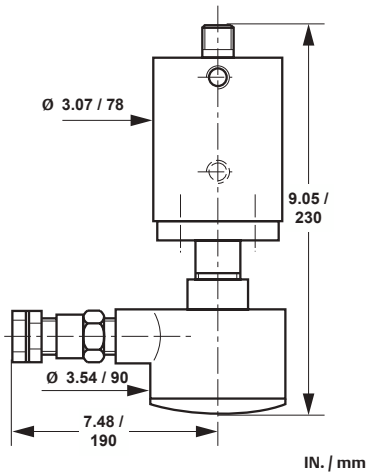


Figure 2. *Dimensions*

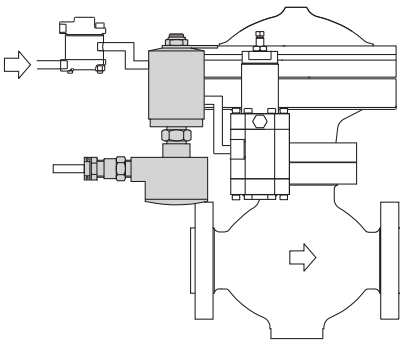


Figure 3. *Installation*

EMERSON
Process Management

Table 1. Recommended Thermostat Setting		
SELECTOR FOR TEMPERATURE A RANGE	ADJUSTMENT FOR B SETTING	DIFFERENTIAL SELECTOR C
0/30	30	2

Table 2. Electric Material For Explosive Atmospheres							
GROUP ACCORDING TO DIRECTIVE 94/9/CE	CATEGORY ACCORDING TO DIRECTIVE 94/9/CE	PROTECTION	CLASSIFICATION	POWER SUPPLY	POWER CONSUMPTION	RECOMMENDED OPERATING TEMPERATURE	MAXIMUM ALLOWABLE ADMITTED TEMPERATURE
Group II	Category 2	EEx d IIC T2	ISSPeP 03 ATEX 090	230 V 50 to 60 Hz	140 W	32 to 86°F / 0 to 30°C	140°F / 60°C

Ordering Guide

Version (Select One)

- ☐ Electrical pilot heater***
- ☐ Electrical pilot heater with thermostat and power relay***
- ☐ Electrical heater for regulator bottom***

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
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**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Regulator Tip:

If you don't see what you're looking for in this Application Guide. . . ask us about it.
Space in this Application Guide does not always permit us to list all of the options or products available to you. If you don't see the product you're looking for, just pick up the phone and ask your local Sales Office to help you find the item you need. To locate your local Sales Office, log on to www.emersonprocess.com/regulators.

Skids

Regulating and Metering Installations and Final Regulating Installations

Introduction

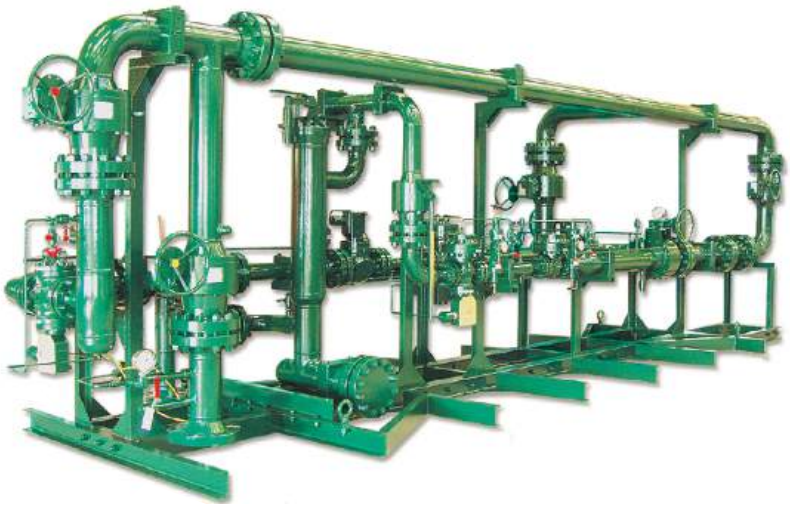
Emerson™ has many years of experience designing and assembling regulating and metering stations.

An array of standard and customized installations are available for transmission, distribution, and utilization applications.

Emerson's regulation and metering stations can be developed for open air, underground, or cabinet/building protected applications.

Additional Technical Data

For more technical information, contact your local Sales Office or log on to: www.emersonprocess.com/regulators

















Regulator Tip:

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Types SR, SRII, SRS, STP, STL and Whisper Trim™

Silencers for Pressure Regulators and Regulating Installations

Introduction

Type SR

Type SR multi-path noise abatement device is incorporated into the regulator on the seat area. It consists of plated stainless steel wires containing no sound deadening materials. This is a solution providing a good result in noise reduction. When crossing the silencer steel wires the gas flow is split, many micro vortexes are created, thus "turbulence bubbles" as well as "shock waves" are reduced. The efficiency of Type SR silencer is kept very high up to a theoretical velocity of 262 ft/s / 80 m/s in the outlet flange; the C_g reduction is by about 3% and noise reduction can be as much as 20 dB(A).

The Type SR Silencer can be used with FL Series, Types Cronos and 971 regulators.

Type SRII

The Type SRII noise abatement device is the next generation of Type SR and is used in case of extreme service conditions (dirty gas, high pressure drops and high gas velocities). Noise characteristics are very similar to the standard Type SR. The Type SRII can also be used with FL Series regulators.

Type SRS

Type SRS consists of a Type SR or SRII plus a widened outlet flange in which a second silencer is fitted. This configuration allows the limits set by velocity to be exceeded. In the outlet flange, there is a second silencer made of a first reactive section and a second section with multiple chambers. Noise reduction is based on the principle of stream splitting and expansion division in several stages.

The use of a wider outlet flange allows the introduction of the silencer and the installation of the regulator directly into the downstream piping without making use of expansion joints which cause a noise increase.

This silencer, being efficient under all working conditions, presents the advantage to reduce the length of the turbulent mixing area and the noise propagation along the downstream piping. Typical noise reduction reaches 25 dB(A) without limiting the velocity in the outlet flange. The C_g reduction is by about 15%. The Type SRS is used with FL Series and Type Cronos regulators.

Whisper Trim™ Cage

Whisper Trim cage provides effective attenuation of aerodynamic noise in gas applications involving high pressure drop ratios. Aerodynamic noise is generated by the turbulence created in the flow of gas as the fluid passes through the port. To achieve effective noise attenuation, a Whisper Trim cage utilizes multiple orifices of special shape, size and spacing. These orifices break up turbulent fluid streams, reducing noise-producing interactions. Whisper Trim Cage reduces noise by up to 8 dB(A). The Whisper Trim cage is a noise attenuation solution for Types EZH and EZHSO.

Type STP

Type STP is an absorption type silencer made of one or more porous channels surrounded by deadening material. The sound penetrating the absorbing layer is then converted into heat by friction.

This type of silencer prevents noise propagation along the piping. It is normally introduced downstream the Type SRS silencer and produces a further noise reduction by 20 dB(A) depending on the approximate length.

This type of silencer is suitably dimensioned in order to satisfy working needs and obtain noise reductions without jeopardizing capacity values.

Type STL

These silencers have been specially developed to be introduced into "T" couplings of pipings. They are reactive-absorption mixed type silencers and allow not to experience any noise increase in the "T" coupling and get a noise reduction in the downstream piping. A suitable dimensioning of the silencer and downstream manifold allows not to experience significant power losses and thus capacity values are not jeopardized. Type STL provides noise reduction of 15 dB(A).

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.emersonprocess.com/regulators

Features

- **Reduces Noise and has an Excellent Cost / Benefit Ratio**
- **Filters Recommended to Prevent Erosion or Damage from Foreign Particles**



Figure 1. *Type SR Built-in Regulator Silencer*



Figure 2. *Type SRII Built-in Regulator Silencer*



Figure 3. *Type SRS Built-in Regulator Silencer*



Figure 4. *Whisper Trim Built-in Regulator Silencer*



Figure 5. *Type STP Regulator Silencer*

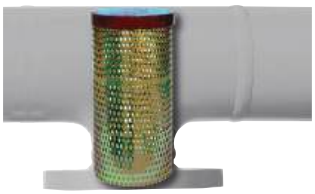


Figure 6. *Type STL Regulator Silencer*

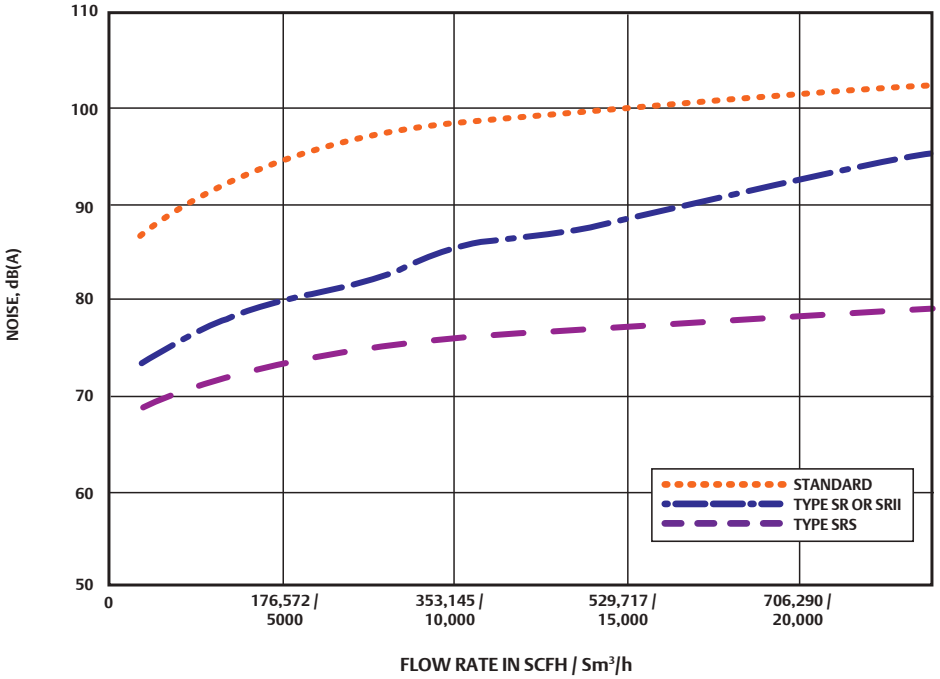


Figure 7. *Typical Sound Emission Comparison among the Different Configurations*

Ordering Guide

Type (Select One)

- ☐ SR***
- ☐ SRII***
- ☐ SRS***

STP

- ☐ STP10 (10 dB(A) attenuation, with length of approximately 1m)***
- ☐ STP20 (20 dB(A) attenuation, with length of approximately 2m)***

- ☐ STL***
- ☐ Whisper Trim™ Cage***

Special Requirements (Specify)

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Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Regulator Tip:

Looking for a specific product? When you know the application and Type or Series of the product you need, you can use the Quick Product Index in the Table of Contents, the Section Outline in the Application Map of each section, or the Product Index at the back of this Application Guide to direct you to the page on which the product is described.

VS100 Series
Slam-Shut Device

FISHER

Introduction

The VS100 Series slam-shut device is designed to shut off the flow of gas to the downstream system in the event of outlet pressure rising above or falling below the predefined levels.

The VS100 Series consists of the following:

- A body with a removable orifice, enclosed by a bonnet
- A VSX4 or VSX8 Series controller

Available Configurations

See Table 3

Connections

Slam-Shut Vent: 1/4 NPT
External Sensing Line: 1/4 NPT

Body Material

Ductile Iron (GS)
Steel (WCC)

Body Sizes and End Connection Styles

See Table 7

Slam-shut Type

DS: Differential Strength
IS: Integral Strength

Maximum Allowable Pressure (PS)

Differential Strength (DS):
290 psig / 20.0 bar
Integral Strength (IS):
87 psig / 6.0 bar

Maximum Inlet Pressure (Pumax)

Differential Strength (DS):
232 psig / 16.0 bar
Integral Strength (IS):
87 psig / 6.0 bar

Specific Maximum Allowable Pressure (PSd)

87 psig / 6.0 bar

1. NPS 1 x 2-1/4, Gaz Body

Operating Temperature (TS)

PED: -4 to 150°F / -20 to 66°C
NON-PED: -20 to 150°F / -30 to 66°C

Response Time (ta)

< 1 second

CE Marking

0062

European EN Reference Standard

EN 14382

Functional Class

A: Min, Min and Max installation
B: Max installation only

Orifice Diameter

Medium Capacity Body (MC):
0.75 in. / 19 mm
High Capacity Body (HC):
1.18 in. / 30 mm

Valve Plug Size

Medium Capacity Body (MC) Ø:
0.94 in. / 24 mm
High Capacity Body (HC) Ø:
1.53 in. / 39 mm

Flow Coefficient (NPS 1)[1]

C_g: 306; **C_1:** 52

Resetting Trip Mechanism

Manually after fault rectification

Pressure Detection

External

Approximate Shipping Weights

See Table 7

Option

- Wire Seal
- Inductive Limit switch

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com



Figure 1. *Type VS111 or VS112*



Figure 2. *Type VS121*

Features

- **Overpressure Shutoff and Underpressure Shutoff capability**
- **Rotation at 360° for easy installation and maintenance**
- **No specific tool for maintenance**
- **Bypass for the rearmament**
- **Travel indicator**
- **Manual trip system**

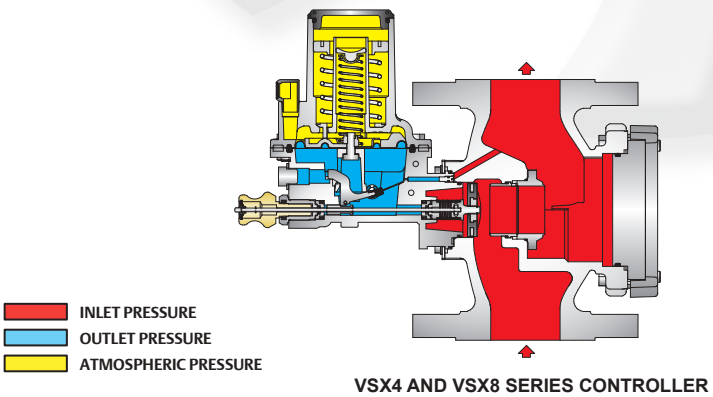


Figure 3. *VS100 Series Operational Schematic*

EMERSON
Process Management

Table 1. PED Information			
TYPE	**DESCRIPTION**	**PED DIRECTORY**	**FLUID GROUP**
VS100	Regulator body with VSX4 or VSX8 Series controller	IV	Groups 1 and 2 according to PED 97/23/EC, 1st and 2nd family gas according to EN 437 or other gases (compressed air and nitrogen). The gas must be non-corrosive, clean (filtration on inlet side necessary) and dry.

Table 2. Accuracy According to EN 14382 - VS100 Series				
ACCURACY GROUP (AG)	**Pd < 0.507 psig / 35 mbar**	**0.507 psig ≤ Pd < 0.87 psig / 35 mbar ≤ Pd < 60 mbar**	**0.87 psig ≤ Pd < 1.5 psig / 60 mbar ≤ Pd < 100 mbar**	**Pd ≥ 1.5 psig / 100 mbar**
AG_{min}	30	15	10	5
AG_{max}	10	10		
Note: Stable inlet pressure AG_{min} = AG 10 (Pd < 0.87 psig / 60 mbar) and AG 5 (Pd > 0.87 psig / 60 mbar), AG_{max} = AG 5				

Table 3. VS100 Series Configuration								
PRODUCT TYPE	**BODY SIZE**	**ORIFICE DIAMETER**		**CONTROLLER**	**OVERPRESSURE MONITORING RANGE (Wdo)**		**UNDERPRESSURE MONITORING RANGE (Wdu)**	
		In.	**mm**		**psig**	**mbar**	**psig**	**mbar**
VS111	Medium Capacity	0.75	19	VSX4L	0.44 to 23.2	30 to 1600	0.07 to 10.9	5 to 750
VS112				VSX4H	16.0 to 79.8	1100 to 5500	7.25 to 40.6	500 to 2800
VS121	High Capacity	1.18	30	VSX8L	0.44 to 23.2	30 to 1600	0.07 to 7.25	5 to 500

Table 4. VS100 Series Overpressure Shutoff (OPSO) Spring Range								
REGULATOR SETPOINT						**CONTROLLER**		
Minimum		**Nominal**		**Maximum**		**Type**	**Spring Range**	**Part Number[2]**
psig	**mbar**	**psig**	**mbar**	**psig**	**mbar**		**Overpressure Shutoff (OPSO) Maximum[1]**	**OPSO / Maximum[1]**
0.15	10	0.29	20	0.44	30	VSX4L and VSX8L	12 to 25 in. w.c. / 30 to 60 mbar	GF02168X012
> 0.44	> 30	0.51	35	0.73	50		16 to 43 in. w.c. / 40 to 110 mbar	GF02169X012
> 0.73	> 50	0.87	60	1.16	80		25 to 75 in. w.c. / 60 to 190 mbar	GF02170X012
> 1.16	> 80	1.45	100	1.89	130		1.4 to 4.1 psig / 95 to 280 mbar	GF02171X012
> 1.89	> 130	2.32	160	3.63	250		2.0 to 7.3 psig / 140 to 500 mbar	GF02172X012
> 3.63	> 250	4.35	300	5.80	400			
> 5.80	> 400	7.25	500	10.2	700		5.8 to 21.0 psig / 400 to 1450 mbar	GF04353X012
> 10.2	> 700	14.5	1000	16.0	1100			
> 16.0	> 1100	18.1	1250	21.8	1500	VSX4H	13.1 to 43.5 psig / 0.9 to 3.0 bar	GF02173X012
> 21.8	> 1500	29.0	2000	36.3	2500		23.2 to 79.8 psig / 1.6 to 5.5 bar	GF04353X012
> 36.3	> 2500	43.5	3000	58.0	4000			

1. OPSO spring range for OPSO installation only.
2. See VSX4 and VSX8 Series Instruction Manual, Table 4 for Spring Characteristics (wire diameter, free length and color).

Table 5. Types VS111 and VS112 Over Pressure (OPSO) and Under Pressure Shut-off (UPSO) - Range Equations						
SLAM-SHUT DEVICE						
Type	**Underpressure Shutoff (UPSO)**			**Overpressure Shutoff (OPSO)[1][2]**		
	Spring Range		**Spring Part Number and Color**	**Spring Range Over UPSO**		**Spring Part Number and Color**
	In. w.c.	**mbar**		**In. w.c.**	**mbar**	
VS111	2 to 12	5 to 30	ERAA05835A0 / White	12 to 25	30 to 60	GF02167X012 / Black
				20 to 52	50 to 130	GF02168X012 / Brown
	4 to 30	10 to 75	T14169T0012 / Blue	20 to 52	50 to 130	GF02168X012 / Brown
				1.38 to 3.92 psig	95 to 270	GF02169X012 / Red
	0.36 to 2.3 psig	25 to 160	T14170T0012 / Silver	2.18 to 5.51 psig	150 to 380	GF02170X012 / Orange
	1.45 to 7.25 psig	100 to 500	FA142869X12 / Orange Stripe	3.8 to 8.7 psig	260 to 600	GF02171X012 / Pink
				5.8 to 16	400 to 1100	GF02172X012 / Green
	1.45 to 10.9 psig	100 to 750	T14171T0012 / Olive	11.6 to 23.2	800 to 1600	GF02173X012 / Silver
VS112	7.25 to 29 psig	500 to 2000	FA142869X12 / Orange Stripe	16 to 29	1100 to 2000	GF02171X012 / Pink
				24.7 to 53.7	1700 to 3700	GF02172X012 / Green
	7.25 to 40.6 psig	500 to 2800	T14171T0012 / Olive	40.6 to 79.8	2800 to 5500	GF02173X012 / Silver

1. OPSO spring range for the combined OPSO and UPSO installation.
2. When selecting OPSO set points, the outlet pressure rating of the regulator should be considered.

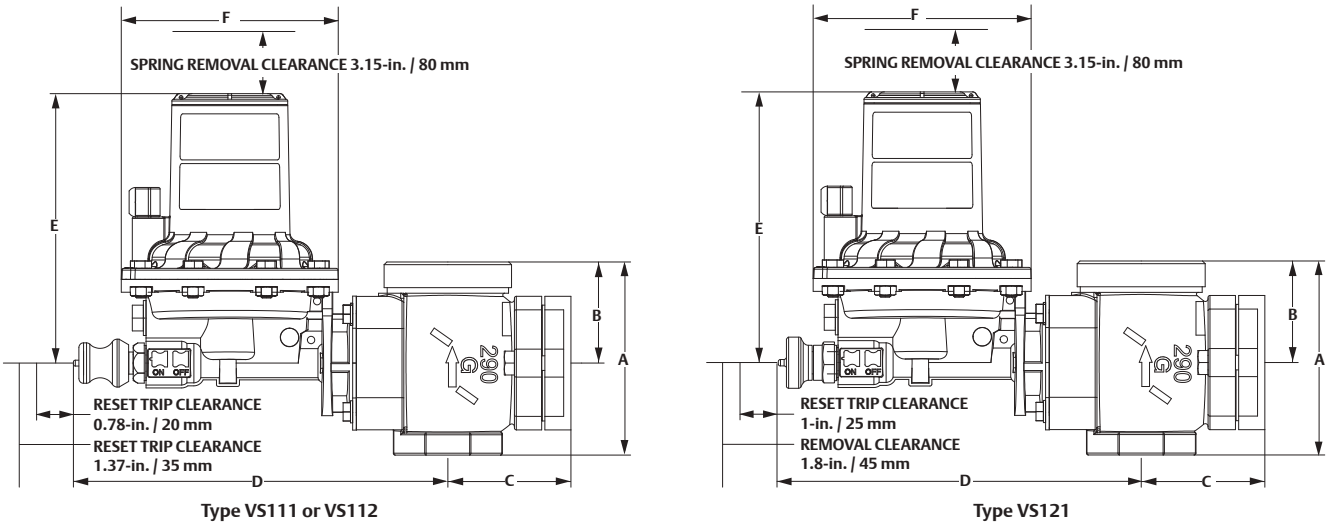


Figure 4. *VS100 Series Dimensions*

Table 6. Type VS121 Over Pressure (OPSO) and Under Pressure Shut-off (UPSO) - Range Equations

SLAM-SHUT DEVICE						
Type	Underpressure Shutoff (UPSO)			Overpressure Shutoff (OPSO)[1][2]		
	Set Range UPSO		Spring Part Number and Color	Set Range Over UPSO		Spring Part Number and Color
	In. w.c.	mbar		In. w.c.	mbar	
VS121	2 to 12	5 to 30	ERAA05835A0 / White	17 to 28	42 to 69	GF02168X012 / Brown
	0.36 to 2.3 psig	25 to 160	T14170T0012 / Silver	1.3 to 3.1 psig	90 to 214	GF02170X012 / Orange
	1.5 to 7.3 psig	100 to 500	FA142869X12 / Orange Stripe	2.7 to 5.5 psig	186 to 379	GF02171X012 / Pink

1. OPSO spring range for the combined OPSO and UPSO installation.
2. When selecting OPSO set points, the outlet pressure rating of the regulator should be considered.

Table 7. VS100 Series Body, Dimension and Weight

TYPE	BODY MATERIAL	INLET SIZE, NPS	OUTLET SIZE, NPS	END CONNECTION	DIMENSION, In. / mm						WEIGHT, lb /kg
					A	B	C	D	E	F	
VS111 and VS112 (Medium Capacity)	Ductile Iron	1	2-1/4	Rp x GAZ	4.1 / 105	2.2 / 55	2.6 / 67	8.1 / 205	5.8 / 147	4.7 / 118	7.7 / 3.5
		1-1/4	1-1/4	Rp	4.5 / 114	2.3 / 57	1.8 / 46.3	8.3 / 210			
		1-1/2	1-1/2	Rp							
		1	1	NPT	3.9 / 100	2.0 / 50					
		1	1	Rp							
		1-1/4	1-1/4	NPT	4.5 / 114	2.3 / 57					
		1-1/2	1-1/2	NPT							
		1-1/2	1-1/2	PN 16 slip-on	7.2 / 184	2.3 / 57					
	Steel	1	1	NPT	3.9 / 100	2.0 / 50					8.7 / 3.7
		1-1/4	1-1/4	NPT	4.5 / 114	2.3 / 57					
		1-1/2	1-1/2	NPT	4.5 / 114	2.3 / 57					
		1	1	Rp	3.9 / 100	2.0 / 50					
		1-1/4	1-1/4	Rp	4.5 / 114	2.3 / 57					
		1-1/2	1-1/2	Rp	4.5 / 114	2.3 / 57					
VS121 (High Capacity)	Ductile Iron	1-1/4	1-1/4	NPT	6.1 / 155	3.1 / 77.5	3.6 / 91.4	8.4 / 212.7	5.8 / 147	4.6 / 118	7.7 / 3.5
		1-1/2	1-1/2	NPT							
		2	2	NPT							
		1-1/4	1-1/4	Rp							
		1-1/2	1-1/2	Rp							
		2	2	Rp							
		2	2	CL125 FF x CL150 FF	7.5 / 191	3.8 / 95.5					
		2	2	CL125 FF x CL150 FF	10 / 254	5.0 / 127					
		2	2	CL125 FF x CL150 FF	11 / 267	5.3 / 133.5					
		2	2	PN 10/16	7.5 / 191	3.8 / 95.5					
		2	2	PN 10/16	10 / 254	5.0 / 127					
	Steel	1-1/4	1-1/4	NPT	6.1 / 155	3.1 / 77.5					8.7 / 3.7
		1-1/2	1-1/2	NPT							
		2	2	NPT							
		1-1/4	1-1/4	Rp							
		1-1/2	1-1/2	Rp							
		2	2	Rp							
		2	2	CL150 RF	10 / 254	5.0 / 127					
		2	2	PN 10/16	10 / 254	5.0 / 127					

Note: Reset trip clearance 1.0 in. / 25 mm on all sizes.

Ordering Guide

Type (Select One)

☐ VS111 ☐ VS112 ☐ VS121

Body Size, Inlet x Outlet (Select One)

Type VS111 or VS112
- ☐ NPS 1 x 1
- ☐ NPS 1 x 2-1/4 (Ductile Iron Only)
- ☐ NPS 1-1/4 x 1-1/4
- ☐ NPS1-1/2 x 1-1/2

Type VS121
- ☐ NPS 1-1/4 x 1-1/4
- ☐ NPS 1-1/2 x 1-1/2
- ☐ NPS 2 x 2

End Connection Style (Select One)

Type VS111 or VS112
- ☐ RP x GAZ (NPS 1 x 2-1/4 Only)
- ☐ RP
- ☐ NPT
- ☐ PN 16 slip-on (NPS1-1/2 x 1-1/2)

Type VS121
- ☐ RP
- ☐ NPT
- ☐ PN 16 slip-on (NPS 2 x 2 only)
- ☐ CL125 FF x CL150 FF (Ductile Iron and NPS 2 x 2 only)
- ☐ CL150 RF (Steel and NPS 2 x 2 only)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Slam-Shut Trip Pressure Setting (Select One)

- ☐ Overpressure Protection Only
  Supply setpoint required: _____
- ☐ Underpressure Protection Only
  Supply setpoint required: _____
- ☐ Overpressure Protection and Underpressure Protection
  Supply overpressure setpoint required:_____
  Supply underpressure setpoint required: _____

Specification Worksheet
Application
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Adequate overpressure protection should be installed to protect the regulator from overpressure. Adequate overpressure protection should also be installed to protect all downstream equipment in the event of regulator failure.

VFA Series

Butterfly Valve Soft Sealed Body

TARTARINI

Introduction

The VFA Series butterfly valves, due to their particular construction features, have very low pressure losses and excellent seal.

They can be employed with natural gas, air, water, etc.

Their reduced overall dimensions allow simple installation and easy maintenance.

Types

Type VFA: Lever-operated
Type VFA-MR: Gear-operated
Type VFA-MRO: Gear-operated for use with absorbing odorizer

Allowable Pressure

PN 16: 232 psig/ 16 bar
CL 150: 276 psig/19 bar

Flanged Connections

2, 2-1/2, 3, 4, 5, 6, 8 and 10-in. /
DN 50, 65, 80, 100, 125, 150, 200 and 250

Flanged Rating

PN16 UNI/DIN
CL150 RF

Temperature Capabilities

Standard Version:
Working: 14 to 140°F / -10 to 60°C

Low Temperature Version:
Working: -4 to 140°F / -20 to 60°C

Configurations

- Without Counter-Flanges
- With Counter-Flanges
- Pneumatic Control
- Electric Control

Applications

- Non-corrosive Gases (natural gases, compressed air, nitrogen, etc.)
- Clean Fluids

Materials

Body: Steel
Disk: Pressed steel
Shaft: Stainless steel
Gasket: Nitrile (NBR) **(standard)** or Fluorocarbon (FKM)

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Hermetic Seal**
- **Compact Design**
- **Easy Installation in All Positions**
- **Easy Maintenance**
- **Very Low Pressure Loss**



Figure 1. *Type VFA*



Figure 2. *Type VFA-MR*

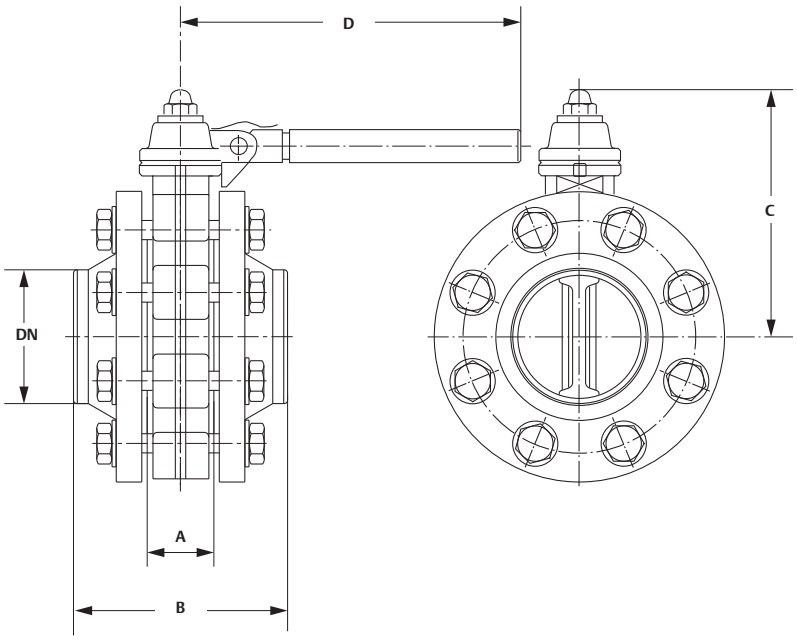


Figure 3. *Type VFA Dimension*

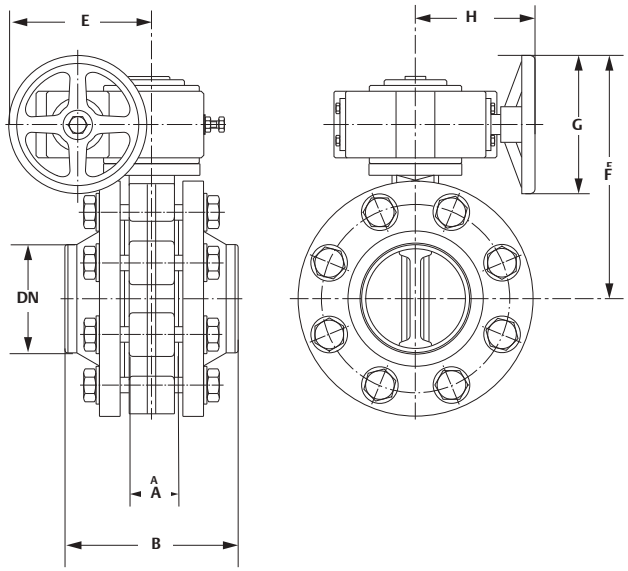


Figure 4. *Types VFA-MR and VFA-MRO Dimension*

Table 1. VFA Series Dimension and Shipping Weight

BODY SIZE		DIMENSION										APPROXIMATE SHIPPING WEIGHT	
		A		B				C		D			
				PN 16		CL150 RF							
In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	lb	kg
2	50	1.69	43	5.35	136	6.81	173	5.79	147	18.5	470	26	12
2-1/2	65	1.81	46	5.47	139	7.44	189	6.18	157	18.5	470	31	14
3	80	1.81	46	5.87	149	7.44	189	6.42	163	18.5	470	40	18
4	100	2.05	52	6.26	159	8.19	208	6.85	174	18.5	470	46	21
5	125	2.20	56	6.65	169	9.33	237	8.23	209	19.3	490	64	29
6	150	2.20	56	6.65	169	9.33	237	8.94	227	19.3	490	79	36
8	200	2.36	60	7.36	187	10.5	267	9.92	252	19.3	490	112	51
10	250	2.68	68	8.43	214	10.9	278	9.41	239	20.9	530	214	97

Table 2. Types VFA-MR and VFA-MRO Dimension and Shipping Weight

BODY SIZE		DIMENSION														APPROXIMATE SHIPPING WEIGHT	
		A		B				E		F		G		H			
				PN 16		CL150 RF											
In.	DN	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	lb	kg
2	50	1.69	43	5.35	136	6.81	173	6.30	160	7.48	190	4.92	125	4.72	120	31	14
2-1/2	65	1.81	46	5.47	139	7.44	189	6.30	160	7.87	200	4.92	125	4.72	120	35	16
3	80	1.81	46	5.87	149	7.44	189	6.30	160	8.07	205	4.92	125	4.72	120	44	20
4	100	2.05	52	6.26	159	8.19	208	6.30	160	8.46	215	4.92	125	4.72	120	51	23
5	125	2.20	56	6.65	169	9.33	237	11.8	300	13.2	335	11.8	300	6.61	168	77	35
6	150	2.20	56	6.65	169	9.33	237	11.8	300	13.6	345	11.8	300	6.61	168	93	42
8	200	2.36	60	7.36	187	10.5	267	11.8	300	14.8	375	11.8	300	6.61	168	126	57
10	250	2.68	68	8.43	214	10.9	278	11.8	300	16.9	430	11.8	300	6.61	168	227	103

Ordering Guide

Type (Select One)

- ☐ VFA***
- ☐ VFA-MR***
- ☐ VFA-MRO***

Flanged Connection (Select One)

- ☐ 2-in. / DN 50***
- ☐ 2-1/2-in. / DN 65***
- ☐ 3-in. / DN 80***
- ☐ 4-in. / DN 100***
- ☐ 5-in. / DN 125***
- ☐ 6-in. / DN 150***
- ☐ 8-in. / DN 200***
- ☐ 10-in. / DN 250***

Flanged Rating (Select One)

- ☐ PN 16 UNI/DIN***
- ☐ CL150 RF***

Elastomer Part (Select One)

- ☐ Nitrile (NBR)***
- ☐ Fluorocarbon (FKM)**

Temperature Construction (Select One)

- ☐ **Standard*****
- ☐ Low Temperature**

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Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Regulator Tip:

Four easy ways to find the products you need . . .
1. Section headers at the top of each page are grouped by application of product (i.e., Natural Gas).
2. The Product Index at the back of this Application Guide contains a detailed list of products arranged by type and application.
3. If you know the application and product number, turn to the Application Map of that section and locate the Section Outline which indexes all of the products found in that section.
4. Look for the product type number in the Quick Reference Chart in the Table of Contents.

Introduction

The spring-loaded relief valves are designed to keep line pressure below preset values. They are mounted downstream of regulators and perform the specific function of releasing small amounts of gas in the event of the regulator not closing perfectly.

V Series relief valves are ideal for use in civil and industrial equipment employing natural gas, propane, butane and noncorrosive gases in general because of their effective release capacity and compact size. The valves are extremely easy to install and are designed for ready and easy maintenance.

The V/50 and V/60 Series relief valves are especially designed for use with low pressures. Their construction features ensure a very low hysteresis value and maximum operation accuracy and sensitivity.

Type V/20-2 relief valve is designed for use at medium and high pressures and cover a wide range of pressure set values, i.e., from 21.8 to 580 psig / 1.5 to 40 bar.

To change setting, simply replace the spring with the one appropriate for the desired value.

Allowable Pressures

V/50 Series:
58 psig / 4.0 bar

V/60 Series:
36 psig / 2.5 bar

Type V/20-2:
1450 psig / 100 bar

Set Pressure Ranges (W_h)

Type V/50:
0.36 to 1.16 psig / 0.025 to 0.08 bar

Type V/51:
1.09 to 10.9 psig / 0.075 to 0.75 bar

Type V/52:
10.2 to 29 psig / 0.70 to 2.0 bar

Type V/60:
0.36 to 1.3 psig / 0.025 to 0.09 bar

Type V/61:
1.16 to 10.9 psig / 0.08 to 0.75 bar

Type V/62:
10.2 to 29 psig / 0.70 to 2.0 bar

Type V/20-2:
21.8 to 580 psig / 1.5 to 40.0 bar

Seat Diameter

V/50 Series: 1-1/4 in. / 32 mm

V/60 Series: 1-1/2 in. / 40 mm

Type V/20-2: 1 in. / 25.4 mm

Threaded Connections

V/50 Series: 1 x 1-1/2 in. BSP

V/60 Series: 1-1/2 x 2 in. BSP

Type V/20-2: 1 in. NPT

Temperature Capabilities

Standard:
14 to 140°F / -10 to 60°C

Low Temperature:
-4 to 140°F / -20 to 60°C

Approximate Weights:

V/50 Series: 2.9 lbs / 1.3 kg

V/60 Series: 4.2 lbs / 1.9 kg

Type V/20-2: 3.5 lbs / 1.6 kg

Applications

Natural Gas
Propane
Butane
Non-corrosive gases

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.tartarini-naturalgas.com

Features

- **Types V/50 and V/60: for Very Low Pressure Applications**
- **Types V/51 and V/61: for Low Pressure Applications**
- **Types V/52 and V/62: for Medium Pressure Applications**
- **Type V/20-2: for Medium and High Pressure Applications**



Figure 1. *Type V/50 Spring-Loaded Relief Valve*



Figure 2. *Type V/60 Spring-Loaded Relief Valve*



Figure 3. *Type V/20-2 Spring-Loaded Relief Valve*

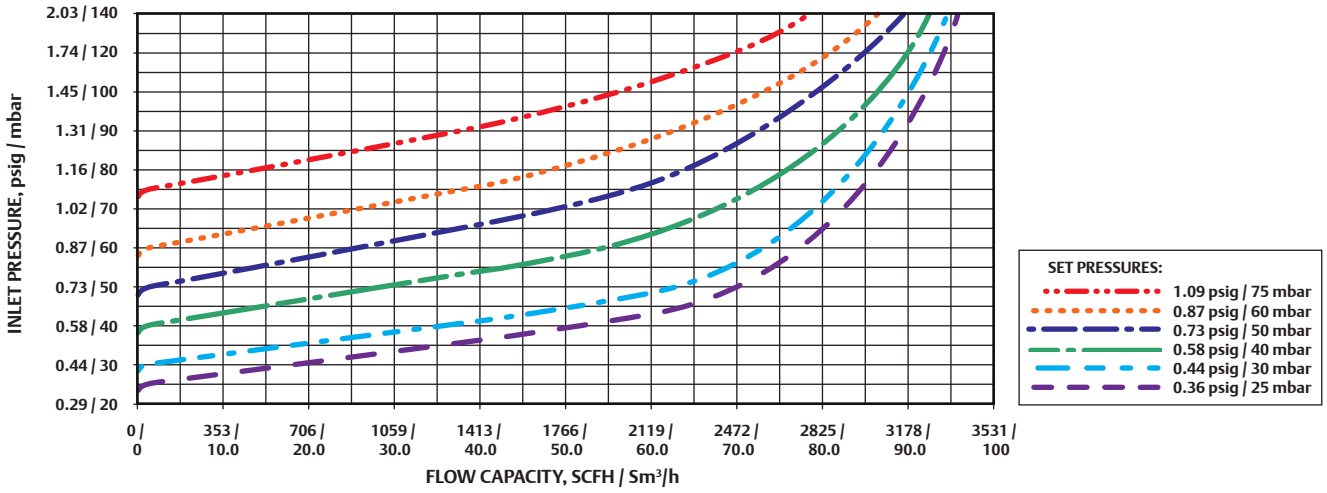


Figure 4. *Type V/50 Flow Capacity Curve*

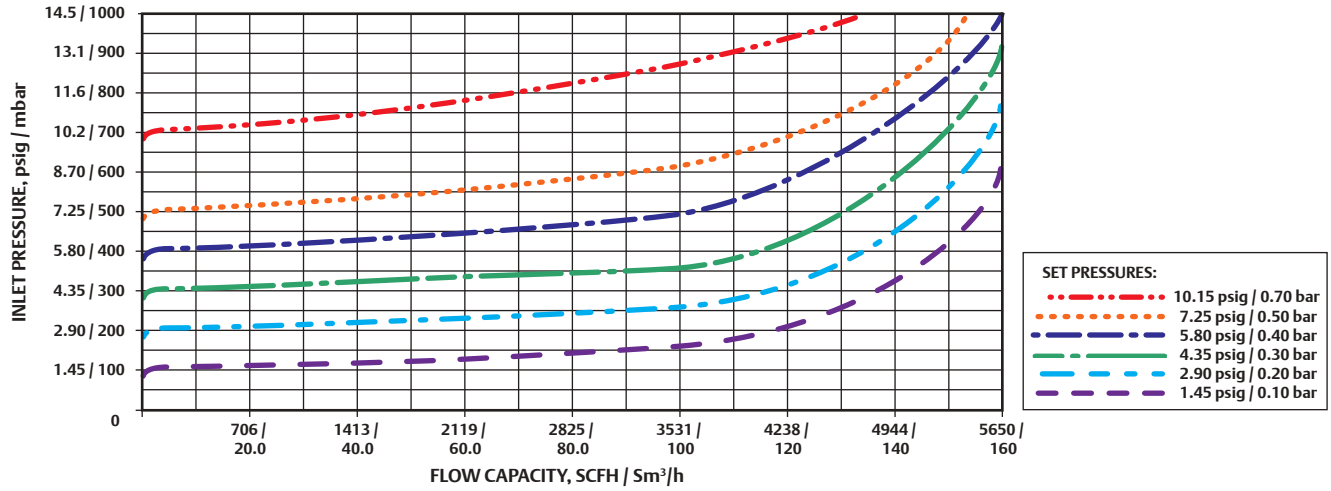


Figure 5. *Type V/51 Flow Capacity Curve*

Table 1. V/50 and V/60 Series Construction Material				
BODY	**COVER**	**VALVE SEAT**	**DIAPHRAGM**	**GASKET**
Aluminum	Aluminum	Brass	Fabric Nitrile (NBR)	Nitrile (NBR)

Table 2. Type V/20-2 Construction Material					
BODY	**PAD RETAINER**	**PAD HOLDER**	**ADJUSTING RING**	**OUTLET CONNECTION**	**PAD**
Brass	Brass	Brass	Brass	Brass	Nitrile (NBR)

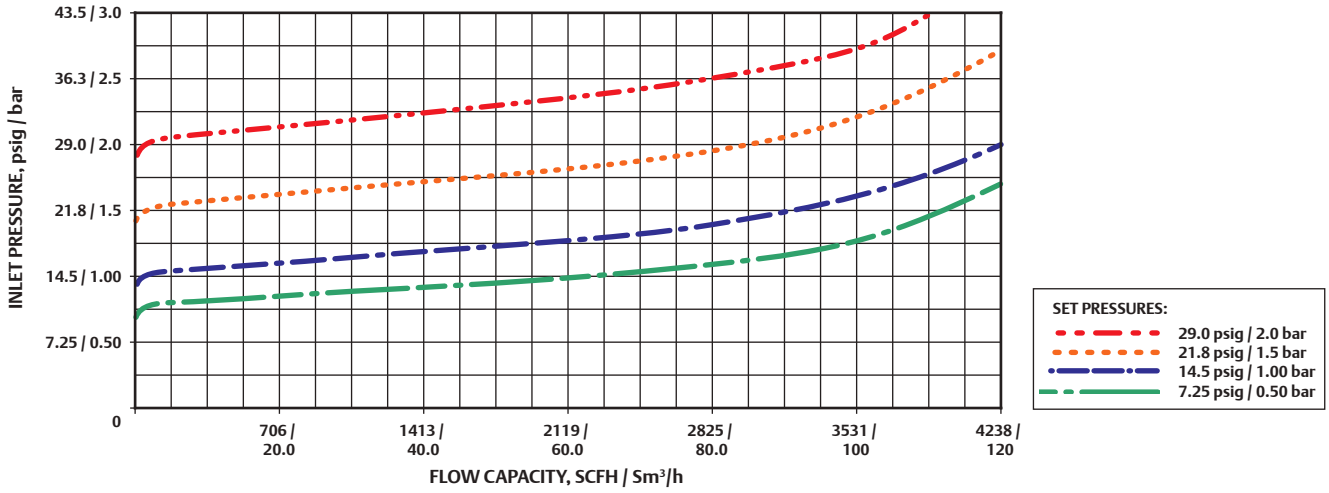


Figure 6. *Type V/52 Flow Capacity Curve*

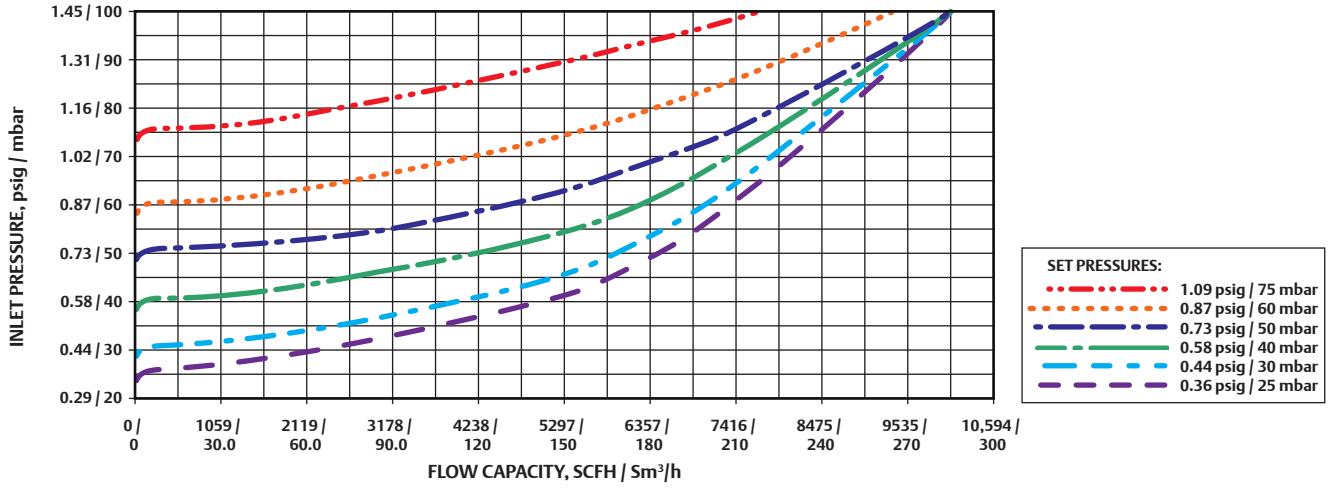


Figure 7. *Type V/60 Flow Capacity Curve*

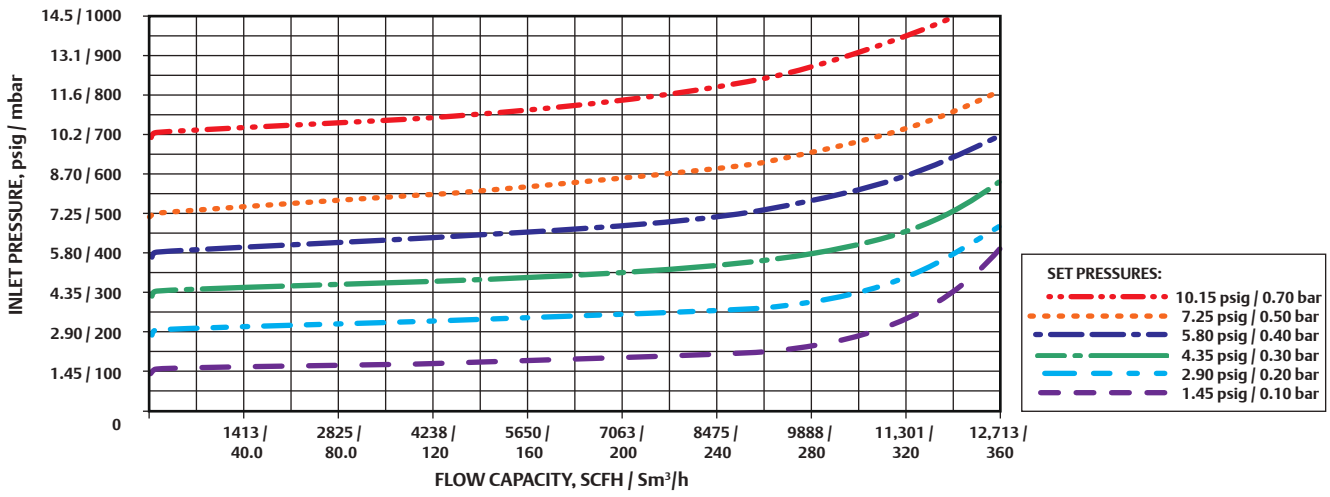


Figure 8. *Type V/61 Flow Capacity Curve*

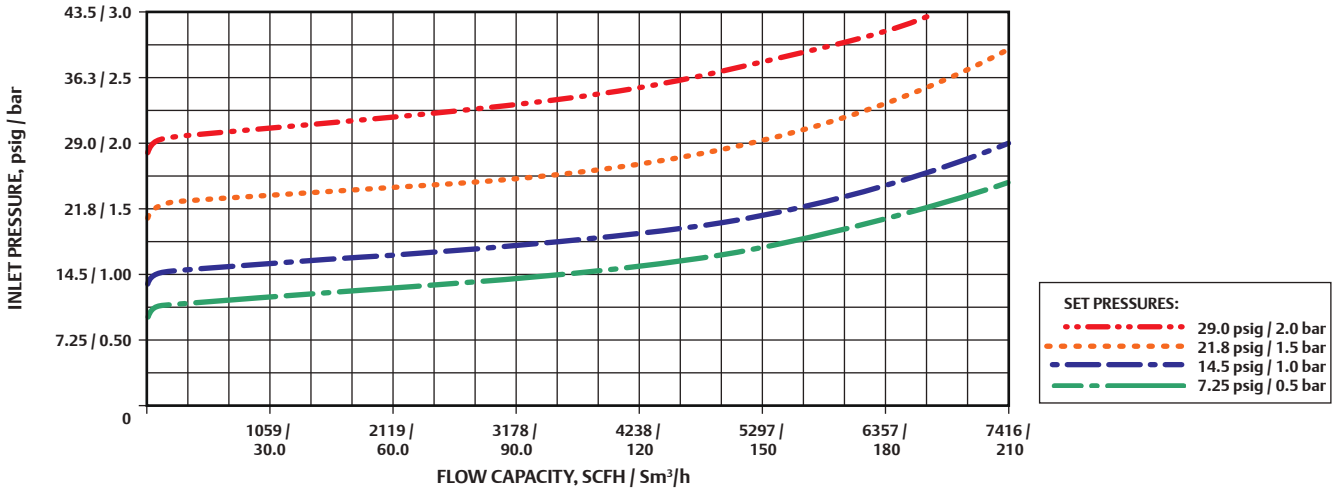


Figure 9. *Type V/62 Flow Capacity Curve*

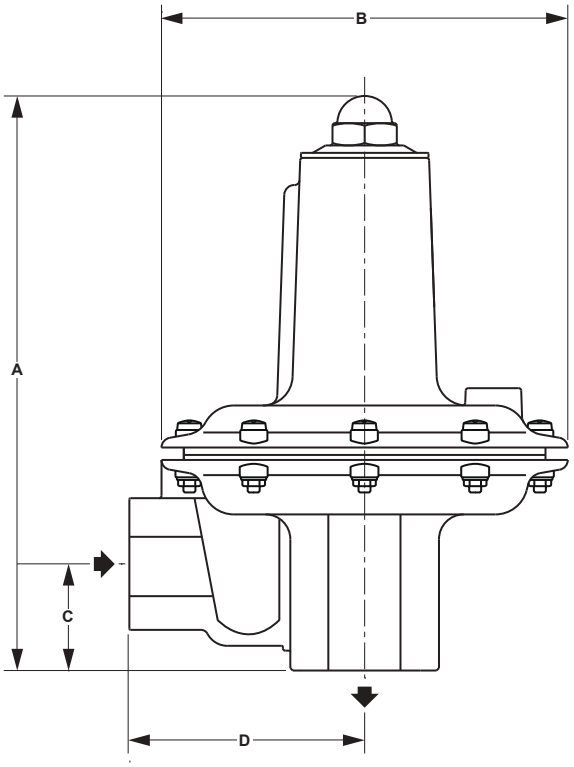


Figure 10. *V/50 and V/60 Series Dimensions*

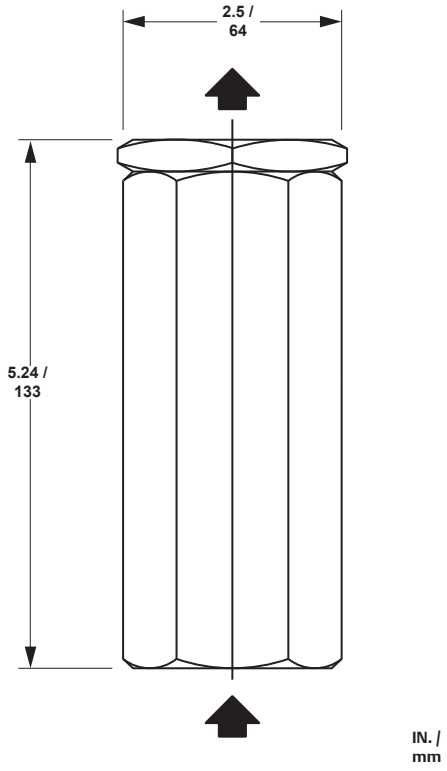


Figure 11. *Type V/20-2 Dimensions*

Table 3. V/50 and V/60 Series Dimension

SERIES	DIMENSION							
	A		B (Diameter)		C		D	
	In.	mm	In.	mm	In.	mm	In.	mm
V/50	9.29	236	6.46	164	1.70	43	3.74	95
V/60	10.16	258	7.80	198	2.76	70	4.33	110

Ordering Guide

Type (Select One)
☐ V/50***
☐ V/51***
☐ V/52***
☐ V/60***
☐ V/61***
☐ V/62***
☐ V/20-2***

Setpoint (Please Specify)

Maximum Flow Rate (Please Specify)

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet
Application
☐ Relief Valve ☐ Backpressure Regulator
Specific Use:
Line Size:
Gas Type and Specific Gravity:
Gas Temperature:
Relief Valve Size
Brand of upstream regulator?
Orifice size of the upstream regulator?
Wide-open coefficient of the upstream regulator?
Pressure
Maximum Inlet Pressure:
Downstream Pressure:
Differential Pressure:
Relief (Inlet) Set Pressure:
Maximum Flow:
Performance Required
Accuracy requirements?
Need for extremely fast response?
Other Requirements:

Regulator Tip:

Keep vents open. Do not use small diameter, long vent lines. Use the rule of thumb of the next nominal pipe size every 10 feet / 3.1 m of vent line and 3 feet / 0.9 m of vent line for every elbow in the line.

Y600A Series

Pressure Reducing Regulators

FISHER

Introduction

Y600A Series direct-operated, spring-loaded regulators provide economical pressure reducing control for a variety of residential, commercial and industrial applications. The large diaphragm area provides more accurate control at low-pressure settings and the pitot tube of the Type Y600A or Y600AR regulator also creates a dynamic boost that helps provide greater capacity.

Type Y600A features internal registration. Type Y600AR has internal registration and relief. Type Y600AM uses external registration with a 1/2 NPT downstream control line connection and an O-ring stem seal.

Body Size and End Connection Style

3/4 or 1 NPT

Flow and Sizing Coefficients

See Table 2

Pressure Registration

Internal or External

Maximum Inlet Pressure (Body Rating)

150 psig / 10.3 bar

See Table 2

Maximum Outlet (Casing) Pressure

20 psig / 1.4 bar

Outlet Pressure Ranges

4 in. w.c. to 7 psig /
10 to 483 mbar in 6 ranges

See Table 3

Temperature Capabilities

-20 to 180°F / -29 to 82°C

Additional Technical Data

For more technical information, contact your local Sales Office or log on to:

www.fisherregulators.com

Features

- **Easy Conversion Between Types Y600A and Y600AM**
- **Tamper-Resistant Adjustment**
- **Easy to maintain**
- **Precision Control at Low-Pressure Settings**



Figure 1. *Type Y600A Pressure Reducing Regulator*

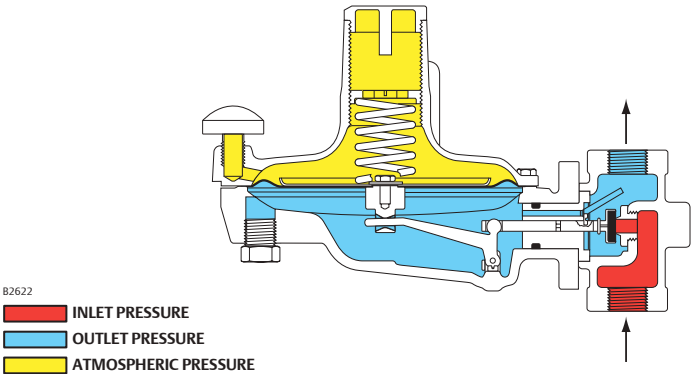
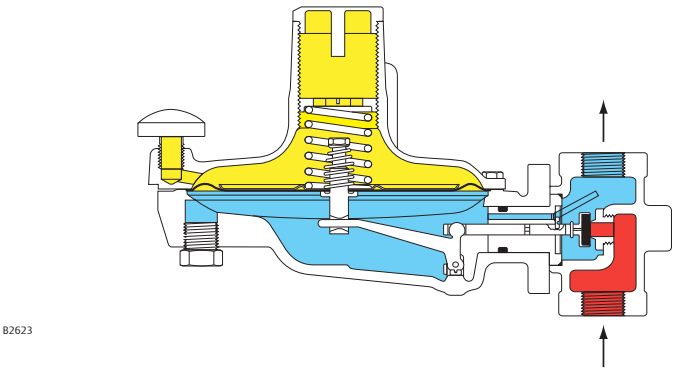
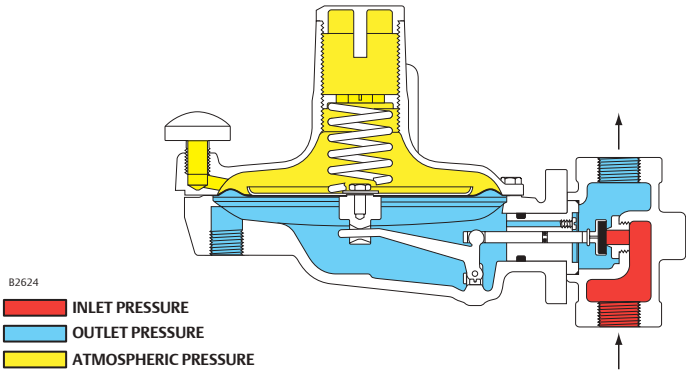


Figure 2. *Type Y600A with Internal Pressure Registration Operational Schematic*



TYPE Y600AR WITH INTERNAL RELIEF/ INTERNAL PRESSURE REGISTRATION



TYPE Y600AM WITH EXTERNAL PRESSURE REGISTRATION

Figure 3. *Types Y600AR and Y600AM Operational Schematics*

EMERSON
Process Management

Table 1. Construction Material

BODY, DIAPHRAGM CASING AND SPRING CASE	ORIFICE	SPRING AND LEVER	DIAPHRAGM AND DISK	PUSHER POST	ADJUSTING SCREW AND DISK HOLDER	CLOSING CAP	STEM	PITOT TUBE (FOR TYPES Y600A AND Y600AR ONLY) AND RELIEF VALVE SPRING
Cast iron	Aluminum	Zinc-plated steel	Nitrile (NBR)	**Types Y600A and Y600AM:** Aluminum **Type Y600AR:** Zinc	Aluminum	Thermoplastic	Stainless steel	Stainless steel

Table 2. Maximum Operating Inlet Pressure and Flow and Sizing Coefficient

ORIFICE SIZE		MAXIMUM OPERATING INLET PRESSURE								WIDE-OPEN FLOW COEFFICIENT FOR EXTERNAL RELIEF SIZING		C_1	IEC SIZING COEFFICIENT		
		With 1.2 psig / 0.08 bar or Less Outlet Pressure Setting		With 1.2 to 2.5 psig / 0.08 to 0.17 bar Outlet Pressure Setting		With 2.5 to 4.5 psig / 0.17 to 0.31 bar Outlet Pressure Setting		With 4.5 to 7 psig / 0.31 to 0.48 bar Outlet Pressure Setting		C_g	C_v		X_T	F_D	F_L
In.	mm	psig	bar	psig	bar	psig	bar	psig	bar						
1/8 3/16 1/4	3.2 4.8 6.4	150 150 75	10.3 10.3 5.2	150	10.3	150	10.3	150	10.3	12.3 27.6 50	0.35 0.79 1.43	35	0.78	0.50	0.89
3/8 1/2 9/16	9.5 13 14	35 8 5	2.4 0.55 0.34	60 10 6	4.1 0.69 0.41	60 12 8	4.1 0.83 0.55	60 12 8	4.1 0.83 0.55	110 200 250	3.14 5.71 7.14				

Table 3. Outlet (Control) Pressure Range

TYPE	CONTROL SPRING COLOR	CONTROL SPRING PART NUMBER	OUTLET PRESSURE RANGE WITH SPRING CASE ABOVE DIAPHRAGM(1)		APPROXIMATE POINT ABOVE PRESSURE SETTING AT WHICH TYPE Y600AR INTERNAL RELIEF STARTS-TO-DISCHARGE	
Y600A, Y600AR and Y600AM	Red	1B653827052	4 to 8 in. w.c.	10 to 20 mbar	10 to 24 in. w.c.	25 to 60 mbar
	Unpainted	1B653927022	7 to 16 in. w.c.	17 to 40 mbar	10 to 26 in. w.c.	25 to 65 mbar
	Yellow	1B537027052	15 in. w.c. to 1.2 psig	37 to 83 mbar		
	Green	1B537127022	1.2 to 2.5 psig	83 mbar to 0.17 bar	0.5 to 2 psig	0.03 to 0.14 psig
	Light Blue	1B537227022	2.5 to 4.5 psig	0.17 to 0.31 bar	0.5 to 3 psig	0.03 to 0.21 bar
	Black	1B537327052	4.5 to 7 psig	0.31 to 0.48 bar	1 to 4 psig	0.07 to 0.28 bar

1. Minimum outlet pressure setting may be approximately 1 in. w.c. / 2 mbar lower if spring case is below diaphragm.

Table 4. Capacities for 3/4-NPT Body Size

OUTLET PRESSURE RANGE, CONTROL SPRING PART NUMBER AND COLOR	OFFSET FROM SETPOINT	OUTLET PRESSURE SETTING	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
					Orifice Size, In. / mm											
					1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13		9/16 / 14	
			psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
4 to 8 in. w.c. / 10 to 20 mbar 1B653827052 Red	1 in. w.c. / 2 mbar	7 in. w.c. / 17 mbar	1	0.07	90	2.4	170	4.6	230	6.2	250	6.7	410	11.0	440	11.8
			5	0.34	220	5.9	280	7.5	450	12.1	490	13.1	520	13.9	970	25.9
			8	0.55	230	6.2	480	12.9	530	14.2	540	14.5	590	15.8		
			20	1.4	520	13.9	600	16.1	620	16.6	650	17.4				
			35	2.4	660	17.7	670	18.0	840	22.5	900	24.1				
			75	5.2	770	20.6	840	22.5	960	25.7						
			150	10.3	1680	45.0	2310	61.9								
7 to 16 in. w.c. / 17 to 40 mbar 1B653927022 Unpainted	1 in. w.c. / 2 mbar	11 in. w.c. / 27 mbar	1	0.07	90	2.4	130	3.5	160	4.3	190	5.1	230	6.2	250	6.7
			5	0.34	160	4.3	250	6.7	280	7.5	350	9.4	530	14.2	750	20.1
			8	0.55	170	4.6	350	9.4	430	11.5	450	12.1	540	14.5		
			20	1.4	350	9.4	490	13.1	590	15.8	610	16.3				
			35	2.4	520	13.9	530	14.2	620	16.6	650	17.4				
			75	5.2	650	17.4	660	17.7	940	25.2						
			150	10.3	1680	45.0	2060	55.2								
15 in. w.c. to 1.2 psig / 37 to 83 mbar 1B537027052 Yellow	5.5 in. w.c. / 14 mbar	15 in. w.c. / 37 mbar	2	0.14	90	2.4	340	9.1	500	13.4	900	24.1	1100	29.5	1150	30.8
			6	0.41	250	6.7	540	14.5	930	24.9	1640	43.9	2100	56.3		
			10	0.69	340	9.1	800	21.4	1380	37.0	1940	51.9				
			30	2.1	680	18.2	1450	38.8	2390	64.0	2450	65.7				
			60	4.1	1160	31.1	2460	66.0	3480	93.3						
			150	10.3	2570	68.8	2710	72.6								
		1.2 psig / 83 mbar	2	0.14	90	2.4	260	7.0	410	11.0	600	16.1	810	21.7	700	18.7
			6	0.41	250	6.7	460	12.3	700	18.7	1290	34.6	1420	38.0		
			10	0.69	310	8.3	660	17.7	1020	27.3	1420	38.0				
			30	2.1	670	18.0	1109	29.7	2060	55.2	2430	65.1				
			60	4.1	1140	30.6	2180	58.4	3350	89.8						
			150	10.3	2480	66.5	2650	71.0								
1.2 to 2.5 psig / 83 mbar to 0.17 bar 1B537127022 Green	0.2 psig / 14 mbar	1.2 psig / 83 mbar	2	0.14	120	3.2	170	4.6	220	5.9	350	9.4	490	13.1	520	13.9
			6	0.41	180	4.8	340	9.1	450	12.1	740	19.8	850	22.8	1070	28.7
			10	0.69	190	5.1	440	11.8	590	15.8	1010	27.0	1170	31.3		
			30	2.1	560	15.0	900	24.1	1550	41.5	1720	46.1				
			60	4.1	860	23.1	1110	29.7	2480	66.5	2340	62.7				
			150	10.3	1990	53.3	3480	93.3	3500	93.8						
		2.5 psig / 0.14 bar	6	0.41	140	3.8	190	5.1	260	7.0	450	12.1	590	15.8	680	18.2
			10	0.69	170	4.6	340	9.1	490	13.1	570	15.3	860	23.1		
			30	2.1	430	11.5	660	17.7	980	26.3	1030	27.6				
			60	4.1	750	20.1	850	22.8	1940	51.9	2250	60.3				
			150	10.3	1480	39.7	2320	62.2	3350	89.8						
2.5 to 4.5 psig / 0.17 to 0.31 bar 1B537227022 Light Blue	0.3 psig / 21 mbar	2.5 psig / 0.17 bar	4	0.28	130	3.5	180	4.8	190	5.1	310	8.3	370	9.9	480	12.9
			8	0.55	140	3.8	280	7.5	360	9.6	520	13.9	710	19.0	800	21.4
			12	0.83	190	5.1	360	9.6	490	13.1	680	18.2	930	24.9		
			30	2.1	430	11.5	620	16.6	900	24.1	1110	29.7				
			60	4.1	660	17.7	1010	27.0	1730	46.4	1830	49.0				
			150	10.3	1570	42.1	2060	55.2	4620	124						
		4.5 psig / 0.31 bar	8	0.55	120	3.2	190	5.1	250	6.7	400	10.7	520	13.9	540	14.5
			12	0.83	160	4.3	210	5.6	320	8.6	530	14.2	720	19.3		
			30	2.1	300	8.0	460	12.3	760	20.4	830	22.2				
			60	4.1	590	15.8	810	21.7	1230	32.9	1340	36.0				
			150	10.3	1230	32.9	1640	43.9	3610	96.8						
4.5 to 7 psig / 0.31 to 0.48 bar 1B537327052 Black	0.7 psig / 48 mbar	4.5 psig / 310 mbar	9	0.62	190	5.1	310	8.3	430	11.5	620	16.6	930	24.9	990	26.5
			12	0.83	210	5.6	400	10.7	560	15.0	810	21.7	1150	30.8		
			30	2.1	520	13.9	860	23.1	1100	29.5	1810	48.5				
			60	4.1	860	23.1	1520	40.7	2050	55.0	2710	72.6				
			150	10.3	1960	52.5	3480	93.3	5040	135						
		7 psig / 0.48 bar	9	0.62	160	4.3	210	5.6	270	7.2	520	13.9	620	16.6	660	17.7
			12	0.83	190	5.1	310	8.3	370	9.9	650	17.4	860	23.1		
			30	2.1	370	9.9	700	18.7	900	24.1	1330	35.6				
			60	4.1	800	21.4	1290	34.6	1720	46.1	2450	65.7				
			150	10.3	1910	51.2	3350	89.8	4050	109						

▭ - Shaded areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.

Table 5. Capacities for 1-NPT Body Size

OUTLET PRESSURE RANGE, CONTROL SPRING PART NUMBER AND COLOR	OFFSET FROM SETPOINT	OUTLET PRESSURE SETTING	INLET PRESSURE		CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS											
					Orifice Size, In. / mm											
					1/8 / 3.2		3/16 / 4.8		1/4 / 6.4		3/8 / 9.5		1/2 / 13		9/16 / 14	
			psig	bar	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h	SCFH	Nm³/h
4 to 8 in. w.c. / 10 to 20 mbar 1B653827052 Red	1 in. w.c. / 2 mbar	7 in. w.c. / 17 mbar	1	0.07	90	2.4	220	5.9	250	6.7	300	8.0	410	10.9	530	14.2
			5	0.34	220	5.9	430	11.5	450	12.1	1140	30.6	1900	50.9	1920	51.5
			8	0.55	230	6.2	490	13.1	530	14.2	2140	57.4	2360	63.3		
			20	1.4	520	13.9	970	25.9	1810	48.5	1170(1)	31.4(1)				
			35	2.4	710	19.0	1480	39.7	2300(1)	61.6(1)	930(1)	24.9(1)				
			75	5.2	1030	27.6	1100(1)	29.5(1)	1390(1)	37.3(1)						
			150	10.3	1680(1)	45.0(1)	1160(1)	31.1(1)								
7 to 16 in. w.c. / 17 to 40 mbar 1B653927022 Unpainted	1 in. w.c. / 2 mbar	11 in. w.c. / 27 mbar	1	0.07	90	2.4	160	4.3	170	4.6	210	5.6	230	6.2	250	6.7
			5	0.34	160	4.3	300	8.0	310	8.3	520	13.9	620	16.6	1160	31.1
			8	0.55	170	4.6	360	9.6	430	11.5	1160	31.1	1460	39.1		
			20	1.4	350	9.4	580	15.5	780	20.9	1630	43.7				
			35	2.4	560	15.0	1030	27.6	2840	76.1	1190(1)	31.8(1)				
			75	5.2	1230	32.9	1290	34.6	1510(1)	40.5(1)						
			150	10.3	1740	46.6	1240(1)	33.2(1)								
15 in. w.c. to 1.2 psig / 37 to 83 mbar 1B537027052 Yellow	5.5 in. w.c. / 14 mbar	15 in. w.c. / 37 mbar	2	0.14	90	2.4	460	12.3	500	13.4	1100	29.5	1160	31.1	1300	34.8
			6	0.41	250	6.7	750	20.1	930	24.9	2500	67.0	2800	75.0		
			10	0.69	340	9.1	920	24.7	1590	42.6	3250	87.1				
			30	2.1	680	18.2	1560	41.8	2830	75.8	5460	146				
			60	4.1	1160	31.1	2550	68.3	4620	124						
			150	10.3	2570	68.9	2770	74.2								
		1.2 psig / 83 mbar	2	0.14	90	2.4	400	10.7	460	12.3	820	22.0	840	22.5	900	24.1
			6	0.41	250	6.7	630	16.9	700	18.7	1550	41.5	1610	43.1		
			10	0.69	320	8.6	860	23.1	1020	27.3	2320	62.2				
			30	2.1	670	18.0	1540	41.3	2550	68.3	4390	118				
			60	4.1	1140	30.6	2550	68.3	4190	112						
			150	10.3	2570	68.9	3100	83.1								
1.2 to 2.5 psig / 83 mbar to 0.17 bar 1B537127022 Green	0.2 psig / 14 mbar	1.2 psig / 83 mbar	2	0.14	120	3.2	210	5.6	230	6.2	360	9.6	620	16.6	660	17.7
			6	0.41	180	4.8	340	9.1	450	12.1	750	20.1	880	23.6	1080	29.0
			10	0.69	190	5.1	560	15.0	650	17.4	1150	30.8	1750	47.0		
			30	2.1	630	16.9	1230	32.9	1600	42.9	1910	51.2				
			60	4.1	1010	27.0	2450	65.7	3600	96.5	2420	64.9				
			150	10.3	2440	65.4	3480	93.3	3870	104						
		2.5 psig / 0.17 bar	6	0.41	140	3.8	260	7.0	270	7.2	500	13.4	670	18.0	680	18.2
			10	0.69	180	4.8	450	12.1	490	13.1	710	19.0	860	23.1		
			30	2.1	570	15.3	720	19.3	1030	27.6	1640	43.9				
			60	4.1	850	22.8	1830	49.1	2520	67.5	3130	83.9				
			150	10.3	2190	58.7	3350	89.8	3480	93.3						
2.5 to 4.5 psig / 0.17 to 0.31 bar 1B537227022 Light Blue	0.3 psig / 21 mbar	2.5 psig / 0.17 bar	4	0.28	140	3.8	180	4.8	190	5.1	410	11.0	430	11.5	480	12.9
			8	0.55	180	4.8	320	8.6	360	9.6	710	19.0	740	19.8	900	24.1
			12	0.82	190	5.1	400	10.7	490	13.1	930	24.9	960	25.7		
			30	2.1	430	11.5	620	16.6	900	24.1	1830	49.0				
			60	4.1	660	17.7	1610	43.1	1740	46.6	2970	79.6				
			150	10.3	2010	53.9	4090	110	6660	178						
		4.5 psig / 0.31 bar	8	0.55	120	3.2	190	5.1	250	6.7	490	13.1	520	13.9	540	14.5
			12	0.83	160	4.3	210	5.6	320	8.6	610	16.3	850	22.8		
			30	2.1	390	10.4	520	13.9	760	20.4	1360	36.4				
			60	4.1	630	16.9	840	22.5	1230	32.9	2580	69.1				
			150	10.3	1390	37.3	2880	77.2	4990	134						
4.5 to 7 psig / 0.31 to 0.48 bar 1B537227052 Black	0.7 psig / 48 mbar	4.5 psig / 0.31 bar	9	0.62	210	5.6	310	8.3	430	11.5	770	20.6	970	25.9	1050	28.1
			12	0.83	230	6.2	400	10.7	560	15.0	1010	27.0	1290	34.6		
			30	2.1	520	13.9	860	23.1	1100	29.5	2080	55.7				
			60	4.1	880	23.6	1520	40.7	2050	55.0	3650	97.8				
			150	10.3	2060	55.2	3510	94.1	6000	161						
		7 psig / 0.48 bar	9	0.62	160	4.3	210	5.6	270	7.2	590	15.8	620	16.6	660	17.7
			12	0.83	210	5.6	310	8.3	370	9.9	770	20.6	890	23.9		
			30	2.1	370	9.9	700	18.7	900	24.1	1650	44.2				
			60	4.1	800	21.4	1290	34.6	1720	46.1	2760	74.0				
			150	10.3	2010	53.9	3390	90.9	4140	111						

- Shaded areas indicate where maximum operating inlet pressure for a given orifice size is exceeded.
1. Indicates capacity limited due to boost.

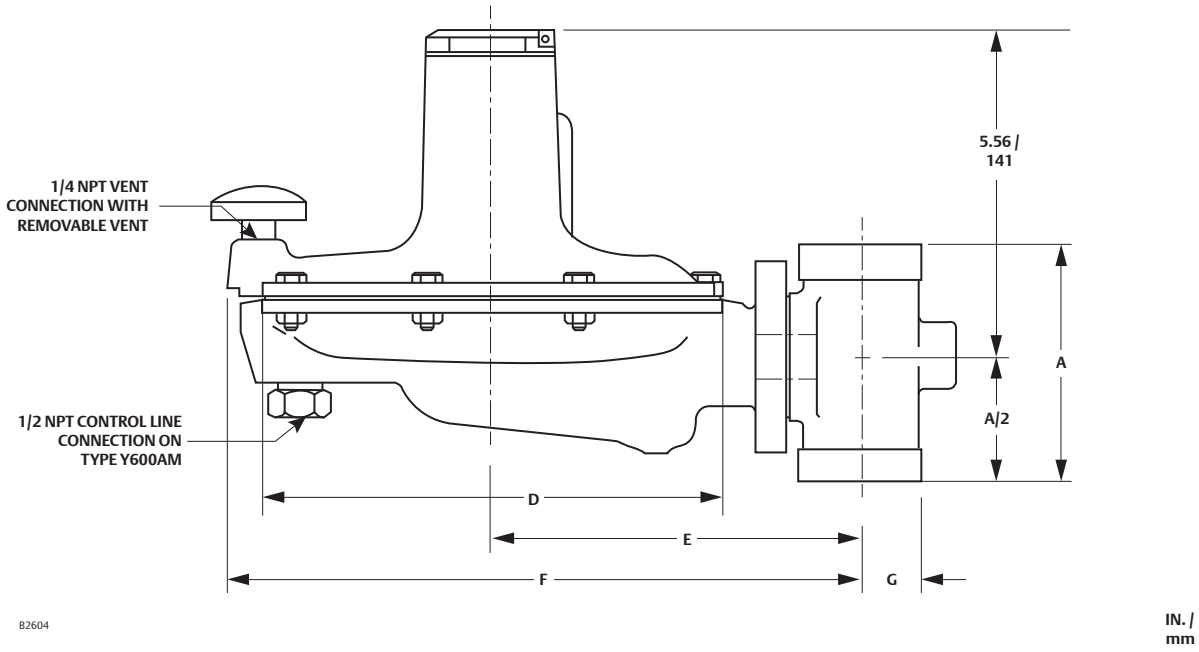


Figure 4. *Y600A Series Dimensions*

Table 6. Dimension and Shipping Weight

BODY SIZE, NPT	DIMENSION, IN. / mm					APPROXIMATE SHIPPING WEIGHT, LB / kg
	A	D (Diameter)	E	F	G	
3/4 or 1	4.00 / 102	8.38 / 213	6.25 / 159	10.69 / 272	1.00 / 25	13 / 6

Ordering Guide

Type (Select One)

- ☐ Y600A (internal pressure registration)***
- ☐ Y600AM (external pressure registration)**
- ☐ Y600AR (internal relief/internal pressure registration)**

Body Size (Select One)

- ☐ 3/4 NPT***
- ☐ 1 NPT***

Orifice Size (Select One)

- ☐ 1/8 in. / 3.2 mm***
- ☐ 3/16 in. / 4.8 mm***
- ☐ 1/4 in. / 6.4 mm***
- ☐ 3/8 in. / 9.5 mm***
- ☐ 1/2 in. / 13 mm***
- ☐ 9/16 in. / 14 mm***

Outlet Pressure Range (Select One)

- ☐ 4 to 8 in. w.c. / 10 to 20 mbar, Red***
- ☐ 7 to 16 in. w.c. / 17 to 40 mbar, Unpainted***
- ☐ 15 in. w.c. to 1.2 psig / 37 to 83 mbar, Yellow***
- ☐ 1.2 to 2.5 psig / 83mbar to 0.17 bar, Green***
- ☐ 2.5 to 4.5 psig / 0.17 to 0.31 bar, Light Blue***
- ☐ 4.5 to 7 psig / 0.31 to 0.48 bar, Black***

To order this product, complete the Ordering Guide Section or complete the Specification Worksheet and forward to your local Sales Office.

If the construction you need is not offered on this page, contact your local Sales Office.

To locate your local Sales Office log on to:
www.emersonprocess.com/regulators

Regulators Quick Order Guide	
***	Readily Available for Shipment
**	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet	
Application	
Specific Use:	
Line Size:	
Gas Type and Specific Gravity:	
Gas Temperature:	
Does the application require overpressure protection?	
☐ Yes, which is preferred?	☐ No
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device	
Is overpressure protection equipment selection assistance desired? ☐ Yes ☐ No	
Pressure	
Maximum Inlet Pressure (P_{1max}):	
Minimum Inlet Pressure (P_{1min}):	
Downstream Pressure Setting(s) (P_2):	
Maximum Flow (Q_{max}):	
Performance Required	
Accuracy requirements?	
Need for extremely fast response?	
Other Requirements:	

Regulator Tip:

A disk with a cookie cut appearance probably means you had an overpressure situation. Thus, investigate further.

Education and Training





The need for training is more critical than ever to achieving and maintaining cost-effective operations.

Emerson Process Management Educational Services offers various courses and other training programs to provide the knowledge and skills to operate, maintain and manage pressure regulators and systems within customers' operations. Through a mixture of theoretical and practical applications, training program participants learn the fundamentals of, and advancements in, pressure control and regulator operations and maintenance.

Whether it is classroom-based training, web-based discussions or eLearning programs, Emerson works hard to ensure customers know how to get the best from their entire process and operation.

For more information about Emerson Process Management pressure regulator and training programs, contact Educational Services.

Emerson Process Management
Regulator Technologies, Inc.

Tel 972-548-3534

Email Education.Regulators@Emerson.com

Technical



The Technical Reference section includes articles covering regulator theory, sizing, selection, overpressure protection and other topics relating to regulators. This section begins with the basic theory of regulators and ends with conversion tables and other informative charts.

This section is for general reference only. For more detailed information please visit **www.emersonprocess.com/regulators** or contact your local Sales Office.

Table of Contents

Regulator Control Theory

Fundamentals of Gas Pressure Regulators 556
Pilot-Operated Regulators 557
Conclusion 557

Regulator Components

Straight Stem Style Direct-Operated 558
Lever Style Direct-Operated 559
Loading Style (Two-Path Control) Pilot-Operated 560
Unloading Style Pilot-Operated 561

Introduction to Regulators

Specific Regulator Types 562
- Pressure Reducing Regulators 562
- Backpressure Regulators and Relief Valves 562
- Pressure Switching Valves 562

Types of Regulators 562
- Direct-Operated (Self-Operated) Regulators 562
- Pilot-Operated Regulators 562

Regulator Selection Criteria 564
- Control Application 564
- Pressure Reducing Regulator Selection 564
- Outlet Pressure to be Controlled 564
- Inlet Pressure of the Regulator 564
- Capacity Required 564
- Shutoff Capability 564
- Process Fluid 565
- Process Fluid Temperature 565
- Accuracy Required 565
- Pipe Size Required 565
- End Connection Style 565
- Required Materials 565
- Control Lines 565
- Stroking Speeds 565
- Overpressure Protection 565
- Regulator Replacement 566
- Regulator Price 566

Backpressure Regulator Selection 566
Relief Valve Selection 566

Theory

Principles of Direct-Operated Regulators

Introduction 567
Regulator Basics 567
Essential Elements 567
- Restricting Element 568
- Measuring Element 568
- Loading Element 568

Regulator Operation 568
- Increasing Demand 568
- Decreasing Demand 568
- Weights versus Springs 568
- Spring Rate 569
- Equilibrium with a Spring 569

Spring as Loading Element 569
- Throttling Example 569
- Regulator Operation and P_2 570

Regulator Performance 570
- Performance Criteria 570
- Setpoint 570
- Droop 570
- Capacity 570
- Accuracy 570
- Lockup 570

Spring Rate and Regulator Accuracy 571
- Spring Rate and Droop 571
- Effect on Plug Travel 571
- Light Spring Rate 571
- Practical Limits 571

Diaphragm Area and Regulator Accuracy 571
- Diaphragm Area 571
- Increasing Diaphragm Area 572
- Diaphragm Size and Sensitivity 572

Restricting Element and Regulator Performance 572
- Critical Flow 572
- Orifice Size and Capacity 572
- Orifice Size and Stability 573
- Orifice Size, Lockup and Wear 573
- Orifice Guideline 573
- Increasing P_1 573

Factors Affecting Regulator Accuracy 573

Performance Limits 573
Cycling 573
Design Variations 573
Improving Regulator Accuracy with a Pitot Tube 574
Numerical Example 574
Decreased Droop (Boost) 574
Improving Performance with a Lever 574

Principles of Pilot-Operated Regulators

Pilot-Operated Regulator Basics 575
Regulator Pilots 575
Gain 575
Identifying Pilots 575
Setpoint 575
Spring Action 575
Pilot Advantage 575
Gain and Restrictions 575
Stability 575
Restrictions, Response Time and Gain 576
Loading and Unloading Designs 576
Two-Path Control (Loading Design) 576
Two-Path Control Advantages 577
Unloading Control 577
Unloading Control Advantages 577
Performance Summary 577
Accuracy 577
Capacity 577
Lockup 578
Applications 578
Two-Path Control 578
Type 1098-EGR 578
Type 99 579
Unloading Design 579

Selecting and Sizing Pressure Reducing Regulators

Introduction 580
Quick Selection Guides 580
Product Pages 580
Special Requirements 580
The Role of Experience 580
Sizing Equations 580
General Sizing Guidelines 581
Body Size 581
Construction 581
Pressure Ratings 581
Wide-Open Flow Rate 581
Outlet Pressure Ranges and Springs 581
Accuracy 581
Inlet Pressure Losses 581
Orifice Diameter 581
Speed of Response 581
Turn-Down Ratio 581
Sizing Exercise: Industrial Plant Gas Supply 582

Overpressure Protection Methods

Methods of Overpressure Protection 583
Relief Valves 583
Types of Relief Valves 583
Advantages 583
Disadvantages 583
Monitoring Regulators 584
Advantages 584
Disadvantages 584
Working Monitor 584
Series Regulation 584
Advantages 585
Disadvantages 585
Shutoff Devices 585
Advantages 585
Disadvantages 585
Relief Monitor 585
Summary 586

Principles of Relief Valves

Overpressure Protection 587
Maximum Pressure Considerations 587
Downstream Equipment 587
Main Regulator 587
Piping 587
Relief Valves 587
Relief Valve Popularity 588
Relief Valve Types 588

Table of Contents

Selection Criteria 588
Pressure Buildup 588
Periodic Maintenance 588
Cost versus Performance 588
Installation and Maintenance Considerations 588
Pop Type Relief Valve 588
Operation 588
Typical Applications 589
Advantages 589
Disadvantage 589
Direct-Operated Relief Valves 589
Operation 589
Product Example 590
Typical Applications 590
Selection Criteria 590
Pilot-Operated Relief Valves 591
Operation 591
Product Example 591
Performance 592
Typical Applications 592
Selection Criteria 592
Internal Relief 592
Operation 592
Product Example 592
Performance and Typical Applications 593
Selection Criteria 593
Selection and Sizing Criteria 593
Maximum Allowable Pressure 593
Regulator Ratings 593
Piping 593
Maximum Allowable System Pressure 593
Determining Required Relief Valve Flow 593
Determine Constant Demand 594
Selecting Relief Valves 594
Required Information 594
Regulator Lockup Pressure 594
Identify Appropriate Relief Valves 594
Final Selection 594
Applicable Regulations 594
Sizing and Selection Exercise 594
Initial Parameters 594
Performance Considerations 594
Upstream Regulator 594
Pressure Limits 594
Relief Valve Flow Capacity 594
Relief Valve Selection 595

Principles of Series Regulation and Monitor Regulators

Series Regulation 596
Failed System Response 596
Regulator Considerations 596
Applications and Limitations 596
Upstream Wide-Open Monitors 596
System Values 596
Normal Operation 596
Worker Regulator B Fails 597
Equipment Considerations 597
Downstream Wide-Open Monitors 597
Normal Operation 597
Worker Regulator A Fails 597
Upstream Versus Downstream Monitors 597
Working Monitors 597
Downstream Regulator 598
Upstream Regulator 598
Normal Operation 598
Downstream Regulator Fails 598
Upstream Regulator Fails 598
Sizing Monitor Regulators 598
Estimating Flow when Pressure Drop is Critical 598
Assuming $P_{intermediate}$ to Determine Flow 598
Fisher Monitor Sizing Program 598

Vacuum Control

Vacuum Applications 599
Vacuum Terminology 599
Vacuum Control Devices 599
Vacuum Regulators 599
Vacuum Breakers (Relief Valves) 599

Table of Contents

Vacuum Regulator Installation Examples 601
Vacuum Breaker Installation Examples. 602
Gas Blanketing in Vacuum 604
Features of Fisher™ Brand Vacuum Regulators and Breakers 604

Valve Sizing Calculations (Traditional Method)

Introduction 605
Sizing for Liquid Service 605
- Viscosity Corrections 605
- Finding Valve Size 605
- Predicting Flow Rate 607
- Predicting Pressure Drop 607
- Flashing and Cavitation 607
- Choked Flow 608
- Liquid Sizing Summary 610
- Liquid Sizing Nomenclature 610

Sizing for Gas or Steam Service 611
- Universal Gas Sizing Equation 611
- General Adaptation for Steam and Vapors 612
- Special Equation for Steam Below 1000 psig 612
- Gas and Steam Sizing Summary 612

Valve Sizing (Standardized Method)

- Introduction 614
- Liquid Sizing 614
- Sizing Valves for Liquids 614
- Determining Allowable Sizing Pressure Drop (ΔP_{max}) 617
- Liquid Sizing Sample Problem 617
- Gas and Steam Sizing 620
- Sizing Valves for Compressible Fluids 620
- Compressible Fluid Sizing Sample Problem 621

Temperature Considerations

Cold Temperature Considerations

Regulators Rated for Low Temperatures 626
Selection Criteria 626

Freezing

Introduction 627
Reducing Freezing Problems 627
- Heat the Gas 627
- Antifreeze Solution 627
- Equipment Selection 627
- System Design 628
- Water Removal 628

Summary 628

Sulfide Stress Cracking— NACE MR0175-2002, MR0175/ISO 15156

The Details 629
These NACE Standards are Applied to 629
NACE MR0175-2002 and Prior 629
NACE MR0175/ISO 15156 630
NACE MR0103 631
Exposed Bolting 631
Coatings 631
Elastomers 631

Reference

Chemical Compatibility of Elastomers and Metals

Introduction 632
Elastomers: Chemical Names and Uses 632
General Properties of Elastomers 633
Fluid Compatibility of Elastomers 634
Compatibility of Metals 635

Regulator Tips

Regulator Tips 637

Conversions, Equivalents and Physical Data

Pressure Equivalents 639
Pressure Conversion - Pounds per Square Inch (PSI) to Bar 639
Volume Equivalents 639
Volume Rate Equivalents 640

Table of Contents

Mass Conversion—Lbs to kg 640
Temperature Conversion Formulas 640
Area Equivalents 640
Kinematic-Viscosity Conversion Formulas 640
Conversion Units 641
Other Useful Conversions 641
Converting Volumes of Gas 641
Fractional In. to mm 642
Length Equivalents 642
Whole In.-mm Equivalents 642
Metric Prefixes and Symbols 642
Greek Alphabet 642
Length Equivalents - Fractional and Decimal In. to mm 643
Temperature Conversions 644
A.P.I. and Baumé Gravity Tables and Weight Factors 647
Characteristics of the Elements 648
Recommended Standard Specifications for Valve Materials Pressure-Containing Castings 649
Physical Constants of Hydrocarbons 652
Physical Constants of Various Fluids 653
Properties of Water 655
Properties of Saturated Steam 655
Properties of Saturated Steam—Metric Units 658
Properties of Superheated Steam 659
Determine Velocity of Steam in Pipes 662
Recommended Steam Pipe Line Velocities 662
Typical Condensation Rates in Insulated Pipes 662
Typical Condensation Rates without Insulation 662
Flow of Water Through Schedule 40 Steel Pipes 663
Flow of Air Through Schedule 40 Steel Pipes 665
Average Properties of Propane 667
Orifice Capacities for Propane 667
Standard Domestic Propane Tank Specifications 667
Approximate Vaporization Capacities of Propane Tanks 667
Pipe and Tubing Sizing 668
Vapor Pressures of Propane 668
Converting Volumes of Gas 668
BTU Comparisons 668
Capacities of Spuds and Orifices 669
Kinematic Viscosity - Centistokes 672
Specific Gravity of Typical Fluids vs Temperature 673
Effect of Inlet Swage On Critical Flow C_g Requirements 674
Seat Leakage Classifications 675
Class VI Seat Leakage Allowable 675
Flange, Valve Size and Pressure-Temperature Rating Designations 676
Pipe Thread Standards 676
Pressure-Temperature Ratings for Valve Bodies 677
Diameter of Bolt Circles 679
ASME Face-To-Face Dimensions for Flanged Regulators 679
Wear and Galling Resistance Chart of Material Combinations 680
Equivalent Lengths of Pipe Fittings and Valves 680
Pipe Data: Carbon and Alloy Steel—Stainless Steel 681
American Pipe Flange Dimensions 683
EN 1092-1 Cast Steel Flange Standards 683
EN 1092-1 Pressure/Temperature Ratings for Cast Steel Valve Ratings 683
Drill Sizes for Pipe Taps 685
Standard Twist Drill Sizes 685

Glossary

Glossary of Terms 686

Fundamentals of Gas Pressure Regulators

The primary function of any gas regulator is to match the flow of gas through the regulator to the demand for gas placed upon the system. At the same time, the regulator must maintain the system pressure within certain acceptable limits.

A typical gas pressure system might be similar to that shown in Figure 1, where the regulator is placed upstream of the valve or other device that is varying its demand for gas from the regulator.

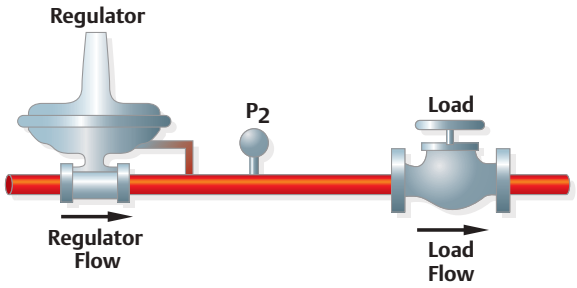


Figure 1

If the load flow decreases, the regulator flow must decrease also. Otherwise, the regulator would put too much gas into the system and the pressure (P2) would tend to increase. On the other hand, if the load flow increases, then the regulator flow must increase also in order to keep P2 from decreasing due to a shortage of gas in the pressure system.

From this simple system, it is easy to see that the prime job of the regulator is to put exactly as much gas into the piping system as the load device takes out.

If the regulator were capable of instantaneously matching its flow to the load flow, then we would never have major transient variation in the pressure (P2) as the load changes rapidly. From practical experience we all know that this is normally not the case, and in most real-life applications, we would expect some fluctuations in P2 whenever the load changes abruptly.

Because the regulator's job is to modulate the flow of gas into the system, we can see that one of the essential elements of any regulator is a restricting element that will fit into the flow stream and provide a variable restriction that can modulate the flow of gas through the regulator.

Figure 2 shows a schematic of a typical regulator restricting element. This restricting element is usually some type of valve arrangement. It can be a single-port globe valve, a cage style valve, butterfly valve or any other type of valve that is capable of operating as a variable restriction to the flow.

In order to cause this restricting element to vary, some type of loading force will have to be applied to it. Thus we see that the second essential element of a gas regulator is a Loading Element that can apply the needed force to the restricting element.

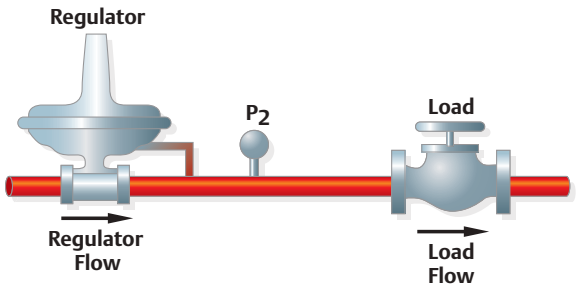


Figure 2

The loading element can be one of any number of things such as a weight, a hand jack, a spring, a diaphragm actuator or a piston actuator, to name a few of the more common ones.

A diaphragm actuator and a spring are frequently combined, as shown in Figure 3, to form the most common type of loading element. A loading pressure is applied to a diaphragm to produce a loading force that will act to close the restricting element. The spring provides a reverse loading force which acts to overcome the weight of the moving parts and to provide a fail-safe operating action that is more positive than a pressure force.

So far, we have a restricting element to modulate the flow through the regulator and we have a loading element that can apply the necessary force to operate the restricting element. But, how do we know when we are modulating the gas flow correctly? How do we know when we have the regulator flow matched to the load flow? It is rather obvious that we need some type of Measuring Element which will tell us when these two flows have been perfectly matched. If we had some economical method of directly measuring these flows, we could use that approach; however, this is not a very feasible method.

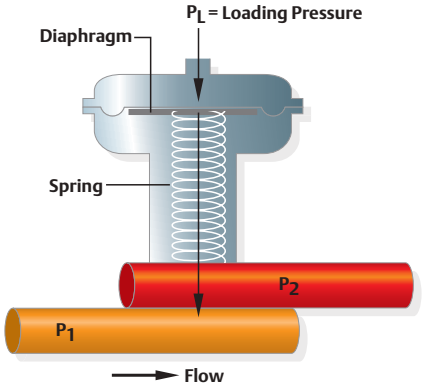


Figure 3

We noted earlier in our discussion of Figure 1 that the system pressure (P2) was directly related to the matching of the two flows. If the restricting element allows too much gas into the system, P2 will increase. If the restricting element allows too little gas into the system, P2 will decrease. We can use this convenient fact to provide a

simple means of measuring whether or not the regulator is providing the proper flow.

Manometers, Bourdon tubes, bellows, pressure gauges and diaphragms are some of the possible measuring elements that we might use. Depending upon what we wish to accomplish, some of these measuring elements would be more advantageous than others. The diaphragm, for instance, will not only act as a measuring element which responds to changes in the measured pressure, but it also acts simultaneously as a loading element. As such, it produces a force to operate the restricting element that varies in response to changes in the measured pressure. If we add this typical measuring element to the loading element and the restricting element that we selected earlier, we will have a complete gas pressure regulator as shown in Figure 4.

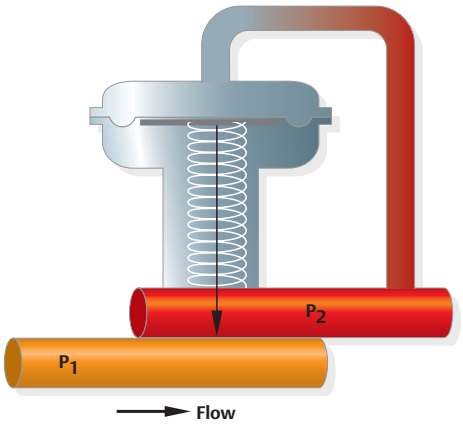


Figure 4

Let's review the action of this regulator. If the restricting element tries to put too much gas into the system, the pressure (P2) will increase. The diaphragm, as a measuring element, responds to this increase in pressure and, as a loading element, produces a force which compresses the spring and thereby restricts the amount of gas going into the system. On the other hand, if the regulator doesn't put enough gas into the system, the pressure (P2) falls and the diaphragm responds by producing less force. The spring will then overcome the reduced diaphragm force and open the valve to allow more gas into the system. This type of self-correcting action is known as negative feedback. This example illustrates that there are three essential elements needed to make any operating gas pressure regulator. They are a restricting element, a loading element and a measuring element. Regardless of how sophisticated the system may become, it still must contain these three essential elements.

Pilot-Operated Regulators

So far we have only discussed direct-operated regulators. This is the name given to that class of regulators where the measured pressure is applied directly to the loading element with no intermediate hardware. There are really only two basic configurations of direct-operated regulators that are practical. These two basic types are illustrated in Figures 4 and 5.

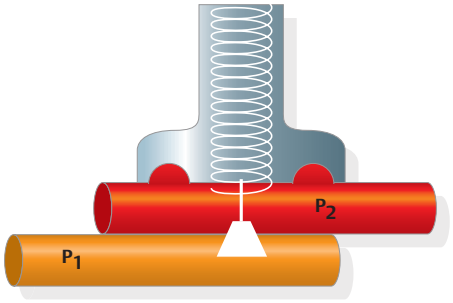


Figure 5

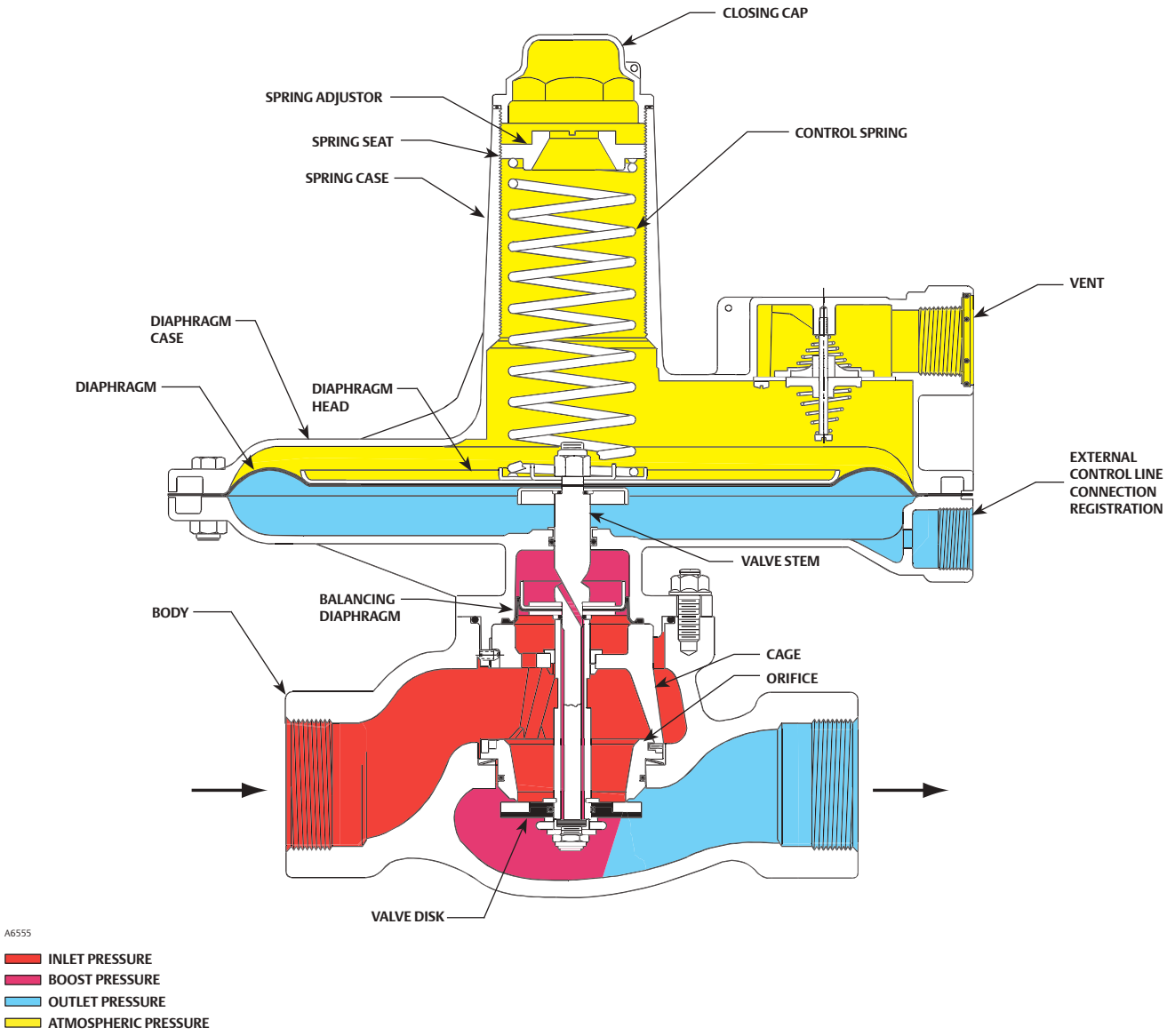
If the proportional band of a given direct-operated regulator is too great for a particular application, there are a number of things we can do. From our previous examples we recall that spring rate, valve travel and effective diaphragm area were the three parameters that affect the proportional band. In the last section we pointed out the way to change these parameters in order to improve the proportional band. If these changes are either inadequate or impractical, the next logical step is to install a pressure amplifier in the measuring or sensing line. This pressure amplifier is frequently referred to as a pilot.

Conclusion

It should be obvious at this point that there are fundamentals to understand in order to properly select and apply a gas regulator to do a specific job. Although these fundamentals are profuse in number and have a sound theoretical base, they are relatively straightforward and easy to understand.

As you are probably aware by now, we made a number of simplifying assumptions as we progressed. This was done in the interest of gaining a clearer understanding of these fundamentals without getting bogged down in special details and exceptions. By no means has the complete story of gas pressure regulation been told. The subject of gas pressure regulation is much broader in scope than can be presented in a single document such as this, but it is sincerely hoped that this application guide will help to gain a working knowledge of some fundamentals that will enable one to do a better job of designing, selecting, applying, evaluating or troubleshooting any gas pressure regulation equipment.

Straight Stem Style Direct-Operated Regulator Components

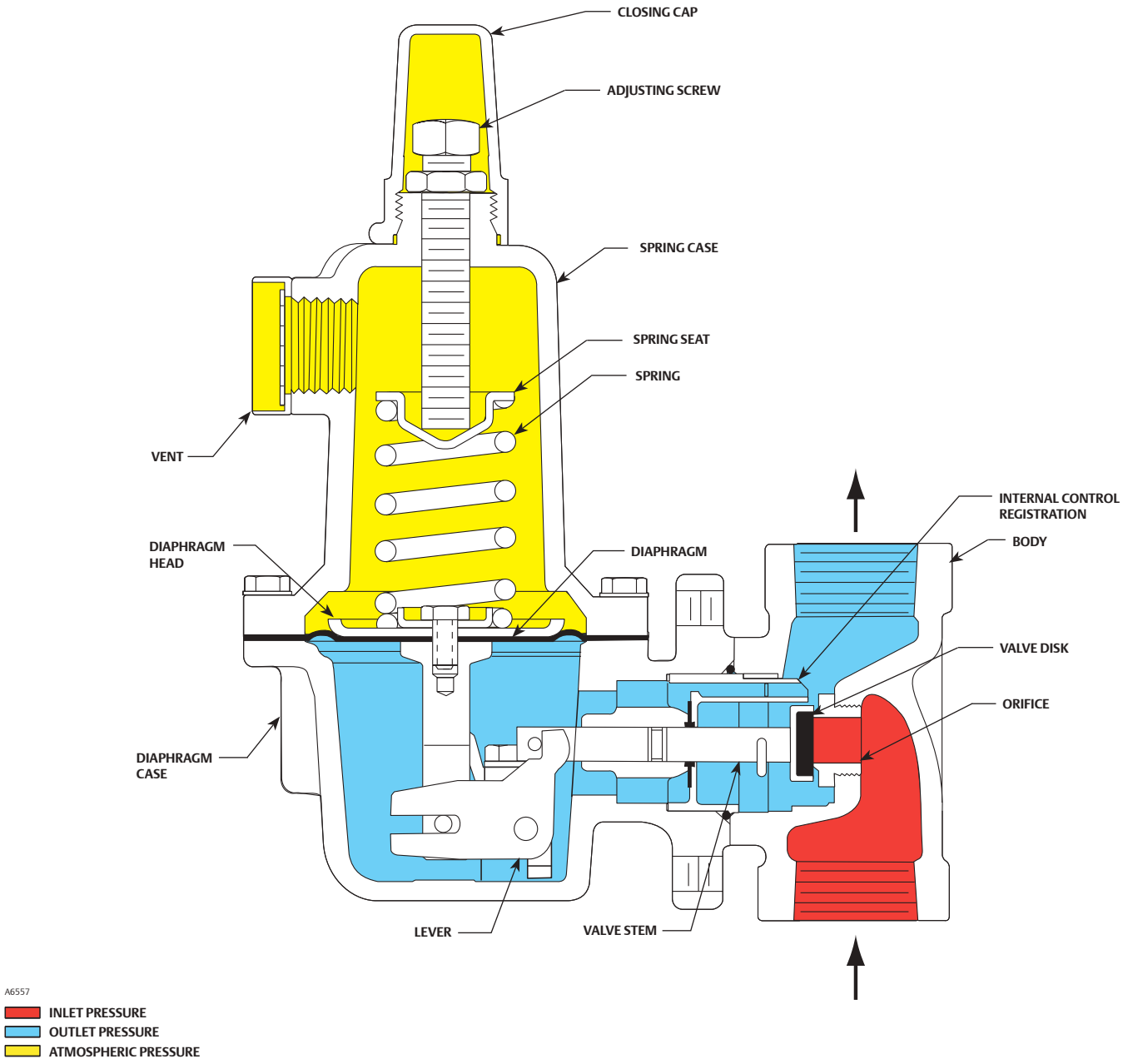


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Regulator Components

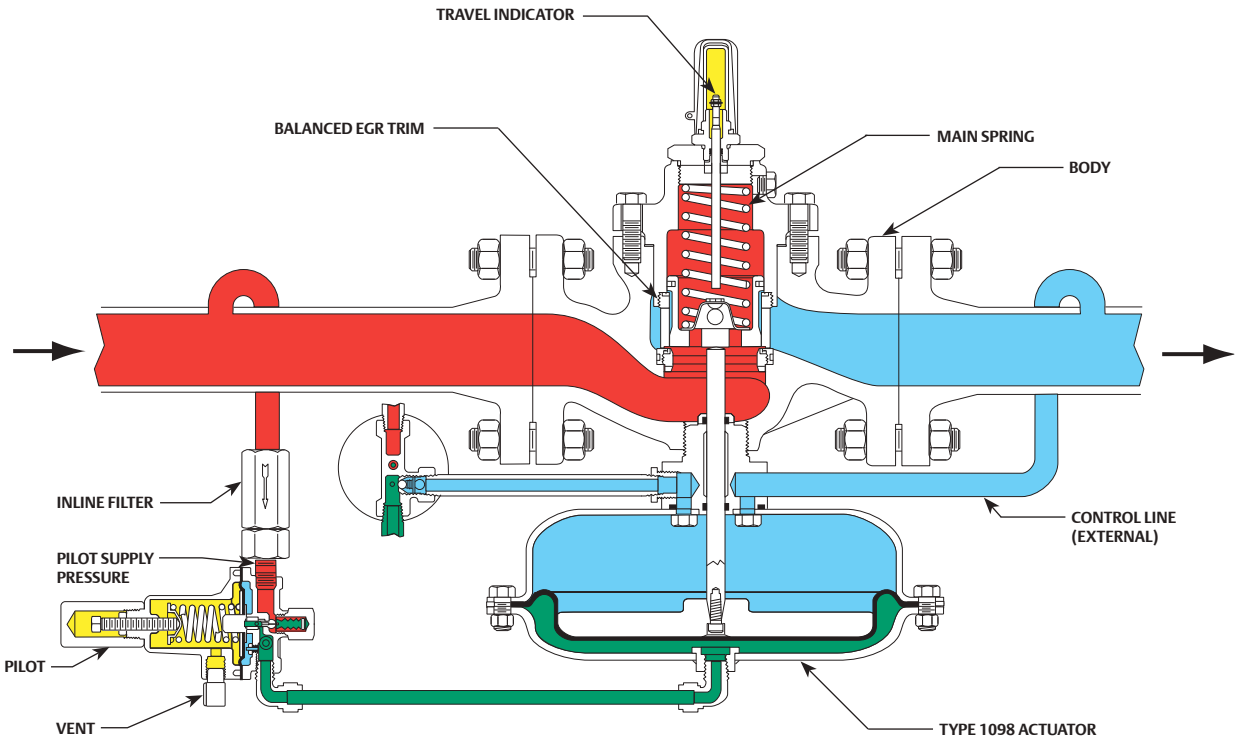
Lever Style Direct-Operated Regulator Components



Type 627

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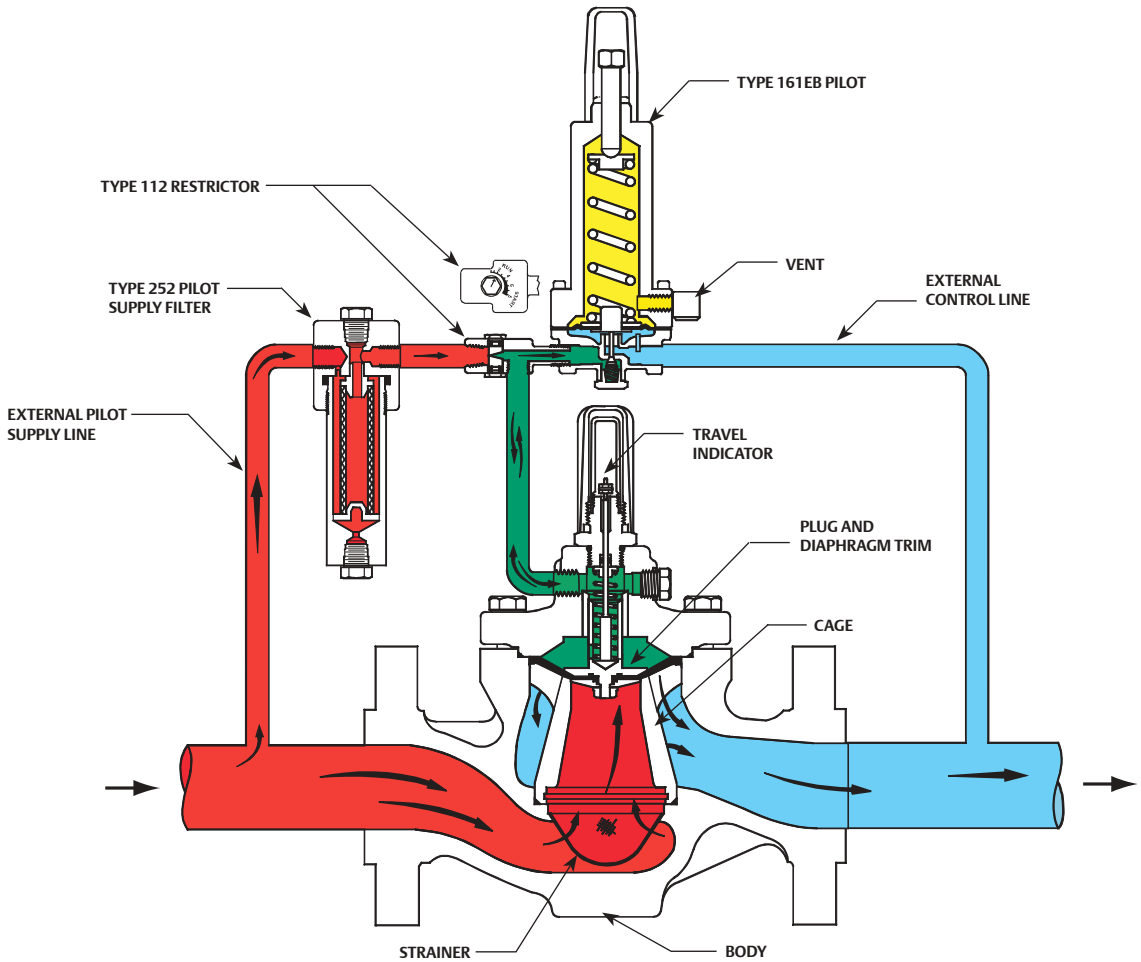
Loading Style (Two-Path Control) Pilot-Operated Regulator Components



Type 1098-EGR

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Unloading Style Pilot-Operated Regulator Components



Type EZR

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Instrument engineers agree that the simpler a system is the better it is, as long as it provides adequate control. In general, regulators are simpler devices than control valves. Regulators are self-contained, direct-operated control devices which use energy from the controlled system to operate whereas control valves require external power sources, transmitting instruments and control instruments.

Specific Regulator Types

Within the broad categories of direct-operated and pilot-operated regulators fall virtually all of the general regulator designs, including:

- Pressure reducing regulators
- Backpressure regulators
- Pressure relief valves
- Pressure switching valves
- Vacuum regulators and breakers

Pressure Reducing Regulators

A pressure reducing regulator maintains a desired reduced outlet pressure while providing the required fluid flow to satisfy a downstream demand. The pressure which the regulator maintains is the outlet pressure setting (setpoint) of the regulator.

Types of Pressure Reducing Regulators

This section describes the various types of regulators. All regulators fit into one of the following two categories:

1. Direct-Operated (also sometimes called Self-Operated)
2. Pilot-Operated

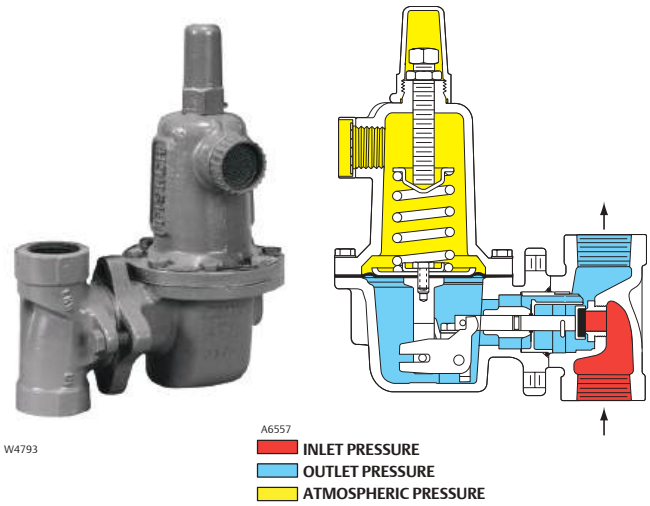


Figure 1. *Type 627 Direct-Operated Regulator and Operational Schematic*

Direct-Operated (Self-Operated) Regulators

Direct-operated regulators are the simplest style of regulators. At low set pressures, typically below 1 psig / 0.07 bar, they can have very accurate (±1%) control. At high control pressures, up to 500 psig / 34.5 bar, 10 to 20% control is typical.

In operation, a direct-operated, pressure reducing regulator senses the downstream pressure through either internal pressure registration or an external control line. This downstream pressure opposes a spring which moves the diaphragm and valve plug to change the size of the flow path through the regulator.

Pilot-Operated Regulators

Pilot-operated regulators are preferred for high flow rates or where precise pressure control is required. A popular type of pilot-operated system uses two-path control. In two-path control, the main valve diaphragm responds quickly to downstream pressure changes, causing an immediate correction in the main valve plug position. At the same

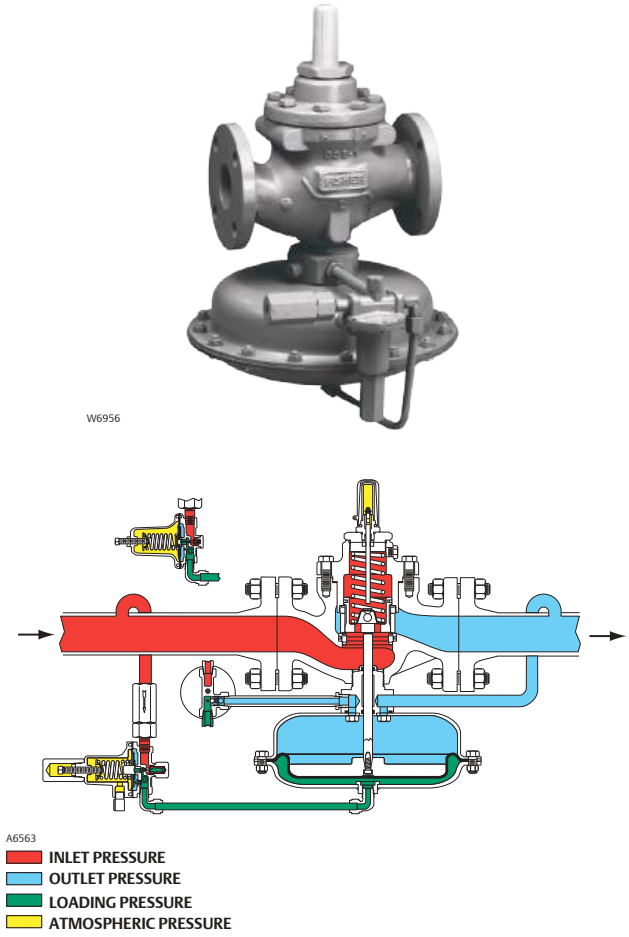


Figure 2. *Type 1098-EGR Pilot-Operated Regulator and Operational Schematic*

time, the pilot diaphragm diverts some of the reduced inlet pressure to the other side of the main valve diaphragm to control the final positioning of the main valve plug. Two-path control results in fast response and accurate control.

Backpressure Regulators and Pressure Relief Valves

A backpressure regulator maintains a desired upstream pressure by varying the flow in response to changes in upstream pressure. A pressure relief valve limits pressure build-up (prevents overpressure) at its location in a pressure system. The relief valve opens to prevent a rise of internal pressure in excess of a specified value. The pressure at which the relief valve begins to open pressure is the relief pressure setting.

Relief valves and backpressure regulators are the same devices. The name is determined by the application. Fisher™ relief valves are not ASME safety relief valves.

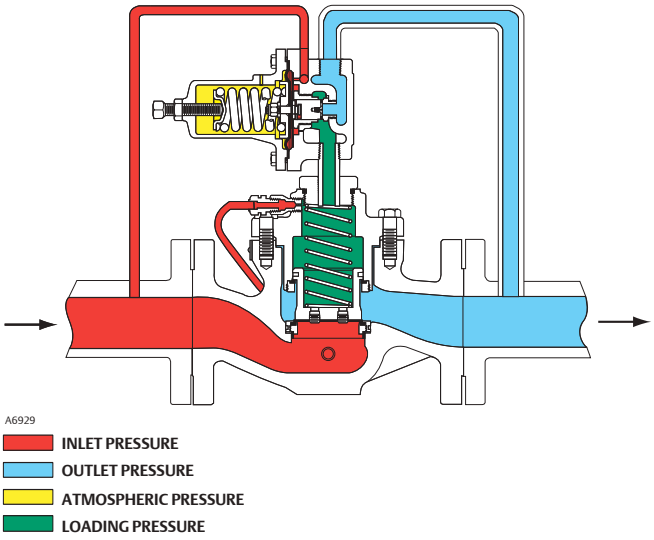


Figure 3. *Type 63EG Backpressure Regulator/Relief Valve Operational Schematic*

Pressure Switching Valves

Pressure switching valves are used in pneumatic logic systems. These valves are for either two-way or three-way switching. Two-way switching valves are used for on/off service in pneumatic systems.

Three-way switching valves direct inlet pressure from one outlet port to another whenever the sensed pressure exceeds or drops below a preset limit.

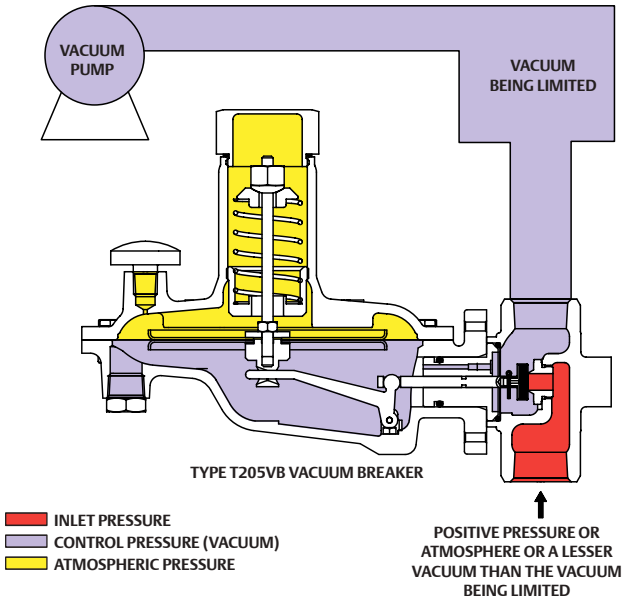


Figure 3. *Typical Vacuum Breaker*

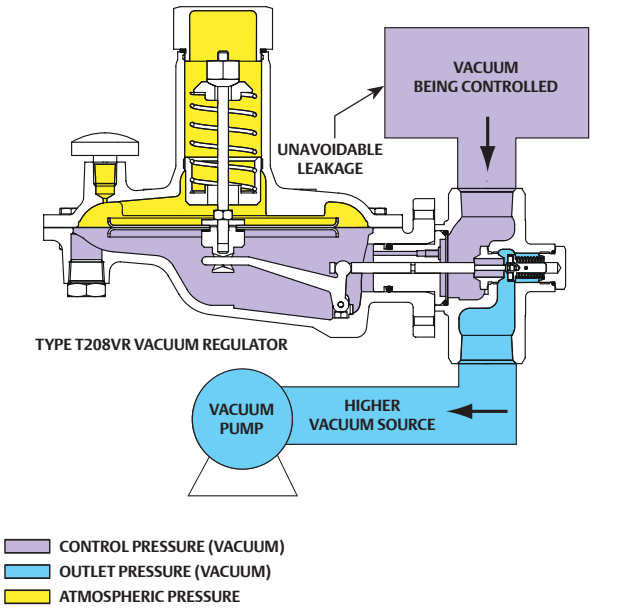


Figure 2. *Typical Vacuum Regulator*

Vacuum Regulators and Breakers

Vacuum regulators and vacuum breakers are devices used to control vacuum. A vacuum regulator maintains a constant vacuum at the regulator inlet with a higher vacuum connected to the outlet. During operation, a vacuum regulator remains closed until a vacuum decrease (a rise in absolute pressure) exceeds the spring setting and opens the valve disk. A vacuum breaker prevents a vacuum from exceeding a specified value. During operation, a vacuum breaker remains closed until an increase in vacuum (a decrease in absolute pressure) exceeds the spring setting and opens the valve disk.

Regulator Selection Criteria

This section describes the procedure normally used to select regulators for various applications. For most applications, there is generally a wide choice of regulators that will accomplish the required function. The vendor and the customer, working together, have the task of deciding which of the available regulators is best suited for the job at hand. The selection procedure is essentially a process of elimination wherein the answers to a series of questions narrow the choice down to a specific regulator.

Control Application

To begin the selection procedure, it is necessary to define what the regulator is going to do. In other words, what is the control application? The answer to this question will determine the general type of regulator required, such as:

- Pressure reducing regulators
- Backpressure regulators
- Pressure relief valves
- Vacuum regulators
- Vacuum breakers

The selection criteria used in selecting each of these general regulator types is described in greater detail in the following subsections.

Pressure Reducing Regulator Selection

The majority of applications require a pressure reducing regulator. Assuming the application calls for a pressure reducing regulator, the following parameters must be determined:

- Outlet pressure to be controlled
- Inlet pressure to the regulator
- Capacity required
- Shutoff capability required
- Process fluid
- Process fluid temperature
- Accuracy required
- Pipe size required
- End connection style
- Material requirements
- Control line needed
- Stroking speed
- Overpressure protection

Outlet Pressure to be Controlled

For a pressure reducing regulator, the first parameter to determine is the required outlet pressure. When the outlet pressure is known, it helps determine:

- Spring requirements
- Casing pressure rating
- Body outlet rating
- Orifice rating and size
- Regulator size

Inlet Pressure of the Regulator

The next parameter is the inlet pressure. The inlet pressure (minimum and maximum) determines the:

- Pressure rating for the body inlet
- Orifice pressure rating and size
- Main spring (in a pilot-operated regulator)
- Regulator size

If the inlet pressure varies significantly, it can have an effect on:

- Accuracy of the controlled pressure
- Capacity of the regulator
- Regulator style (two-stage or unloading)

Capacity Required

The required flow capacity influences the following decisions:

- Size of the regulator
- Orifice size
- Style of regulator (direct-operated or pilot-operated)

Shutoff Capability

The required shutoff capability determines the type of disk material:

- Standard disk materials are Nitrile (NBR) and Neoprene (CR), these materials provide the tightest shutoff.
- Other materials, such as Nylon (PA), Polytetrafluoroethylene (PTFE), Fluorocarbon (FKM) and Ethylenepropylene (EPDM) are used when standard material cannot be used.
- Metal disks are used in high temperatures and when elastomers are not compatible with the process fluid; however, tight shutoff is typically not achieved.

Introduction to Regulators

Process Fluid

Each process fluid has its own set of unique characteristics in terms of its chemical composition, corrosive properties, impurities, flammability, hazardous nature, toxic effect, explosive limits and molecular structure. In some cases special care must be taken to select the proper materials that will come in contact with the process fluid.

Process Fluid Temperature

Fluid temperature might determine the materials used in the regulator. Standard regulators use Steel and Nitrile (NBR) or Neoprene (CR) elastomers that are good for a temperature range of -40 to 180°F / -40 to 82°C. Temperatures above and below this range may require other materials, such as Stainless steel, Ethylenepropylene (EPDM) or Perfluoroelastomer (FFKM).

Accuracy Required

The accuracy requirement of the process determines the acceptable droop (also called proportional band or offset). Regulators fall into the following groups as far as droop is concerned:

- **Rough-cut Group** — This group generally includes many first-stage, rough-cut direct-operated regulators. This group usually has the highest amount of droop. However, some designs are very accurate, especially the low-pressure gas or air types, such as house service regulators, which incorporate a relatively large diaphragm casing.
- **Close-control Group** — This group usually includes pilot-operated regulators. They provide high accuracy over a large range of flows. Applications that require close control include these examples:
  - Burner control where the fuel/air ratio is critical to burner efficiency and the gas pressure has a significant effect on the fuel/air ratio.
  - Metering devices, such as gas meters, which require constant input pressures to ensure accurate measurement.

Pipe Size Required

If the pipe size is known, it gives the specifier of a new regulator a more defined starting point. If, after making an initial selection of a regulator, the regulator is larger than the pipe size, it usually means that an error has been made either in selecting the pipe size or the regulator or in determining the original parameters (such as pressure or flow) required for regulator selection. In many cases, the outlet piping needs to be larger than the regulator for the regulator to reach full capacity.

End Connection Style

In general, the following end connections are available for the indicated regulator sizes:

- Pipe threads or socket weld: 2 in. / DN 50 and smaller
- Flanged: 1 in. / DN 25 and larger
- Butt weld: 1 in. / DN 25 and larger

Note: Not all end connections are available for all regulators.

Required Materials

The regulator construction materials are generally dictated by the application. Standard materials are:

- Aluminum
- Cast iron or Ductile iron
- Steel
- Bronze and Brass
- Stainless steel

Special materials required by the process can have an effect on the type of regulator that can be used. Oxygen service, for example, requires special materials, requires special cleaning preparation and requires that no oil or grease be in the regulator.

Control Lines

For pressure registration, control lines are connected downstream of a pressure reducing regulator and upstream of a backpressure regulator. Typically large direct-operated regulators have external control lines and small direct-operated regulators have internal registration instead of a control line. Most pilot-operated regulators have external control lines, but this should be confirmed for each regulator type considered.

Stroking Speed

Stroking speed is often an important selection criteria. Direct-operated regulators are very fast and pilot-operated regulators are slightly slower. Both types are faster than most control valves. When speed is critical, techniques can be used to decrease stroking time.

Overpressure Protection

The need for overpressure protection should always be considered. Overpressure protection is generally provided by an external relief valve or in some regulators, by an internal relief valve. Internal relief is an option that you must choose at the time of purchase. The capacity of internal relief is usually limited in comparison with a separate relief valve. Other methods such as shutoff valves or monitor regulators can also be used.

Regulator Replacement

When a regulator is being selected to replace an existing regulator, the existing regulator can provide the following information:

- Style of regulator
- Size of regulator
- Type number of the regulator
- Special requirements for the regulator, such as downstream pressure sensing through a control line versus internal pressure registration.

Regulator Price

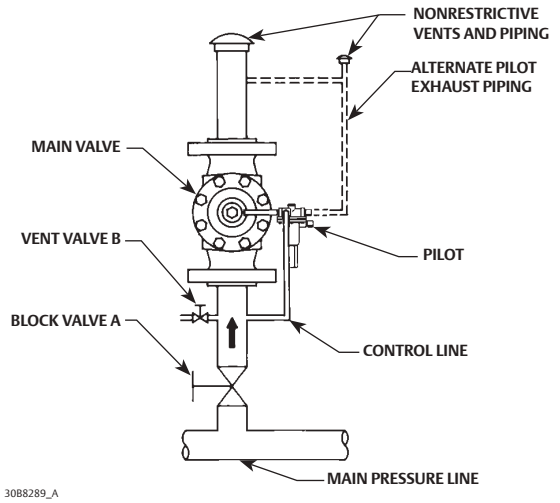
The price of a regulator is only a part of the cost of ownership. Additional costs include installation and maintenance. In selecting a regulator, you should consider all of the costs that will accrue over the life of the regulator. The regulator with a low initial cost might not be the most economical in the long run. For example, a direct-operated regulator is generally less expensive, but a pilot-operated regulator might provide more capacity for the initial investment. To illustrate, a 2 in. / DN 50 pilot-operated regulator can have the same capacity and a lower price than a 3 in. / DN 80, direct-operated regulator.

Backpressure Regulator Selection

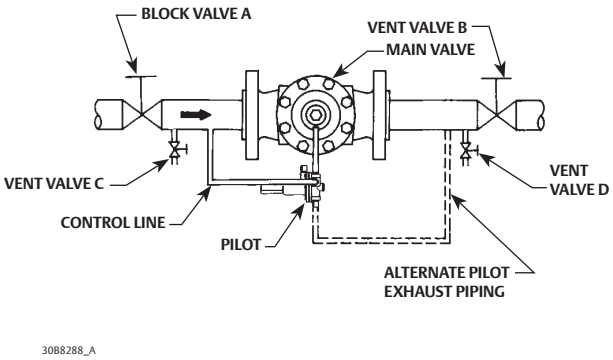
Backpressure regulators control the inlet pressure rather than the outlet pressure. The selection criteria for a backpressure regulator the same as for a pressure reducing regulator.

Relief Valve Selection

An external relief valve is a form of backpressure regulator. A relief valve opens when the inlet pressure exceeds a set value. Relief is generally to atmosphere. The selection criteria is the same as for a pressure reducing regulator.



RELIEF PRESSURE CONTROL AT RELIEF VALVE INLET



BACKPRESSURE CONTROL

Figure 5. *Backpressure Regulator/Relief Valve Applications*

Principles of Direct-Operated Regulators

Introduction

Pressure regulators have become very familiar items over the years and nearly everyone has grown accustomed to seeing them in factories, public buildings, by the roadside and even on the outside of their own homes. As is frequently the case with such familiar items, we have a tendency to take them for granted. It's only when a problem develops or when we are selecting a regulator for a new application, that we need to look more deeply into the fundamentals of the regulator's operation.

Regulators provide a means of controlling the flow of a gas or other fluid supply to downstream processes or customers. An ideal regulator would supply downstream demand while keeping downstream pressure constant; however, the mechanics of direct-operated regulator construction are such that there will always be some deviation (droop or offset) in downstream pressure.

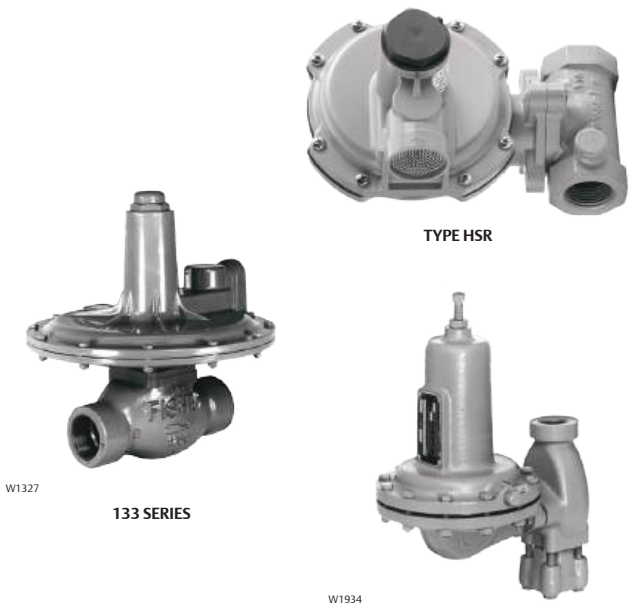


Figure 1. *Direct-Operated Regulators*

Regulator Basics

A pressure reducing regulator must satisfy a downstream demand while maintaining the system pressure within certain acceptable limits. When the flow rate is low, the regulator plug or disk approaches its seat and restricts the flow. When demand increases, the plug or disk moves away from its seat, creating a larger opening and increased flow. Ideally, a regulator should provide a constant downstream pressure while delivering the required flow.

The service regulator mounted on the meter outside virtually every home serves as an example. As appliances such as a furnace or stove call for the flow of more gas, the service regulator responds by delivering the required flow. As this happens, the pressure should be held constant. This is important because the gas meter, which is the cash register of the system, is often calibrated for a given pressure.

Direct-operated regulators have many commercial and residential uses. Typical applications include industrial, commercial and domestic gas service, instrument air supply and a broad range of applications in industrial processes.

Regulators automatically adjust flow to meet downstream demand. Before regulators were invented, someone had to watch a pressure gauge for pressure drops which signaled an increase in downstream demand. When the downstream pressure decreased, more flow was required. The operator then opened the regulating valve until the gauge pressure increased, showing that downstream demand was being met.

Essential Elements

Direct-operated regulators have three essential elements:

- A restricting element— a valve, disk or plug
- A measuring element— generally a diaphragm
- A loading element— generally a spring

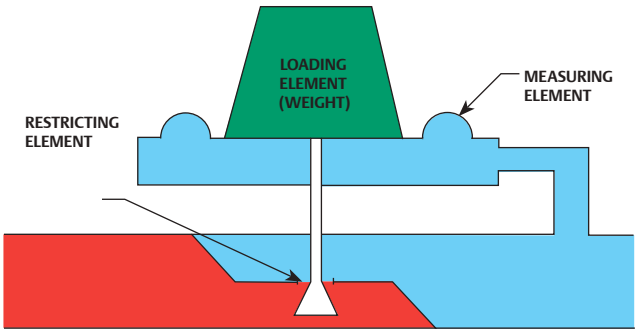


Figure 2. *Three Essential Elements*

Restricting Element

The regulator's restricting element is generally a disk or plug that can be positioned fully open, fully closed or somewhere in between to control the amount of flow. When fully closed, the disk or plug seats tightly against the valve orifice or seat ring to shutoff flow.

Measuring Element

The measuring element is usually a flexible diaphragm that senses downstream pressure (P_2). The diaphragm moves as pressure beneath it changes. The restricting element is often attached to the diaphragm with a stem so that when the diaphragm moves, so does the restricting element.

Loading Element

A weight or spring acts as the loading element. The loading element counterbalances downstream pressure (P_2). The amount of unbalance between the loading element and the measuring element determines the position of the restricting element. Therefore, we can adjust the desired amount of flow through the regulator or setpoint, by varying the load. Some of the first direct-operated regulators used weights as loading elements. Most modern regulators use springs.

Regulator Operation

To examine how the regulator works, let's consider these values for a direct-operated regulator installation:

- Upstream Pressure (P_1) = 100 psig
- Downstream Pressure (P_2) = 10 psig
- Pressure Drop Across the Regulator (P) = 90 psi
- Diaphragm Area (A_D) = 10 in^2
- Loading Weight = 100 lbs.

Let's examine a regulator in equilibrium as shown in Figure 3. The pressure acting against the diaphragm creates a force acting up to 100 lbs.

Diaphragm Force (F_D) = Pressure (P_2) x Area of Diaphragm (A_D)
or
F_D = 10 psig x 10 in^2 = 100 lbs

The 100 lbs weight acts down with a force of 100 lbs, so all the opposing forces are equal and the regulator plug remains stationary.

Increasing Demand

If the downstream demand increases, P_2 will drop. The pressure on the diaphragm drops, allowing the regulator to open further. Suppose in our example P_2 drops to 9 psig. The force acting up then equals 90 lbs (9 psig x 10 in^2 = 90 lbs). Because of the unbalance of the measuring element and the loading element, the restricting element will move to allow passage of more flow.

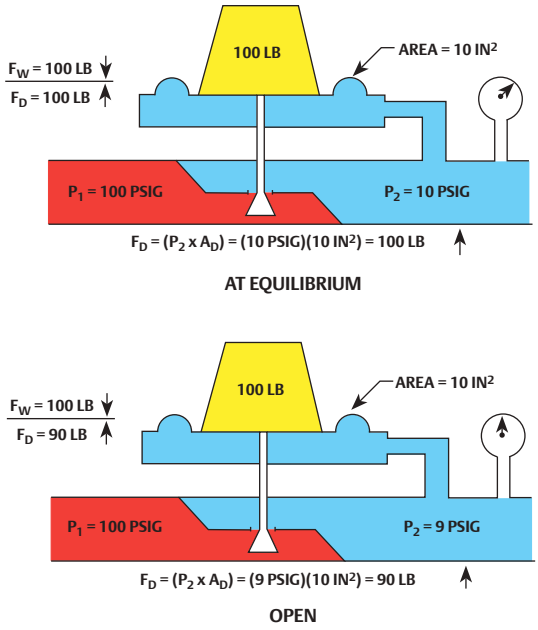


Figure 3. *Elements*

Decreasing Demand

If the downstream demand for flow decreases, downstream pressure increases. In our example, suppose P_2 increases to 11 psig. The force acting up against the weight becomes 110 lbs (11 psig x 10 in^2 = 110 lbs). In this case, unbalance causes the restricting element to move up to pass less flow or lockup.

Weights versus Springs

One of the problems with weight-loaded systems is that they are slow to respond. So if downstream pressure changes rapidly, our weight-loaded regulator may not be able to keep up. Always behind, it may become unstable and cycle—continuously going from the fully open to the fully closed position. There are other problems. Because the amount of weight controls regulator setpoint, the regulator is not easy to adjust. The weight will always have to be on top of the diaphragm. So, let's consider using a spring. By using a spring instead of a weight, regulator stability increases because a spring has less stiffness.

Principles of Direct-Operated Regulators

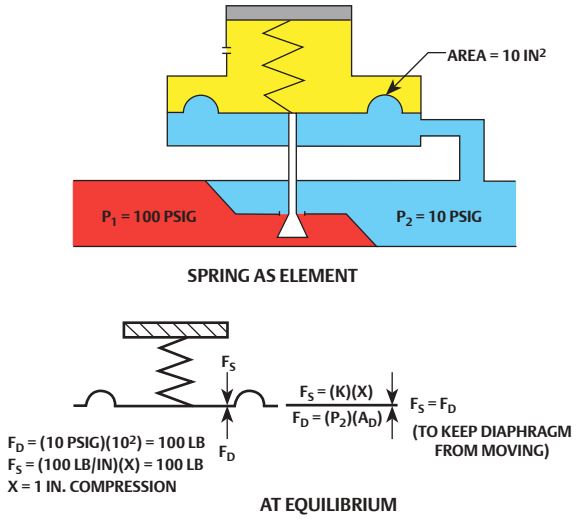


Figure 4. *Spring as Element*

Spring Rate

We choose a spring for a regulator by its spring rate (K). K represents the amount of force necessary to compress the spring 1 in. For example, a spring with a rate of 100 lbs/in. needs 100 lbs of force to compress it 1 in., 200 lbs of force to compress it 2 in. and so on.

Equilibrium with a Spring

Instead of a weight, let's substitute a spring with a rate of 100 lbs/in. And, with the regulator's spring adjustor, we'll wind in 1 in. of compression to provide a spring force (F_S) of 100 lbs. This amount of compression of the regulator spring determines setpoint or the downstream pressure that we want to hold constant. By adjusting the initial spring compression, we change the spring loading force, so P_2 will be at a different value in order to balance the spring force.

Now the spring acts down with a force of 100 lbs and the downstream pressure acts up against the diaphragm producing a force of 100 lbs ($F_D = P_2 \times A_D$). Under these conditions the regulator has achieved equilibrium; that is, the plug or disk is holding a fixed position.

Spring as Loading Element

By using a spring instead of a fixed weight, we gain better control and stability in the regulator. The regulator will now be less likely to go fully open or fully closed for any change in downstream pressure (P_2). In effect, the spring acts like a multitude of different weights.

Throttling Example

Assume we still want to maintain 10 psig downstream. Consider what happens now when downstream demand increases and pressure P_2 drops to 9 psig. The diaphragm force (F_D) acting up is now 90 lbs.

$$F_D = P_2 \times A_D$$
$$F_D = 9 \text{ psig} \times 10 \text{ in}^2$$
$$F_D = 90 \text{ lbs}$$

We can also determine how much the spring will move (extend) which will also tell us how much the disk will travel. To keep the regulator in equilibrium, the spring must produce a force (F_S) equal to the force of the diaphragm. The formula for determining spring force (F_S) is:

$$F_S = (K)(X)$$

where K = spring rate in lbs/in. and X = travel or compression in in.

We know F_S is 90 lbs and K is 100 lbs/in., so we can solve for X with:

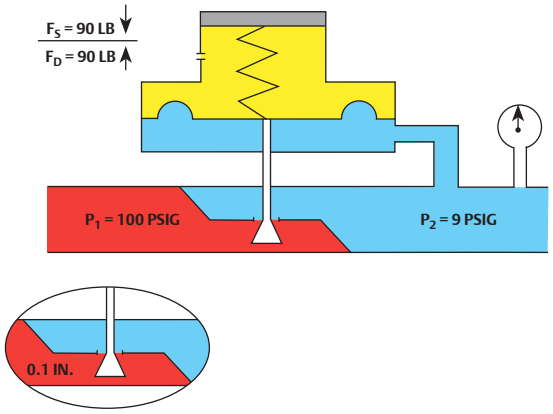
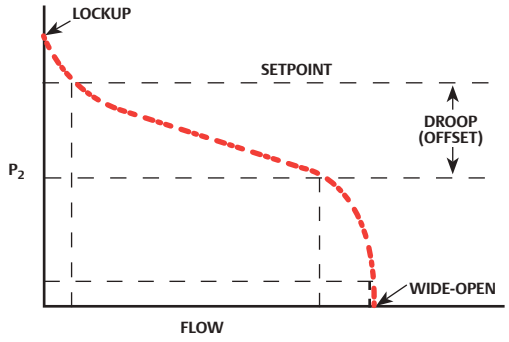


Figure 5. *Plug Travel*



AS THE FLOW RATE APPROACHES ZERO, P_2 INCREASES STEEPLY. LOCKUP IS THE TERM APPLIED TO THE VALUE OF P_2 AT ZERO FLOW.

Figure 6. *Typical Performance Curve*

$X = F_S \div K$
X = 90 lbs ÷ 100 lbs/in.
X = 0.9 in.

The spring, and therefore the disk, has moved down 1/10 in., allowing more flow to pass through the regulator body.

Regulator Operation and P_2

Now we see the irony in this regulator design. We recall that the purpose of an ideal regulator is to match downstream demand while keeping P_2 constant. But for this regulator design to increase flow, there must be a change in P_2.

Regulator Performance

We can check the performance of any regulating system by examining its characteristics. Most of these characteristics can be best described using pressure versus flow curves as shown in Figure 6.

Performance Criteria

We can plot the performance of an ideal regulator such that no matter how the demand changes, our regulator will match that demand (within its capacity limits) with no change in the downstream pressure (P_2). This straight line performance becomes the standard against which we can measure the performance of a real regulator.

Setpoint

The constant pressure desired is represented by the setpoint. But no regulator is ideal. The downward sloping line on the diagram represents pressure (P_2) plotted as a function of flow for an actual direct-operated regulator. The setpoint is determined by the initial compression of the regulator spring.

By adjusting the initial spring compression you change the spring loading force, so P_2 will be at a different value in order to balance the spring force. This establishes setpoint.

Droop

Droop, proportional band and offset are terms used to describe the phenomenon of P_2 dropping below setpoint as flow increases. Droop is the amount of deviation from setpoint at a given flow, expressed as a percentage of setpoint. This “droop” curve is important to a user because it indicates regulating (useful) capacity.

Capacity

Capacities published by regulator manufacturers are given for different amounts of droop. Let’s see why this is important.

Let’s say that for our original problem, with the regulator set at 10 psig, our process requires 200 SCFH (standard cubic feet per hour) with no more than a 1 psi drop in setpoint. We need to keep the pressure at or above 9 psig because we have a low limit safety switch set at 9 psig that will shut the system down if pressure falls below this point.

Figure 6 illustrates the performance of a regulator that can do the job. And, if we can allow the downstream pressure to drop below 9 psig, the regulator can allow even more flow.

The capacities of a regulator published by manufacturers are generally given for 10% droop and 20% droop. In our example, this would relate to flow at 9 psig and at 8 psig.

Accuracy

The accuracy of a regulator is determined by the amount of flow it can pass for a given amount of droop. The closer the regulator is to the ideal regulator curve (setpoint), the more accurate it is.

Lockup

Lockup is the pressure above setpoint that is required to shut the regulator off tight. In many regulators, the orifice has a knife edge while the disk is a soft material. Some extra pressure, P_2, is required to force the soft disk into the knife edge to make a tight seal. The amount of extra pressure required is lockup pressure. Lockup pressure may be important for a number of reasons. Consider the example above where a low pressure limit switch would shut down the system if P_2 fell below 9 psig. Now consider the same system with a high pressure safety cut out switch set a 10.5 psig. Because our regulator has a lockup pressure of 11 psig, the high limit switch will shut the system down before the regulator can establish tight shutoff. Obviously, we’ll want to select a regulator with a lower lockup pressure.

Spring Rate and Regulator Accuracy

Using our initial problem as an example, let's say we now need the regulator to flow 300 SCFH at a droop of 10% from our original setpoint of 10 psig. Ten percent of 10 psig = 1 psig, so P_2 cannot drop below 10 to 1 or 9 psi. Our present regulator would not be accurate enough. For our regulator to pass 300 SCFH, P_2 will have to drop to 8 psig or 20% droop.

Spring Rate and Droop

One way to make our regulator more accurate is to change to a lighter spring rate. To see how spring rate affects regulator accuracy, let's return to our original example. We first tried a spring with a rate of 100 lbs/in. Let's substitute one with a rate of 50 lbs/in. To keep the regulator in equilibrium, we'll have to initially adjust the spring to balance the 100 lbs force produced by P_2 acting on the diaphragm. Recall how we calculate spring force:

$$\mathbf{F_S = K\ (spring\ rate) \times X\ (compression)}$$

Knowing that F_S must equal 100 lbs and K = 50 lbs/in., we can solve for X or spring compression, with:

$$\mathbf{X = F_S \div K \text{ or } X = 2\ in.}$$

So, we must wind in 2 in. of initial spring compression to balance diaphragm force, F_D.

Effect on Plug Travel

We saw before that with a spring rate of 100 lbs/in., when P_2 dropped from 10 to 9 psig, the spring relaxed (and the valve disk traveled) 0.1 in. Now let's solve for the amount of disk travel with the lighter spring rate of 50 lbs/in. The force produced by the diaphragm is still 90 lbs.

$$\mathbf{F_D = P_2 \times A_D}$$

To maintain equilibrium, the spring must also produce a force of 90 lbs. Recall the formula that determines spring force:

$$\mathbf{F_S = (K)(X)}$$

Because we know F_S must equal 90 lbs and our spring rate (K) is 50 lbs/in., we can solve for compression (X) with:

$$\mathbf{X = F_S \div K}$$

$$\mathbf{X = 90\ lbs \div 50\ lbs/in.}$$

$$\mathbf{X = 1.8\ in.}$$

To establish setpoint, we originally compressed this spring 2 in. Now it has relaxed so that it is only compressed 1.8 in., a change of 0.2 in. So with a spring rate of 50 lbs/in., the regulator responded to a 1 psig drop in P_2 by opening twice as far as it did with a spring rate of 100 lbs/in. Therefore, our regulator is now more accurate because it has greater capacity for the same change in P_2. In other words, it has less droop or offset. Using this example, it is easy to see how capacity and accuracy are related and how they are related to spring rate.

Light Spring Rate

Experience has shown that choosing the lightest available spring rate will provide the most accuracy (least droop). For example, a spring with a range of 35 to 100 psig is more accurate than a spring with a range of 90 to 200 psig. If you want to set your regulator at 100 psig, the 35 to 100 psig spring will provide better accuracy.

Practical Limits

While a lighter spring can reduce droop and improve accuracy, using too light a spring can cause instability problems. Fortunately, most of the work in spring selection is done by regulator manufacturers. They determine spring rates that will provide good performance for a given regulator and publish these rates along with other sizing information.

Diaphragm Area and Regulator Accuracy

Diaphragm Area

Until this point, we have assumed the diaphragm area to be constant. In practice, the diaphragm area changes with travel. We're interested in this changing area because it has a major influence on accuracy and droop.

Diaphragms have convolutions in them so that they are flexible enough to move over a rated travel range. As they change position, they also change shape because of the pressure applied to them. Consider the example shown in Figure 7. As downstream pressure (P_2) drops, the diaphragm moves down. As it moves down, it changes shape and diaphragm area increases because the centers of the convolutions become further apart. The larger diaphragm area magnifies the effect of P_2 so even less P_2 is required to hold the diaphragm in place. This is called diaphragm effect. The result is decreased accuracy because incremental changes in P_2 do not result in corresponding changes in spring compression or disk position.

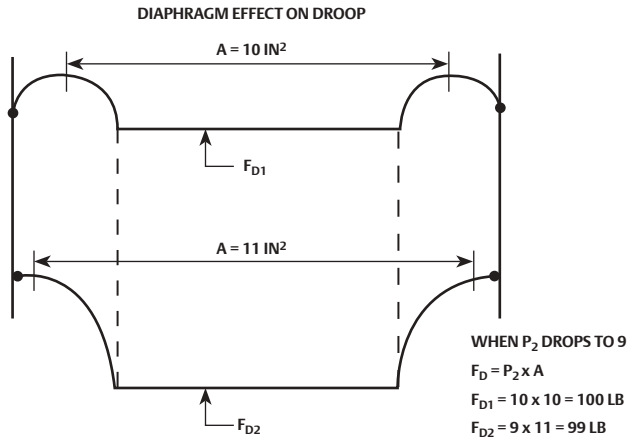


Figure 7. *Changing Diaphragm Area*

Increasing Diaphragm Area

To better understand the effects of changing diaphragm area, let's calculate the forces in the exaggerated example given in Figure 7. First, assume that the regulator is in equilibrium with a downstream pressure P_2 of 10 psig. Also assume that the area of the diaphragm in this position is 10 in^2. The diaphragm force (F_D) is:

$$F_D = (P_2)(A_D)$$
$$F_D = (10\ psi)\ (10\ in^2)$$
$$F_D = 100\ lbs$$

Now assume that downstream pressure drops to 9 psig signaling the need for increased flow. As the diaphragm moves, its area increases to 11 in^2. The diaphragm force now produced is:

$$F_D = (9\ psi)\ (11\ in^2)$$
$$F_D = 99\ lbs$$

The change in diaphragm area increases the regulator's droop. While it's important to note that diaphragm effect contributes to droop, diaphragm sizes are generally determined by manufacturers for different regulator types, so there is rarely a user option.

Diaphragm Size and Sensitivity

Also of interest is the fact that increasing diaphragm size can result in increased sensitivity. A larger diaphragm area will produce more force for a given change in P_2. Therefore, larger diaphragms are often used when measuring small changes in low-pressure applications. Service regulators used in domestic gas service are an example.

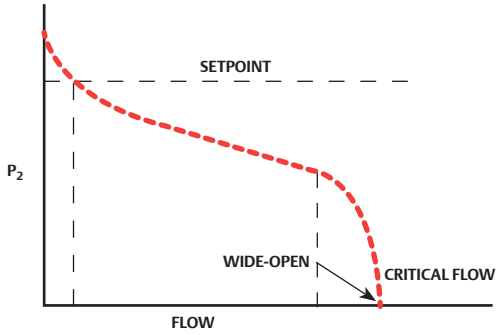


Figure 8. *Critical Flow*

Restricting Element and Regulator Performance

Critical Flow

Although changing the orifice size can increase capacity, a regulator can pass only so much flow for a given orifice size and inlet pressure, no matter how much we improve the unit's accuracy. Shown in Figure 8, after the regulator is wide-open, reducing P_2 does not result in higher flow. This area of the flow curve identifies critical flow. To increase the amount of flow through the regulator, the flowing fluid must pass at higher and higher velocities. But, the fluid can only go so fast. Holding P_1 constant while decreasing P_2, flow approaches a maximum which is the speed of sound in that particular gas or its sonic velocity. Sonic velocity depends on the inlet pressure and temperature for the flowing fluid. Critical flow is generally anticipated when downstream pressure (P_2) approaches a value that is less than or equal to one-half of inlet pressure (P_1).

Orifice Size and Capacity

One way to increase capacity is to increase the size of the orifice. The variable flow area between disk and orifice depends directly on orifice diameter. Therefore, the disk will not have to travel as far with a larger orifice to establish the required regulator flow rate and droop is reduced. Sonic velocity is still a limiting factor, but the flow rate at sonic velocity is greater because more gas is passing through the larger orifice.

Stated another way, a given change in P_2 will produce a larger change in flow rate with a larger orifice than it would with a smaller orifice. However, there are definite limits to the size of orifice that can be used. Too large an orifice makes the regulator more sensitive to fluctuating inlet pressures. If the regulator is overly sensitive, it will have a tendency to become unstable and cycle.

Principles of Direct-Operated Regulators

Orifice Size and Stability

One condition that results from an oversized orifice is known as the "bathtub stopper" effect. As the disk gets very close to the orifice, the forces of fluid flow tend to slam the disk into the orifice and shutoff flow. Downstream pressure drops and the disk opens. This causes the regulator to cycle—open, closed, open, closed. By selecting a smaller orifice, the disk will operate farther away from the orifice so the regulator will be more stable.

Orifice Size, Lockup and Wear

A larger orifice size also requires a higher shutoff pressure or lockup pressure. In addition, an oversized orifice usually produces faster wear on the valve disk and orifice because it controls flow with the disk near the seat. This wear is accelerated with high flow rates and when there is dirt or other erosive material in the flow stream.

Orifice Guideline

Experience indicates that using the smallest possible orifice is generally the best rule-of-thumb for proper control and stability.

Increasing P_1

Regulator capacity can be increased by increasing inlet pressure (P_1).

Factors Affecting Regulator Accuracy

As we have seen, the design elements of a regulator—the spring, diaphragm and orifice size—can affect its accuracy. Some of these inherent limits can be overcome with changes to the regulator design.

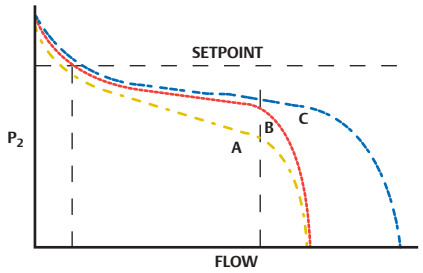


Figure 9. *Increased Sensitivity*

Performance Limits

The three curves in Figure 9 summarize the effects of spring rate, diaphragm area and orifice size on the shape of the controlled pressure-flow rate curve. Curve A is a reference curve representing a typical regulator. Curve B represents the improved performance from either increasing diaphragm area or decreasing spring rate. Curve C represents the effect of increasing orifice size. Note that increased orifice size also offers higher flow capabilities. But remember that too large an orifice size can produce problems that will negate any gains in capacity.

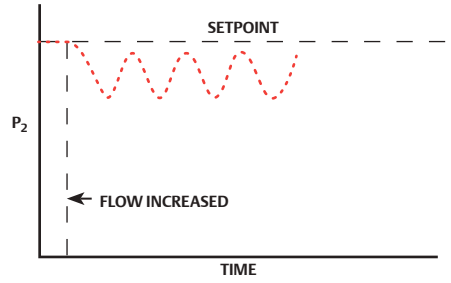


Figure 10. *Cycling*

Cycling

The sine wave in Figure 10 might be what we see if we increase regulator sensitivity beyond certain limits. The sine wave indicates instability and cycling.

Design Variations

All direct-operated regulators have performance limits that result from droop. Some regulators are available with features designed to overcome or minimize these limits.

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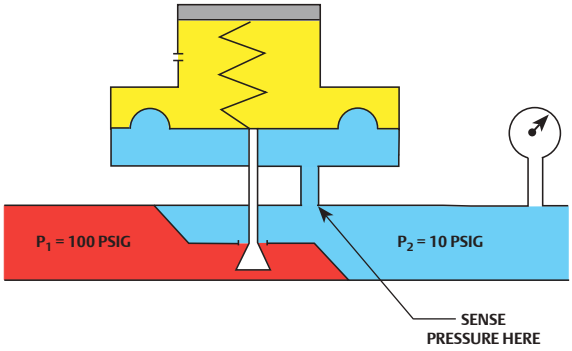


Figure 11. *Pitot Tube*

Improving Regulator Accuracy with a Pitot Tube

In addition to the changes we can make to diaphragm area, spring rate, orifice size and inlet pressure, we can also improve regulator accuracy by adding a pitot tube as shown in Figure 11. Internal to the regulator, the pitot tube connects the diaphragm casing with a low-pressure, high velocity region within the regulator body. The pressure at this area will be lower than P_2 further downstream. By using a pitot tube to measure the lower pressure, the regulator will make more dramatic changes in response to any change in P_2. In other words, the pitot tube tricks the regulator, causing it to respond more than it would otherwise.

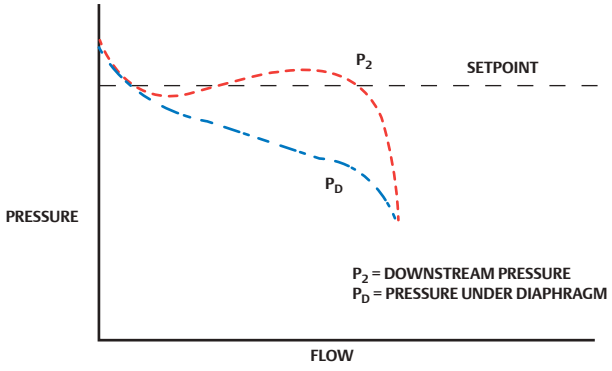


Figure 12. *Performance with Pitot Tube*

Numerical Example

For example, we'll establish setpoint by placing a gauge downstream and adjusting spring compression until the gauge reads 10 psig for P_2. Because of the pitot tube, the regulator might actually be sensing a lower pressure. When P_2 drops from 10 psig to 9 psig, the pressure sensed by the pitot tube may drop from 8 psig to 6 psig. Therefore, the regulator opens further than it would if it were sensing actual downstream pressure.

Decreased Droop (Boost)

The pitot tube offers one chief advantage for regulator accuracy, it decreases droop. Shown in Figure 12, the diaphragm pressure, P_D, must drop just as low with a pitot tube as without to move the disk far enough to supply the required flow. But the solid curve shows that P_2 does not decrease as much as it did without a pitot tube. In fact, P_2 may increase. This is called boost instead of droop. So the use of a pitot tube, or similar device, can dramatically improve droop characteristics of a regulator.

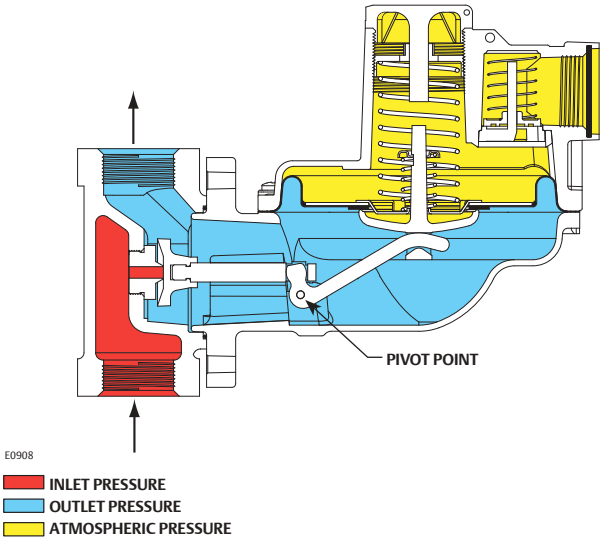


Figure 13. *Lever Style Regulator*

Improving Performance with a Lever

The lever style regulator is a variation of the simple direct-operated regulator. It operates in the same manner, except that it uses a lever to gain mechanical advantage and provide a high shutoff force.

In earlier discussions, we noted that the use of a larger diaphragm can result in increased sensitivity. This is because any change in P_2 will result in a larger change in diaphragm force. The same result is obtained by using a lever to multiply the force produced by the diaphragm as shown in Figure 13.

The main advantage of lever designs is that they provide increased force for lockup without the extra cost, size and weight associated with larger diaphragms, diaphragm casings and associated parts.

Principles of Pilot-Operated Regulators

Pilot-Operated Regulator Basics

In the evolution of pressure regulator designs, the shortcomings of the direct-operated regulator naturally led to attempts to improve accuracy and capacity. A logical next step in regulator design is to use what we know about regulator operation to explore a method of increasing sensitivity that will improve all of the performance criteria discussed.

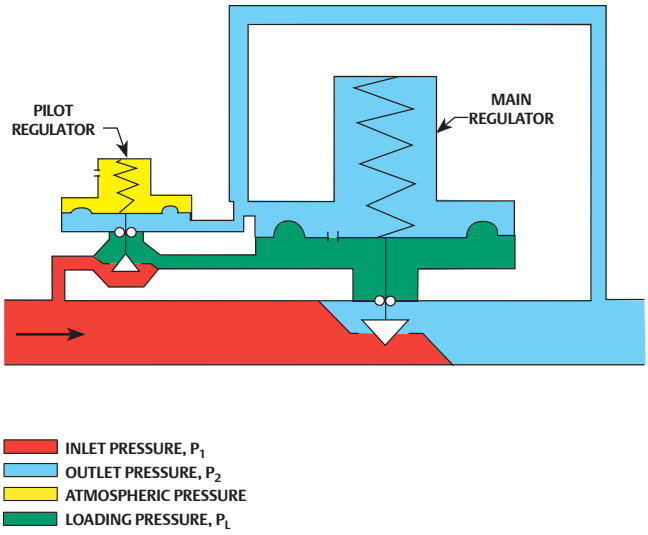


Figure 1. *Pilot-Operated Regulator*

Regulator Pilots

To improve the sensitivity of our regulator, we would like to be able to sense P_2 and then somehow make a change in loading pressure (P_L) that is greater than the change in P_2. To accomplish this, we can use a device called a pilot or pressure amplifier.

The major function of the pilot is to increase regulator sensitivity. If we can sense a change in P_2 and translate it into a larger change in P_L, our regulator will be more responsive (sensitive) to changes in demand. In addition, we can significantly reduce droop so its effect on accuracy and capacity is minimized.

Gain

The amount of amplification supplied by the pilot is called "gain". To illustrate, a pilot with a gain of 20 will multiply the effect of a 1 psi change on the main diaphragm by 20. For example, a decrease in P_2 opens the pilot to increase P_L 20 times as much.

Identifying Pilots

Analysis of pilot-operated regulators can be simplified by viewing them as two independent regulators connected together. The smaller of the two is generally the pilot.

Setpoint

We may think of the pilot as the "brain" of the system. Setpoint and many performance variables are determined by the pilot. It senses P_2 directly and will continue to make changes in P_L on the main regulator until the system is in equilibrium. The main regulator is the "muscle" of the system and may be used to control large flows and pressures.

Spring Action

Notice that the pilot uses a spring-open action as found in direct-operated regulators. The main regulator, shown in Figure 1, uses a spring-close action. The spring, rather than loading pressure, is used to achieve shutoff. Increasing P_L from the pilot onto the main diaphragm opens the main regulator.

Pilot Advantage

Because the pilot is the controlling device, many of the performance criteria we have discussed apply to the pilot. For example, droop is determined mainly by the pilot. By using very small pilot orifices and light springs, droop can be made small. Because of reduced droop, we will have greater usable capacity. Pilot lockup determines the lockup characteristics for the system. The main regulator spring provides tight shutoff whenever the pilot is locked up.

Gain and Restrictions

Stability

Although increased gain (sensitivity) is often considered an advantage, it also increases the gain of the entire pressure regulator system. If the system gain is too high, it may become unstable. In other words, the regulator might tend to oscillate; over-reacting by continuously opening and closing. Pilot gain can be modified to tune the regulator to the system. To provide a means for changing gain, every pilot-operated regulator system contains both a fixed and a variable restriction. The relative size of one restriction compared to the other can be varied to change gain and speed of response.

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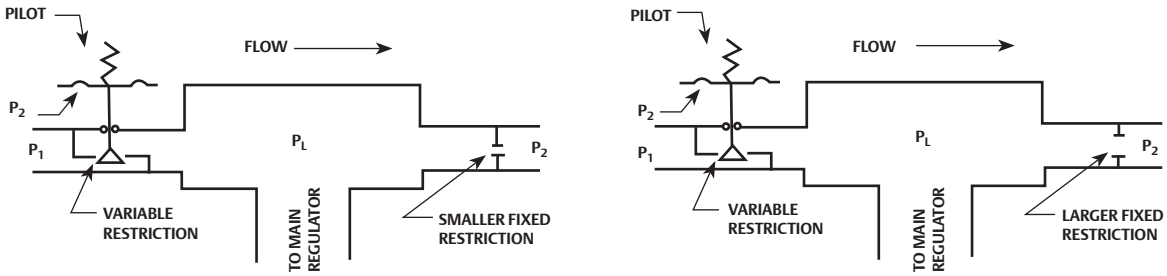


Figure 2. *Fixed Restrictions and Gain (Used on Two-Path Control Systems)*

Restrictions, Response Time and Gain

Consider the example shown in Figure 2 with a small fixed restriction. Decreasing P_2 will result in pressure P_L increasing. Increasing P_2 will result in a decrease in P_L while P_L bleeds out through the small fixed restriction.

If a larger fixed restriction is used with a variable restriction, the gain (sensitivity) is reduced. A larger decrease in P_2 is required to increase P_L to the desired level because of the larger fixed restriction.

Loading and Unloading Designs

A loading pilot-operated design (Figure 2), also called two-path control, is so named because the action of the pilot loads P_L onto the main regulator measuring element. The variable restriction or pilot orifice, opens to increase P_L.

An unloading pilot-operated design (Figure 3) is so named because the action of the pilot unloads P_L from the main regulator.

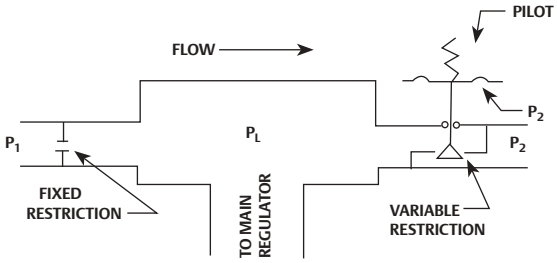


Figure 3. *Unloading Systems*

Two-Path Control (Loading Design)

In two-path control systems (Figure 4), the pilot is piped so that P_2 is registered on the pilot diaphragm and on the main regulator diaphragm at the same time. When downstream demand is constant, P_2 positions the pilot diaphragm so that flow through the pilot will keep P_2 and P_L on the main regulator diaphragm. When P_2 changes, the force on top of the main regulator diaphragm and on the bottom of the pilot diaphragm changes. As P_2 acts on the main diaphragm, it begins repositioning the main valve plug. This immediate reaction to changes in P_2 tends to make two-path designs faster than other pilot-operated regulators. Simultaneously, P_2 acting on the pilot diaphragm repositions the pilot valve

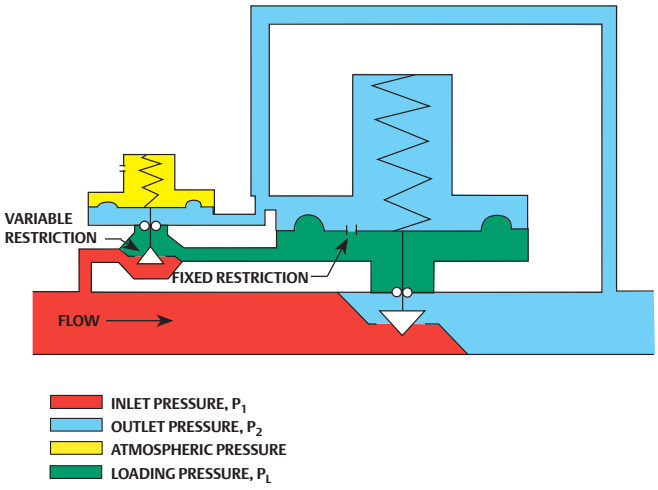


Figure 4. *Two-Path Control*

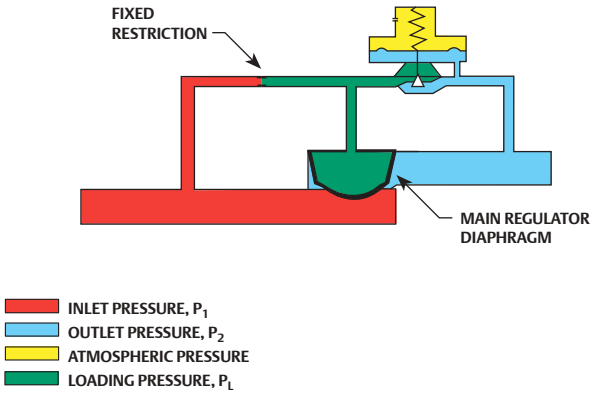


Figure 5. *Unloading Control*

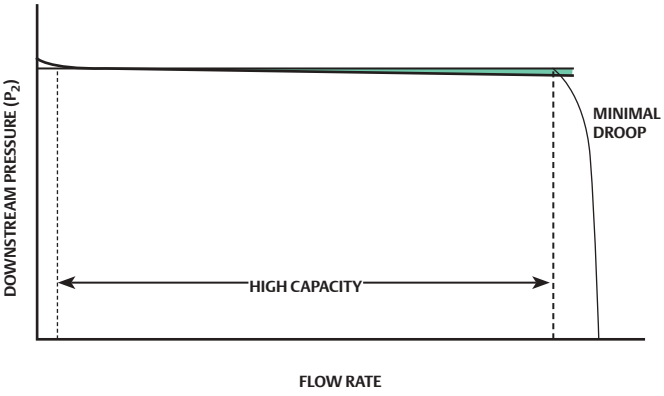


Figure 6. *Pilot-Operated Regulator Performance*

and changes P_L on the main regulator diaphragm. This adjustment to P_L accurately positions the main regulator valve plug. P_L on the main regulator diaphragm bleeds through a fixed restriction until the forces on both sides are in equilibrium. At that point, flow through the regulator valve matches the downstream demand.

Two-Path Control Advantages

The primary advantages of two-path control are speed and accuracy. These systems may limit droop to less than 1%. They are well suited to systems with requirements for high accuracy, large capacity and a wide range of pressures.

Unloading Control

Unloading systems (Figure 5) locate the pilot so that P_2 acts only on the pilot diaphragm. P_1 constantly loads under the regulator diaphragm and has access to the top of the diaphragm through a fixed restriction.

When downstream demand is constant, the pilot valve is open enough that P_L holds the position of the main regulator diaphragm. When downstream demand changes, P_2 changes and the pilot diaphragm reacts accordingly. The pilot valve adjusts P_L to reposition and hold the main regulator diaphragm.

Unloading Control Advantages

Unloading systems are not quite as fast as two-path systems and they can require higher differential pressures to operate. However, they are simple and more economical, especially in large regulators. Unloading control is used with popular elastomer diaphragm style regulators. These regulators use a flexible membrane to throttle flow.

Performance Summary

Accuracy

Because of their high gain, pilot-operated regulators are extremely accurate. Droop for a direct-operated regulator might be in the range of 10 to 20 % whereas pilot-operated regulators are between 1 and 3% with values under 1% possible.

Capacity

Pilot-operated designs provide high capacity for two reasons. First, we have shown that capacity is related to droop. And because droop can be made very small by using a pilot, capacity is increased. In addition, the pilot becomes the “brain” of the system and controls a larger, sometimes much larger, main regulator. This also allows increased flow capabilities.

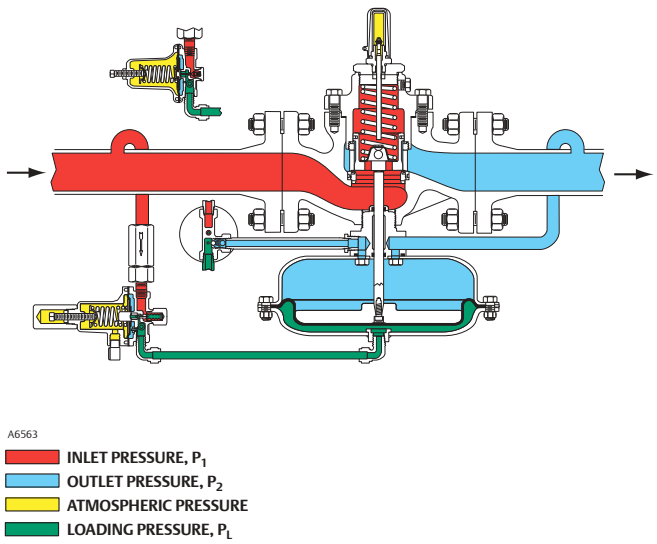


Figure 7. *Type 1098-EGR, Typical Two-Path Control*

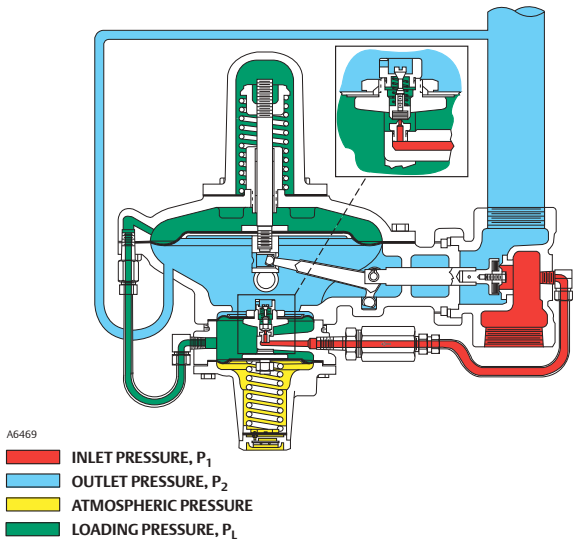


Figure 8. *Type 99, Typical Two-Path Control with Integrally Mounted Pilot*

Lockup

The lockup characteristics for a pilot-operated regulator are the lockup characteristics of the pilot. Therefore, with small orifices, lockup pressures can be small.

Applications

Pilot-operated regulators should be considered whenever accuracy, capacity and/or high pressure are important selection criteria. They can often be applied to high capacity services with greater economy than a control valve and actuator with controller.

Two-Path Control

In some designs (Figure 7), the pilot and main regulator are separate components. In others (Figure 8), the system is integrated into a single package. All, however, follow the basic design concepts discussed earlier.

Type 1098-EGR

The schematic in Figure 7 illustrates the Type 1098-EGR regulator's operation. It can be viewed as a model for all two-path, pilot-operated regulators. The pilot is simply a sensitive direct-operated regulator used to send loading pressure to the main regulator diaphragm.

Identify the inlet pressure (P_1). Find the downstream pressure (P_2). Follow it to where it opposes the loading pressure on the main regulator diaphragm. Then, trace P_2 back to where it opposes the control spring in the pilot. Finally, locate the route of P_2 between the pilot and the regulator diaphragm.

Changes in P_2 register on the pilot and main regulator diaphragms at the same time. As P_2 acts on the main diaphragm, it begins repositioning the main valve plug. Simultaneously, P_2 acting on the pilot diaphragm repositions the pilot valve and changes P_L on the main regulator diaphragm. This adjustment in P_L accurately positions the main regulator valve plug.

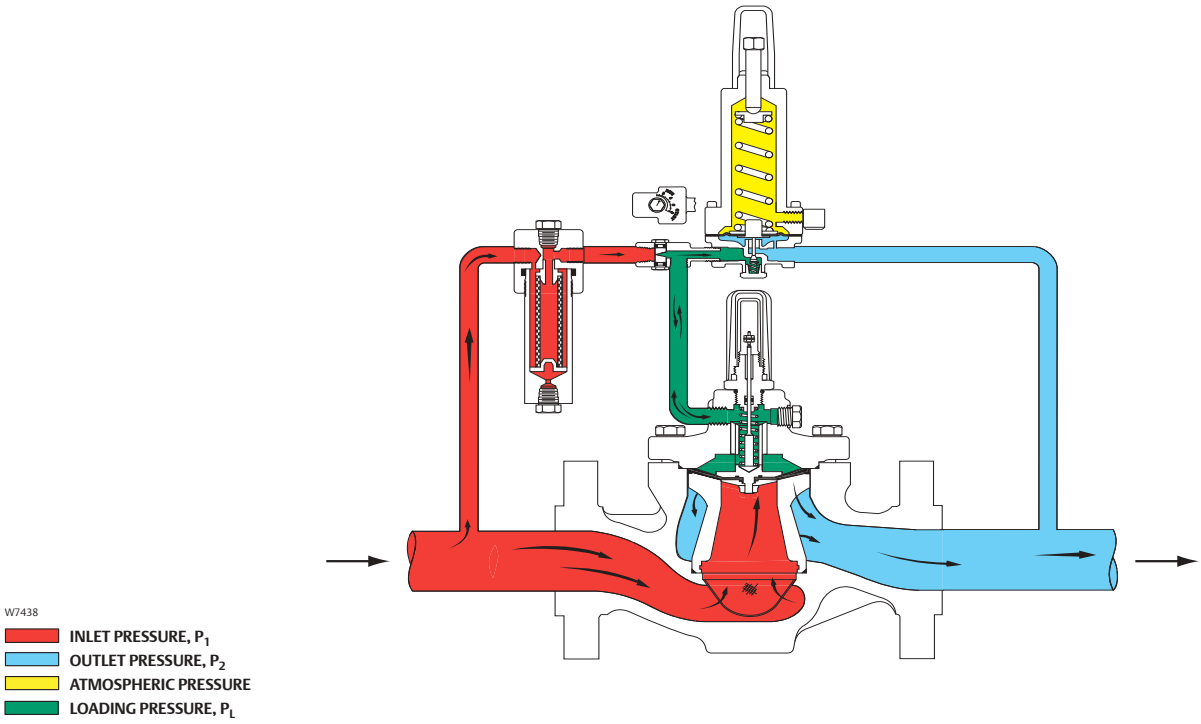


Figure 9. *Type EZR, Unloading Design*

As downstream demand is met, P_2 rises. Because P_2 acts directly on both the pilot and main regulator diaphragms, this design provides fast response.

Type 99

The schematic in Figure 8 illustrates another typical two-path control design, the Type 99. The difference between the Type 1098-EGR and the Type 99 is the integrally mounted pilot of the Type 99.

The pilot diaphragm measures P_2. When P_2 falls below the pilot setpoint, the diaphragm moves away from the pilot orifice and allows loading pressure to increase. This loads the top of the main regulator diaphragm and strokes the main regulator valve open further.

Unloading Design

Unloading designs incorporate a molded composition diaphragm that serves as the combined loading and restricting component of the main regulator. Full upstream pressure (P_1) is used to load the regulator diaphragm when it is seated. The regulator shown in Figure 9 incorporates an elastomeric valve closure member.

Unloading regulator designs are slower than two-path control systems because the pilot must first react to changes in P_2 before the main regulator valve moves. Recall that in two-path designs, the pilot and main regulator diaphragms react simultaneously.

P_1 passes through a fixed restriction and fills the space above the regulator diaphragm. This fixed restriction can be adjusted to increase or decrease regulator gain. P_1 also fills the cavity below the regulator diaphragm. Because the surface area on the top side of the diaphragm is larger than the area exposed to P_1 below, the diaphragm is forced down against the cage to close the regulator.

When downstream demand increases, the pilot opens. When the pilot opens, regulator loading pressure escapes downstream much faster than P_1 can bleed through the fixed restriction. As pressure above the regulator diaphragm decreases, P_1 forces the diaphragm away from its seat.

When downstream demand is reduced, P_2 increases until it's high enough to compress the pilot spring and close the pilot valve. As the pilot valve closes, P_1 continues to pass through the fixed restriction and flows into the area above the main regulator diaphragm. This loading pressure, P_L, forces the diaphragm back toward the cage, reducing flow through the regulator.

Selecting and Sizing Pressure Reducing Regulators

Introduction

Those who are new to the regulator selection and sizing process are often overwhelmed by the sheer number of regulator types available and the seemingly endless lists of specifications in manufacturer's literature. This application guide is designed to assist you in selecting a regulator that fits your application's specific needs.

Although it might seem obvious, the first step is to consider the application itself. Some applications immediately point to a group of regulators designed specifically for that type of service. The Application Guide has sections to help identify regulators that are designed for specific applications. There are Application Maps, Quick Selection Guides, an Applications section and Product Pages. The Application Map shows some of the common applications and the regulators that are used in those applications. The Quick Selection Guide lists the regulators by application and provides important selection information about each regulator. The Applications section explains the applications covered in the section and it also explains many of the application considerations. The Product Pages provide specific details about the regulators that are suitable for the applications covered in the section. To begin selecting a regulator, turn to the Quick Selection Guide in the appropriate Applications section.

Quick Selection Guides

Quick Selection Guides identify the regulators with the appropriate pressure ratings, outlet pressure ranges and capacities. These guides quickly narrow the range of potentially appropriate regulators. The choices identified by using a Quick Selection Guide can be narrowed further by using the Product Pages to find more information about each of the regulators.

Product Pages

Identifying the regulators that can pass the required flow narrows the possible choices further. When evaluating flow requirements, consider the minimum inlet pressure and maximum flow requirements. Again, this worst case combination ensures that the regulator can pass the required flow under all anticipated conditions.

After one or more regulators have been identified as potentially suitable for the service conditions, consult specific Product Pages to check regulator specifications and capabilities. The application requirements are compared to regulator specifications to narrow the range of appropriate selections. The following specifications can be evaluated in the Product Pages:

- Product description and available sizes
- Maximum inlet and outlet pressures (operating and emergency)
- Outlet pressure ranges
- Flow capacity
- End connection styles
- Regulator construction materials
- Accuracy
- Pressure registration (internal or external)
- Temperature capabilities

After comparing the regulator capabilities with the application requirements, the choices can be narrowed to one or a few regulators. Final selection might depend upon other factors including special requirements, availability, price and individual preference.

Special Requirements

Finally, evaluate any special considerations, such as the need for external control lines, special construction materials or internal overpressure protection. Although overpressure protection might be considered during sizing and selection, it is not covered in this section.

The Role of Experience

Experience in the form of knowing what has worked in the past and familiarity with specific products, has great value in regulator sizing and selection. Knowing the regulator performance characteristics required for a specific application simplifies the process. For example, when fast speed of response is required, a direct-operated regulator may come to mind; or a pilot-operated regulator with an auxiliary, large capacity pilot to speed changes in loading pressure.

Sizing Equations

Sizing equations are useful when sizing pilot-operated regulators and relief valves. They can also be used to calculate the wide-open flow of direct-operated regulators. Use the capacity tables or curves in this application guide when sizing direct-operated regulators and relief/backpressure regulators. The sizing equations are in the Valve Sizing Calculations section.

Selecting and Sizing Pressure Reducing Regulators

General Sizing Guidelines

The following are intended to serve only as guidelines when sizing pressure reducing regulators. When sizing any regulator, consult with experienced personnel or the regulator manufacturer for additional guidance and information relating to specific applications.

Body Size

Regulator body size should never be larger than the pipe size. However, a properly sized regulator may be smaller than the pipeline.

Construction

Be certain that the regulator is available in materials that are compatible with the controlled fluid and the temperatures used. Also, be sure that the regulator is available with the desired end connections.

Pressure Ratings

While regulators are sized using minimum inlet pressures to ensure that they can provide full capacity under all conditions, pay particular attention to the maximum inlet and outlet pressure ratings.

Wide-Open Flow Rate

The capacity of a regulator when it has failed wide-open is usually greater than the regulating capacity. For that reason, use the regulating capacities when sizing regulators and the wide-open flow rates only when sizing relief valves.

Outlet Pressure Ranges and Springs

If two or more available springs have published outlet pressure ranges that include the desired pressure setting, use the spring with the lower range for better accuracy. Also, it is not necessary to attempt to stay in the middle of a spring range, it is acceptable to use the full published outlet pressure range without sacrificing spring performance or life.

Accuracy

Of course, the need for accuracy must be evaluated. Accuracy is generally expressed as droop or the reduction of outlet pressure experienced as the flow rate increases. It is stated in percent, in. w.c. or lbs/in^2. It indicates the difference between the outlet pressure at low flow rates and the outlet pressure at the published maximum flow rate. Droop is also called offset or proportional band.

Inlet Pressure Losses

The regulator inlet pressure used for sizing should be measured directly at the regulator inlet. Measurements made at any distance upstream from the regulator are suspect because line loss can significantly reduce the actual inlet pressure to the regulator. If the regulator inlet pressure is given as a system pressure upstream, some compensation should be considered. Also, remember that downstream pressure always changes to some extent when inlet pressure changes.

Orifice Diameter

The recommended selection for orifice size is the smallest diameter that will handle the flow. This can benefit operation in several ways: instability and premature wear might be avoided, relief valves may be smaller and lockup pressures may be reduced.

Speed of Response

Direct-operated regulators generally have faster response to quick flow changes than pilot-operated regulators.

Turn-Down Ratio

Within reasonable limits, most soft-seated regulators can maintain pressure down to zero flow. Therefore, a regulator sized for a high flow rate will usually have a turndown ratio sufficient to handle pilot-light sized loads during periods of low demand.

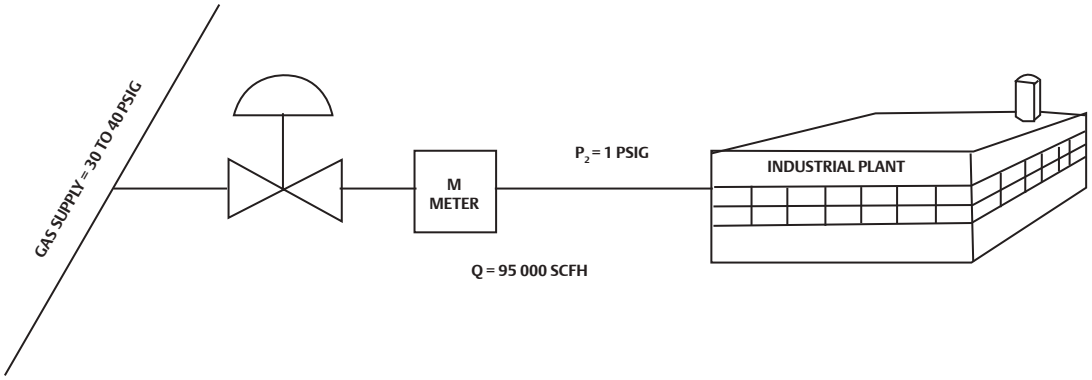


Figure 1. *Natural Gas Supply*

Sizing Exercise: Industrial Plant Gas Supply

Regulator selection and sizing generally requires some subjective evaluation and decision making. For those with little experience, the best way to learn is through example. Therefore, these exercises present selection and sizing problems for practicing the process of identifying suitable regulators.

Our task is to select a regulator to supply reduced pressure natural gas to meet the needs of a small industrial plant. The regulated gas is metered before entering the plant. The selection parameters are:

- Minimum inlet pressure, P_{1min} = 30 psig
- Maximum inlet pressure, P_{1max} = 40 psig
- Outlet pressure setting, P_2 = 1 psig
- Flow, Q = 95 000 SCFH
- Accuracy (droop required) = 10% or less

Quick Selection Guide

Turn to the Commercial/Industrial Quick Selection Guide. From the Quick Selection Guide, we find that the choices are:

- Type 133
- Type 1098-EGR

Product Pages

Under the product number on the Quick Selection Guide is the page number of the product page. Look at the flow capacities of each of the possible choices. From the product pages we found the following:

- At 30 psig inlet pressure and 10% droop, the Type 133 has a flow capacity of 90,000 SCFH. This regulator does not meet the required flow capacity.
- At 30 psig inlet pressure, the Type 1098-EGR has a flow capacity of 131,000 SCFH. By looking at the Proportional Band (Droop) table, we see that the Type 6352 pilot with the yellow pilot spring and the green main valve has 0.05 psig droop. This regulator meets the selection criteria.

Final Selection

We find that the Type 1098-EGR meets the selection criteria.

Overpressure Protection Methods

Overpressure protective devices are of vital concern. Safety codes and current laws require their installation each time a pressure reducing station is installed that supplies gas from any system to another system with a lower maximum allowable operating pressure.

Methods of Overpressure Protection

The most commonly used methods of overpressure protection, not necessarily in order of use or importance, include:

- Relief Valves (Figure 1)
- Monitors (Figures 2 and 3)
- Series Regulation (Figure 4)
- Shutoff (Figure 5)
- Relief Monitor (Figure 6)

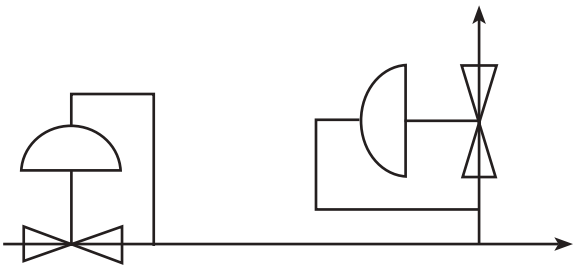


Figure 1. *Relief Valve Schematic*

Relief Valves

A relief valve is a device that vents process fluid to atmosphere to maintain the pressure downstream of the regulator below the safe maximum pressure. Relief is a common form of overpressure protection typically used for low to medium capacity applications. (Note: Fisher™ relief valves are not ASME safety relief valves.)

Types of Relief Valves

The basic types of relief valves are:

- Pop type
- Direct-operated relief valves
- Pilot-operated relief valves
- Internal relief valves

The pop type relief valve is the simplest form of relief. Pop relief valves tend to go wide-open once the pressure has exceeded its setpoint by a small margin. The setpoint can drift over time and because of its quick opening characteristic the pop relief can sometimes become unstable when relieving, slamming open and closed. Many have a non-adjustable setpoint that is set and pinned at the factory.

If more accuracy is required from a relief valve, the direct-operated relief valve would be the next choice. They can throttle better than a pop relief valve and tend to be more stable, yet are still relatively simple. Although there is less drift in the setpoint of the direct-operated relief valve, a significant amount of build-up is often required to obtain the required capacity.

The pilot-operated relief valves have the most accuracy, but are also the most complicated and expensive type of relief. They use a pilot to dump loading pressure, fully stroking the main valve with very little build-up above setpoint. They have a large capacity and are available in larger sizes than other types of relief.

Many times, internal relief will provide adequate protection for a downstream system. Internal relief uses a relief valve built into the regulator for protection. If the pressure builds too far above the setpoint of the regulator, the relief valve in the regulator opens up, allowing excess pressure to escape through the regulator vent.

Advantages

The relief valve is considered to be the most reliable type of overpressure protection because it is not subject to blockage by foreign objects in the line during normal operations. It also imposes no decrease in the regulator capacity which it is protecting and it has the added advantage of being its own alarm when it vents. It is normally reasonable in cost and keeps the customer in service despite the malfunction of the pressure reducing valve.

Disadvantages

When the relief valve blows, it could possibly create a hazard in the surrounding area by venting. The relief valve must be sized carefully to relieve the gas or fluid that could flow through the pressure reducing valve at its maximum inlet pressure and in the wide-open position, assuming no flow to the downstream. Therefore, each application must be sized individually. The requirement for periodic testing of relief valves also creates an operational and/or public relations problem.

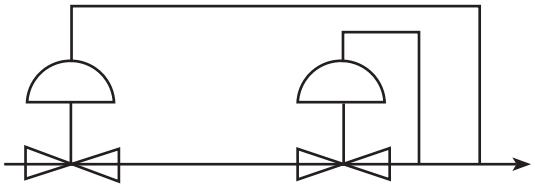


Figure 2. *Monitoring Regulators Schematic*

Monitoring Regulators

Monitoring is overpressure control by containment. When the working pressure reducing valve ceases to control the pressure, a second regulator installed in series, which has been sensing the downstream pressure, goes into operation to maintain the downstream pressure at a slightly higher than normal pressure. The monitoring concept is gaining in popularity, especially in low-pressure systems, because very accurate relay pilots permit reasonably close settings of the working and monitoring regulators.

The two types of wide-open monitoring are upstream and downstream monitoring. One question often asked is, "Which is better, upstream or downstream monitoring?" Using two identical regulators, there is no difference in overall capacity with either method.

When using monitors to protect a system or customer who may at times have zero load, a small relief valve is sometimes installed downstream of the monitor system with a setpoint just above the monitor. This allows for a token relief in case dust or dirt in the system prevents bubble tight shutoff of the regulators.

Advantages

The major advantage is that there is no venting to atmosphere. During an overpressure situation, monitoring keeps the customer on line and keeps the downstream pressure relatively close to the setpoint of the working regulator. Testing is relatively easy and safe. To perform a periodic test on a monitor, increase the outlet set pressure of the working device and watch the pressure to determine if the monitor takes over.

Disadvantages

Compared to relief valves, monitoring generally requires a higher initial investment. Monitoring regulators are subject to blocking, which is why filters or strainers are specified with increasing frequency. Because the monitor is in series, it is an added restriction in the line. This extra restriction can sometimes force one to use a larger, more expensive working regulator.

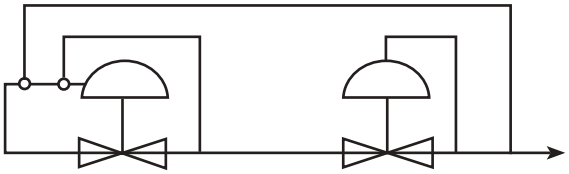


Figure 3. *Working Monitor Schematic*

Working Monitor

A variation of monitoring overpressure protection that overcomes some of the disadvantages of a wide-open monitor is the "working monitor" concept wherein a regulator upstream of the working regulator uses two pilots. This additional pilot permits the monitoring regulator to act as a series regulator to control an intermediate pressure during normal operation. In this way, both units are always operating and can be easily checked for proper operation. Should the downstream pressure regulator fail to control, however, the monitoring pilot takes over the control at a slightly higher than normal pressure and keeps the customer on line. This is pressure control by containment and eliminates public relations problems.

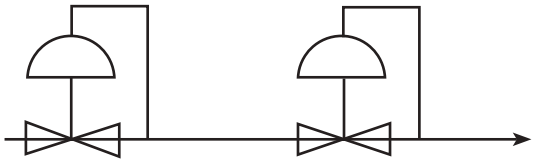


Figure 4. *Series Regulation Schematic*

Series Regulation

Series regulation is also overpressure protection by containment in that two regulators are set in the same pipeline. The first unit maintains an inlet pressure to the second valve that is within the maximum allowable operating pressure of the downstream system. Under this setup, if either regulator should fail, the resulting downstream pressure maintained by the other regulator would not exceed the safe maximum pressure.

This type of protection is normally used where the regulator station is reducing gas to a pressure substantially below the maximum allowable operating pressure of the distribution system being supplied. Series regulation is also found frequently in farm taps and in similar situations within the guidelines mentioned above.

Advantages

Again, nothing is vented to atmosphere.

Disadvantages

Because the intermediate pressure must be cut down to a pressure that is safe for the entire downstream, the second-stage regulator often has very little pressure differential available to create flow. This can sometimes make it necessary to increase the size of the second regulator significantly. Another drawback occurs when the first-stage regulator fails and no change in the final downstream pressure is noticed because the system operates in what appears to be a "normal" manner without benefit of protection. Also, the first-stage regulator and intermediate piping must be capable of withstanding and containing maximum upstream pressure.

The second-stage regulator must also be capable of handling the full inlet pressure in case the first-stage unit fails to operate. In case the second-stage regulator fails, its actuator will be subjected to the intermediate pressure set by the first-stage unit. The second-stage actuator pressure ratings should reflect this possibility.

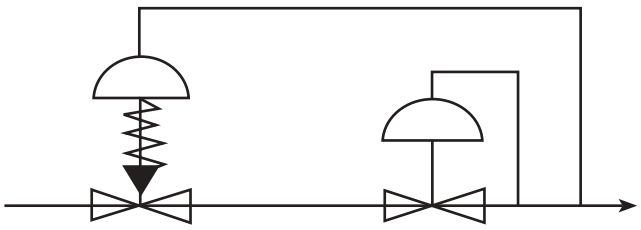


Figure 5. *Shutoff Schematic*

Shutoff Devices

The shutoff device also accomplishes overpressure protection by containment. In this case, the customer is shutoff completely until the cause of the malfunction is determined and the device is manually reset. Many gas distribution companies use this as an added measure of protection for places of public assembly such as schools, hospitals, churches and shopping centers. In those cases, the shutoff device is a secondary form of overpressure protection. Shutoff valves are also commonly used by boiler manufacturers in combustion systems.

Advantages

By shutting off the customer completely, the safety of the downstream system is assured. Again, there is no public relations problem or hazard from venting gas or other media.

Disadvantages

The customer may be shutoff because debris has temporarily lodged under the seat of the operating regulator, preventing tight shutoff. A small relief valve can take care of this situation.

On a distribution system with a single supply, using a slam-shut can require two trips to each customer, the first to shutoff the service valve and the second visit after the system pressure has been restored to turn the service valve back on and re-light the appliances. In the event a shutoff is employed on a service line supplying a customer with processes such as baking, melting metals or glass making, the potential economic loss could dictate the use of an overpressure protection device that would keep the customer online.

Another problem associated with shutoffs is encountered when the gas warms up under no-load conditions. For instance, a regulator locked up at approximately 7 in. w.c. could experience a pressure rise of approximately 0.8 in. w.c. per degree Fahrenheit rise, which could cause the high-pressure shutoff to trip when there is actually no equipment failure.

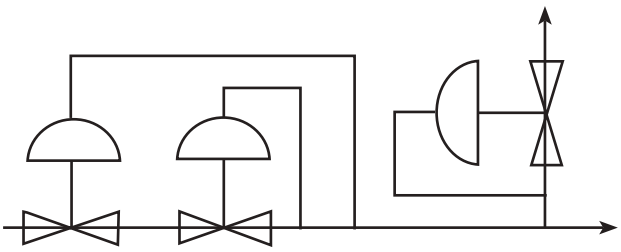


Figure 6. *Relief Monitor Schematic*

Relief Monitor

Another concept in overpressure protection for small industrial and commercial loads, up to approximately 10,000 ft^3/hr, incorporates both an internal relief valve and a monitor. In this device, the relief capacity is purposely restricted to prevent excess venting of gas in order to bring the monitor into operation more quickly. The net result is that the downstream pressure is protected, in some cases to less than 1 psig. The amount of gas vented under maximum inlet pressure conditions does not exceed the amount vented by a domestic relief type service regulator.

TYPES OF OVERPRESSURE PROTECTION

PERFORMANCE QUESTIONS	RELIEF	WORKING MONITOR	MONITOR	SERIES REGULATION	SHUTOFF	RELIEF MONITOR
Keeps application online?	Yes	Yes	Yes	Yes	No	Yes
Venting to atmosphere?	Yes	No	No	No	No	Minor
Manual resetting required after operation?	No	No	No	No	Yes	No
Reduces capacity of regulator?	No	Yes	Yes	Yes	No	No
Constantly working during normal operation?	No	Yes	No	Yes	No	Yes
Demands "emergency" action?	Yes	No	No	No	Yes	Maybe
Will surveillance of pressure charts indicate partial loss of performance of overpressure devices?	No	Yes	Maybe	Yes	No	No
Will surveillance of pressure charts indicate regulator has failed and safety device is in control?	Yes	Yes	Yes	Yes	Yes	Yes

With this concept, the limitation by regulator manufacturers of inlet pressure by orifice size, as is found in "full relief" devices, is overcome. Downstream protection is maintained, even with abnormally high inlet pressure. Public relations problems are kept to a minimum by the small amount of vented gas. Also, the unit does not require manual resetting, but can go back into operation automatically.

Dust or dirt can clear itself off the seat, but if the obstruction to the disk closing still exists when the load goes on, the customer would be kept online. When the load goes off, the downstream pressure will again be protected. During normal operation, the monitoring portion of the relief monitor is designed to move slightly with minor fluctuations in downstream pressure or flow.

Summary

From the foregoing discussion, it becomes obvious that there are many design philosophies available and many choices of equipment to meet overpressure protection requirements.

Also, assume the overpressure device will be called upon to operate sometime after it is installed. The overall design must include an analysis of the conditions created when the protection device operates.

The accompanying table shows:

- What happens when the various types of overpressure protection devices operate
- The type of reaction required
- The effect upon the customer or the public
- Some technical conditions

These are the general characteristics of the various types of safety devices. From the conditions and results shown, it is easier to decide which type of overpressure equipment best meets your needs. Undoubtedly, compromises will have to be made between the conditions shown here and any others which may govern your operating parameters.

Principles of Relief Valves

Overpressure Protection

Overpressure protection is a primary consideration in the design of any piping system. The objective of overpressure protection is to maintain the pressure downstream of a regulator at a safe maximum value.

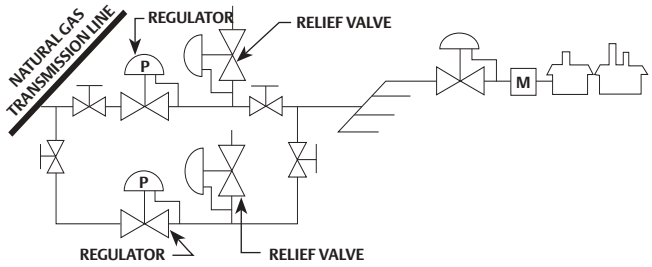


Figure 1. *Distribution System*

In the system shown in Figure 1, a high-pressure transmission system delivers natural gas through a pressure reducing regulator to a lower pressure system that distributes gas to individual customers. The regulators, the piping and the devices that consume gas are protected from overpressure by relief valves. The relief valve's setpoint is adjusted to a level established by the lowest maximum pressure rating of any of the lower pressure system components.

Maximum Pressure Considerations

Overpressure occurs when the pressure of a system is above the setpoint of the device controlling its pressure. It is evidence of some failure in the system (often the upstream regulator) and it can cause the entire system to fail if it's not limited. To implement overpressure protection, the weakest part in the pressure system is identified and measures are taken to limit overpressure to that component's maximum pressure rating. The most vulnerable components are identified by examining the maximum pressure ratings of the:

- Downstream equipment
- Low-pressure side of the main regulator
- Piping

The lowest maximum pressure rating of the three is the maximum allowable pressure.

Downstream Equipment

The downstream component (appliance, burner, boiler, etc.) with the lowest maximum pressure rating sets the highest pressure that all the downstream equipment can be subjected to.

Main Regulator

Pressure reducing regulators have different pressure ratings which refer to the inlet, outlet and internal components. The lowest of these should be used when determining the maximum allowable pressure.

Piping

Piping is limited in its ability to contain pressure. In addition to any physical limitations, some applications must also conform to one or more applicable pressure rating codes or regulations.

Relief Valves

Relief involves maintaining the pressure downstream of a regulator at a safe maximum pressure using any device that vents fluid to a lower pressure system (often the atmosphere). Relief valve exhaust must be directed or piped to a safe location. Relief valves perform this function. They are considered to be one of the most reliable types of overpressure protection available and are available in a number of different types. Fisher™ relief valves are not ASME safety relief valves.


W1921

H200 SERIES POP TYPE


W1870

TYPE 289 DIRECT-OPERATED


W3167

TYPE 289P-6358 PILOT-OPERATED


W4793

TYPE 627 WITH INTERNAL RELIEF

Figure 2. *Types of Relief Valves*

Relief Valve Popularity

Relief valves are popular for several reasons. They do not block the normal flow through a line. They do not decrease the capacities of the regulators they protect. And, they have the added advantage of being an alarm if they vent to atmosphere.

Relief Valve Types

Relief valves are available in four general types. These include: pop type, direct-operated, pilot-operated and internal relief valves.

Selection Criteria

Pressure Build-up

A relief valve has a setpoint at which it begins to open. For the valve to fully open and pass the maximum flow, pressure must build up to some level above the setpoint of the relief valve. This is known as pressure build-up over setpoint or simply build-up.

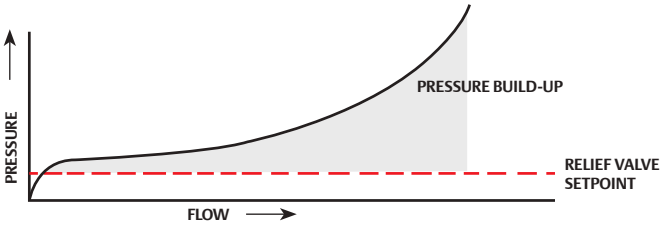


Figure 3. *Pressure Build-up*

Periodic Maintenance

A relief valve installed in a system that normally performs within design limits is very seldom exercised. The relief valve sits and waits for a failure. If it sits for long periods it may not perform as expected. Disks may stick in seats, setpoints can shift over time and small passages can become clogged with pipeline debris. Therefore, periodic maintenance and inspection is recommended. Maintenance requirements might influence the selection of a relief valve.

Cost Versus Performance

Given several types of relief valves to choose from, selecting one type is generally based on the ability of the valve to provide adequate protection at the most economical cost. Reduced pressure build-up and increased capacity generally come at an increased price.

Installation and Maintenance Considerations

Initial costs are only a part of the overall cost of ownership. Maintenance and installation costs must also be considered over the life of the relief valve. For example, internal relief might be initially more economical than an external relief valve. However, maintaining a regulator with internal relief requires that the system be shut down and the regulator isolated. This may involve additional time and the installation of parallel regulators and relief valves if flow is to be maintained to the downstream system during maintenance operations.

Pop Type Relief Valve

The most simple type of relief valve is the pop type. They are used wherever economy is the primary concern and some setpoint drift is acceptable.

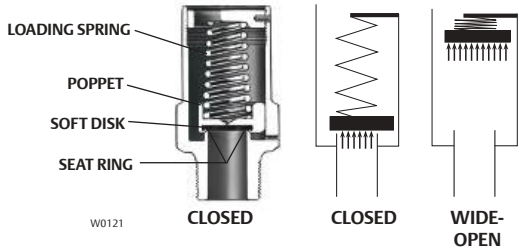


Figure 4. *Pop Type Relief Valve Construction and Operation*

Operation

Pop type relief valves are essentially on-off devices. They operate in either the closed or wide-open position. Pop type designs register pressure directly on a spring-opposed poppet. The poppet assembly includes a soft disk for tight shutoff against the seat ring. When the inlet pressure increases above setpoint, the poppet assembly is pushed away from the seat. As the poppet rises, pressure registers against a greater surface area of the poppet. This dramatically increases the force on the poppet. Therefore, the poppet tends to travel to the fully open position reducing pressure build-up.

Build-up Over Setpoint

Recall that pressure build-up relates capacity to pressure; increasing capacity requires some increase in pressure. In throttling relief valves, pressure build-up is related to accuracy. In pop type relief valves, build-up over setpoint results largely because the device is a restriction to flow rather than the spring rate of the valve's loading spring.

Fixed Setpoint

The setpoint of a pop type valve cannot be adjusted by the user. The spring is initially loaded by the manufacturer. A pinned spring retainer keeps the spring in position. This is a safety measure that prevents tampering with the relief valve setpoint.

Typical Applications

This type of relief valve may be used where venting to the atmosphere is acceptable, when the process fluid is compatible with the soft disk and when relief pressure variations are allowable. They are often used as inexpensive token relief. For example, they may be used simply to provide an audible signal of an overpressure condition.

These relief valves may be used to protect against overpressure stemming from a regulator with a minimal amount of seat leakage. Unchecked, this seat leakage could allow downstream pressure to build to full P_1 over time. The use of a small pop type valve can be installed to protect against this situation.

These relief valves are also commonly installed with a regulator in a natural gas system farm tap, in pneumatic lines used to operate air drills, jackhammers and other pneumatic equipment and in many other applications.

Advantages

Pop type relief valves use few parts. Their small size allows installation where space is limited. Also, low initial cost, easy installation and high capacity per dollar invested can result in economical system relief.

Disadvantages

The setpoint of a pop type relief valve may change over time. The soft disk may stick to the seat ring and cause the pop pressure to increase.

As an on-off device, this style of relief valve does not throttle flow over a pressure range. Because of its on-off nature, this type of relief valve may create pressure surges in the downstream system.

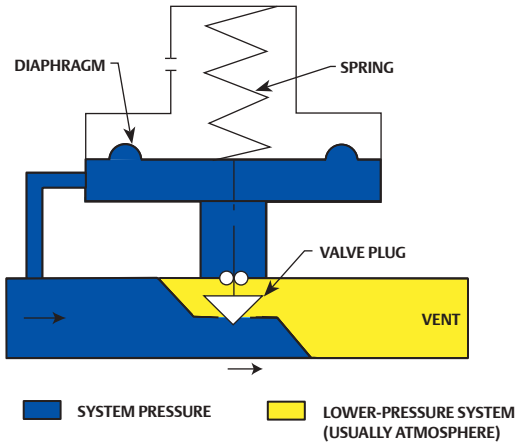


Figure 5. *Direct-Operated Relief Valve Schematic*

If the relief valve capacity is significantly larger than the failed regulator's capacity, the relief valve may over-compensate each time it opens and closes. This can cause the downstream pressure system to become unstable and cycle. Cycling can damage the relief valve and downstream equipment.

Direct-Operated Relief Valves

Compared to pop type relief valves, direct-operated relief valves provide throttling action and may require less pressure build-up to open the relief valve.

Operation

A schematic of a direct-operated relief valve is shown in Figure 5. It looks like an ordinary direct-operated regulator except that it senses upstream pressure rather than downstream pressure. And, it uses a spring-close rather than a spring-open action. It contains the same essential elements as a direct-operated regulator:

- A diaphragm that measures system pressure
- A spring that provides the initial load to the diaphragm and is used to establish the relief setpoint
- A valve that throttles the relief flow

Opening the Valve

As the inlet pressure rises above the setpoint of the relief valve, the diaphragm is pushed upward moving the valve plug away from the seat. This allows fluid to escape.

Pressure Build-up Over Setpoint

As system pressure increases, the relief valve opens wider. This allows more fluid to escape and protects the system. The increase in pressure above the relief setpoint that is required to produce more flow through the relief valve is referred to as pressure build-up. The spring rate and orifice size influence the amount of pressure build-up that is required to fully stroke the valve.

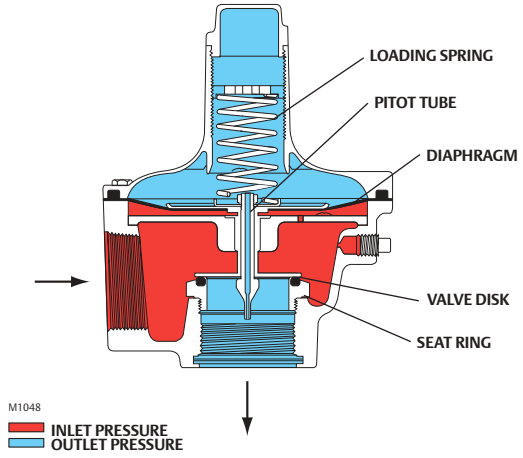


Figure 6. *Type 289 Relief Valve with Pitot Tube*

Product Example

Pitot Tube

The relief valve shown in Figure 6 includes a pitot tube to reduce pressure build-up. When the valve is opening, high fluid velocity through the seat ring creates an area of relatively low pressure. Low pressure near the end of the pitot tube draws fluid out of the volume above the relief valve diaphragm and creates a partial vacuum which helps to open the valve. The partial vacuum above the diaphragm increases the relief valve capacity with less pressure build-up over setpoint.

Typical Applications

Direct-operated relief valves are commonly used in natural gas systems supplying commercial enterprises such as restaurants and laundries and in industry to protect industrial furnaces and other equipment.

Selection Criteria

Pressure Build-up

Some direct-operated relief valves require significant pressure build-up to achieve maximum capacity. Others, such as those using pitot tubes, often pass high flow rates with minimal pressure build-up. Direct-operated relief valves can provide good accuracy within their design capacities.

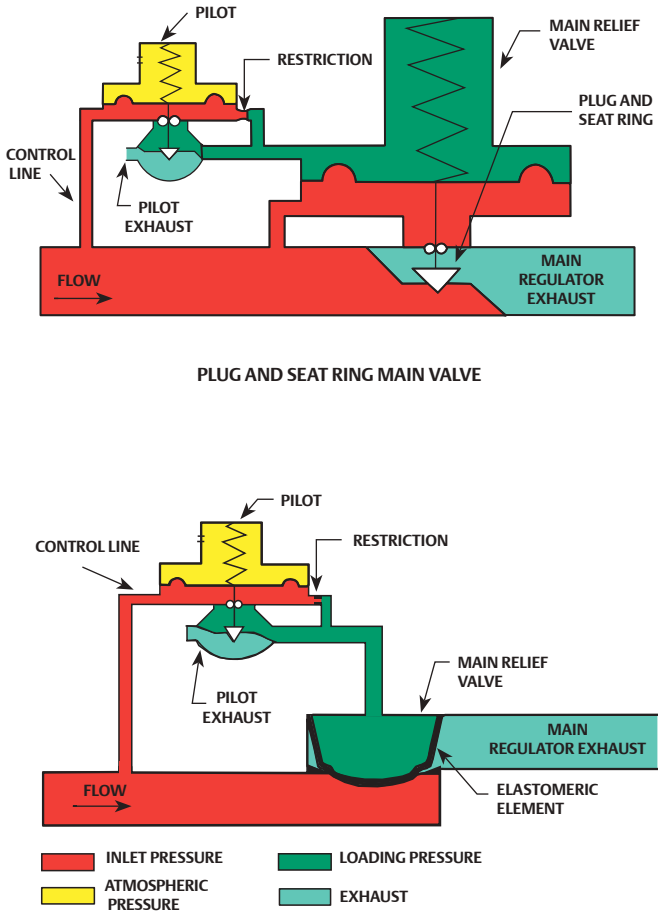


Figure 7. *Pilot-Operated Designs*

Principles of Relief Valves

Cost Versus Performance

The purchase price of a direct-operated relief valve is typically lower than that of a pilot-operated design of the same size. However, pilot-operated designs may cost less per unit of capacity at very high flow rates.

Pilot-Operated Relief Valves

Pilot-operated relief valves utilize a pair of direct-operated relief valves; a pilot and a main relief valve. The pilot increases the effect of changes in inlet pressure on the main relief valve.

Operation

The operation of a pilot-operated relief valve is quite similar to the operation of a pilot-operated pressure reducing regulator. In normal operation, when system pressure is below setpoint of the relief valve, the pilot remains closed. This allows loading pressure to register on top of the main relief valve diaphragm. Loading pressure on top of the diaphragm is opposed by an equal pressure (inlet pressure) on the bottom side of the diaphragm. With little or no pressure differential across the diaphragm, the spring keeps the valve seated. Notice that a light-rate spring may be used because it does not oppose a large pressure differential across the diaphragm. The light-rate spring enables the main valve to travel to the wide-open position with little pressure build-up.

Increasing Inlet Pressure

When the inlet pressure rises above the relief setpoint, the pilot spring is compressed and the pilot valve opens. The open pilot bleeds fluid out of the main valve spring case, decreasing pressure above the main relief valve diaphragm. If loading pressure escapes faster than it can be replaced through the restriction, the loading pressure above the main relief valve diaphragm is reduced and the relief valve opens. System overpressure exhausts through the vent.

Decreasing Inlet Pressure

If inlet pressure drops back to the relief valve setpoint, the pilot loading spring pushes the pilot valve plug back against the pilot valve seat. Inlet pressure again loads the main relief valve diaphragm and closes the main valve.

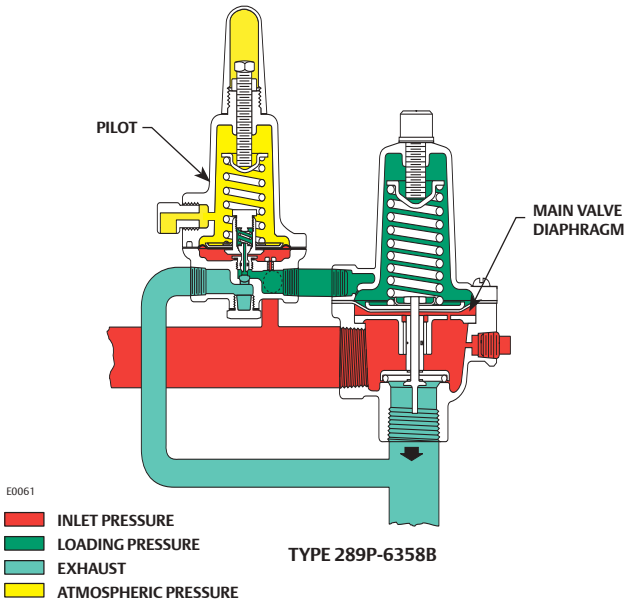


Figure 8. *Pilot-Operated Relief Valve*

Control Line

The control line connects the pilot with the pressure that is to be limited. When overpressure control accuracy is a high priority, the control line tap is installed where protection is most critical.

Product Example

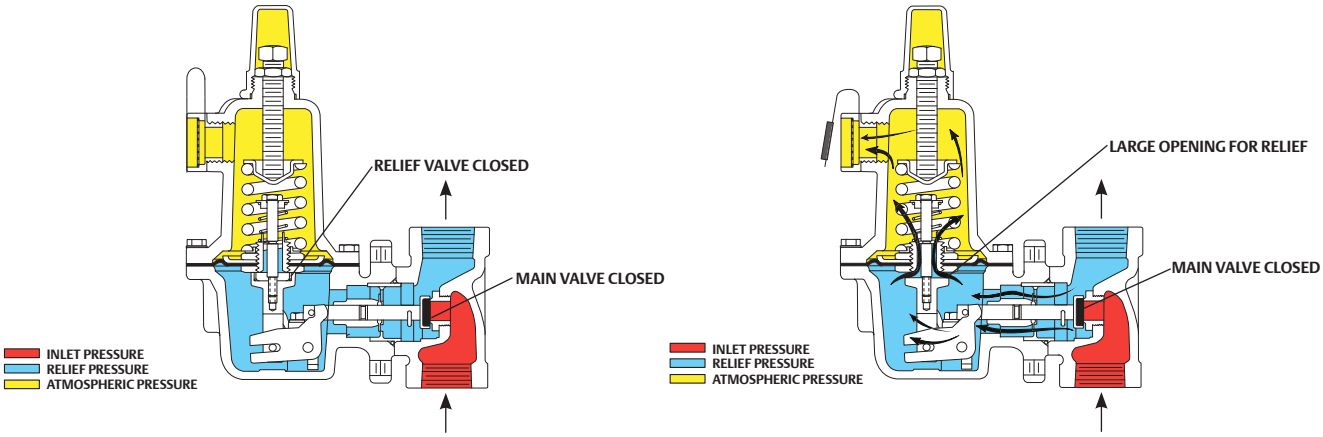
Physical Description

This relief valve is a direct-operated relief valve with a pilot attached (Figure 8). The pilot is a modified direct-operated relief valve, the inlet pressure loads the diaphragm and flows through a restriction to supply loading pressure to the main relief valve diaphragm.

Operation

During normal operation, the pilot is closed allowing loading pressure to register above the main relief valve's diaphragm. This pressure is opposed by inlet pressure acting on the bottom of the diaphragm.

If inlet pressure rises above setpoint, the pilot valve opens, exhausting the loading pressure. If loading pressure is reduced above the main relief valve diaphragm faster than it is replaced through the pilot fixed restriction, loading pressure is reduced and inlet pressure below the diaphragm will cause the main regulator to open.



REGULATORS THAT INCLUDE INTERNAL RELIEF VALVES OFTEN ELIMINATE THE REQUIREMENT FOR EXTERNAL OVERPRESSURE PROTECTION. THE ILLUSTRATION ON THE LEFT SHOWS THE REGULATOR WITH BOTH THE RELIEF VALVE AND THE REGULATOR VALVE IN THE CLOSED POSITION. THE ILLUSTRATION ON THE RIGHT SHOWS THE SAME UNIT AFTER P_2 HAS INCREASED ABOVE THE RELIEF VALVE SETPOINT. THE DIAPHRAGM HAS MOVED OFF THE RELIEF VALVE SEAT ALLOWING FLOW (EXCESS PRESSURE) TO EXHAUST THROUGH THE SCREENED VENT.

Figure 9. *Internal Relief Design*

If inlet pressure falls below the relief set pressure, the pilot spring will again close the pilot exhaust, increasing loading pressure above the main relief valve diaphragm. This increasing loading pressure causes the main valve to travel towards the closed position.

Performance

Pilot-operated relief valves are able to pass large flow rates with a minimum pressure build-up.

Typical Applications

Pilot-operated relief valves are used in applications requiring high capacity and low pressure build-up.

Selection Criteria

Minimal Build-up

The use of a pilot to load and unload the main diaphragm and the light-rate spring enables the main valve to travel wide-open with little pressure build-up over setpoint.

Throttling Action

The sensitive pilot produces smooth throttling action when inlet pressure rises above setpoint. This helps to maintain a steady downstream system pressure.

Internal Relief

Regulators that include internal relief valves may eliminate the requirement for external overpressure protection.

Operation

The regulator shown in Figure 9 includes an internal relief valve. The relief valve has a measuring element (the main regulator diaphragm), a loading element (a light spring) and a restricting element (a valve seat and disk). The relief valve assembly is located in the center of the regulator diaphragm.

Build-up Over Setpoint

Like other spring-loaded designs, internal relief valves will only open wider if the inlet pressure increases. The magnitude of pressure build-up is determined by the spring rates of the loading spring plus the main spring. Both springs are considered because they act together to resist diaphragm movement when pressure exceeds the relief valve setpoint.

Product Example

A typical internal relief regulator construction is shown in Figure 9. The illustration on the left shows the regulator with both the relief valve and regulator valve in the closed position. The illustration on the right shows the same unit after the inlet pressure has increased above the relief valve setpoint. The diaphragm has moved off the relief valve seat allowing the excess pressure to exhaust through the vent.

Principles of Relief Valves

Performance and Typical Applications

This design is available in configurations that can protect many pressure ranges and flow rates. Internal relief is often used in applications such as farm taps, industrial applications where atmospheric exhaust is acceptable and house service regulators.

Selection Criteria

Pressure Build-up

Relief setpoint is determined by a combination of the relief valve and regulator springs; this design generally requires significant pressure build-up to reach its maximum relief flow rate. For the same reason, internal relief valves have limited relief capacities. They may provide full relief capacity, but should be carefully sized for each application.

Space

Internal relief has a distinct advantage when there is not enough space for an external relief valve.

Cost versus Performance

Because a limited number of parts are simply added to the regulator, this type of overpressure protection is relatively inexpensive compared to external relief valves of comparable capacity.

Maintenance

Because the relief valve is an integral part of the regulator's diaphragm, the regulator must be taken out of service when maintenance is performed. Therefore, the application should be able to tolerate either the inconvenience of intermittent supply or the expense of parallel regulators and relief valves.

Selection and Sizing Criteria

There are a number of common steps in the relief valve selection and sizing process. For every application, the maximum pressure conditions, the wide-open regulator flow capacity and constant downstream demand should be determined. Finally, this information is used to select an appropriate relief valve for the application.

Maximum Allowable Pressure

Downstream equipment includes all the components of the system that contain pressure; household appliances, tanks, tools, machines, outlet rating of the upstream regulators or other equipment. The component with the lowest maximum pressure rating establishes the maximum allowable system pressure.

Regulator Ratings

Pressure reducing regulators upstream of the relief valve have ratings for their inlet, outlet and internal components. The lowest rating should be used when determining maximum allowable pressure.

Piping

Piping pressure limitations imposed by governmental agencies, industry standards, manufacturers or company standards should be verified before defining the maximum overpressure level.

Maximum Allowable System Pressure

The smallest of the pressure ratings mentioned above should be used as the maximum allowable pressure. This pressure level should not be confused with the relief valve setpoint which must be set below the maximum allowable system pressure.

Determining Required Relief Valve Flow

A relief valve must be selected to exhaust enough flow to prevent the pressure from exceeding the maximum allowable system pressure. To determine this flow, review all upstream components for the maximum possible flow that will cause overpressure. If overpressure is caused by a pressure reducing regulator, use the regulator's wide-open flow coefficient to calculate the required flow of the relief valve. This regulator's wide-open flow is larger than the regulating flow used to select the pressure reducing regulator.

Sizing equations have been developed to standardize valve sizing. Refer to the Valve Sizing Calculations section to find these equations and explanations on how they are used.

Determine Constant Demand

In some applications, the required relief capacity can be reduced by subtracting any load that is always on the system. This procedure should be approached with caution because it may be difficult to predict the worst-case scenario for downstream equipment failures. It may also be important to compare the chances of making a mistake in predicting the level of continuous flow consumption with the potential negative aspects of an error. Because of the hazards involved, relief valves are often sized assuming no continuous flow to downstream equipment.

Selecting Relief Valves

Required Information

We have already reviewed the variables required to calculate the regulator's wide-open flow rate. In addition, we need to know the type and temperature of the fluid in the system and the size of the piping. Finally, if a vent stack will be required, any additional build-up due to vent stack resistance should be considered.

Regulator Lockup Pressure

A relief valve setpoint is adjusted to a level higher than the regulator's lockup pressure. If the relief valve setpoint overlaps lockup pressure of the regulator, the relief valve may open while the regulator is still attempting to control the system pressure.

Identify Appropriate Relief Valves

Once the size, relief pressure and flow capacity are determined, we can identify a number of potentially suitable relief valves using the Quick Selection Guide in the front of each application section in this application guide. These selection guides give relief set (inlet) pressures, capacities and type numbers. These guides can then be further narrowed by reviewing individual product pages in each section.

Final Selection

Final selection is usually a matter of compromise. Relief capacities, build-up levels, sensitivity, throttling capabilities, cost of installation and maintenance, space requirements, initial purchase price and other attributes are all considered when choosing any relief valve.

Applicable Regulations

The relief valves installed in some applications must meet governmental, industry or company criteria.

Sizing and Selection Exercise

To gain a better understanding of the selection and sizing process, it may be helpful to step through a typical relief valve sizing exercise.

Initial Parameters

We'll assume that we need to specify an appropriate relief valve for a regulator serving a large plant air supply. There is sufficient space to install the relief valve and the controlled fluid is clean plant air that can be exhausted without adding a vent stack.

Performance Considerations

The plant supervisor wants the relief valve to throttle open smoothly so that pressure surges will not damage instruments and equipment in the downstream system. This will require the selection of a relief valve that will open smoothly. Plant equipment is periodically shut down but the air supply system operates continuously. Therefore, the relief valve must also have the capacity to exhaust the full flow of the upstream system.

Upstream Regulator

The regulator used is 1 in. in size with a 3/8 in. orifice. The initial system parameters of pressure and flow were determined when the regulator was sized for this application.

Pressure Limits

The plant maintenance engineer has determined that the relief valve should begin to open at 20 psig and downstream pressure should not rise above 30 psig maximum allowable system pressure.

Relief Valve Flow Capacity

The wide-open regulator flow is calculated to be 23,188 SCFH.

Principles of Relief Valves

Relief Valve Selection

Quick Selection Guide

Find the Relief Valve Quick Selection Guide in this Application Guide; it gives relief set (inlet) pressures and comparative flow capacities of various relief valves. Because this guide is used to identify potentially suitable relief valves, we can check the relief set (inlet) pressures closest to 20 psig and narrow the range of choices. We find that two relief valves have the required flow capacity at our desired relief set (inlet) pressure.

Product Pages

If we look at the product pages for the potential relief valves, we find that a 1 in. Type 289H provides the required capacity within the limits of pressure build-up specified in our initial parameters.

Checking Capacity

Capacity curves for the 1 in. Type 289H with this spring are shown in Figure 10. By following the curve for the 20 psig setpoint to the point where it intersects with the 30 psig division, we find that our relief valve can handle more than the 23,188 SCFH required.

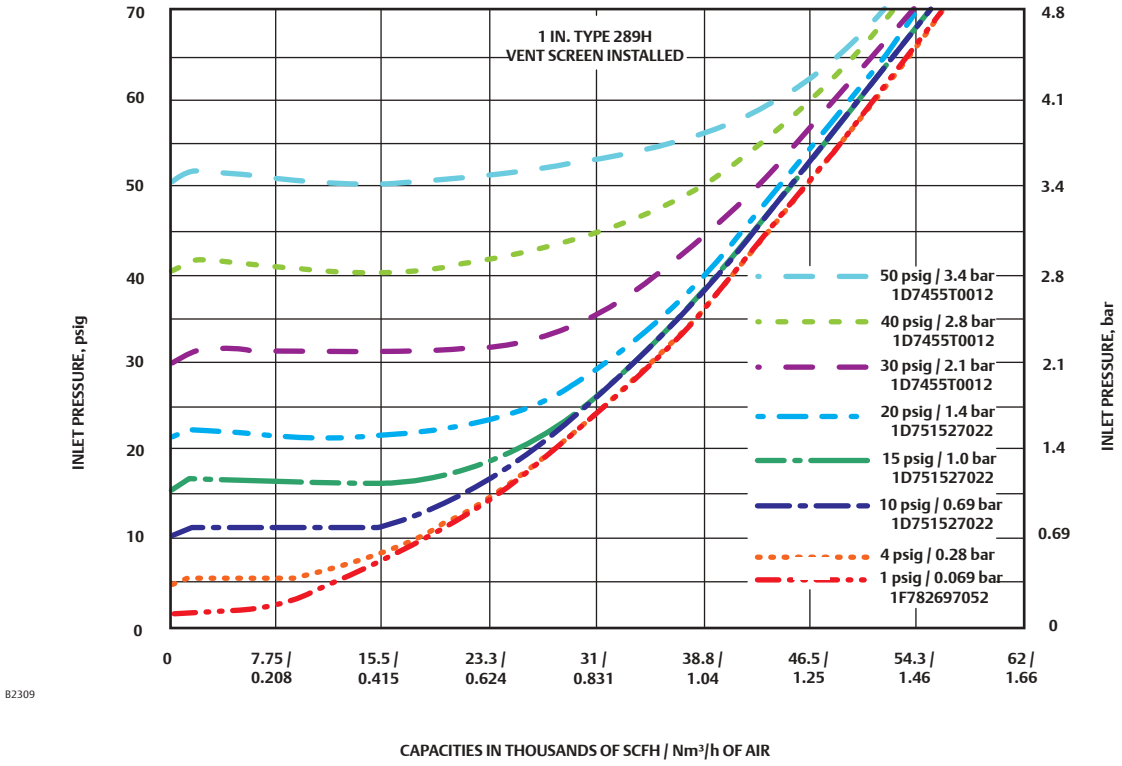


Figure 10. *Type 289H Flow Capacities*

Principles of Series Regulation and Monitor Regulators

Series Regulation

Series regulation is one of the simplest systems used to provide overpressure protection by containment. In the example shown in Figure 1, the inlet pressure is 100 psig, the desired downstream pressure is 10 psig and the maximum allowable operating pressure (MAOP) is 40 psig. The setpoint of the downstream regulator is 10 psig and the setpoint of the upstream regulator is 30 psig.

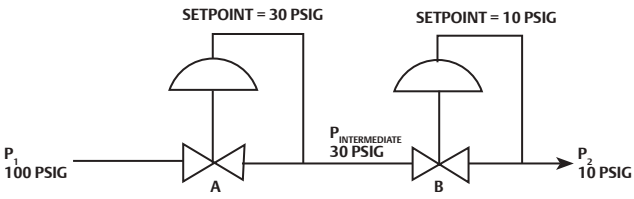


Figure 1. *Series Regulation*

Failed System Response

If regulator B fails, downstream pressure (P_2) is maintained at the setpoint of regulator A less whatever drop is required to pass the required flow through the failed regulator B. If regulator A fails, the intermediate pressure will be 100 psig. Regulator B must be able to withstand 100 psig inlet pressure.

Regulator Considerations

Either direct-operated or pilot-operated regulators may be used in this system. Should regulator A fail, $P_{Intermediate}$ will approach P_1 so the outlet rating and spring casing rating of regulator A must be high enough to withstand full P_1. This situation may suggest the use of a relief valve between the two regulators to limit the maximum value of $P_{Intermediate}$.

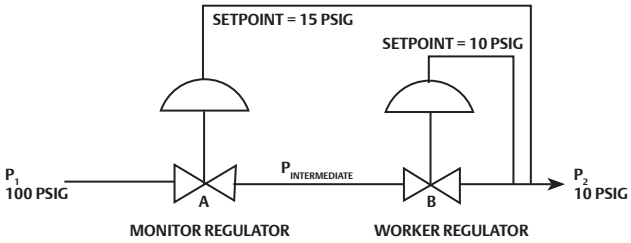
Applications and Limitations

A problem with series regulation is maintaining tight control of P_2 if the downstream regulator fails. In this arrangement, it is often impractical to have the setpoints very close together. If they are, the pressure drop across regulator B will be quite small. With a small pressure drop, a very large regulator may be required to pass the desired flow.

Because of the problem in maintaining close control of P_2, series regulation is best suited to applications where the regulator station is reducing pressure to a value substantially below the maximum allowable operating pressure of the downstream system. Farm taps are a good example. The problem of low-pressure drop across the second regulator is less pronounced in low flow systems.

Upstream Wide-Open Monitors

The only difference in configuration between series regulation and monitors is that in monitor installations, both regulators sense downstream pressure, P_2. Thus, the upstream regulator must have a control line.



IN WIDE-OPEN MONITOR SYSTEMS, BOTH REGULATORS SENSE DOWNSTREAM PRESSURE. SETPOINTS MAY BE VERY CLOSE TO EACH OTHER. IF THE WORKER REGULATOR FAILS, THE MONITOR ASSUMES CONTROL AT A SLIGHTLY HIGHER SETPOINT. IF THE MONITOR REGULATOR FAILS, THE WORKER CONTINUES TO PROVIDE CONTROL.

Figure 2. *Wide-Open Upstream Monitor*

System Values

In the example shown in Figure 2, assume that P_1 is 100 psig and the desired downstream pressure, P_2, is 10 psig. Also assume that the maximum allowable operating pressure of the downstream system is 20 psig; this is the limit we cannot exceed. The setpoint of the downstream regulator is set at 10 psig to maintain the desired P_2 and the setpoint of the upstream regulator is set at 15 psig to maintain P_2 below the maximum allowable operating pressure.

Normal Operation

When both regulators are functioning properly, regulator B holds P_2 at its setpoint of 10 psig. Regulator A, sensing a pressure lower than its setpoint of 15 psig tries to increase P_2 by going wide-open. This configuration is known as an upstream wide-open monitor where upstream regulator A monitors the pressure established by regulator B. Regulator A is referred to as the monitor or standby regulator while regulator B is called the worker or the operator.

Principles of Series Regulation and Monitor Regulators

Worker Regulator B Fails

If regulator B fails open, regulator A, the monitor, assumes control and holds P_2 at 15 psig. Note that pressure $P_{Intermediate}$ is now P_2 plus whatever drop is necessary to pass the required flow through the failed regulator B.

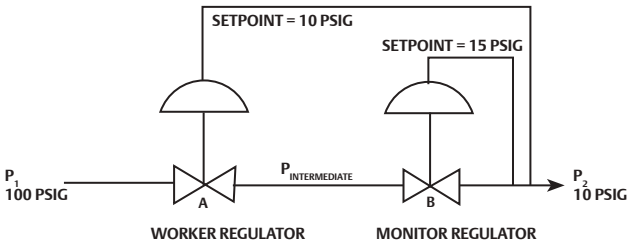
Equipment Considerations

Wide-open monitoring systems may use either direct- or pilot-operated regulators, the choice of which is dependent on other system requirements. Obviously, the upstream regulator must have external registration capability in order to sense downstream pressure, P_2.

In terms of ratings, $P_{Intermediate}$ will rise to full P_1 when regulator A fails, so the body outlet of regulator A and the inlet of regulator B must be rated for full P_1.

Downstream Wide-Open Monitors

The difference between upstream and downstream monitor systems (Figure 3) is that the functions of the two regulators are reversed. In other words, the monitor or standby regulator, is downstream of the worker or operator. Systems can be changed from upstream to downstream monitors, and vice versa, by simply reversing the setpoints of the two regulators.



THE ONLY DIFFERENCE BETWEEN UPSTREAM WIDE-OPEN MONITOR SYSTEMS AND DOWNSTREAM WIDE-OPEN MONITOR SYSTEMS IS THE ROLE EACH REGULATOR PLAYS. WORKERS AND MONITORS MAY BE SWITCHED BY SIMPLY REVERSING THE SETPOINTS.

Figure 3. *Wide-Open Downstream Monitor*

Normal Operation

Again, assume an inlet pressure of 100 psig and a controlled pressure (P_2) of 10 psig. Regulator A is now the worker so it maintains P_2 at its setpoint of 10 psig. Regulator B, the monitor, is set at 15 psig and so remains open.

Worker Regulator A Fails

If the worker, regulator A, fails in an open position, the monitor, regulator B, senses the increase in P_2 and holds P_2 at its setpoint of 15 psig. Note that $P_{Intermediate}$ is now P_1 minus whatever drop is taken across the failed regulator A.

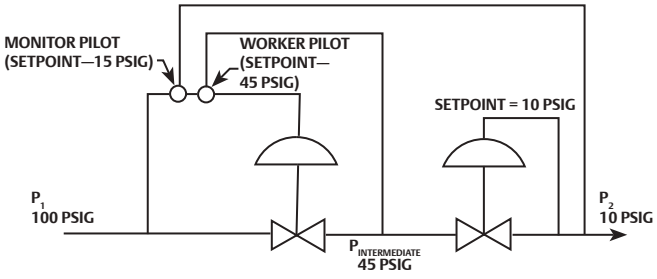
Upstream Versus Downstream Monitors

The decision to use either an upstream or downstream monitor system is largely a matter of personal preference or company policy.

In normal operation, the monitor remains open while the worker is frequently exercised. Many users see value in changing the system from an upstream to a downstream monitor at regular intervals, much like rotating the tires on an automobile. Most fluids have some impurities such as moisture, rust or other debris, which may deposit on regulator components, such as stems and cause them to become sticky or bind. Therefore, occasionally reversing the roles of the regulators so that both are exercised is sometimes seen as a means of ensuring that protection is available when needed. The job of switching is relatively simple as only the setpoints of the two regulators are changed. In addition, the act of changing from an upstream to a downstream monitor requires that someone visit the site so there is an opportunity for routine inspection.

Working Monitors

Working monitors (Figure 4) use design elements from both series regulation and wide-open monitors. In a working monitor installation, the two regulators are continuously working as series regulators to take two pressure cuts.



WORKING MONITOR SYSTEMS MUST USE A PILOT-OPERATED REGULATOR AS THE MONITOR, WHICH IS ALWAYS IN THE UPSTREAM POSITION. TWO PILOTS ARE USED ON THE MONITOR REGULATOR; ONE TO CONTROL THE INTERMEDIATE PRESSURE AND ONE TO MONITOR THE DOWNSTREAM PRESSURE. BY TAKING TWO PRESSURE DROPS, BOTH REGULATORS ARE ALLOWED TO EXERCISE.

Figure 4. *Working Monitor*

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Downstream Regulator

The downstream regulator may be either direct or pilot-operated. It is installed just as in a series or wide-open monitor system. Its setpoint controls downstream pressure, P_2.

Upstream Regulator

The upstream regulator must be a pilot-operated type because it uses two pilots; a monitor pilot and a worker pilot. The worker pilot is connected just as in series regulation and controls the intermediate pressure $P_{Intermediate}$. Its setpoint 45 psig is at some intermediate value that allows the system to take two pressure drops. The monitor pilot is in series ahead of the worker pilot and is connected so that it senses downstream pressure, P_2. The monitor pilot setpoint 15 psig is set slightly higher than the normal P_2 10 psig.

Normal Operation

When both regulators are performing properly, downstream pressure is below the setting of the monitor pilot, so it is fully open trying to raise system pressure. Standing wide-open, the monitor pilot allows the worker pilot to control the intermediate pressure, $P_{Intermediate}$ at 45 psig. The downstream regulator is controlling P_2 at 10 psig.

Downstream Regulator Fails

If the downstream regulator fails, the monitor pilot will sense the increase in pressure and take control at 15 psig.

Upstream Regulator Fails

If the upstream regulator fails, the downstream regulator will remain in control at 10 psig. Note that the downstream regulator must be rated for the full system inlet pressure P_1 of 100 psig because this will be its inlet pressure if the upstream regulator fails. Also note that the outlet rating of the upstream regulator and any other components that are exposed to $P_{Intermediate}$, must be rated for full P_1.

Sizing Monitor Regulators

The difficult part of sizing monitor regulators is that $P_{Intermediate}$ is needed to determine the flow capacity for both regulators. Because $P_{Intermediate}$ is not available, other sizing methods are used to determine the capacity. There are three methods for sizing monitor regulators: estimating flow when pressure drop is critical, assuming $P_{Intermediate}$ to calculate flow and the Fisher™ Monitor Sizing Program.

Estimating Flow when Pressure Drop is Critical

If the pressure drop across both regulators from P_1 to P_2 is critical (assume $P_{Intermediate} = P_1 - P_2/2 + P_2$, $P_1 - P_{Intermediate} \geq P_1$ and $P_{Intermediate} - P_2 \geq 1/2\ P_{Intermediate}$) and both regulators are the same type, the capacity of the two regulators together is 70 to 73% of a single regulator reducing the pressure from P_1 to P_2.

Assuming $P_{Intermediate}$ to Determine Flow

Assume $P_{Intermediate}$ is halfway between P_1 and P_2. Guess a regulator size. Use the assumed $P_{Intermediate}$ and the C_g for each regulator to calculate the available flow rate for each regulator. If $P_{Intermediate}$ was correct, the calculated flow through each regulator will be the same. If the flows are not the same, change $P_{Intermediate}$ and repeat the calculations. ($P_{Intermediate}$ will go to the correct assumed pressure whenever the flow demand reaches maximum capacity.)

Fisher Monitor Sizing Program

Emerson Process Management - Regulator Technologies offers a Monitor Sizing Program on the Regulator Technologies Literature CD. Call your local Sales Office to request a copy of the CD. To locate your local Sales Office, log on to: www.emersonprocess.com/regulators.

Vacuum Control

Vacuum Applications

Vacuum regulators and vacuum breakers are widely used in process plants. Conventional regulators and relief valves might be suitable for vacuum service if applied correctly. This section provides fundamentals and examples.

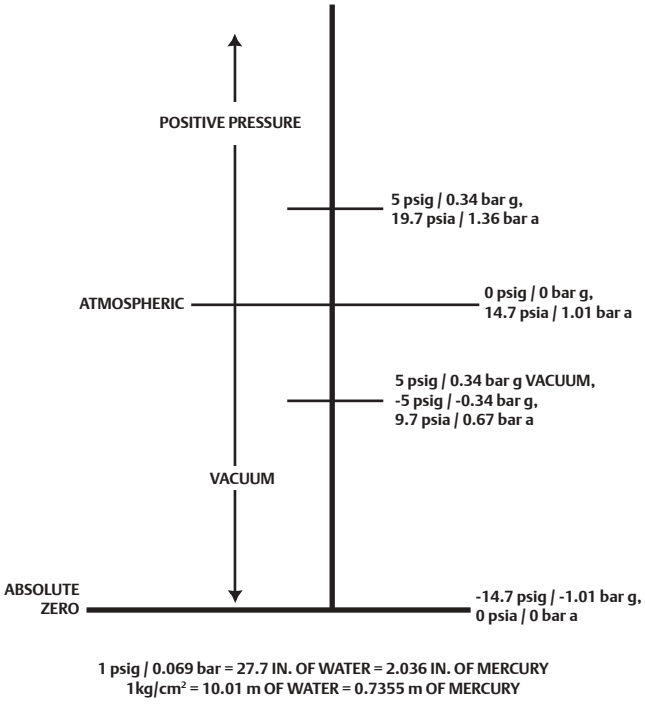


Figure 1. *Vacuum Terminology*

Vacuum Terminology

Engineers use a variety of terms to describe vacuum, which can cause some confusion. Determine whether the units are in absolute pressure or gauge pressure (0 psig / 0 bar g) is atmospheric pressure.

- 5 psig / 0.34 bar g vacuum is 5 psi / 0.34 bar below atmospheric pressure.
- -5 psig / -0.34 bar g is 5 psi / 0.34 bar below atmospheric pressure.
- 9.7 psia / 0.67 bar a is 9.7 psi / 0.67 bar above absolute zero or 5 psi / 0.34 bar below atmospheric pressure (14.7 psia - 5 psi = 9.7 psia / 1.01 bar a - 0.34 bar = 0.67 bar a).

Vacuum Control Devices

Just like there are pressure reducing regulators and pressure relief valves for positive pressure service, there are also two basic types of valves for vacuum service. The terms used for each are sometimes confusing. Therefore, it is sometimes necessary to ask further questions to determine the required function of the valve. The terms vacuum regulator and vacuum breaker will be used in these pages to differentiate the two types.

Vacuum Regulators

Vacuum regulators maintain a constant vacuum at the regulator inlet. A loss of this vacuum (increase in absolute pressure) beyond setpoint registers on the diaphragm and opens the disk. It depends on the valve as to which side of the diaphragm control pressure is measured. Opening the valve plug permits a downstream vacuum of lower absolute pressure than the controlled vacuum to restore the upstream vacuum to its original setting.

Besides the typical vacuum regulator, a conventional regulator can be suitable if applied correctly. Any pressure reducing regulator (spring to open device) that has an external control line connection and an O-ring stem seal can be used as a vacuum regulator. Installation requires a control line to connect the vacuum being controlled and the spring case. The regulator spring range is now a negative pressure range and the body flow direction is the same as in conventional pressure reducing service.

Vacuum Breakers (Relief Valves)

Vacuum breakers are used in applications where an increase in vacuum must be limited. An increase in vacuum (decrease in absolute pressure) beyond a certain value causes the diaphragm to move and open the disk. This permits atmospheric pressure or a positive pressure or an upstream vacuum that has higher absolute pressure than the downstream vacuum, to enter the system and restore the controlled vacuum to its original pressure setting.

A vacuum breaker is a spring-to-close device, meaning that if there is no pressure on the valve the spring will push the valve plug into its seat. There are various Fisher™ brand products to handle this application. Some valves are designed as vacuum breakers. Fisher brand relief valves can also be used as vacuum breakers.

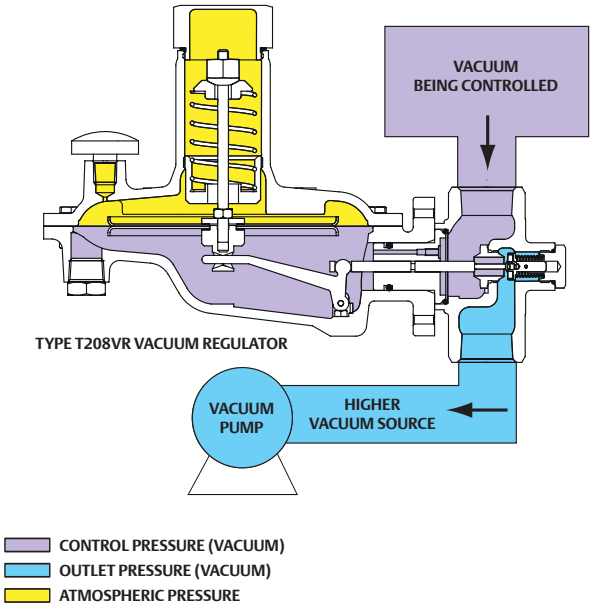


Figure 2. *Typical Vacuum Regulator*

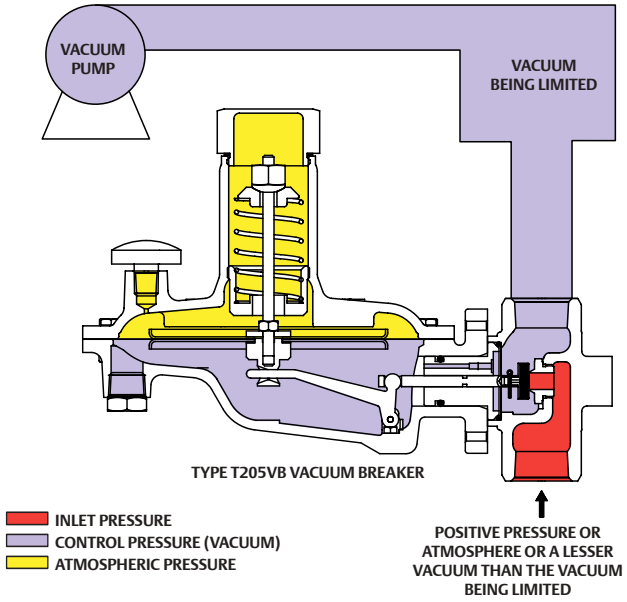


Figure 3. *Typical Vacuum Breaker*

A conventional relief valve can be used as a vacuum breaker, as long as it has a threaded spring case vent so a control line can be attached. If inlet pressure is atmospheric air, then the internal pressure registration from body inlet to lower casing admits atmospheric pressure to the lower casing. If inlet pressure is not atmospheric, a relief valve in which the lower casing can be vented to atmosphere when the body inlet is pressurized must be chosen. In this case, the terminology "blocked throat" and "external registration with O-ring stem seal" are used for clarity.

A spring that normally has a range of 6 to 11 in. w.c. / 15 to 27 mbar positive pressure will now have a range of 6 to 11 in. w.c. / 15 to 27 mbar vacuum (negative pressure). It may be expedient to bench set the vacuum breaker if the type chosen uses a spring case closing cap. Removing the closing cap to gain access to the adjusting screw will admit air into the spring case when in vacuum service.

Vacuum Regulator Installation Examples

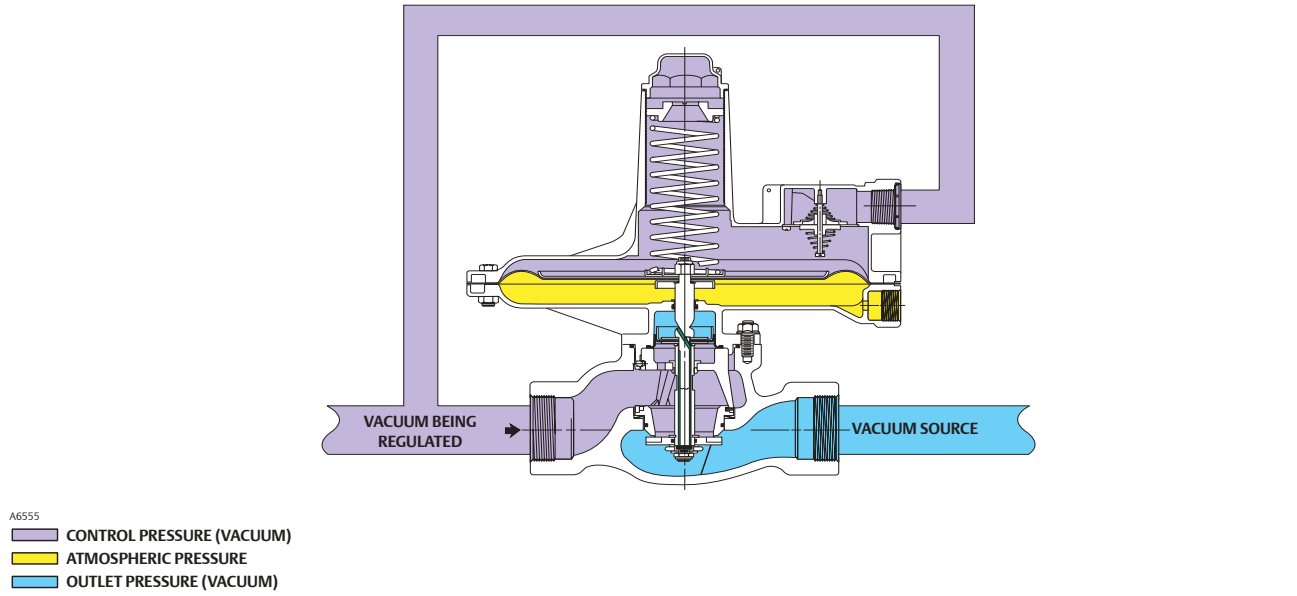


Figure 4. *Type 133L*

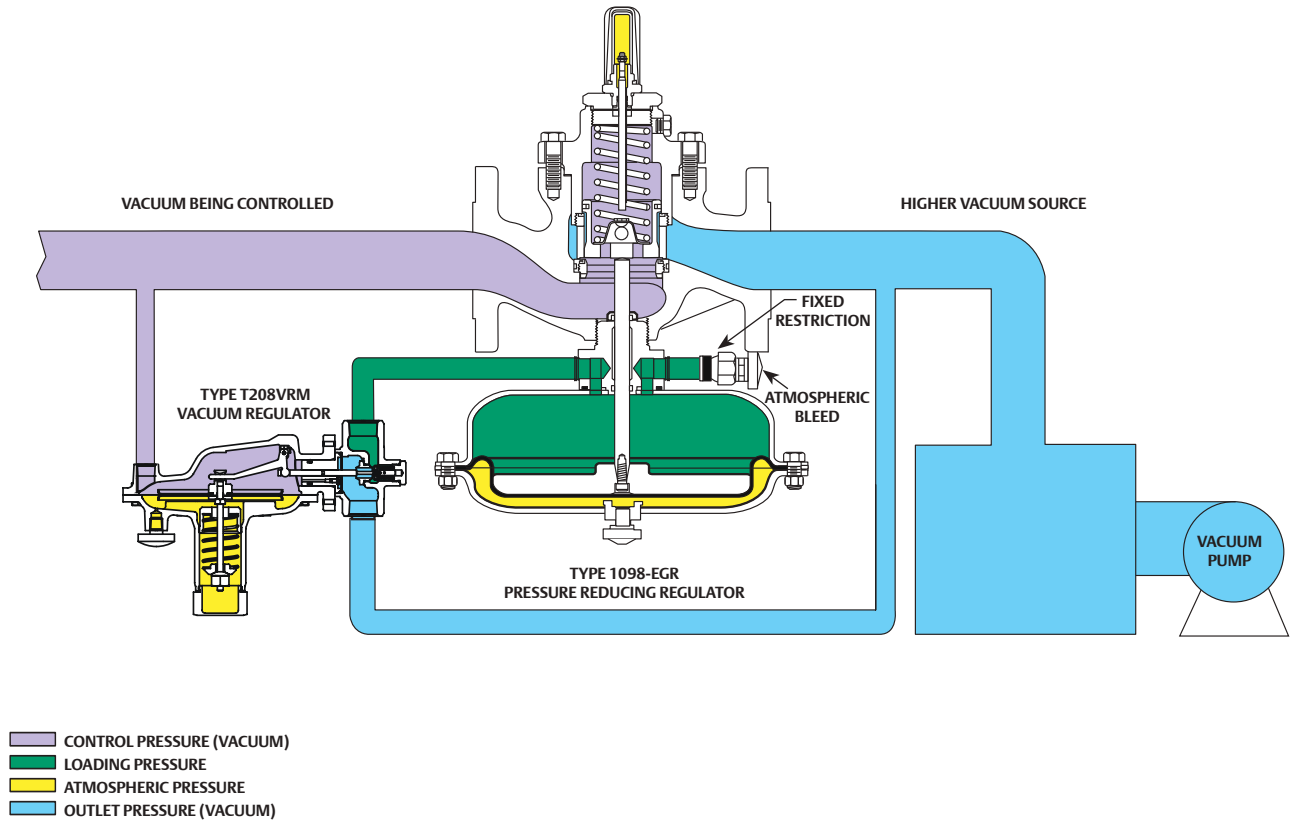


Figure 5. *Type T208VRM used with Type 1098-EGR in a Vacuum Regulator Installation*

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Vacuum Breaker Installation Examples

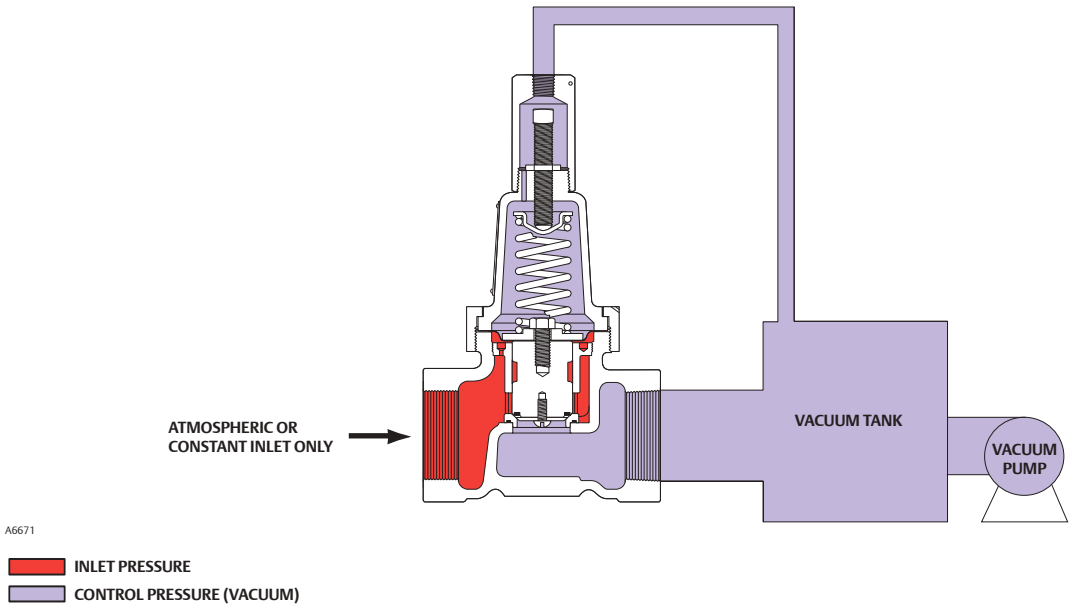


Figure 6. *Type 1805*

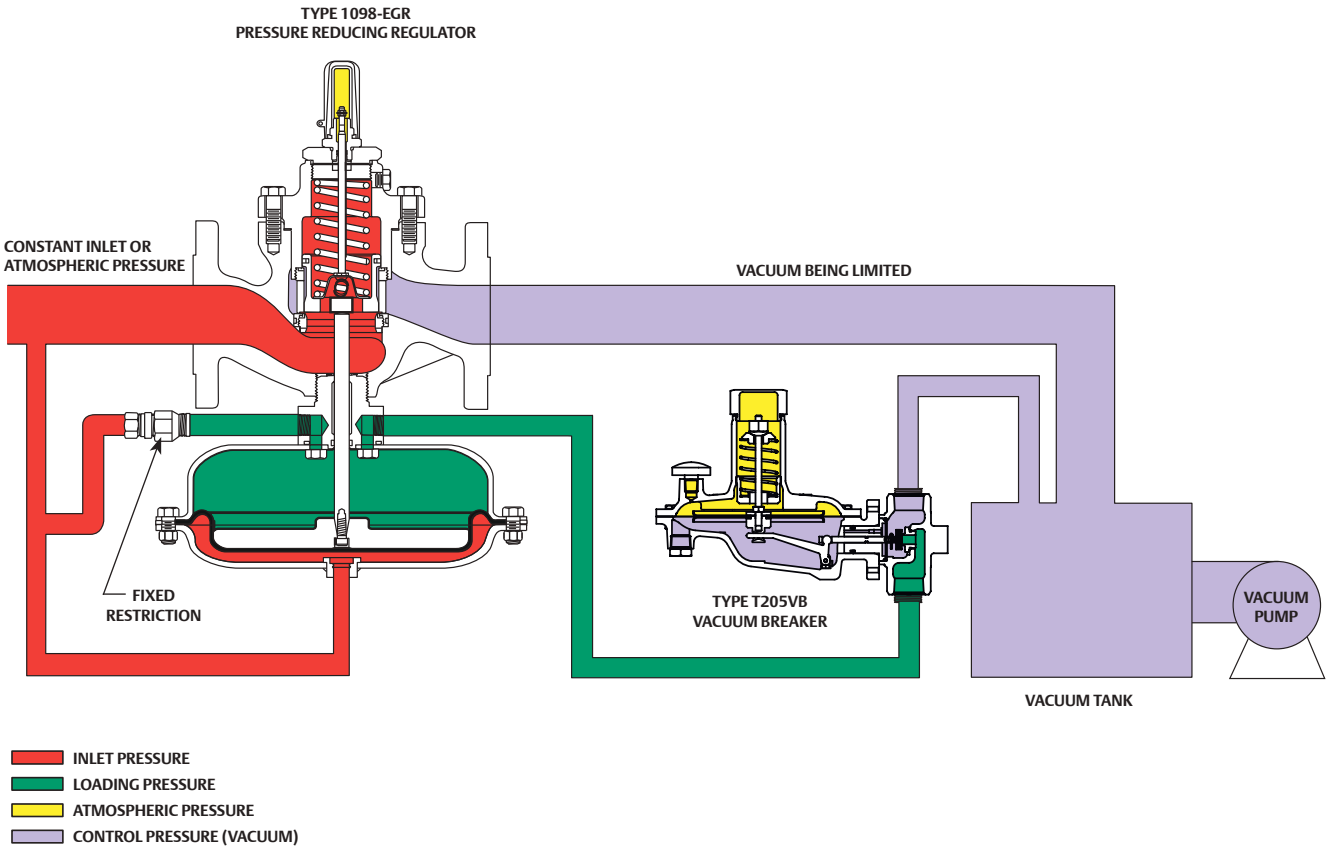


Figure 7. *Type T205VB used with Type 1098-EGR in a Vacuum Breaker Installation. If the positive pressure exceeds the Type 1098-EGR casing rating, then a Type 67CF with a Type H800 relief valve should be added.*

Vacuum Breaker Installation Examples

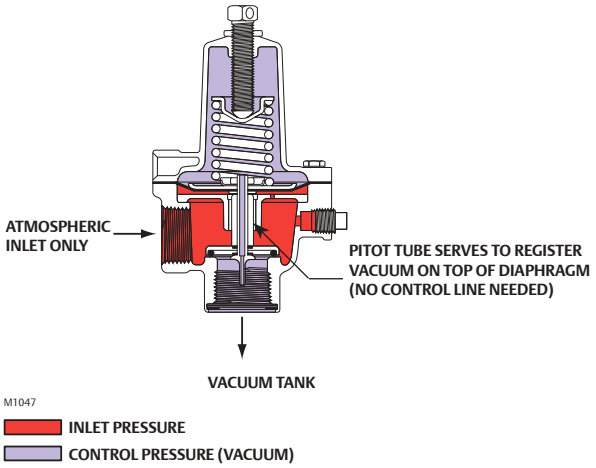
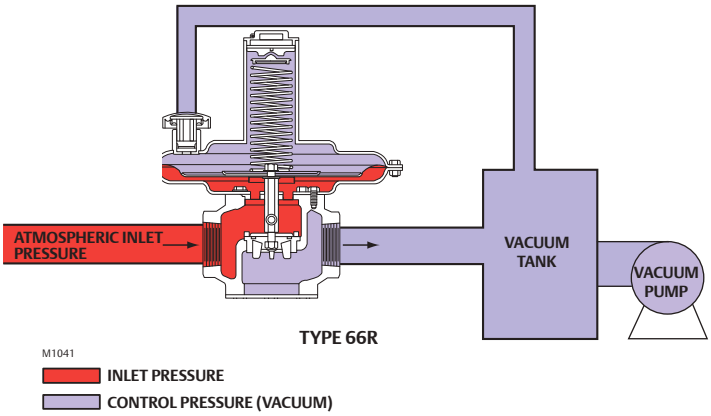


Figure 8. Type 289H Relief Valve used in a Vacuum Breaker Installation



If inlet is positive pressure:

- Select balancing diaphragm and tapped lower casing construction.
- Leave lower casing open to atmospheric pressure.

Figure 9. Type 66R Relief Valve used in a Vacuum Breaker Installation

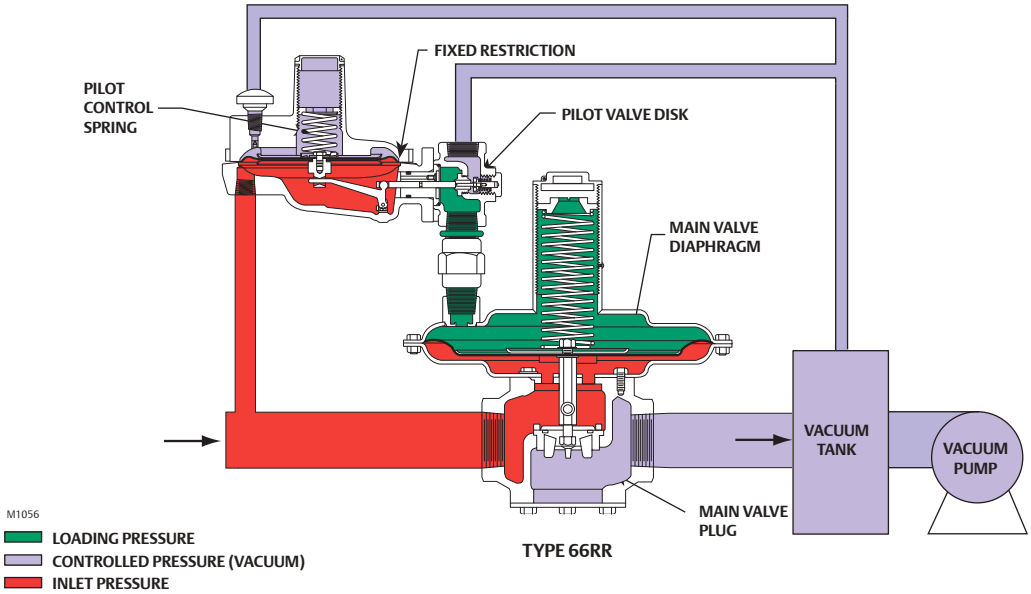


Figure 10. Type 66RR Relief Valve used in a Vacuum Breaker Installation

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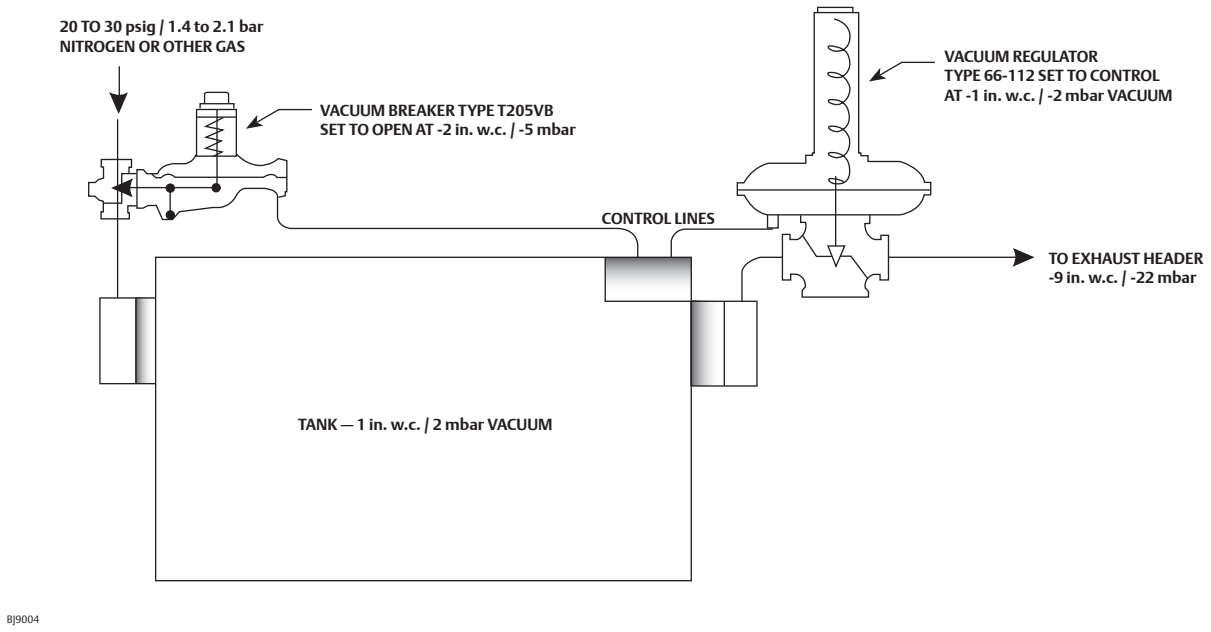


Figure 11. *Example of Gas Blanketing in Vacuum*

Gas Blanketing in Vacuum

When applications arise where the gas blanketing requirements are in vacuum, a combination of a vacuum breaker and a regulator may be used. For example, in low inches of water column vacuum, a Type T205VB vacuum breaker and a Type 66-112 vacuum regulator can be used for very precise control.

Vacuum blanketing is useful for vessel leakage to atmosphere and the material inside the vessel is harmful to the surrounding environment. If leakage were to occur, only outside air would enter the vessel because of the pressure differential in the tank. Therefore, any process vapors in the tank would be contained.

Features of Fisher™ Brand Vacuum Regulators and Breakers

- **Precision Control of Low Pressure Settings**—Large diaphragm areas provide more accurate control at low pressure settings. Some of these regulators are used as pilots on our Tank Blanketing and Vapor Recovery Regulators. Therefore, they are designed to be highly accurate, usually within 1 in. w.c. / 2 mbar.
- **Corrosion Resistance**—Constructions are available in a variety of materials for compatibility with corrosive process gases. Wide selection of elastomers compatible with flowing media.
- **Rugged Construction**—Diaphragm case and internal parts are designed to withstand vibration and shock.
- **Wide Product Offering**—Fisher brand regulators can be either direct-operated or pilot-operated regulators.
- **Fisher Brand Advantage**—Widest range of products and a proven history in the design and manufacture of process control equipment. A sales channel that offers local stock and support.
- **Spare Parts**—Low cost parts that are interchangeable with other Fisher brand in your plant.
- **Easy Sizing and Selection**—Most applications can be sized utilizing the Fisher brand Sizing Program and Sizing Coefficients.

Valve Sizing Calculations (Traditional Method)

Introduction

Fisher™ regulators and valves have traditionally been sized using equations derived by the company. There are now standardized calculations that are becoming accepted worldwide. Some product literature continues to demonstrate the traditional method, but the trend is to adopt the standardized method. Therefore, both methods are covered in this application guide.

Improper valve sizing can be both expensive and inconvenient. A valve that is too small will not pass the required flow and the process will be starved. An oversized valve will be more expensive and it may lead to instability and other problems.

The days of selecting a valve based upon the size of the pipeline are gone. Selecting the correct valve size for a given application requires a knowledge of process conditions that the valve will actually see in service. The technique for using this information to size the valve is based upon a combination of theory and experimentation.

Sizing for Liquid Service

Using the principle of conservation of energy, Daniel Bernoulli found that as a liquid flows through an orifice, the square of the fluid velocity is directly proportional to the pressure differential across the orifice and inversely proportional to the specific gravity of the fluid. The greater the pressure differential, the higher the velocity; the greater the density, the lower the velocity. The volume flow rate for liquids can be calculated by multiplying the fluid velocity times the flow area.

By taking into account units of measurement, the proportionality relationship previously mentioned, energy losses due to friction and turbulence and varying discharge coefficients for various types of orifices (or valve bodies), a basic liquid sizing equation can be written as follows

$$Q = C_V\sqrt{\Delta P / G} \qquad (1)$$

where:

Q = Capacity in gallons per minute

C_v = Valve sizing coefficient determined experimentally for each style and size of valve, using water at standard conditions as the test fluid

ΔP = Pressure differential in psi

G = Specific gravity of fluid (water at 60°F = 1.0000)

Thus, C_v is numerically equal to the number of U.S. gallons of water at 60°F that will flow through the valve in one minute when the pressure differential across the valve is 1 lb/in^2. C_v varies with both size and style of valve, but provides an index for comparing liquid capacities of different valves under a standard set of conditions.

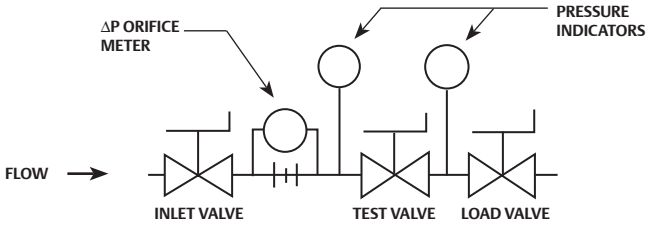


Figure 1. *Standard FCI Test Piping for C_v Measurement*

To aid in establishing uniform measurement of liquid flow capacity coefficients (C_v) among valve manufacturers, the Fluid Controls Institute (FCI) developed a standard test piping arrangement, shown in Figure 1. Using such a piping arrangement, most valve manufacturers develop and publish C_v information for their products, making it relatively easy to compare capacities of competitive products.

To calculate the expected C_v for a valve controlling water or other liquids that behave like water, the basic liquid sizing equation above can be re-written as follows

$$C_V = Q\sqrt{\frac{G}{\Delta P}} \qquad (2)$$

Viscosity Corrections

Viscous conditions can result in significant sizing errors in using the basic liquid sizing equation, since published C_v values are based on test data using water as the flow medium. Although the majority of valve applications will involve fluids where viscosity corrections can be ignored or where the corrections are relatively small, fluid viscosity should be considered in each valve selection.

Emerson Process Management Regulator Technologies, Inc. has developed a nomograph (Figure 2) that provides a viscosity correction factor (F_v). It can be applied to the standard C_v coefficient to determine a corrected coefficient (C_{vr}) for viscous applications.

Finding Valve Size

Using the C_v determined by the basic liquid sizing equation and the flow and viscosity conditions, a fluid Reynolds number can be found by using the nomograph in Figure 2. The graph of Reynolds number vs. viscosity correction factor (F_v) is used to determine the correction factor needed. (If the Reynolds number is greater than 3500, the correction will be ten percent or less.) The actual required C_v (C_{vr}) is found by the equation:

$$C_{vr} = F_V C_V \qquad (3)$$

From the valve manufacturer's published liquid capacity information, select a valve having a C_v equal to or higher than the required coefficient (C_{vr}) found by the equation above.

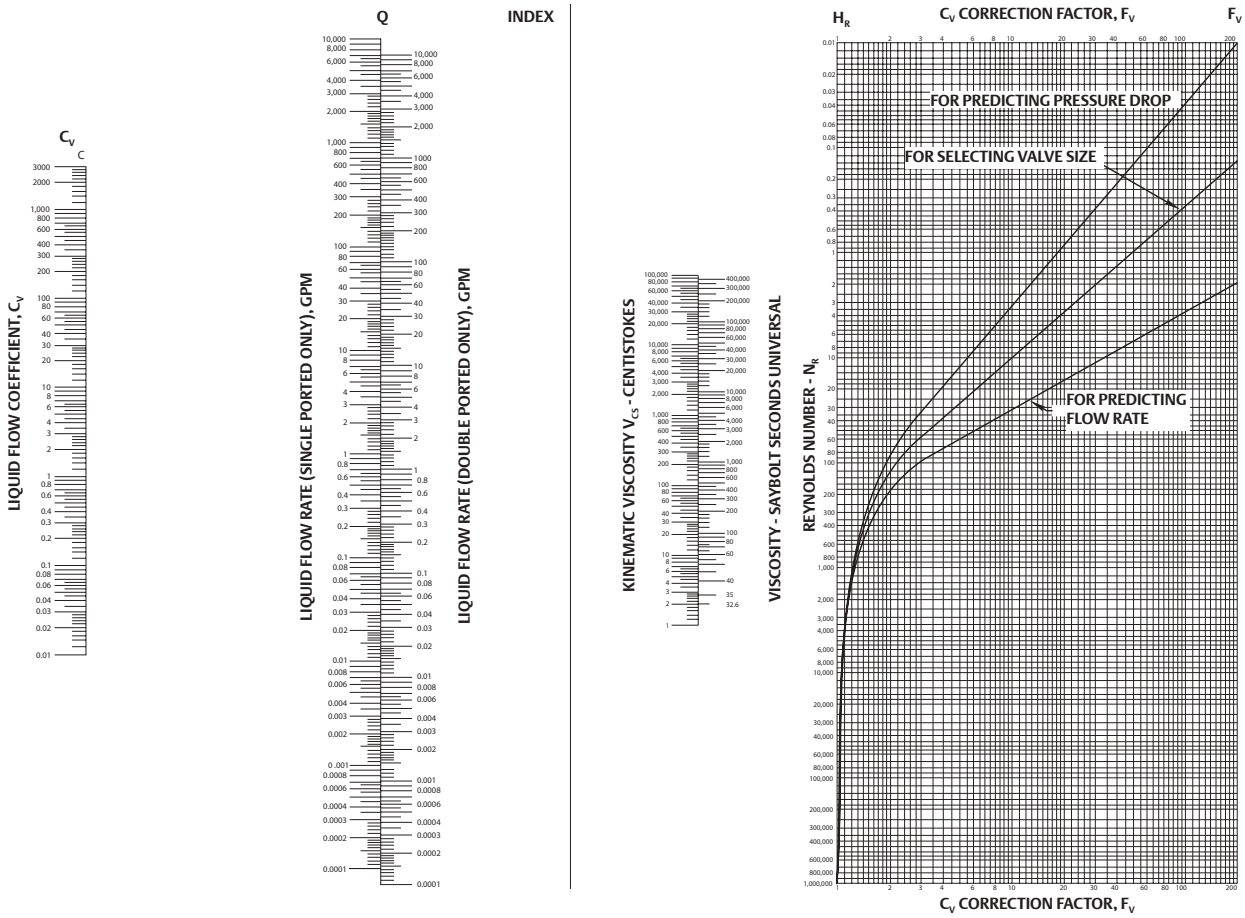


Figure 2. *Nomograph for Determining Viscosity Correction*

Nomograph Instructions

Use this nomograph to correct for the effects of viscosity. When assembling data, all units must correspond to those shown on the nomograph. For high-recovery, ball-type valves, use the liquid flow rate Q scale designated for single-ported valves. For butterfly and eccentric disk rotary valves, use the liquid flow rate Q scale designated for double-ported valves.

Nomograph Equations

1. Single-Ported Valves: $N_R = 17{,}250 \dfrac{Q}{\sqrt{C_V \nu_{CS}}}$

2. Double-Ported Valves: $N_R = 12{,}200 \dfrac{Q}{\sqrt{C_V \nu_{CS}}}$

Nomograph Procedure

1. Lay a straight edge on the liquid sizing coefficient on C_v scale and flow rate on Q scale. Mark intersection on index line. Procedure A uses value of C_{vc}; Procedures B and C use value of C_{vr}.

2. Pivot the straight edge from this point of intersection with index line to liquid viscosity on proper n scale. Read Reynolds number on N_R scale.

3. Proceed horizontally from intersection on N_R scale to proper curve and then vertically upward or downward to F_v scale. Read C_v correction factor on F_v scale.

Valve Sizing Calculations (Traditional Method)

Predicting Flow Rate

Select the required liquid sizing coefficient (C_{vr}) from the manufacturer's published liquid sizing coefficients (C_v) for the style and size valve being considered. Calculate the maximum flow rate (Q_{max}) in gallons per minute (assuming no viscosity correction required) using the following adaptation of the basic liquid sizing equation:

$$Q_{max} = C_{vr}\sqrt{\Delta P / G} \qquad (4)$$

Then incorporate viscosity correction by determining the fluid Reynolds number and correction factor F_v from the viscosity correction nomograph and the procedure included on it.

Calculate the predicted flow rate (Q_{pred}) using the formula:

$$Q_{pred} = \frac{Q_{max}}{F_V} \qquad (5)$$

Predicting Pressure Drop

Select the required liquid sizing coefficient (C_{vr}) from the published liquid sizing coefficients (C_v) for the valve style and size being considered. Determine the Reynolds number and correct factor F_v from the nomograph and the procedure on it. Calculate the sizing coefficient (C_{vc}) using the formula:

$$C_{VC} = \frac{C_{vr}}{F_v} \qquad (6)$$

Calculate the predicted pressure drop (ΔP_{pred}) using the formula:

$$\Delta P_{pred} = G\,(Q/C_{vc})^2 \qquad (7)$$

Flashing and Cavitation

The occurrence of flashing or cavitation within a valve can have a significant effect on the valve sizing procedure. These two related physical phenomena can limit flow through the valve in many applications and must be taken into account in order to accurately size a valve. Structural damage to the valve and adjacent piping may also result. Knowledge of what is actually happening within the valve might permit selection of a size or style of valve which can reduce or compensate for, the undesirable effects of flashing or cavitation.

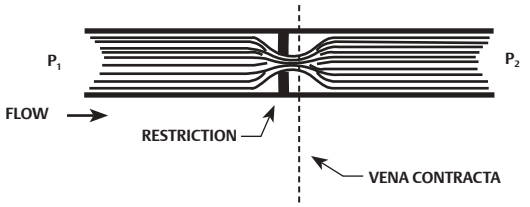


Figure 3. *Vena Contracta*

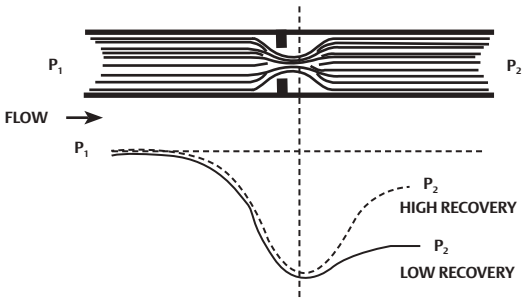


Figure 4. *Comparison of Pressure Profiles for High and Low Recovery Valves*

The "physical phenomena" label is used to describe flashing and cavitation because these conditions represent actual changes in the form of the fluid media. The change is from the liquid state to the vapor state and results from the increase in fluid velocity at or just downstream of the greatest flow restriction, normally the valve port. As liquid flow passes through the restriction, there is a necking down or contraction, of the flow stream. The minimum cross-sectional area of the flow stream occurs just downstream of the actual physical restriction at a point called the vena contracta, as shown in Figure 3.

To maintain a steady flow of liquid through the valve, the velocity must be greatest at the vena contracta, where cross sectional area is the least. The increase in velocity (or kinetic energy) is accompanied by a substantial decrease in pressure (or potential energy) at the vena contracta. Farther downstream, as the fluid stream expands into a larger area, velocity decreases and pressure increases. But, of course, downstream pressure never recovers completely to equal the pressure that existed upstream of the valve. The pressure differential (ΔP) that exists across the valve is a measure

of the amount of energy that was dissipated in the valve. Figure 4 provides a pressure profile explaining the differing performance of a streamlined high recovery valve, such as a ball valve and a valve with lower recovery capabilities due to greater internal turbulence and dissipation of energy.

Regardless of the recovery characteristics of the valve, the pressure differential of interest pertaining to flashing and cavitation is the differential between the valve inlet and the vena contracta. If pressure at the vena contracta should drop below the vapor pressure of the fluid (due to increased fluid velocity at this point) bubbles will form in the flow stream. Formation of bubbles will increase greatly as vena contracta pressure drops further below the vapor pressure of the liquid. At this stage, there is no difference between flashing and cavitation, but the potential for structural damage to the valve definitely exists.

If pressure at the valve outlet remains below the vapor pressure of the liquid, the bubbles will remain in the downstream system and the process is said to have "flashed." Flashing can produce serious erosion damage to the valve trim parts and is characterized by a smooth, polished appearance of the eroded surface. Flashing damage is normally greatest at the point of highest velocity, which is usually at or near the seat line of the valve plug and seat ring.

However, if downstream pressure recovery is sufficient to raise the outlet pressure above the vapor pressure of the liquid, the bubbles will collapse or implode, producing cavitation. Collapsing of the vapor bubbles releases energy and produces a noise similar to what one would expect if gravel were flowing through the valve. If the bubbles collapse in close proximity to solid surfaces, the energy released gradually wears the material leaving a rough, cylinder like surface. Cavitation damage might extend to the downstream pipeline, if that is where pressure recovery occurs and the bubbles collapse. Obviously, "high recovery" valves tend to be more subject to cavitation, since the downstream pressure is more likely to rise above the vapor pressure of the liquid.

Choked Flow

Aside from the possibility of physical equipment damage due to flashing or cavitation, formation of vapor bubbles in the liquid flow stream causes a crowding condition at the vena contracta which tends to limit flow through the valve. So, while the basic liquid sizing equation implies that there is no limit to the amount of flow through a valve as long as the differential pressure across the valve increases, the realities of flashing and cavitation prove otherwise. If valve

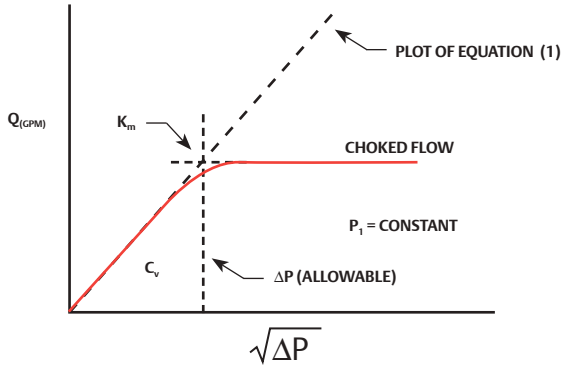


Figure 5. *Flow Curve Showing C_v and K_m*

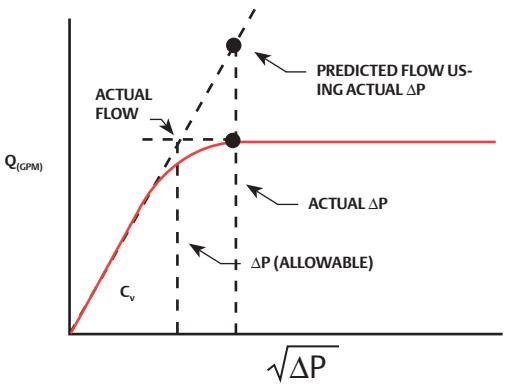
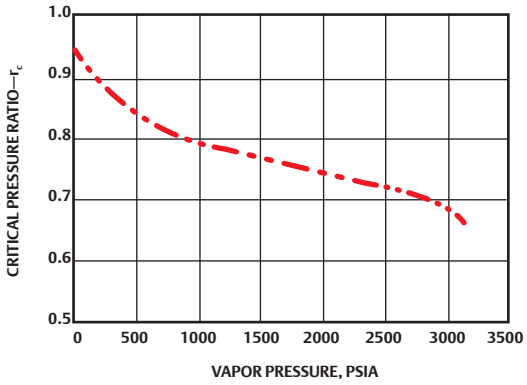


Figure 6. *Relationship Between Actual ΔP and ΔP Allowable*

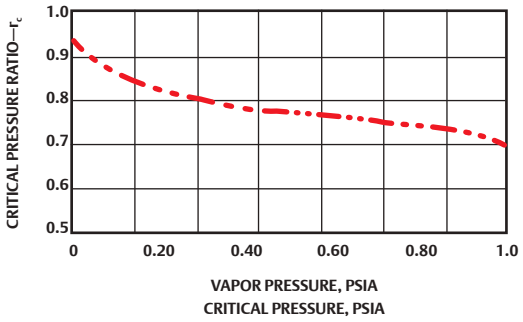
pressure drop is increased slightly beyond the point where bubbles begin to form, a choked flow condition is reached. With constant upstream pressure, further increases in pressure drop (by reducing downstream pressure) will not produce increased flow. The limiting pressure differential is designated ΔP_{allow} and the valve recovery coefficient (K_m) is experimentally determined for each valve, in order to relate choked flow for that particular valve to the basic liquid sizing equation. K_m is normally published with other valve capacity coefficients. Figures 5 and 6 show these flow vs. pressure drop relationships.

Valve Sizing Calculations (Traditional Method)



USE THIS CURVE FOR WATER. ENTER ON THE ABSCISSA AT THE WATER VAPOR PRESSURE AT THE VALVE INLET. PROCEED VERTICALLY TO INTERSECT THE CURVE. MOVE HORIZONTALLY TO THE LEFT TO READ THE CRITICAL PRESSURE RATIO, R_c, ON THE ORDINATE.

Figure 7. *Critical Pressure Ratios for Water*



USE THIS CURVE FOR LIQUIDS OTHER THAN WATER. DETERMINE THE VAPOR PRESSURE/CRITICAL PRESSURE RATIO BY DIVIDING THE LIQUID VAPOR PRESSURE AT THE VALVE INLET BY THE CRITICAL PRESSURE OF THE LIQUID. ENTER ON THE ABSCISSA AT THE RATIO JUST CALCULATED AND PROCEED VERTICALLY TO INTERSECT THE CURVE. MOVE HORIZONTALLY TO THE LEFT AND READ THE CRITICAL PRESSURE RATIO, R_c, ON THE ORDINATE.

Figure 8. *Critical Pressure Ratios for Liquid Other than Water*

Use the following equation to determine maximum allowable pressure drop that is effective in producing flow. Keep in mind, however, that the limitation on the sizing pressure drop, ΔP_{allow}, does not imply a maximum pressure drop that may be controlled y the valve.

$$\Delta P_{allow} = K_m (P_1 - r_c P_v) \quad (8)$$

where:

ΔP_{allow} = maximum allowable differential pressure for sizing purposes, psi

K_m = valve recovery coefficient from manufacturer's literature

P_1 = body inlet pressure, psia

r_c = critical pressure ratio determined from Figures 7 and 8

P_v = vapor pressure of the liquid at body inlet temperature, psia (vapor pressures and critical pressures for many common liquids are provided in the Physical Constants of Hydrocarbons and Physical Constants of Fluids tables; refer to the Table of Contents for the page number).

After calculating ΔP_{allow}, substitute it into the basic liquid sizing equation $Q = C_V\sqrt{\Delta P / G}$ to determine either Q or C_v. If the actual ΔP is less the ΔP_{allow}, then the actual ΔP should be used in the equation.

The equation used to determine ΔP_{allow} should also be used to calculate the valve body differential pressure at which significant cavitation can occur. Minor cavitation will occur at a slightly lower pressure differential than that predicted by the equation, but should produce negligible damage in most globe-style control valves.

Consequently, initial cavitation and choked flow occur nearly simultaneously in globe-style or low-recovery valves.

However, in high-recovery valves such as ball or butterfly valves, significant cavitation can occur at pressure drops below that which produces choked flow. So although ΔP_{allow} and K_m are useful in predicting choked flow capacity, a separate cavitation index (K_c) is needed to determine the pressure drop at which cavitation damage will begin (ΔP_c) in high-recovery valves.

The equation can be expressed:

$$\Delta P_C = K_C (P_1 - P_V) \quad (9)$$

This equation can be used anytime outlet pressure is greater than the vapor pressure of the liquid.

Addition of anti-cavitation trim tends to increase the value of K_m. In other words, choked flow and incipient cavitation will occur at substantially higher pressure drops than was the case without the anti-cavitation accessory.

Valve Sizing Calculations (Traditional Method)

LIQUID SIZING EQUATION APPLICATION

	EQUATION	
1	$Q = C_v \sqrt{\Delta P / G}$	Basic liquid sizing equation. Use to determine proper valve size for a given set of service conditions. (Remember that viscosity effects and valve recovery capabilities are not considered in this basic equation.)
2	$C_V = Q \sqrt{\frac{G}{\Delta P}}$	Use to calculate expected C_v for valve controlling water or other liquids that behave like water.
3	$C_{vr} = F_V C_V$	Use to find actual required C_v for equation (2) after including viscosity correction factor.
4	$Q_{max} = C_{vr} \sqrt{\Delta P / G}$	Use to find maximum flow rate assuming no viscosity correction is necessary.
5	$Q_{pred} = \frac{Q_{max}}{F_V}$	Use to predict actual flow rate based on equation (4) and viscosity factor correction.
6	$C_{VC} = \frac{C_{vr}}{F_v}$	Use to calculate corrected sizing coefficient for use in equation (7).
7	$\Delta P_{pred} = G\,(Q/C_{vc})^2$	Use to predict pressure drop for viscous liquids.
8	$\Delta P_{allow} = K_m\,(P_1 - r_c\,P_v)$	Use to determine maximum allowable pressure drop that is effective in producing flow.
9	$\Delta P_C = K_C\,(P_1 - P_V)$	Use to predict pressure drop at which cavitation will begin in a valve with high recovery characteristics.

Liquid Sizing Summary

The most common use of the basic liquid sizing equation is to determine the proper valve size for a given set of service conditions. The first step is to calculate the required C_v by using the sizing equation. The ΔP used in the equation must be the actual valve pressure drop or ΔP_{allow}, whichever is smaller. The second step is to select a valve, from the manufacturer's literature, with a C_v equal to or greater than the calculated value.

Accurate valve sizing for liquids requires use of the dual coefficients of C_v and K_m. A single coefficient is not sufficient to describe both the capacity and the recovery characteristics of the valve. Also, use of the additional cavitation index factor K_c is appropriate in sizing high recovery valves, which may develop damaging cavitation at pressure drops well below the level of the choked flow.

Liquid Sizing Nomenclature

C_v = valve sizing coefficient for liquid determined experimentally for each size and style of valve, using water at standard conditions as the test fluid

C_{vc} = calculated C_v coefficient including correction for viscosity

C_{vr} = corrected sizing coefficient required for viscous applications

ΔP = differential pressure, psi

ΔP_{allow} = maximum allowable differential pressure for sizing purposes, psi

ΔP_c = pressure differential at which cavitation damage begins, psi

F_v = viscosity correction factor

G = specific gravity of fluid (water at 60°F = 1.0000)

K_c = dimensionless cavitation index used in determining ΔP_c

K_m = valve recovery coefficient from manufacturer's literature

P_1 = body inlet pressure, psia

P_v = vapor pressure of liquid at body inlet temperature, psia

Q = flow rate capacity, gallons per minute

Q_{max} = designation for maximum flow rate, assuming no viscosity correction required, gallons per minute

Q_{pred} = predicted flow rate after incorporating viscosity correction, gallons per minute

r_c = critical pressure ratio

Valve Sizing Calculations (Traditional Method)

Sizing for Gas or Steam Service

A sizing procedure for gases can be established based on adaptions of the basic liquid sizing equation. By introducing conversion factors to change flow units from gallons per minute to cubic feet per hour and to relate specific gravity in meaningful terms of pressure, an equation can be derived for the flow of air at 60°F. Because 60°F corresponds to 520° on the Rankine absolute temperature scale and because the specific gravity of air at 60°F is 1.0, an additional factor can be included to compare air at 60°F with specific gravity (G) and absolute temperature (T) of any other gas. The resulting equation an be written:

$$Q_{SCFH} = 59.64\, C_V P_1 \sqrt{\frac{\Delta P}{P_1}} \sqrt{\frac{520}{GT}} \qquad (A)$$

The equation shown above, while valid at very low pressure drop ratios, has been found to be very misleading when the ratio of pressure drop (ΔP) to inlet pressure (P_1) exceeds 0.02. The deviation of actual flow capacity from the calculated flow capacity is indicated in Figure 8 and results from compressibility effects and critical flow limitations at increased pressure drops.

Critical flow limitation is the more significant of the two problems mentioned. Critical flow is a choked flow condition caused by increased gas velocity at the vena contracta. When velocity at the vena contracta reaches sonic velocity, additional increases in ΔP by reducing downstream pressure produce no increase in flow. So, after critical flow condition is reached (whether at a pressure drop/inlet pressure ratio of about 0.5 for glove valves or at much lower ratios for high recovery valves) the equation above becomes completely useless. If applied, the C_v equation gives a much higher indicated capacity than actually will exist. And in the case of a high recovery valve which reaches critical flow at a low pressure drop ratio (as indicated in Figure 8), the critical flow capacity of the valve may be overestimated by as much as 300 percent.

The problems in predicting critical flow with a C_v-based equation led to a separate gas sizing coefficient based on air flow tests. The coefficient (C_g) was developed experimentally for each type and size of valve to relate critical flow to absolute inlet pressure. By including the correction factor used in the previous equation to compare air at 60°F with other gases at other absolute temperatures, the critical flow equation an be written:

$$Q_{critical} = C_g P_1 \sqrt{520 / GT} \qquad (B)$$

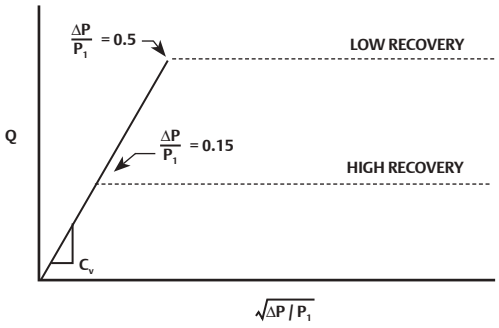


Figure 9. *Critical Flow for High and Low Recovery Valves with Equal C_v*

Universal Gas Sizing Equation

To account for differences in flow geometry among valves, equations (A) and (B) were consolidated by the introduction of an additional factor (C_1). C_1 is defined as the ratio of the gas sizing coefficient and the liquid sizing coefficient and provides a numerical indicator of the valve's recovery capabilities. In general, C_1 values can range from about 16 to 37, based on the individual valve's recovery characteristics. As shown in the example, two valves with identical flow areas and identical critical flow (C_g) capacities can have widely differing C_1 values dependent on the effect internal flow geometry has on liquid flow capacity through each valve. Example:

High Recovery Valve

C_g = 4680
C_v = 254
$C_1 = C_g/C_v$
= 4680/254
= 18.4

Low Recovery Valve

C_g = 4680
C_v = 135
$C_1 = C_g/C_v$
= 4680/135
= 34.7

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So we see that two sizing coefficients are needed to accurately size valves for gas flow—C_g to predict flow based on physical size or flow area and C_1 to account for differences in valve recovery characteristics. A blending equation, called the Universal Gas Sizing Equation, combines equations (A) and (B) by means of a sinusoidal function and is based on the "perfect gas" laws. It can be expressed in either of the following manners:

$$Q_{SCFH} = \sqrt{\frac{520}{GT}}\ C_g P_1 \text{ SIN} \left[\left(\frac{59.64}{C_1}\right)\left(\sqrt{\frac{\Delta P}{P_1}}\right)\right] \text{ rad} \qquad \text{(C)}$$

OR

$$Q_{SCFH} = \sqrt{\frac{520}{GT}}\ C_g P_1 \text{ SIN} \left[\left(\frac{3417}{C_1}\right)\left(\sqrt{\frac{\Delta P}{P_1}}\right)\right] \text{ Deg} \qquad \text{(D)}$$

In either form, the equation indicates critical flow when the sine function of the angle designated within the brackets equals unity. The pressure drop ratio at which critical flow occurs is known as the critical pressure drop ratio. It occurs when the sine angle reaches $\pi/2$ radians in equation (C) or 90 degrees in equation (D). As pressure drop across the valve increases, the sine angle increases from zero up to $\pi/2$ radians (90°). If the angle were allowed to increase further, the equations would predict a decrease in flow. Because this is not a realistic situation, the angle must be limited to 90 degrees maximum.

Although "perfect gases," as such, do not exist in nature, there are a great many applications where the Universal Gas Sizing Equation, (C) or (D), provides a very useful and usable approximation.

General Adaptation for Steam and Vapors

The density form of the Universal Gas Sizing Equation is the most general form and can be used for both perfect and non-perfect gas applications. Applying the equation requires knowledge of one additional condition not included in previous equations, that being the inlet gas, steam or vapor density (d_1) in lbs/ft^3. (Steam density can be determined from tables.)

Then the following adaptation of the Universal Gas Sizing Equation can be applied:

$$Q_{lb/hr} = 1.06\sqrt{d_1 P_1}\ C_g \text{ SIN} \left(\frac{3417}{C_1}\right)\left(\sqrt{\frac{\Delta P}{P_1}}\right) \text{Deg} \qquad \text{(E)}$$

Special Equation Form for Steam Below 1000 psig

If steam applications do not exceed 1000 psig, density changes can be compensated for by using a special adaptation of the Universal Gas Sizing Equation. It incorporates a factor for amount of superheat in degrees Fahrenheit (T_{sh}) and also a sizing coefficient (C_s) for steam. Equation (F) eliminates the need for finding the density of superheated steam, which was required in Equation (E). At pressures below 1000 psig, a constant relationship exists between the gas sizing coefficient (C_g) and the steam coefficient (C_s). This relationship can be expressed: $C_s = C_g/20$. For higher steam pressure application, use Equation (E).

$$Q_{lb/hr} = \left[\frac{C_s P_1}{1 + 0.00065T_{sh}}\right] \text{ SIN} \left[\left(\frac{3417}{C_1}\right)\left(\sqrt{\frac{\Delta P}{P_1}}\right)\right] \text{ Deg} \qquad \text{(F)}$$

Gas and Steam Sizing Summary

The Universal Gas Sizing Equation can be used to determine the flow of gas through any style of valve. Absolute units of temperature and pressure must be used in the equation. When the critical pressure drop ratio causes the sine angle to be 90 degrees, the equation will predict the value of the critical flow. For service conditions that would result in an angle of greater than 90 degrees, the equation must be limited to 90 degrees in order to accurately determine the critical flow.

Most commonly, the Universal Gas Sizing Equation is used to determine proper valve size for a given set of service conditions. The first step is to calculate the required C_g by using the Universal Gas Sizing Equation. The second step is to select a valve from the manufacturer's literature. The valve selected should have a C_g which equals or exceeds the calculated value. Be certain that the assumed C_1 value for the valve is selected from the literature.

It is apparent that accurate valve sizing for gases that requires use of the dual coefficient is not sufficient to describe both the capacity and the recovery characteristics of the valve.

Proper selection of a control valve for gas service is a highly technical problem with many factors to be considered. Leading valve manufacturers provide technical information, test data, sizing catalogs, nomographs, sizing slide rules and computer or calculator programs that make valve sizing a simple and accurate procedure.

Valve Sizing Calculations (Traditional Method)

GAS AND STEAM SIZING EQUATION APPLICATION

	EQUATION	
A	$Q_{SCFH} = 59.64\, C_V P_1 \sqrt{\frac{\Delta P}{P_1}} \sqrt{\frac{520}{GT}}$	Use only at very low pressure drop (DP/P_1) ratios of 0.02 or less.
B	$Q_{critical} = C_g P_1 \sqrt{520 / GT}$	Use only to determine critical flow capacity at a given inlet pressure.
C	$Q_{SCFH} = \sqrt{\frac{520}{GT}}\ C_g P_1\ SIN \left[\frac{59.64}{C_1}\right]\left(\sqrt{\frac{\Delta P}{P_1}}\right)$ rad OR	Universal Gas Sizing Equation. Use to predict flow for either high or low recovery valves, for any gas adhering to the perfect gas laws and under any service conditions.
D	$Q_{SCFH} = \sqrt{\frac{520}{GT}}\ C_g P_1\ SIN \left[\frac{3417}{C_1}\right]\left(\sqrt{\frac{\Delta P}{P_1}}\right)$ Deg	
E	$Q_{lb/hr} = 1.06\sqrt{d_1 P_1}\ C_g\ SIN \left[\frac{3417}{C_1}\right]\left(\sqrt{\frac{\Delta P}{P_1}}\right)$ Deg	Use to predict flow for perfect or non-perfect gas sizing applications, for any vapor including steam, at any service condition when fluid density is known.
F	$Q_{lb/hr} = \left[\frac{C_S P_1}{1 + 0.00065 T_{sh}}\right]\ SIN \left[\frac{3417}{C_1}\right]\left(\sqrt{\frac{\Delta P}{P_1}}\right)$ Deg	Use only to determine steam flow when inlet pressure is 1000 psig or less.

Gas and Steam Sizing Nomenclature

C_1 = C_g/C_v
C_g = gas sizing coefficient
C_s = steam sizing coefficient, $C_g/20$
C_v = liquid sizing coefficient
d_1 = density of steam or vapor at inlet, lbs/ft^3
G = gas specific gravity (air = 1.0)
P_1 = valve inlet pressure, psia
ΔP = pressure drop across valve, psi
$Q_{critical}$ = critical flow rate, SCFH
Q_{SCFH} = gas flow rate, SCFH
$Q_{lb/hr}$ = steam or vapor flow rate, lbs/hr
T = absolute temperature of gas at inlet, degrees Rankine
T_{sh} = degrees of superheat, °F

Introduction

Fisher™ regulators and valves have traditionally been sized using equations derived by the company. There are now standardized calculations that are becoming accepted world wide. Some product literature continues to demonstrate the traditional method, but the trend is to adopt the standardized method. Therefore, both methods are covered in this application guide.

Liquid Valve Sizing

Standardization activities for control valve sizing can be traced back to the early 1960s when a trade association, the Fluids Control Institute, published sizing equations for use with both compressible and incompressible fluids. The range of service conditions that could be accommodated accurately by these equations was quite narrow and the standard did not achieve a high degree of acceptance. In 1967, the ISA established a committee to develop and publish standard equations. The efforts of this committee culminated in a valve sizing procedure that has achieved the status of American National Standard. Later, a committee of the International Electrotechnical Commission (IEC) used the ISA works as a basis to formulate international standards for sizing control valves. (Some information in this introductory material has been extracted from ANSI/ISA S75.01 standard with the permission of the publisher, the ISA.) Except for some slight differences in nomenclature and procedures, the ISA and IEC standards have been harmonized. ANSI/ISA Standard S75.01 is harmonized with IEC Standards 534-2-1 and 534-2-2. (IEC Publications 534-2, Sections One and Two for incompressible and compressible fluids, respectively.)

In the following sections, the nomenclature and procedures are explained and sample problems are solved to illustrate their use.

Sizing Valves for Liquids

Following is a step-by-step procedure for the sizing of control valves for liquid flow using the IEC procedure. Each of these steps is important and must be considered during any valve sizing procedure. Steps 3 and 4 concern the determination of certain sizing factors that may or may not be required in the sizing equation depending on the service conditions of the sizing problem. If one, two or all three of these sizing factors are to be included in the equation for a particular sizing problem, refer to the appropriate factor determination section(s) located in the text after the sixth step.

1. *Specify the variables required to size the valve as follows:*
   - Desired design
   - Process fluid (water, oil, etc.) and
   - Appropriate service conditions q or w, P_1, P_2 or ΔP, T_1, G_f, P_v, P_c and υ.

   The ability to recognize which terms are appropriate for a specific sizing procedure can only be acquired through experience with different valve sizing problems. If any of the above terms appears to be new or unfamiliar, refer to the Abbreviations and Terminology Table 3-1 for a complete definition.

2. *Determine the equation constant, N.*

   N is a numerical constant contained in each of the flow equations to provide a means for using different systems of units. Values for these various constants and their applicable units are given in the Equation Constants Table 3-2.

   Use N_1, if sizing the valve for a flow rate in volumetric units (GPM or Nm^3/h).

   Use N_6, if sizing the valve for a flow rate in mass units (lb/hr or kg/hr).

3. *Determine F_p, the piping geometry factor.*

   F_p is a correction factor that accounts for pressure losses due to piping fittings such as reducers, elbows or tees that might be attached directly to the inlet and outlet connections of the control valve to be sized. If such fittings are attached to the valve, the F_p factor must be considered in the sizing procedure. If, however, no fittings are attached to the valve, F_p has a value of 1.0 and simply drops out of the sizing equation.

   For rotary valves with reducers (swaged installations) and other valve designs and fitting styles, determine the F_p factors by using the procedure for determining F_p, the Piping Geometry Factor, page 637.

4. *Determine q_{max} (the maximum flow rate at given upstream conditions) or ΔP_{max} (the allowable sizing pressure drop).*

   The maximum or limiting flow rate (q_{max}), commonly called choked flow, is manifested by no additional increase in flow rate with increasing pressure differential with fixed upstream conditions. In liquids, choking occurs as a result of vaporization of the liquid when the static pressure within the valve drops below the vapor pressure of the liquid.

   The IEC standard requires the calculation of an allowable sizing pressure drop (ΔP_{max}), to account for the possibility of choked flow conditions within the valve. The calculated ΔP_{max} value is compared with the actual pressure drop specified in the service conditions and the lesser of these two values is used in the sizing equation. If it is desired to use ΔP_{max} to account for the possibility of choked flow conditions, it can be calculated using the procedure for determining q_{max}, the Maximum Flow Rate or ΔP_{max}, the Allowable Sizing Pressure Drop. If it can be recognized that choked flow conditions will not develop within the valve, ΔP_{max} need not be calculated.

5. *Solve for required C_v, using the appropriate equation:*
   - For volumetric flow rate units:

$$C_v = \frac{q}{N_1 F_p \sqrt{\frac{P_1 - P_2}{G_f}}}$$

   - For mass flow rate units:

$$C_v = \frac{w}{N_6 F_p \sqrt{(P_1 - P_2)\gamma}}$$

   In addition to C_v, two other flow coefficients, K_v and A_v, are used, particularly outside of North America. The following relationships exist:

   $K_v = (0.865)(C_v)$

   $A_v = (2.40 \times 10^{-5})(C_v)$

6. *Select the valve size using the appropriate flow coefficient table and the calculated C_v value.*

Valve Sizing (Standardized Method)

Table 3-1. Abbreviations and Terminology

SYMBOL		SYMBOL	
C_v	Valve sizing coefficient	P_1	Upstream absolute static pressure
d	Nominal valve size	P_2	Downstream absolute static pressure
D	Internal diameter of the piping	P_c	Absolute thermodynamic critical pressure
F_d	Valve style modifier, dimensionless	P_v	Vapor pressure absolute of liquid at inlet temperature
F_F	Liquid critical pressure ratio factor, dimensionless	ΔP	Pressure drop (P_1-P_2) across the valve
F_k	Ratio of specific heats factor, dimensionless	$\Delta P_{max(L)}$	Maximum allowable liquid sizing pressure drop
F_L	Rated liquid pressure recovery factor, dimensionless	$\Delta P_{max(LP)}$	Maximum allowable sizing pressure drop with attached fittings
F_{LP}	Combined liquid pressure recovery factor and piping geometry factor of valve with attached fittings (when there are no attached fittings, F_{LP} equals F_L), dimensionless	q	Volume rate of flow
F_P	Piping geometry factor, dimensionless	q_{max}	Maximum flow rate (choked flow conditions) at given upstream conditions
G_f	Liquid specific gravity (ratio of density of liquid at flowing temperature to density of water at 60°F), dimensionless	T_1	Absolute upstream temperature (Kelvin or deg Rankine)
G_g	Gas specific gravity (ratio of density of flowing gas to density of air with both at standard conditions(1), i.e., ratio of molecular weight of gas to molecular weight of air), dimensionless	w	Mass rate of flow
k	Ratio of specific heats, dimensionless	x	Ratio of pressure drop to upstream absolute static pressure ($\Delta P/P_1$), dimensionless
K	Head loss coefficient of a device, dimensionless	x_T	Rated pressure drop ratio factor, dimensionless
M	Molecular weight, dimensionless	Y	Expansion factor (ratio of flow coefficient for a gas to that for a liquid at the same Reynolds number), dimensionless
N	Numerical constant	Z	Compressibility factor, dimensionless
		γ^1	Specific weight at inlet conditions
		υ	Kinematic viscosity, centistokes

1. Standard conditions are defined as 60°F and 14.7 psia.

Table 3-2. Equation Constants(1)

		N	w	q	p(2)	γ	T	d, D
N_1		0.0865 0.865 1.00	---- ---- ----	Nm^3/h Nm^3/h GPM	kPa bar psia	---- ---- ----	---- ---- ----	---- ---- ----
N_2		0.00214 890	---- ----	---- ----	---- ----	---- ----	---- ----	mm in.
N_5		0.00241 1000	---- ----	---- ----	---- ----	---- ----	---- ----	mm in.
N_6		2.73 27.3 63.3	kg/hr kg/hr lb/hr	---- ---- ----	kPa bar psia	kg/m^3 kg/m^3 lb/ft^3	---- ---- ----	---- ---- ----
N_7(3)	Normal Conditions T_N = 0°C	3.94 394	---- ----	Nm^3/h Nm^3/h	kPa bar	---- ----	Kelvin Kelvin	---- ----
	Standard Conditions T_s = 16°C	4.17 417	---- ----	Nm^3/h Nm^3/h	kPa bar	---- ----	Kelvin Kelvin	---- ----
	Standard Conditions T_s = 60°F	1360	----	SCFH	psia	----	deg Rankine	----
N_8		0.948 94.8 19.3	kg/hr kg/hr lb/hr	---- ---- ----	kPa bar psia	---- ---- ----	Kelvin Kelvin deg Rankine	---- ---- ----
N_9(3)	Normal Conditions T_N = 0°C	21.2 2120	---- ----	Nm^3/h Nm^3/h	kPa bar	---- ----	Kelvin Kelvin	---- ----
	Standard Conditions T_s = 16°C	22.4 2240	---- ----	Nm^3/h Nm^3/h	kPa bar	---- ----	Kelvin Kelvin	---- ----
	Standard Conditions T_s = 60°F	7320	----	SCFH	psia	----	deg Rankine	----

1. Many of the equations used in these sizing procedures contain a numerical constant, N, along with a numerical subscript. These numerical constants provide a means for using different units in the equations. Values for the various constants and the applicable units are given in the above table. For example, if the flow rate is given in U.S. GPM and the pressures are psia, N_1 has a value of 1.00. If the flow rate is Nm^3/h and the pressures are kPa, the N_1 constant becomes 0.0865.
2. All pressures are absolute.
3. Pressure base is 101.3 kPa = 1.01 bar = 14.7 psia.

Determining Piping Geometry Factor (F_p)

Determine an F_p factor if any fittings such as reducers, elbows or tees will be directly attached to the inlet and outlet connections of the control valve that is to be sized. When possible, it is recommended that F_p factors be determined experimentally by using the specified valve in actual tests.

Calculate the F_p factor using the following equation:

$$F_p = \left[1 + \frac{\sum K}{N_2}\left(\frac{C_v}{d^2}\right)^2\right]^{-1/2}$$

where,

N_2 = Numerical constant found in the Equation Constants table
d = Assumed nominal valve size
C_v = Valve sizing coefficient at 100% travel for the assumed valve size

In the above equation, the $\sum K$ term is the algebraic sum of the velocity head loss coefficients of all of the fittings that are attached to the control valve.

$$\sum K = K_1 + K_2 + K_{B1} - K_{B2}$$

where,

K_1 = Resistance coefficient of upstream fittings
K_2 = Resistance coefficient of downstream fittings
K_{B1} = Inlet Bernoulli coefficient
K_{B2} = Outlet Bernoulli coefficient

The Bernoulli coefficients, K_{B1} and K_{B2}, are used only when the diameter of the piping approaching the valve is different from the diameter of the piping leaving the valve, whereby:

$$K_{B1} \text{ or } K_{B2} = 1 - \left(\frac{d}{D}\right)^4$$

where,

d = Nominal valve size
D = Internal diameter of piping

If the inlet and outlet piping are of equal size, then the Bernoulli coefficients are also equal, $K_{B1} = K_{B2}$ and therefore they are dropped from the equation.

The most commonly used fitting in control valve installations is the short-length concentric reducer. The equations for this fitting are as follows:

- For an inlet reducer:

$$K_1 = 0.5\left(1 - \frac{d^2}{D^2}\right)^2$$

- For an outlet reducer:

$$K_2 = 1.0\left(1 - \frac{d^2}{D^2}\right)^2$$

- For a valve installed between identical reducers:

$$K_1 + K_2 = 1.5\left(1 - \frac{d^2}{D^2}\right)^2$$

Determining Maximum Flow Rate (q_{max})

Determine either q_{max} or ΔP_{max} if it is possible for choked flow to develop within the control valve that is to be sized. The values can be determined by using the following procedures.

$$q_{max} = N_1 F_L C_V \sqrt{\frac{P_1 - F_F P_V}{G_f}}$$

Values for F_F, the liquid critical pressure ratio factor, can be obtained from Figure 3-1 or from the following equation:

$$F_F = 0.96 - 0.28\sqrt{\frac{P_V}{P_C}}$$

Values of F_L, the recovery factor for rotary valves installed without fittings attached, can be found in published coefficient tables. If the given valve is to be installed with fittings such as reducer attached to it, F_L in the equation must be replaced by the quotient F_{LP}/F_P, where:

$$F_{LP} = \left[\frac{K_1}{N_2}\left(\frac{C_V}{d^2}\right)^2 + \frac{1}{F_L^2}\right]^{-1/2}$$

and

$$K_1 = K_1 + K_{B1}$$

where,

K_1 = Resistance coefficient of upstream fittings

K_{B1} = Inlet Bernoulli coefficient

(See the procedure for Determining F_p, the Piping Geometry Factor, for definitions of the other constants and coefficients used in the above equations.)

Valve Sizing (Standardized Method)

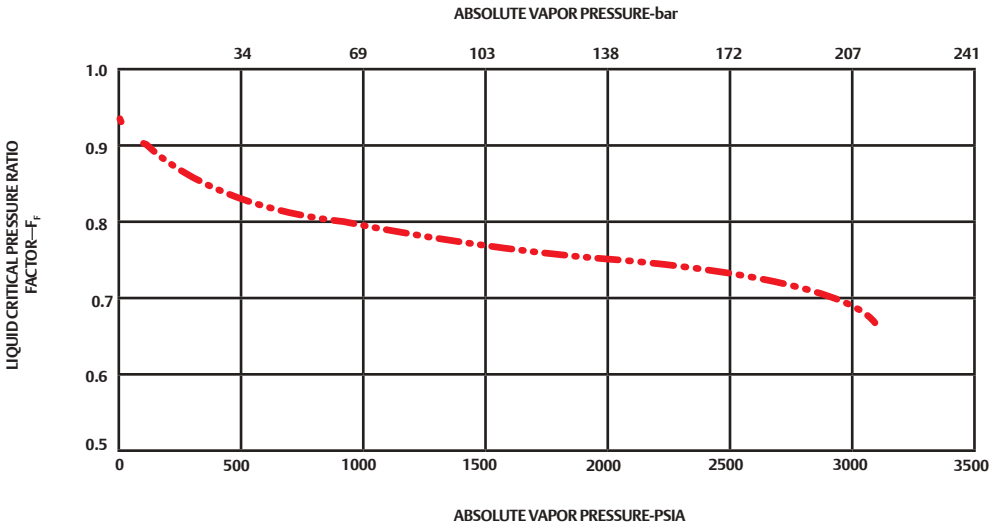


Figure 3-1. *Liquid Critical Pressure Ratio Factor for Water*

Determining Allowable Sizing Pressure Drop (ΔP_{max})

ΔP_{max} (the allowable sizing pressure drop) can be determined from the following relationships:

For valves installed without fittings:

$$\Delta P_{max(L)} = F_L^2 (P_1 - F_F P_V)$$

For valves installed with fittings attached:

$$\Delta P_{max(LP)} = \left(\frac{F_{LP}}{F_P}\right)^2 (P_1 - F_F P_V)$$

where,

P_1 = Upstream absolute static pressure

P_2 = Downstream absolute static pressure

P_v = Absolute vapor pressure at inlet temperature

Values of F_F, the liquid critical pressure ratio factor, can be obtained from Figure 3-1 or from the following equation:

$$F_F = 0.96 - 0.28 \sqrt{\frac{P_V}{P_c}}$$

An explanation of how to calculate values of F_{LP}, the recovery factor for valves installed with fittings attached, is presented in the preceding procedure Determining q_{max} (the Maximum Flow Rate).

Once the ΔP_{max} value has been obtained from the appropriate equation, it should be compared with the actual service pressure differential ($\Delta P = P_1 - P_2$). If ΔP_{max} is less than ΔP, this is an indication that choked flow conditions will exist under the service conditions specified. If choked flow conditions do exist ($\Delta P_{max} < P_1 - P_2$), then step 5 of the procedure for Sizing Valves for Liquids must be modified by replacing the actual service pressure differential ($P_1 - P_2$) in the appropriate valve sizing equation with the calculated ΔP_{max} value.

Note

Once it is known that choked flow conditions will develop within the specified valve design (ΔP_{max} is calculated to be less than ΔP), a further distinction can be made to determine whether the choked flow is caused by cavitation or flashing. The choked flow conditions are caused by flashing if the outlet pressure of the given valve is less than the vapor pressure of the flowing liquid. The choked flow conditions are caused by cavitation if the outlet pressure of the valve is greater than the vapor pressure of the flowing liquid.

Liquid Sizing Sample Problem

Assume an installation that, at initial plant startup, will not be operating at maximum design capability. The lines are sized for the ultimate system capacity, but there is a desire to install a control valve now which is sized only for currently anticipated requirements. The line size is 8 in. / DN 200 and an ASME CL300 globe valve with an equal percentage cage has been specified. Standard concentric reducers will be used to install the valve into the line. Determine the appropriate valve size.

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Process Management

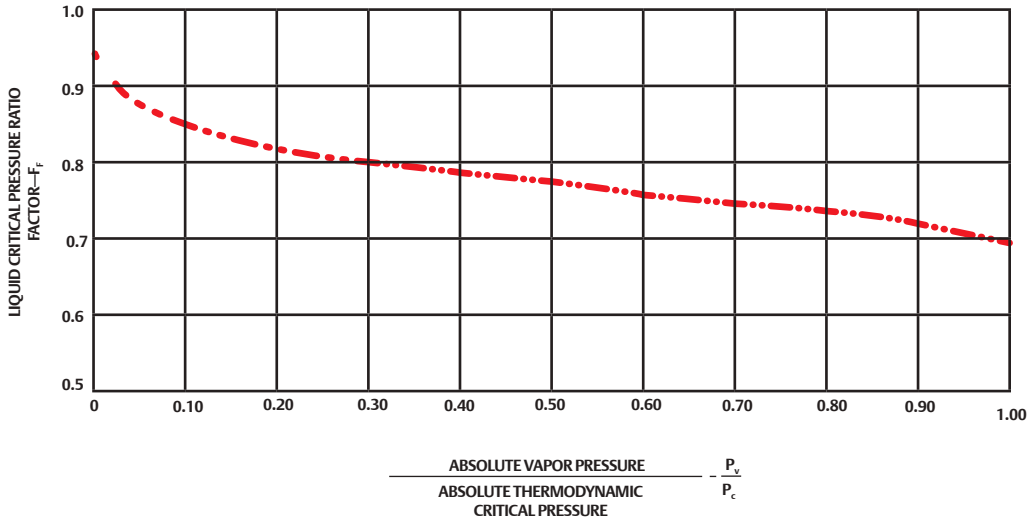


Figure 3-2. *Liquid Critical Pressure Ratio Factor for Liquids Other Than Water*

1. *Specify the necessary variables required to size the valve:*
   - Desired Valve Design—ASME CL300 globe valve with equal percentage cage and an assumed valve size of 3 in.
   - Process Fluid—liquid propane
   - Service Conditions—q = 800 GPM / 3028 l/min

     P_1 = 300 psig / 20.7 bar = 314.7 psia / 21.7 bar a

     P_2 = 275 psig / 19.0 bar = 289.7 psia / 20.0 bar a

     ΔP = 25 psi / 1.7 bar

     T_1 = 70°F / 21°C

     G_f = 0.50

     P_v = 124.3 psia / 8.6 bar a

     P_c = 616.3 psia / 42.5 bar a
2. *Use an N_1 value of 1.0 from the Equation Constants table.*
3. *Determine F_p, the piping geometry factor.*

   Because it is proposed to install a 3 in. valve in an 8 in. / DN 200 line, it will be necessary to determine the piping geometry factor, F_p, which corrects for losses caused by fittings attached to the valve.

$$F_p = \left[1 + \frac{\sum K}{N_2}\left(\frac{C_v}{d^2}\right)^2\right]^{-1/2}$$

where,

N_2 = 890, from the Equation Constants table

d = 3 in. / 76 mm, from step 1

C_v = 121, from the flow coefficient table for an ASME CL300, 3 in. globe valve with equal percentage cage

To compute $\sum K$ for a valve installed between identical concentric reducers:

$$\sum K = K_1 + K_2$$

$$= 1.5\left(1 - \frac{d^2}{D^2}\right)^2$$

$$= 1.5\left(1 - \frac{(3)^2}{(8)^2}\right)^2$$

$$= 1.11$$

Valve Sizing (Standardized Method)

where,

D = 8 in. / 203 mm, the internal diameter of the piping so,

$$F_p = \left[1 + \frac{1.11}{890}\left(\frac{121}{3^2}\right)^2\right]^{-1/2}$$

$$= 0.90$$

4. *Determine ΔP_{max} (the Allowable Sizing Pressure Drop.)*

   Based on the small required pressure drop, the flow will not be choked ($\Delta P_{max} > \Delta P$).

5. *Solve for C_v, using the appropriate equation.*

$$C_v = \frac{q}{N_1 F_p \sqrt{\frac{P_1 - P_2}{G_f}}}$$

$$= \frac{800}{(1.0)\,(0.90)\sqrt{\frac{25}{0.5}}}$$

$$= 125.7$$

6. *Select the valve size using the flow coefficient table and the calculated C_v value.*

   The required C_v of 125.7 exceeds the capacity of the assumed valve, which has a C_v of 121. Although for this example it may be obvious that the next larger size (4 in.) would be the correct valve size, this may not always be true and a repeat of the above procedure should be carried out.

   Assuming a 4 in. valve, C_v = 203. This value was determined from the flow coefficient table for an ASME CL300, 4 in. globe valve with an equal percentage cage.

   Recalculate the required C_v using an assumed C_v value of 203 in the F_p calculation.

where,

$$\Sigma K = K_1 + K_2$$

$$= 1.5\left(1 - \frac{d^2}{D^2}\right)^2$$

$$= 1.5\left(1 - \frac{16}{64}\right)^2$$

$$= 0.84$$

and

$$F_p = \left[1.0 + \frac{\Sigma K}{N_2}\left(\frac{C_v}{d^2}\right)^2\right]^{-1/2}$$

$$= \left[1.0 + \frac{0.84}{890}\left(\frac{203}{4^2}\right)^2\right]^{-1/2}$$

$$= 0.93$$

and

$$C_v = \frac{q}{N_1 F_p \sqrt{\frac{P_1 - P_2}{G_f}}}$$

$$= \frac{800}{(1.0)\,(0.93)\sqrt{\frac{25}{0.5}}}$$

$$= 121.7$$

This solution indicates only that the 4 in. valve is large enough to satisfy the service conditions given. There may be cases, however, where a more accurate prediction of the C_v is required. In such cases, the required C_v should be redetermined using a new F_p value based on the C_v value obtained above. In this example, C_v is 121.7, which leads to the following result:

$$F_p = \left[1.0 + \frac{\Sigma K}{N_2}\left(\frac{C_v}{d^2}\right)^2\right]^{-1/2}$$

$$= \left[1.0 + \frac{0.84}{890}\left(\frac{121.7}{4^2}\right)^2\right]^{-1/2}$$

$$= 0.97$$

The required C_v then becomes:

$$C_v = \frac{q}{N_1 F_p \sqrt{\frac{P_1 - P_2}{G_f}}}$$

$$= \frac{800}{(1.0)\,(0.97)\sqrt{\frac{25}{0.5}}}$$

$$= 116.2$$

Because this newly determined C_v is very close to the C_v used initially for this recalculation (116.2 versus 121.7), the valve sizing procedure is complete and the conclusion is that a 4 in. valve opened to about 75% of total travel should be adequate for the required specifications.

Gas and Steam Valve Sizing

Sizing Valves for Compressible Fluids

Following is a six-step procedure for the sizing of control valves for compressible flow using the ISA standardized procedure. Each of these steps is important and must be considered during any valve sizing procedure. Steps 3 and 4 concern the determination of certain sizing factors that may or may not be required in the sizing equation depending on the service conditions of the sizing problem. If it is necessary for one or both of these sizing factors to be included in the sizing equation for a particular sizing problem, refer to the appropriate factor determination section(s), which is referenced and located in the following text.

1. *Specify the necessary variables required to size the valve as follows:*

   - Desired valve design (e.g. balanced globe with linear cage)
   - Process fluid (air, natural gas, steam, etc.) and
   - Appropriate service conditions—
     q or w, P_1, P_2 or ΔP, T_1, G_g, M, k, Z and γ_1

   The ability to recognize which terms are appropriate for a specific sizing procedure can only be acquired through experience with different valve sizing problems. If any of the above terms appear to be new or unfamiliar, refer to the Abbreviations and Terminology Table 3-1 in Liquid Valve Sizing Section for a complete definition.

2. *Determine the equation constant, N.*

   N is a numerical constant contained in each of the flow equations to provide a means for using different systems of units. Values for these various constants and their applicable units are given in the Equation Constants Table 3-2 in Liquid Valve Sizing Section.

   Use either N_7 or N_9 if sizing the valve for a flow rate in volumetric units (SCFH or Nm^3/h). Which of the two constants to use depends upon the specified service conditions. N_7 can be used only if the specific gravity, G_g, of the following gas has been specified along with the other required service conditions. N_9 can be used only if the molecular weight, M, of the gas has been specified.

   Use either N_6 or N_8 if sizing the valve for a flow rate in mass units (lb/hr or kg/hr). Which of the two constants to use depends upon the specified service conditions. N_6 can be used only if the specific weight, γ_1, of the flowing gas has been specified along with the other required service conditions. N_8 can be used only if the molecular weight, M, of the gas has been specified.

3. *Determine F_p, the piping geometry factor.*

   F_p is a correction factor that accounts for any pressure losses due to piping fittings such as reducers, elbows or tees that might be attached directly to the inlet and outlet connections of the control valves to be sized. If such fittings are attached to the valve, the F_P factor must be considered in the sizing procedure. If, however, no fittings are attached to the valve, F_P has a value of 1.0 and simply drops out of the sizing equation.

   Also, for rotary valves with reducers and other valve designs and fitting styles, determine the F_P factors by using the procedure for Determining F_P, the Piping Geometry Factor, which is located in Liquid Valve Sizing Section.

4. *Determine Y, the expansion factor, as follows:*

$$Y = 1 - \frac{x}{3F_k x_T}$$

   where,

   F_k = k/1.4, the ratio of specific heats factor

   k = Ratio of specific heats

   $x = \Delta P/P_1$, the pressure drop ratio

   x_T = The pressure drop ratio factor for valves installed without attached fittings. More definitively, x_T is the pressure drop ratio required to produce critical or maximum, flow through the valve when $F_k = 1.0$

   If the control valve to be installed has fittings such as reducers or elbows attached to it, then their effect is accounted for in the expansion factor equation by replacing the x_T term with a new factor x_{TP}. A procedure for determining the x_{TP} factor is described in the following section for Determining x_{TP}, the Pressure Drop Ratio Factor.

Note

Conditions of critical pressure drop are realized when the value of x becomes equal to or exceeds the appropriate value of the product of either $F_k x_T$ or $F_k x_{TP}$ at which point:

$$y = 1 - \frac{x}{3F_k x_T} = 1 - 1/3 = 0.667$$

   Although in actual service, pressure drop ratios can and often will, exceed the indicated critical values, this is the point where critical flow conditions develop. Thus, for a constant P_1, decreasing P_2 (i.e., increasing ΔP) will not result in an increase in the flow rate through the valve. Values of x, therefore, greater than the product of either $F_k x_T$ or $F_k x_{TP}$ must never be substituted in the expression for Y. This means that Y can never be less than 0.667. This same limit on values of x also applies to the flow equations that are introduced in the next section.

5. *Solve for the required C_v using the appropriate equation:*

   For volumetric flow rate units—

   - If the specific gravity, G_g, of the gas has been specified:

$$C_v = \frac{q}{N_7 F_P P_1 Y \sqrt{\frac{x}{G_g T_1 Z}}}$$

- If the molecular weight, M, of the gas has been specified:

$$C_v = \frac{q}{N_7 F_P P_1 Y \sqrt{\frac{x}{M T_1 Z}}}$$

For mass flow rate units—

- If the specific weight, γ_1, of the gas has been specified:

$$C_v = \frac{w}{N_6 F_P Y \sqrt{x P_1 \gamma_1}}$$

- If the molecular weight, M, of the gas has been specified:

$$C_v = \frac{w}{N_8 F_P P_1 Y \sqrt{\frac{x M}{T_1 Z}}}$$

In addition to C_v, two other flow coefficients, K_v and A_v, are used, particularly outside of North America. The following relationships exist:

$K_v = (0.865)(C_v)$

$A_v = (2.40 \times 10^{-5})(C_v)$

6. Select the valve size using the appropriate flow coefficient table and the calculated C_v value.

Determining x_{TP}, the Pressure Drop Ratio Factor

If the control valve is to be installed with attached fittings such as reducers or elbows, then their effect is accounted for in the expansion factor equation by replacing the x_T term with a new factor, x_{TP}.

$$x_{TP} = \frac{x_T}{F_p^2}\left[1 + \frac{x_T K_i}{N_5}\left(\frac{C_v}{d^2}\right)^2\right]^{-1}$$

where,

N_5 = Numerical constant found in the Equation Constants table

d = Assumed nominal valve size

C_v = Valve sizing coefficient from flow coefficient table at 100% travel for the assumed valve size

F_p = Piping geometry factor

x_T = Pressure drop ratio for valves installed without fittings attached. x_T values are included in the flow coefficient tables

In the above equation, K_i, is the inlet head loss coefficient, which is defined as:

$K_i = K_1 + K_{B1}$

where,

K_1 = Resistance coefficient of upstream fittings (see the procedure for Determining F_p, the Piping Geometry Factor, which is contained in the section for Sizing Valves for Liquids).

K_{B1} = Inlet Bernoulli coefficient (see the procedure for Determining F_p, the Piping Geometry Factor, which is contained in the section for Sizing Valves for Liquids).

Compressible Fluid Sizing Sample Problem No. 1

Determine the size and percent opening for a Fisher™ Design V250 ball valve operating with the following service conditions. Assume that the valve and line size are equal.

1. Specify the necessary variables required to size the valve:

- Desired valve design—Design V250 valve
- Process fluid—Natural gas
- Service conditions—

P_1 = 200 psig / 13.8 bar = 214.7 psia / 14.8 bar a

P_2 = 50 psig / 3.4 bar = 64.7 psia / 4.5 bar a

ΔP = 150 psi / 10.3 bar

$x = \Delta P/P_1 = 150/214.7 = 0.70$

T_1 = 60°F / 16°C = 520°R

M = 17.38

G_g = 0.60

k = 1.31

q = 6.0×10^6 SCFH

2. Determine the appropriate equation constant, N, from the Equation Constants Table 3-2 in Liquid Valve Sizing Section.

Because both G_g and M have been given in the service conditions, it is possible to use an equation containing either N_7 or N_9. In either case, the end result will be the same. Assume that the equation containing G_g has been arbitrarily selected for this problem. Therefore, N_7 = 1360.

3. Determine F_p, the piping geometry factor.

Since valve and line size are assumed equal, F_p = 1.0.

4. Determine Y, the expansion factor.

$$F_k = \frac{k}{1.40}$$

$$= \frac{1.31}{1.40}$$

= 0.94

It is assumed that an 8 in. Design V250 valve will be adequate for the specified service conditions. From the flow coefficient Table 4-2, x_T for an 8 in. Design V250 valve at 100% travel is 0.137.

x = 0.70 (This was calculated in step 1.)

Since conditions of critical pressure drop are realized when the calculated value of x becomes equal to or exceeds the appropriate value of $F_k x_T$, these values should be compared.

$F_k x_T = (0.94)(0.137)$

$= 0.129$

Because the pressure drop ratio, x = 0.70 exceeds the calculated critical value, $F_k x_T = 0.129$, choked flow conditions are indicated. Therefore, Y = 0.667 and $x = F_k x_T = 0.129$.

5. Solve for required C_v using the appropriate equation.

$$C_v = \frac{q}{N_7 F_P P_1 Y \sqrt{\frac{x}{G_g T_1 Z}}}$$

The compressibility factor, Z, can be assumed to be 1.0 for the gas pressure and temperature given and $F_p = 1$ because valve size and line size are equal.

So,

$$C_v = \frac{6.0 \times 10^6}{(1360)(1.0)(214.7)(0.667)\sqrt{\frac{0.129}{(0.6)(520)(1.0)}}} = 1515$$

6. Select the valve size using the flow coefficient table and the calculated C_v value.

The above result indicates that the valve is adequately sized (rated $C_v = 2190$). To determine the percent valve opening, note that the required C_v occurs at approximately 83 degrees for the 8 in. Design V250 valve. Note also that, at 83 degrees opening, the x_T value is 0.252, which is substantially different from the rated value of 0.137 used initially in the problem. The next step is to rework the problem using the x_T value for 83 degrees travel.

The $F_k x_T$ product must now be recalculated.

$x = F_k x_T$

$= (0.94)(0.252)$

$= 0.237$

The required C_v now becomes:

$$C_v = \frac{q}{N_7 F_P P_1 Y \sqrt{\frac{x}{G_g T_1 Z}}}$$

$$= \frac{6.0 \times 10^6}{(1360)(1.0)(214.7)(0.667)\sqrt{\frac{0.237}{(0.6)(520)(1.0)}}}$$

$= 1118$

The reason that the required C_v has dropped so dramatically is attributable solely to the difference in the x_T values at rated and 83 degrees travel. A C_v of 1118 occurs between 75 and 80 degrees travel.

The appropriate flow coefficient table indicates that x_T is higher at 75 degrees travel than at 80 degrees travel. Therefore, if the problem were to be reworked using a higher x_T value, this should result in a further decline in the calculated required C_v.

Reworking the problem using the x_T value corresponding to 78 degrees travel (i.e., $x_T = 0.328$) leaves:

$x = F_k x_T$

$= (0.94)(0.328)$

$= 0.308$

and,

$$C_v = \frac{q}{N_7 F_P P_1 Y \sqrt{\frac{x}{G_g T_1 Z}}}$$

$$= \frac{6.0 \times 10^6}{(1360)(1.0)(214.7)(0.667)\sqrt{\frac{0.308}{(0.6)(520)(1.0)}}}$$

$= 980$

The above C_v of 980 is quite close to the 75 degree travel C_v. The problem could be reworked further to obtain a more precise predicted opening; however, for the service conditions given, an 8 in. Design V250 valve installed in an 8 in. / 203 mm line will be approximately 75 degrees open.

Compressible Fluid Sizing Sample Problem No. 2

Assume steam is to be supplied to a process designed to operate at 250 psig / 17 bar. The supply source is a header maintained at 500 psig / 34.5 bar and 500°F / 260°C. A 6 in. / DN 150 line from the steam main to the process is being planned. Also, make the assumption that if the required valve size is less than 6 in. / DN 150, it will be installed using concentric reducers. Determine the appropriate Design ED valve with a linear cage.

1. Specify the necessary variables required to size the valve:

a. Desired valve design—ASME CL300 Design ED valve with a linear cage. Assume valve size is 4 in.

b. Process fluid—superheated steam

c. Service conditions—

w = 125,000 lbs/hr / 56,700 kg/hr

P_1 = 500 psig / 34.5 bar = 514.7 psia / 35.5 bar a

P_2 = 250 psig / 17 bar = 264.7 psia / 18.3 bar a

P = 250 psi / 17 bar

$x = \Delta P / P_1 = 250/514.7 = 0.49$

T_1 = 500°F / 260°C

γ_1 = 1.0434 lb/ft³ / 16.71 kg/m³
(from Properties of Saturated Steam Table)

k = 1.28 (from Properties of Saturated Steam Table)

Valve Sizing (Standardized Method)

2. Determine the appropriate equation constant, N, from the Equation Constants Table 3-2 in Liquid Valve Sizing Section.

Because the specified flow rate is in mass units, (lb/hr) and the specific weight of the steam is also specified, the only sizing equation that can be used is that which contains the N_6 constant. Therefore,

$N_6 = 63.3$

3. Determine F_p, the piping geometry factor.

$$F_p = \left[1 + \frac{\Sigma K}{N_2}\left(\frac{C_v}{d^2}\right)^2\right]^{-1/2}$$

where,

$N_2 = 890$, determined from the Equation Constants Table

$d = 4$ in.

$C_v = 236$, which is the value listed in the flow coefficient Table 4-3 for a 4 in. Design ED valve at 100% total travel.

$$\Sigma K = K_1 + K_2$$

$$= 1.5\left(1 - \frac{d^2}{D^2}\right)^2$$

$$= 1.5\left(1 - \frac{4^2}{6^2}\right)^2$$

$$= 0.463$$

Finally,

$$F_p = \left[1 + \frac{0.463}{890}\left(\frac{(1.0)(236)}{(4)^2}\right)^2\right]^{-1/2}$$

$$= 0.95$$

4. Determine Y, the expansion factor.

$$Y = 1 - \frac{x}{3F_k x_{TP}}$$

where,

$$F_k = \frac{k}{1.40}$$

$$= \frac{1.28}{1.40}$$

$$= 0.91$$

$x = 0.49$ (As calculated in step 1.)

Because the 4 in. valve is to be installed in a 6 in. line, the x_T term must be replaced by x_{TP}.

$$x_{TP} = \frac{x_T}{F_p^2}\left[1 + \frac{x_T K_i}{N_5}\left(\frac{C_v}{d^2}\right)^2\right]^{-1}$$

where,

$N_5 = 1000$, from the Equation Constants Table

$d = 4$ in.

$F_p = 0.95$, determined in step 3

$x_T = 0.688$, a value determined from the appropriate listing in the flow coefficient table

$C_v = 236$, from step 3

and

$$K_i = K_1 + K_{B1}$$

$$= 0.5\left(1 - \frac{d^2}{D^2}\right)^2 + \left[1 - \left(\frac{d}{D}\right)^4\right]$$

$$= 0.5\left(1 - \frac{4^2}{6^2}\right)^2 + \left[1 - \left(\frac{4}{6}\right)^4\right]$$

$$= 0.96$$

where D = 6 in.

so:

$$x_{TP} = \frac{0.69}{0.95^2}\left[1 + \frac{(0.69)(0.96)}{1000}\left(\frac{236}{4^2}\right)^2\right]^{-1} = 0.67$$

Finally:

$$Y = 1 - \frac{x}{3F_k x_{TP}}$$

$$= 1 - \frac{0.49}{(3)(0.91)(0.67)}$$

$$= 0.73$$

5. Solve for required C_v using the appropriate equation.

$$C_v = \frac{w}{N_6 F_P Y \sqrt{x P_1 \gamma_1}}$$

$$= \frac{125{,}000}{(63.3)(0.95)(0.73)\sqrt{(0.49)(514.7)(1.0434)}}$$

$$= 176$$

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Table 4-1. Representative Sizing Coefficients for Type 1098-EGR Regulator

BODY SIZE		LINEAR CAGE						
		Line Size Equals Body Size		2:1 Line Size to Body Size		X_T	F_D	F_L
		C_v		C_v				
In.	DN	Regulating	Wide-Open	Regulating	Wide-Open			
1	25	16.8	17.7	17.2	18.1	0.806	0.43	0.84
2	50	63.3	66.7	59.6	62.8	0.820	0.35	
3	80	132	139	128	135	0.779	0.30	
4	100	202	213	198	209	0.829	0.28	
6	150	397	418	381	404	0.668	0.28	
BODY SIZE		WHISPER TRIM™ CAGE						
		Line Size Equals Body Size Piping		2:1 Line Size to Body Size Piping		X_T	F_D	F_L
		C_v		C_v				
In.	DN	Regulating	Wide-Open	Regulating	Wide-Open			
1	25	16.7	17.6	15.6	16.4	0.753	0.10	0.89
2	50	54	57	52	55	0.820	0.07	
3	80	107	113	106	110	0.775	0.05	
4	100	180	190	171	180	0.766	0.04	
6	150	295	310	291	306	0.648	0.03	

Table 4-2. Representative Sizing Coefficients for Rotary Shaft Valves

VALVE SIZE, IN.	VALVE STYLE	DEGREES OF VALVE OPENING	C_v	F_L	X_T	F_D
1	V-Notch Ball Valve	60 90	15.6 34.0	0.86 0.86	0.53 0.42	---- ----
1-1/2	V-Notch Ball Valve	60 90	28.5 77.3	0.85 0.74	0.50 0.27	---- ----
2	V-Notch Ball Valve	60 90	59.2 132	0.81 0.77	0.53 0.41	---- ----
	High Performance Butterfly Valve	60 90	58.9 80.2	0.76 0.71	0.50 0.44	0.49 0.70
3	V-Notch Ball Valve	60 90	120 321	0.80 0.74	0.50 0.30	0.92 0.99
	High Performance Butterfly Valve	60 90	115 237	0.81 0.64	0.46 0.28	0.49 0.70
4	V-Notch Ball Valve	60 90	195 596	0.80 0.62	0.52 0.22	0.92 0.99
	High Performance Butterfly Valve	60 90	270 499	0.69 0.53	0.32 0.19	0.49 0.70
6	V-Notch Ball Valve	60 90	340 1100	0.80 0.58	0.52 0.20	0.91 0.99
	High Performance Butterfly Valve	60 90	664 1260	0.66 0.55	0.33 0.20	0.49 0.70
8	V-Notch Ball Valve	60 90	518 1820	0.82 0.54	0.54 0.18	0.91 0.99
	High Performance Butterfly Valve	60 90	1160 2180	0.66 0.48	0.31 0.19	0.49 0.70
10	V-Notch Ball Valve	60 90	1000 3000	0.80 0.56	0.47 0.19	0.91 0.99
	High Performance Butterfly Valve	60 90	1670 3600	0.66 0.48	0.38 0.17	0.49 0.70
12	V-Notch Ball Valve	60 90	1530 3980	0.78 0.63	0.49 0.25	0.92 0.99
	High Performance Butterfly Valve	60 90	2500 5400	---- ----	---- ----	0.49 0.70
16	V-Notch Ball Valve	60 90	2380 8270	0.80 0.37	0.45 0.13	0.92 1.00
	High Performance Butterfly Valve	60 90	3870 8600	0.69 0.52	0.40 0.23	---- ----

Valve Sizing (Standardized Method)

Table 4-3. Representative Sizing Coefficients for Design ED Single-Ported Globe Style Valve Bodies

VALVE SIZE, IN.	VALVE PLUG STYLE	FLOW CHARACTERISTIC	PORT DIAMETER		RATED TRAVEL		C_v	F_L	X_T	F_D
			In.	mm	In.	mm				
1/2	Post Guided	Equal Percentage	0.38	9.7	0.50	12.7	2.41	0.90	0.54	0.61
3/4	Post Guided	Equal Percentage	0.56	14.2	0.50	12.7	5.92	0.84	0.61	0.61
1	Micro-Form™	Equal Percentage	3/8 1/2 3/4	9.5 12.7 19.1	3/4 3/4 3/4	19.1 19.1 19.1	3.07 4.91 8.84	0.89 0.93 0.97	0.66 0.80 0.92	0.72 0.67 0.62
	Cage Guided	Linear	1-5/16	33.3	3/4	19.1	20.6	0.84	0.64	0.34
		Equal Percentage	1-5/16	33.3	3/4	19.1	17.2	0.88	0.67	0.38
1-1/2	Micro-Form™	Equal Percentage	3/8 1/2 3/4	9.5 12.7 19.1	3/4 3/4 3/4	19.1 19.1 19.1	3.20 5.18 10.2	0.84 0.91 0.92	0.65 0.71 0.80	0.72 0.67 0.62
	Cage Guided	Linear	1-7/8	47.6	3/4	19.1	39.2	0.82	0.66	0.34
		Equal Percentage	1-7/8	47.6	3/4	19.1	35.8	0.84	0.68	0.38
2	Cage Guided	Linear	2-5/16	58.7	1-1/8	28.6	72.9	0.77	0.64	0.33
		Equal Percentage	2-5/16	58.7	1-1/8	28.6	59.7	0.85	0.69	0.31
3	Cage Guided	Linear	3-7/16	87.3	1-1/2	38.1	148	0.82	0.62	0.30
		Equal Percentage	----		----		136	0.82	0.68	0.32
4	Cage Guided	Linear	4-3/8	111	2	50.8	236	0.82	0.69	0.28
		Equal Percentage	----		----		224	0.82	0.72	0.28
6	Cage Guided	Linear	7	178	2	50.8	433	0.84	0.74	0.28
		Equal Percentage	----		----		394	0.85	0.78	0.26
8	Cage Guided	Linear	8	203	3	76.2	846	0.87	0.81	0.31
		Equal Percentage	----		----		818	0.86	0.81	0.26

6. *Select the valve size using flow coefficient tables and the calculated C_v value.*

   Refer to the flow coefficient Table 4-3 for Design ED valves with linear cage. Because the assumed 4 in. valve has a C_v of 236 at 100% travel and the next smaller size (3 in.) has a C_v of only 148, it can be surmised that the assumed size is correct. In the event that the calculated required C_v had been small enough to have been handled by the next smaller size or if it had been larger than the rated C_v for the assumed size, it would have been necessary to rework the problem again using values for the new assumed size.

7. *Sizing equations for compressible fluids.*

   The equations listed below identify the relationships between flow rates, flow coefficients, related installation factors and pertinent service conditions for control valves handling compressible fluids. Flow rates for compressible fluids may be encountered in either mass or volume units and thus equations are necessary to handle both situations. Flow coefficients may be calculated using the appropriate equations selected from the following. A sizing flow chart for compressible fluids is given in Annex B.

   The flow rate of a compressible fluid varies as a function of the ratio of the pressure differential to the absolute inlet pressure ($\Delta P/P_1$), designated by the symbol x. At values of x near zero, the equations in this section can be traced to the basic Bernoulli equation for Newtonian incompressible fluids. However, increasing values of x result in expansion and compressibility effects that require the use of appropriate factors (see Buresh, Schuder and Driskell references).

7.1 Turbulent flow

7.1.1 Non-choked turbulent flow

7.1.1.1 Non-choked turbulent flow without attached fittings

[*Applicable if* $x < F_\gamma x_T$]

The flow coefficient shall be calculated using one of the following equations:

Eq. 6

$$C = \frac{W}{N_6 Y \sqrt{x P_1 \rho_1}}$$

Eq. 7

$$C = \frac{W}{N_8 P_1 Y} \sqrt{\frac{T_1 Z}{xM}}$$

Eq. 8a

$$C = \frac{Q}{N_9 P_1 Y} \sqrt{\frac{M T_1 Z}{x}}$$

Eq. 8b

$$C = \frac{Q}{N_7 P_1 Y} \sqrt{\frac{G_g T_1 Z}{x}}$$

NOTE 1 Refer to 8.5 for details of the expansion factor *Y*.

NOTE 2 See Annex C for values of *M*.

7.1.1.2 Non-choked turbulent flow with attached fittings

[*Applicable if* $x < F_\gamma x_{TP}$]

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Cold Temperature Considerations

Regulators Rated for Low Temperatures

In some areas of the world, regulators periodically operate in temperatures below -20°F / -29°C. These cold temperatures require special construction materials to prevent regulator failure. Emerson Process Management offers regulator constructions that are RATED for use in service temperatures below -20°F / -29°C.

Selection Criteria

When selecting a regulator for extreme cold temperature service, the following guidelines should be considered:

- The body material should be 300 Series stainless steel, LCC or LCB due to low carbon content in the material makeup.
- Give attention to the bolts used. Generally, special stainless steel bolting is required.
- Gaskets and O-rings may need to be addressed if providing a seal between two parts exposed to the cold.
- Special springs may be required in order to prevent fracture when exposed to extreme cold.
- Soft parts in the regulator that are also being used as a seal gasket between two metal parts (such as a diaphragm) may need special consideration. Alternate diaphragm materials should be used to prevent leakage caused by hardening and stiffening of the standard materials.

Freezing

Introduction

Freezing has been a problem since the birth of the gas industry. This problem will likely continue, but there are ways to minimize the effects of the phenomenon.

There are two areas of freezing. The first is the formation of ice from water travelling within the gas stream. Ice will form when temperatures drop below 32°F / 0°C.

The second is hydrate formation. Hydrate is a frozen mixture of water and hydrocarbons. This bonding of water around the hydrocarbon molecule forms a compound which can freeze above 32°F / 0°C. Hydrates can be found in pipelines that are saturated with water vapor. It is also common to have hydrate formation in natural gas of high BTU content. Hydrate formation is dependent upon operating conditions and gas composition.

Reducing Freezing Problems

To minimize problems, we have several options.

1. Keep the fluid temperature above the freezing point by applying heat.
2. Feed an antifreeze solution into the flow stream.
3. Select equipment that is designed to be ice-free in the regions where there are moving parts.
4. Design systems that minimize freezing effects.
5. Remove the water from the flow stream.

Heat the Gas

Obviously, warm water does not freeze. What we need to know is when is it necessary to provide additional heat.

Gas temperature is reduced whenever pressure is reduced. This temperature drop is about 1°F / -17°C for each 15 psi / 1.03 bar pressure drop. Potential problems can be identified by calculating the temperature drop and subtracting from the initial temperature. Usually ground temperature, about 50°F / 10°C is the initial temperature. If a pressure reducing station dropped the pressure from 400 to 250 psi / 28 to 17 bar and the initial temperature is 50°F / 10°C, the final temperature would be 40°F / 4°C.

50°F - (400 to 250 psi) (1°F/15 psi) = 40°F

(10°C - (28 to 17 bar) (-17°C/1.03 bar) = 5°C)

In this case, a freezing problem is not expected. However, if the final pressure was 25 psi / 1.7 bar instead of 250 psi / 17 bar, the final temperature would be 25°F / -4°C. We should expect freezing in this example if there is any moisture in the gas stream.

We can heat the entire gas stream with line heaters where the situation warrants. However, this does involve some large equipment and considerable fuel requirements.

Many different types of large heaters are on the market today. Some involve boilers that heat a water/glycol solution which is circulated through a heat exchanger in the main gas line. Two important considerations are: (1) fuel efficiencies and (2) noise generation.

In many cases, it is more practical to build a box around the pressure reducing regulator and install a small catalytic heater to warm the regulator. When pilot-operated regulators are used, we may find that the ice passes through the regulator without difficulty but plugs the small ports in the pilot. A small heater can be used to heat the pilot supply gas or the pilot itself. A word of caution is appropriate. When a heater remains in use when it is not needed, it can overheat the rubber parts of the regulator. They are usually designed for 180°F / 82°C maximum. Using an automatic temperature control thermostat can prevent overheating.

Antifreeze Solution

An antifreeze solution can be introduced into the flow stream where it will combine with the water. The mixture can pass through the pressure reducing station without freezing. The antifreeze is dripped into the pipeline from a pressurized reservoir through a needle valve. This system is quite effective if one remembers to replenish the reservoir. There is a system that allows the antifreeze to enter the pipeline only when needed. We can install a small pressure regulator between the reservoir and the pipeline with the control line of the small regulator connected downstream of the pressure reducing regulator in the pipeline. The small regulator is set at a lower pressure than the regulator in the pipeline. When the controlled pressure is normal, the small regulator remains closed and conserves the antifreeze. When ice begins to block the regulator in the pipeline, downstream pressure will fall below the setpoint of the small regulator which causes it to open, admitting antifreeze into the pipeline as it is needed. When the ice is removed, the downstream pressure returns to normal and the small regulator closes until ice begins to re-form. This system is quite reliable as long as the supply of the antifreeze solution is maintained. It is usually used at low volume pressure reducing stations.

Equipment Selection

We can select equipment that is somewhat tolerant of freezing if we know how ice forms in a pressure reducing regulator. Since the pressure drop occurs at the orifice, this is the spot where we might expect the ice formation. However, this is not necessarily the case. Metal regulator bodies are good heat conductors. As a result, the body, not just the port, is cooled by the pressure drop. The moisture in the incoming gas strikes the cooled surface as it enters the body and freezes to the body wall before it reaches the orifice. If the valve plug is located upstream of the orifice, there is a good chance that it will become trapped in the ice

and remain in the last position. This ice often contains worm holes which allow gas to continue to flow. In this case, the regulator will be unable to control downstream pressure when the flow requirement changes. If the valve plug is located downstream of the port, it is operating in an area that is frequently ice-free. It must be recognized that any regulator can be disabled by ice if there is sufficient moisture in the flow stream.

System Design

We can arrange station piping to reduce freezing if we know when to expect freezing. Many have noted that there are few reported instances of freezing when the weather is very cold (0°F / -18°C). They have observed that most freezing occurs when the atmospheric temperature is between 35 and 45°F / 2 and 7°C. When the atmospheric temperature is quite low, the moisture within the gas stream freezes to the pipe wall before it reaches the pressure reducing valve which leaves only dry gas to pass through the valve. We can take advantage of this concept by increasing the amount of piping that is exposed above ground upstream of the pressure reducing valve. This will assure ample opportunity for the moisture to contact the pipe wall and freeze to the wall.

When the atmospheric temperature rises enough to melt the ice from the pipe wall, it is found that the operating conditions are not favorable to ice formation in the pressure reducing valve. There may be sufficient solar heat gain to warm the regulator body or lower flow rates which reduces the refrigeration effect of the pressure drop.

Parallel pressure reducing valves make a practical antifreeze system for low flow stations such as farm taps. The two parallel regulators are set at slightly different pressures (maybe one at 50 psi / 3.4 bar and one at 60 psi / 4.1 bar). The flow will automatically go through the regulator with the higher setpoint. When this regulator freezes closed, the pressure will drop and the second regulator will open and carry the load. Since most freezing instances occur when the atmospheric temperature is between 35 and 45°F / 2 and 7°C, we expect the ice in the first regulator to begin thawing as soon as the flow stops. When the ice melts from the first regulator, it will resume flowing gas. These two regulators will continue to alternate between flowing and freezing until the atmospheric temperature decreases or increases, which will get the equipment out of the ice formation temperature range.

Water Removal

Removing the moisture from the flow stream solves the problem of freezing. However, this can be a difficult task. Where moisture is a significant problem, it may be beneficial to use a method of dehydration. Dehydration is a process that removes the water from the gas stream. Effective dehydration removes enough water to prevent reaching the dew point at the lowest temperature and highest pressure.

Two common methods of dehydration involve glycol absorption and desiccants. The glycol absorption process requires the gas stream to pass through glycol inside a contactor. Water vapor is absorbed by the glycol which in turn is passed through a regenerator that removes the water by distillation. The glycol is reused after being stripped of the water. The glycol system is continuous and fairly low in cost. It is important, however, that glycol is not pushed downstream with the dried gas.

The second method, solid absorption or desiccant, has the ability to produce much drier gas than glycol absorption. The solid process has the gas stream passing through a tower filled with desiccant. The water vapor clings to the desiccant, until it reaches saturation. Regeneration of the desiccant is done by passing hot gas through the tower to dry the absorption medium. After cooling, the system is ready to perform again. This is more of a batch process and will require two or more towers to keep a continuous flow of dry gas. The desiccant system is more expensive to install and operate than the glycol units.

Most pipeline gas does not have water content high enough to require these measures. Sometimes a desiccant dryer installed in the pilot gas supply lines of a pilot-operated regulator is quite effective. This is primarily true where water is present on an occasional basis.

Summary

It is ideal to design a pressure reducing station that will never freeze, but anyone who has spent time working on this problem will acknowledge that no system is foolproof. We can design systems that minimize the freezing potential by being aware of the conditions that favor freezing.

NACE Sulfide Stress Cracking

Details

NACE International is a technical society concerned with corrosion and corrosion-related issues. NACE is responsible for a large number of standards, but by far the most influential and well known is MR0175, formerly entitled "Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment". MR0175 was issued by NACE in 1975 to provide guidelines for the selection of materials that are resistant to failure in hydrogen sulfide – containing oil and gas production environments. MR0175 has been so widely referenced that, throughout the process industry, the term "NACE" has become nearly synonymous with "MR0175". However, the situation changed in 2003.

MR0175 was modified significantly in a 2003 revision to cover chloride stress corrosion cracking in addition to sulfide stress cracking. Then, in late 2003, the document was reformatted and released as a joint NACE/ISO document called NACE MR0175/ISO 15156, "Petroleum and Natural Gas Industries – Materials for Use in H_2S – Containing Environments in Oil and Gas Production".

In April 2003, NACE also released a new standard, MR0103, which is entitled, "Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments." This standard is essentially the refining industry's "NACE MR0175". MR0103 only addresses sulfide stress cracking, and as such is similar in many respects to the pre-2003 revisions of MR0175.

These NACE standards are applied to:

- MR0175-2002 (and prior)—Intended primarily for upstream *(Oil and gas production)* applications; has historically also been applied to downstream (refinery) applications
- MR0175/ISO 15156—Applies to upstream *(Oil and gas production)* applications only; does not apply to refineries; Includes stress corrosion cracking
- MR0103– Applies to downstream *(Refinery)* applications only
- MR0175-2003—Applies to upstream *(Oil and gas production)*; Replaced by MR0175/ISO 15156

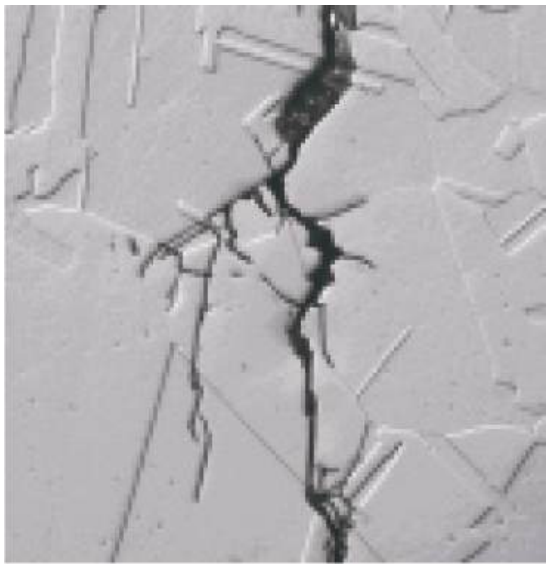


Figure 1. *Photomicrograph Showing Stress Corrosion Cracking*

NACE MR0175-2002 and Prior

The following statements, although based on information and requirements in the pre-2003 revisions of MR0175, cannot be presented in the detail furnished in the actual standard and do not guarantee suitability for any given material in hydrogen sulfide-containing sour environments. The reader is urged to refer to the actual standard before selecting equipment for sour service.

- Most ferrous metals can become susceptible to sulfide stress cracking (SSC) due to hardening by heat treatment and/or cold work. Conversely, many ferrous metals can be heat treated to improve resistance to SSC.
- Carbon and low-alloy steels must be properly heat treated to provide resistance to SSC. A maximum hardness limit of 22 HRC applies to carbon and low-alloy steels.
- Austenitic stainless steels are most resistant to SSC in the annealed condition; some specific grades and conditions of stainless steels are acceptable up to 35 HRC.

- Copper-base alloys are inherently resistant to SSC, but are generally not used in critical parts of equipment without the approval of the purchaser due to concerns about general corrosion.
- Nickel alloys generally provide the best resistance to SSC. Some precipitation-hardenable nickel alloys are acceptable for use in applications requiring high strength and/or hardness up to 40 HRC.
- Chromium, nickel and other types of plating offer no protection against SSC. Their use is allowed in sour applications for wear resistance, but they cannot be used in an attempt to protect a non-resistant base material from SSC.
- Weld repairs and fabrication welds on carbon and low-alloy steels must be properly processed to ensure that they meet the 22 HRC maximum hardness requirement in the base metal, heat-affected zone (HAZ) and weld deposit. Alloy steels require post-weld heat treatment, and post- weld heat treatment is generally used for carbon steels as well.
- Conventional identification stamping is permissible in low stress areas, such as on the outside diameter of line flanges. Low-stress identification stamping must be used in other areas.
- The standard precludes using ASTM A193 Grade B7 bolting for applications that are considered “exposed”. Use of SSC-resistant bolting materials (such as ASTM A193 Grade B7M) sometimes necessitates to derating of valves designed originally to use B7 bolting.

NACE MR0175/ISO 15156

NACE MR0175/ISO 15156 introduced significant changes to the standard. However, many end users continue to specify NACE MR0175-2002, feeling that it adequately meets their needs in providing good service life. The most significant changes in NACE MR0175/ISO 15156 include:

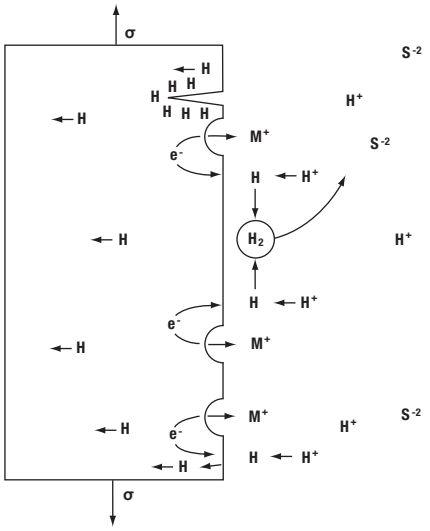


Figure 2. *Schematic Showing the Generation of Hydrogen Producing SSC*

- The revision addresses both sulfide stress cracking and chloride stress corrosion cracking. Prior versions simply listed most materials as acceptable or unacceptable. Because its scope was expanded to cover chloride stress corrosion cracking, the new standard lists all corrosion-resistant alloys as acceptable within limits, referred to as “environmental limits or environmental restrictions”. These are typically expressed in terms of H_2S partial pressure, maximum temperature, ppm chlorides and the presence of free sulfur.
- 316 stainless steel usage is still allowed but under very limited environmental conditions. The impact, if strictly followed, is that this material will find very little use.
- The standard applies only to petroleum production, drilling, gathering and flow line equipment and field processing facilities to be used in H_2S bearing hydrocarbon service. It does not apply to refineries.
- There is clear responsibility placed on the buyer to specify the correct materials. The manufacturer is responsible for meeting the metallurgical requirements of MR0175/ISO 15156.

NACE Sulfide Stress Cracking

NACE MR0103

As mentioned, NACE MR0103 is similar in many respects to the pre-2003 revisions of NACE MR0175. The following are some major differences:

- MR0103 utilizes different, refinery-based definitions for what constitutes a sour environment. The user is responsible for imposing the requirements of MR0103 when they are applicable. The manufacturer is responsible for meeting the metallurgical requirements of NACE MR0103.

- The 2002 and prior revisions of MR0175 included environmental restrictions on a few materials that were continued in the latter editions. MR0103 only deals with sulfide stress cracking. It does not impose environmental limits on any materials. Materials are either acceptable or not.

- Carbon steel base materials that are classified as P-No. 1, group 1 or 2 steels in the ASME Boiler and Pressure Vessel Code are acceptable per MR0103 without base metal hardness requirements. P-No. 1 groups 1 and 2 include WCC and LCC castings, A105 forgings, A516 Grade 70 plate and the other common carbon steel pressure vessel materials.

- MR0103 imposes welding controls on carbon steels that are more rigorous than those imposed by MR0175-2002. MR0103 requires that P-No. 1 carbon steels be welded per another NACE document called SP0472 “Methods and Controls to Prevent In-Service Environmental Cracking of Carbon Steel Weldments in Corrosive Petroleum Refining Environments”. SP0472 imposes controls that ensure both the weld deposit and heat affected zone (HAZ) in a weldment will be soft enough to resist sulfide stress cracking. SP0472 invokes actual hardness testing of weld deposits in production, although hardness testing is waived if certain welding process/filler material combinations are employed. HAZ hardness may be controlled by either post-weld heat treatment (PWHT) or by a combination of cooling rate controls and base material chemistry restrictions such as imposing a maximum carbon equivalent (CE).

Exposed Bolting

It is the user’s responsibility to determine if the body-to-bonnet bolting is considered exposed. NACE defines exposed bolting as any bolting that is exposed to the sour service. However, the NACE documents also extend the definition to include external bolting (such as body-to-bonnet bolting) that is buried, insulated, equipped with flange protectors, or otherwise denied direct atmospheric exposure. The logic is that, in these situations, the sour environment might be trapped around the bolting in the event of a gasket leak, so the bolting is to be treated as if it were inside the pressure containment.

Coatings

NACE standards only address the base materials, and do not include restrictions on coatings or hard facing options. Coatings may be used provided the base metal is in a condition which is acceptable per the NACE standard. The coatings may not be used to protect a base metal which is susceptible to stress corrosion cracking.

Elastomers

NACE standards only limit metallic materials, since they were written to address corrosion induced wear. There are still possible limitations of certain elastomers based on your process fluid, temperature and pressures. Please consult product bulletins and literature for more information.

Reference: D101881X012Fisher Control Valve Handbook – Fourth Edition©Fisher Controls International LLC 2005

Chemical Compatibility of Elastomers and Metals

Introduction

This section explains the uses and compatibilities of elastomers commonly used in Fisher™ regulators. The following tables provide the compatibility of the most common elastomers and metals to a variety of chemicals and/or compounds.

The information contained herein is extracted from data we believe to be reliable. However, because of variable service conditions over which we have no control, we do not in any way make any warranty, either express or implied, as to the properties of any materials or as to the performance of any such materials in any particular application and we hereby expressly disclaim any responsibility for the accuracy of any of the information set forth herein.

Refer to the applicable process gas service code or standard to determine if a specific material found in the Process Gases Application Guide is allowed to be used in that service.

Elastomers: Chemical Names and Uses

NBR - Nitrile Rubber, also called Buna-N, is a copolymer of butadiene and acrylonitrile. Nitrile is recommended for: general purpose sealing, petroleum oils and fluids, water, silicone greases and oils, di-ester based lubricants (such as MIL-L-7808) and ethylene glycol based fluids (Hydrolubes). It is not recommended for: halogenated hydrocarbons, nitro hydrocarbons (such as nitrobenzene and aniline), phosphate ester hydraulic fluids (Skydrol, Cellulube, Pydraul), ketones (MEK, acetone), strong acids, ozone and automotive brake fluid. Its temperature range is -60 to 225°F / -51 to 107°C, although this would involve more than one compound and would depend upon the stress state of the component in service.

EPDM, EPM - Ethylenepropylene rubber is an elastomer prepared from ethylene and propylene monomers. EPM is a copolymer of ethylene and propylene, while EPDM contains a small amount of a third monomer (a diene) to aid in the curing process. EP is recommended for: phosphate ester based hydraulic fluids, steam to 400°F / 204°C, water, silicone oils and greases, dilute acids, dilute alkalis, ketones, alcohols and automotive brake fluids. It is not recommended for: petroleum oils and di-ester based lubricants. Its temperature range is -60 to 500°F / -51 to 260°C (the high limit would make use of a special high temperature formulation developed for geothermal applications).

FKM - This is a Fluorocarbon of the polymethylene type having substituent fluoro and perfluoroalkyl or perfluoroalkoxy groups on the polymer chain. Viton® and Fluorel® are the most common trade names. FKM is recommended for: petroleum oils, di-ester based lubricants, silicate ester based lubricants (such as MLO 8200, MLO 8515, OS-45), silicone fluids and greases, halogenated hydrocarbons, selected phosphate ester fluids and some acids. It is not recommended for: ketones, Skydrol 500, amines (UDMH), anhydrous ammonia, low molecular weight esters and ethers and hot hydrofluoric and chlorosulfonic acids. Its temperature range is -20 to 450°F / -29 to 232°C, (this extended range would require special grades and would limit use on each end of the range).

CR - This is chloroprene, commonly know as Neoprene, which is a homopolymer of chloroprene (chlorobutadiene). CR is recommended for: refrigerants (Freons, ammonia), high aniline point petroleum oils, mild acids and silicate ester fluids. It is not recommended for: phosphate ester fluids and ketones. Its temperature range is -60 to 200°F / -51 to 93°C, although this would involve more than one compound.

NR - This is natural rubber which is a natural polyisoprene, primarily from the tree, Hevea Brasiliensis. The synthetics have all but completely replaced natural rubber for seal use. NR is recommended for automotive brake fluid and it is not recommended for petroleum products. Its temperature range is -80 to 180°F / -62 to 82°C.

FXM - This is a copolymer of tetrafluoroethylene and propylene; hence, it is sometimes called PTFE/P rubber. Common trade names are Aflas® (Asahi Glass Co., Ltd) and Fluoraz® (Greene, Tweed & Co.). It is generally used where resistance to both hydrocarbons and hot water are required. Its temperature range is 20 to 400°F / -7 to 204°C.

ECO - This is commonly called Hydrin® rubber, although that is a trade name for a series of rubber materials by B.F. Goodrich. CO is the designation for the homopolymer of epichlorohydrin, ECO is the designation for a copolymer of ethylene oxide and chloromethyl oxirane (epichlorohydrin copolymer) and ETER is the designation for the terpolymer of epichlorohydrin, ethylene oxide and an unsaturated monomer. All the epichlorohydrin rubbers exhibit better heat resistance than nitrile rubbers, but corrosion with aluminum may limit applications. Normal temperature range is (-40 to 250°F / -40 to 121°C), while maximum temperature ranges are -40 to 275°F / -40 to 135°C (for homopolymer CO) and -65 to 275°F / -54 to 135°C (for copolymer ECO and terpolymer ETER).

FFKM - This is a perfluoroelastomer generally better known as Kalrez® (DuPont) and Chemraz® (Greene, Tweed). Perfluoro rubbers of the polymethylene type have all substituent groups on the polymer chain of fluoro, perfluoroalkyl or perfluoroalkoxy groups. The resulting polymer has superior chemical resistance and heat temperature resistance. This elastomer is extremely expensive and should be used only when all else fails. Its temperature range is 0 to 480°F / -18 to 249°C. Some materials, such as Kalrez® 1050LF is usable to 550°F / 288°C and Kalrez® 4079 can be used to 600°F / 316°C.

FVMQ - This is fluorosilicone rubber which is an elastomer that should be used for static seals because it has poor mechanical properties. It has good low and high temperature resistance and is reasonably resistant to oils and fuels because of its fluorination. Because of the cost, it only finds specialty use. Its temperature range is -80 to 400°F / -62 to 204°C.

VMQ - This is the most general term for silicone rubber. Silicone rubber can be designated MQ, PMQ and PVMQ, where the Q designates any rubber with silicon and oxygen in the polymer chain and M, P and V represent methyl, phenyl and vinyl substituent groups on the polymer chain. This elastomer is used only for static seals due to its poor mechanical properties. Its temperature range is -175 to 600°F / -115 to 316°C (extended temperature ranges require special compounds for high or low temperatures).

Chemical Compatibility of Elastomers and Metals

General Properties of Elastomers

PROPERTY		NATURAL RUBBER	BUNA-S	NITRILE (NBR)	NEOPRENE (CR)	BUTYL	THIOKOL®	SILICONE	HYPALON®	FLUORO-CARBON[1,2] (FKM)	POLY-URETHANE[2]	POLY-ACRYLIC[1]	ETHYLENE-PROPYLENE[3] (EPDM)
Tensile Strength, psi / bar	Pure Gum	3000 / 207	400 / 28	600 / 41	3500 / 241	3000 / 207	300 / 21	200 to 450 / 14 to 31	4000 / 276	----	----	100 / 7	----
	Reinforced	4500 / 310	3000 / 207	4000 / 276	3500 / 241	3000 / 207	1500 / 103	1100 / 76	4400 / 303	2300 / 159	6500 / 448	1800 / 124	2500 / 172
Tear Resistance		Excellent	Poor-Fair	Fair	Good	Good	Fair	Poor-Fair	Excellent	Good	Excellent	Fair	Poor
Abrasion Resistance		Excellent	Good	Good	Excellent	Fair	Poor	Poor	Excellent	Very Good	Excellent	Good	Good
Aging: Sunlight Oxidation		Poor Good	Poor Fair	Poor Fair	Excellent Good	Excellent Good	Good Good	Good Very Good	Excellent Very Good	Excellent Excellent	Excellent Excellent	Excellent Excellent	---- Good
Heat (Maximum Temperature)		200°F / 93°C	200°F / 93°C	250°F / 121°C	200°F / 93°C	200°F / 93°C	140°F / 60°C	450°F / 232°C	300°F / 149°C	400°F / 204°C	200°F / 93°C	350°F / 177°C	350°F / 177°C
Static (Shelf)		Good	Good	Good	Very Good	Good	Fair	Good	Good	----	----	Good	Good
Flex Cracking Resistance		Excellent	Good	Good	Excellent	Excellent	Fair	Fair	Excellent	----	Excellent	Good	----
Compression Set Resistance		Good	Good	Very Good	Excellent	Fair	Poor	Good	Poor	Poor	Good	Good	Fair
Solvent Resistance: Aliphatic Hydrocarbon Aromatic Hydrocarbon Oxygenated Solvent Halogenated Solvent		Very Poor Very Poor Good Very Poor	Very Poor Very Poor Good Very Poor	Good Fair Poor Very Poor	Fair Poor Fair Very Poor	Poor Very Poor Good Poor	Excellent Good Fair Poor	Poor Very Poor Poor Very Poor	Fair Poor Poor Very Poor	Excellent Very Good Good ----	Very Good Fair Poor ----	Good Poor Poor Poor	Poor Fair ---- Poor
Oil Resistance: Low Aniline Mineral Oil High Aniline Mineral Oil Synthetic Lubricants Organic Phosphates		Very Poor Very Poor Very Poor Very Poor	Very Poor Very Poor Very Poor Very Poor	Excellent Excellent Fair Very Poor	Fair Good Very Poor Very Poor	Very Poor Very Poor Poor Good	Excellent Excellent Poor Poor	Poor Good Fair Poor	Fair Good Poor Poor	Excellent Excellent ---- Poor	---- ---- ---- Poor	Excellent Excellent Fair Poor	Poor Poor Poor Very Good
Gasoline Resistance: Aromatic Non-Aromatic		Very Poor Very Poor	Very Poor Very Poor	Good Excellent	Poor Good	Very Poor Very Poor	Excellent Excellent	Poor Good	Poor Fair	Good Very Good	Fair Good	Fair Poor	Fair Poor
Acid Resistance: Diluted (Under 10%) Concentrated[4]		Good Fair	Good Poor	Good Poor	Fair Fair	Good Fair	Poor Very Poor	Fair Poor	Good Good	Excellent Very Good	Fair Poor	Poor Poor	Very Good Good
Low Temperature Flexibility (Maximum)		-65°F/ -54°C	-50°F/ -46°C	-40°F / -40°C	-40°F / -40°C	-40°F / -40°C	-40°F / -40°C	-100°F / -73°C	-20°F/ -29°C	-30°F/ -34°C	-40°F / -40°C	-10°F / -23°C	-50°F / -45°C
Permeability to Gases		Fair	Fair	Fair	Very Good	Very Good	Good	Fair	Very Good	Good	Good	Good	Good
Water Resistance		Good	Very Good	Very Good	Fair	Very Good	Fair	Fair	Fair	Excellent	Fair	Fair	Very Good
Alkali Resistance: Diluted (Under 10%) Concentrated		Good Fair	Good Fair	Good Fair	Good Good	Very Good Very Good	Poor Poor	Fair Poor	Good Good	Excellent Very Good	Fair Poor	Poor Poor	Excellent Good
Resilience		Very Good	Fair	Fair	Very Good	Very Good	Poor	Good	Good	Good	Fair	Very Poor	Very Good
Elongation (Maximum)		700%	500%	500%	500%	700%	400%	300%	300%	425%	625%	200%	500%

1. Do not use with steam.
2. Do not use with ammonia.
3. Do not use with petroleum based fluids. Use with ester based non-flammable hydraulic oils and low pressure steam applications to 300°F / 149°C.
4. Except for nitric and sulfuric acid.

EMERSON
Process Management

Fluid Compatibility of Elastomers

FLUID	MATERIAL				
	Neoprene (CR)	Nitrile (NBR)	Fluorocarbon (FKM)	Ethylenepropylene (EPDM)	Perfluoroelastomer (FFKM)
Acetic Acid (30%)	B	C	C	A	A
Acetone	C	C	C	A	A
Air, Ambient	A	A	A	A	A
Air, Hot (200°F / 93°C)	C	B	A	A	A
Alcohol (Ethyl)	A	C	C	A	A
Alcohol (Methyl)	A	A	C	A	A
Ammonia (Anhydrous) (Cold)	A	A	C	A	A
Ammonia (Gas, Hot)	B	C	C	B	A
Beer	A	A	A	A	A
Benzene	C	C	B	C	A
Brine (Calcium Chloride)	A	A	B	A	A
Butadiene Gas	C	C	B	C	A
Butane (Gas)	A	A	A	C	A
Butane (Liquid)	C	A	A	C	A
Carbon Tetrachloride	C	C	A	C	A
Chlorine (Dry)	C	C	A	C	A
Chlorine (Wet)	C	C	B	C	A
Coke Oven Gas	C	C	A	C	A
Ethyl Acetate	C	C	C	B	A
Ethylene Glycol	A	A	A	A	A
Freon 11	C	B	A	C	A
Freon 12	A	A	B	B	A
Freon 22	A	C	C	A	A
Freon 114	A	A	B	A	A
Gasoline (Automotive)	C	B	A	C	A
Hydrogen Gas	A	A	A	A	A
Hydrogen Sulfide (Dry)	A	A(1)	C	A	A
Hydrogen Sulfide (Wet)	B	C	C	A	A
Jet Fuel (JP-4)	B	A	A	C	A
Methyl Ethyl Ketone (MEK)	C	C	C	A	A
MTBE	C	C	C	C	A
Natural Gas	A	A	A	C	A
Nitric Acid (50 to 100%)	C	C	B	C	A
Nitrogen	A	A	A	A	A
Oil (Fuel)	C	A	A	C	A
Propane	B	A	A	C	A
Sulfur Dioxide	A	C	A	A	A
Sulfuric Acid (up to 50%)	B	C	A	B	A
Sulfuric Acid (50 to 100%)	C	C	A	B	A
Water (Ambient)	A	A	A	A	A
Water (at 200°F / 93°C)	C	B	B	A	A

1. Performance worsens with hot temperatures.
A - Recommended
B - Minor to moderate effect. Proceed with caution.
C - Unsatisfactory
N/A - Information not available

Chemical Compatibility of Elastomers and Metals

Compatibility of Metals

Fluid	CORROSION INFORMATION													
	Material													
	Carbon Steel	Cast Iron	S302 or S304 Stainless Steel	S316 Stainless Steel	Bronze	Monel®	Hastelloy® B	Hastelloy® C	Durimet® 20	Titanium	Cobalt-Base Alloy 6	S416 Stainless Steel	440C Stainless Steel	17-4PH Stainless Steel
Acetaldehyde	A	A	A	A	A	A	IL	A	A	IL	IL	A	A	A
Acetic Acid, Air Free	C	C	B	B	B	B	A	A	A	A	A	C	C	B
Acetic Acid, Aerated	C	C	A	A	A	A	A	A	A	A	A	C	C	B
Acetic Acid Vapors	C	C	A	A	B	B	IL	A	B	A	A	C	C	B
Acetone	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Acetylene	A	A	A	A	IL	A	A	A	A	IL	A	A	A	A
Alcohols	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Aluminum Sulfate	C	C	A	A	B	B	A	A	A	A	IL	C	C	IL
Ammonia	A	A	A	A	C	A	A	A	A	A	A	A	A	IL
Ammonium Chloride	C	C	B	B	B	B	A	A	A	A	B	C	C	IL
Ammonium Nitrate	A	C	A	A	C	C	A	A	A	A	A	C	B	IL
Ammonium Phosphate (Mono Basic)	C	C	A	A	B	B	A	A	B	A	A	B	B	IL
Ammonium Sulfate	C	C	B	A	B	A	A	A	A	A	A	C	C	IL
Ammonium Sulfite	C	C	A	A	C	C	IL	A	A	A	A	B	B	IL
Aniline	C	C	A	A	C	B	A	A	A	A	A	C	C	IL
Asphalt	A	A	A	A	A	A	A	A	A	IL	A	A	A	A
Beer	B	B	A	A	B	A	A	A	A	A	A	B	B	A
Benzene (Benzol)	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Benzoic Acid	C	C	A	A	A	A	IL	A	A	A	IL	A	A	A
Boric Acid	C	C	A	A	A	A	A	A	A	A	A	B	B	IL
Butane	A	A	A	A	A	A	A	A	A	IL	A	A	A	A
Calcium Chloride (Alkaline)	B	B	C	B	C	A	A	A	A	A	IL	C	C	IL
Calcium Hypochlorite	C	C	B	B	B	B	C	A	A	A	IL	C	C	IL
Carbolic Acid	B	B	A	A	A	A	A	A	A	A	A	IL	IL	IL
Carbon Dioxide, Dry	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Carbon Dioxide, Wet	C	C	A	A	B	A	A	A	A	A	A	A	A	A
Carbon Disulfide	A	A	A	A	C	B	A	A	A	A	A	B	B	IL
Carbon Tetrachloride	B	B	B	B	A	A	B	A	A	A	IL	C	A	IL
Carbonic Acid	C	C	B	B	B	A	A	A	A	IL	IL	A	A	A
Chlorine Gas, Dry	A	A	B	B	B	A	A	A	A	C	B	C	C	C
Chlorine Gas, Wet	C	C	C	C	C	C	C	B	C	A	B	C	C	C
Chlorine, Liquid	C	C	C	C	B	C	C	A	B	C	B	C	C	C
Chromic Acid	C	C	C	B	C	A	C	A	C	A	B	C	C	C
Citric Acid	IL	C	B	A	A	B	A	A	A	A	IL	B	B	B
Coke Oven Gas	A	A	A	A	B	B	A	A	A	A	A	A	A	A
Copper Sulfate	C	C	B	B	B	C	IL	A	A	A	IL	A	A	A
Cottonseed Oil	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Creosote	A	A	A	A	C	A	A	A	A	IL	A	A	A	A
Ethane	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Ether	B	B	A	A	A	A	A	A	A	A	A	A	A	A
Ethyl Chloride	C	C	A	A	A	A	A	A	A	A	A	B	B	IL
Ethylene	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Ethylene Glycol	A	A	A	A	A	A	IL	IL	A	IL	A	A	A	A
Ferric Chloride	C	C	C	C	C	C	C	B	C	A	B	C	C	IL
Formaldehyde	B	B	A	A	A	A	A	A	A	A	A	A	A	A
Formic Acid	IL	C	B	B	A	A	A	A	A	C	B	C	C	B
Freon, Wet	B	B	B	A	A	A	A	A	A	A	A	IL	IL	IL
Freon, Dry	B	B	A	A	A	A	A	A	A	A	A	IL	IL	IL
Furfural	A	A	A	A	A	A	A	A	A	A	A	B	B	IL
Gasoline, Refine	A	A	A	A	A	A	A	A	A	A	A	A	A	A

A - Recommended
B - Minor to moderate effect. Proceed with caution.
C - Unsatisfactory
IL - Information lacking

- continued -

Compatibility of Metals (continued)

CORROSION INFORMATION														
Fluid	Material													
	Carbon Steel	Cast Iron	S302 or S304 Stainless Steel	S316 Stainless Steel	Bronze	Monel®	Hastelloy® B	Hastelloy® C	Durimet® 20	Titanium	Cobalt-Base Alloy 6	S416 Stainless Steel	440C Stainless Steel	17-4PH Stainless Steel
Glucose	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Hydrochloric Acid, Aerated	C	C	C	C	C	C	A	B	C	C	B	C	C	C
Hydrochloric Acid, Air free	C	C	C	C	C	C	A	B	C	C	B	C	C	C
Hydrofluoric Acid, Aerated	B	C	C	B	C	C	A	A	B	C	B	C	C	C
Hydrofluoric Acid, Air free	A	C	C	B	C	A	A	A	B	C	IL	C	C	IL
Hydrogen	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Hydrogen Peroxide	IL	A	A	A	C	A	B	B	A	A	IL	B	B	IL
Hydrogen Sufide, Liquid	C	C	A	A	C	C	A	A	B	A	A	C	C	IL
Magnesium Hydroxide	A	A	A	A	B	A	A	A	A	A	A	A	A	IL
Mercury	A	A	A	A	C	B	A	A	A	A	A	A	A	B
Methanol	A	A	A	A	A	A	A	A	A	A	A	A	B	A
Methyl Ethyl Ketone	A	A	A	A	A	A	A	A	A	IL	A	A	A	A
Milk	C	C	A	A	A	A	A	A	A	A	A	C	C	C
Natural Gas	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Nitric Acid	C	C	A	B	C	C	C	B	A	A	C	C	C	B
Oleic Acid	C	C	A	A	B	A	A	A	A	A	A	A	A	IL
Oxalic Acid	C	C	B	B	B	B	A	A	A	B	B	B	B	IL
Oxygen	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Petroleum Oils, Refined	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Phosphoric Acid, Aerated	C	C	A	A	C	C	A	A	A	B	A	C	C	IL
Phosphoric Acid, Air Free	C	C	A	A	C	B	A	A	A	B	A	C	C	IL
Phosphoric Acid Vapors	C	C	B	B	C	C	A	IL	A	B	C	C	C	IL
Picric Acid	C	C	A	A	C	C	A	A	A	IL	IL	B	B	IL
Potassium Chloride	B	B	A	A	B	B	A	A	A	A	IL	C	C	IL
Potassium Hydroxide	B	B	A	A	B	A	A	A	A	A	IL	B	B	IL
Propane	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Rosin	B	B	A	A	A	A	A	A	A	IL	A	A	A	A
Silver Nitrate	C	C	A	A	C	C	A	A	A	A	B	B	B	IL
Sodium Acetate	A	A	B	A	A	A	A	A	A	A	A	A	A	A
Sodium Carbonate	A	A	A	A	A	A	A	A	A	A	A	B	B	A
Sodium Chloride	C	C	B	B	A	A	A	A	A	A	A	B	B	B
Sodium Chromate	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Hydroxide	A	A	A	A	C	A	A	A	A	A	A	B	B	A
Sodium Hypochloride	C	C	C	C	B-C	B-C	C	A	B	A	IL	C	C	IL
Sodium Thiosulfate	C	C	A	A	C	C	A	A	A	A	IL	B	B	IL
Stannous Chloride	B	B	C	A	C	B	A	A	A	A	IL	C	C	IL
Stearic Acid	A	C	A	A	B	B	A	A	A	A	B	B	B	IL
Sulfate Liquor (Black)	A	A	A	A	C	A	A	A	A	A	A	IL	IL	IL
Sulfur	A	A	A	A	C	A	A	A	A	A	A	A	A	A
Sulfur Dioxide, Dry	A	A	A	A	A	A	B	A	A	A	A	B	B	IL
Sulfur Trioxide, Dry	A	A	A	A	A	A	B	A	A	A	A	B	B	IL
Sufuric Acid (Aerated)	C	C	C	C	C	C	A	A	A	B	B	C	C	C
Sufuric Acid (Air Free)	C	C	C	C	B	B	A	A	A	B	B	C	C	C
Sulfurous Acid	C	C	B	B	B	C	A	A	A	A	B	C	C	IL
Tar	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Trichloroethylene	B	B	B	A	A	A	A	A	A	A	A	B	B	IL
Turpentine	B	B	A	A	A	B	A	A	A	A	A	A	A	A
Vinegar	C	C	A	A	B	A	A	A	A	IL	A	C	C	A
Water, Boiler Feed	B	C	A	A	C	A	A	A	A	A	A	B	A	A
Water, Distilled	A	A	A	A	A	A	A	A	A	A	A	B	B	IL
Water, Sea	B	B	B	B	A	A	A	A	A	A	A	C	C	A
Whiskey and Wines	C	C	A	A	A	B	A	A	A	A	A	C	C	IL
Zinc Chloride	C	C	C	C	C	C	A	A	A	A	B	C	C	IL
Zinc Sulfate	C	C	A	A	B	A	A	A	A	A	A	B	B	IL

A - Recommended
B - Minor to moderate effect. Proceed with caution.
C - Unsatisfactory
IL - Information lacking

Regulator Tips

1. All regulators should be installed and used in accordance with federal, state and local codes and regulations.
2. Adequate overpressure protection should be installed to protect the regulator from overpressure. Adequate overpressure protection should also be installed to protect all downstream equipment in the event of regulator failure.
3. Downstream pressures significantly higher than the regulator's pressure setting may damage soft seats and other internal parts.
4. If two or more available springs have published pressure ranges that include the desired pressure setting, use the spring with the lower range for better accuracy.
5. The recommended selection for orifice diameters is the smallest orifice that will handle the flow.
6. Most regulators shown in this application guide are generally suitable for temperatures to 180°F / 82°C. With high temperature Fluorocarbon (FKM) (if available), the regulators can be used for temperatures to 300°F / 149°C. Check the temperature capabilities to determine materials and temperature ranges available. Use stainless steel diaphragms and seats for higher temperatures, such as steam service.
7. The full advertised range of a spring can be utilized without sacrificing performance or spring life.
8. Regulator body size should not be larger than the pipe size. In many cases, the regulator body is one size smaller than the pipe size.
9. Do not oversize regulators. Pick the smallest orifice size or regulator that will work. Keep in mind when sizing a station that most restricted trims that do not reduce the main port size do not help with improved low flow control.
10. Speed of regulator response, in order:
    - Direct-operated
    - Two-path pilot-operated
    - Unloading pilot-operated
    - Control valve

    Note: Although direct-operated regulators give the fastest response, all types provide quick response.
11. When a regulator appears unable to pass the published flow rate, be sure to check the inlet pressure measured at the regulator body inlet connection. Piping up to and away from regulators can cause significant flowing pressure losses.
12. When adjusting setpoint, the regulator should be flowing at least five percent of the normal operating flow.
13. Direct-operated regulators generally have faster response to quick flow changes than pilot-operated regulators.
14. Droop is the reduction of outlet pressure experienced by pressure-reducing regulators as the flow rate increases. It is stated as a percent, in in. w.c. / mbar or in lbs/in^2 / bar and indicates the difference between the outlet pressure setting made at low flow rates and the actual outlet pressure at the published maximum flow rate. Droop is also called offset or proportional band.
15. Downstream pressure always changes to some extent when inlet pressure changes.
16. Most soft-seated regulators will maintain the pressure within reasonable limits down to zero flow. Therefore, a regulator sized for a high flow rate will usually have a turndown ratio sufficient to handle pilot-light loads during off cycles.
17. Do not undersize the monitor set. It is important to realize that the monitor regulator, even though it is wide-open, will require pressure drop for flow. Using two identical regulators in a monitor set will yield approximately 70 percent of the capacity of a single regulator.
18. Diaphragms leak a small amount due to migration of gas through the diaphragm material. To allow escape of this gas, be sure casing vents (where provided) remain open.
19. Use control lines of equal or greater size than the control tap on the regulator. If a long control line is required, make it bigger. A rule of thumb is to use the next nominal pipe size for every 20 ft. / 6.1 m of control line. Small control lines cause a delayed response of the regulator, leading to increased chance of instability. 3/8 in. / 9.5 mm OD tubing is the minimum recommended control line size.
20. For every 15 psid / 1.0 bar d pressure differential across the regulator, expect approximately a one degree drop in gas temperature due to the natural refrigeration effect. Freezing is often a problem when the ambient temperature is between 30 and 45°F / -1 and 7°C.
21. A disk with a cookie cut appearance probably means you had an overpressure situation. Thus, investigate further.
22. When using relief valves, be sure to remember that the reseat point is lower than the start-to-bubble point. To avoid seepage, keep the relief valve setpoint far enough above the regulator setpoint.

23. Vents should be pointed down to help avoid the accumulation of water condensation or other materials in the spring case.

24. Make control line connections in a straight run of pipe about 10 pipe diameters downstream of any area of turbulence, such as elbows, pipe swages or block valves.

25. When installing a working monitor station, get as much volume between the two regulators as possible. This will give the upstream regulator more room to control intermediate pressure.

26. Cutting the supply pressure to a pilot-operated regulator reduces the regulator gain or sensitivity and, thus, may improve regulator stability. (This can only be used with two path control.)

27. Regulators with high flows and large pressure drops generate noise. Noise can wear parts which can cause failure and/or inaccurate control. Keep regulator noise below 110 dBA.

28. Do not place control lines immediately downstream of rotary or turbine meters.

29. Keep vents open. Do not use small diameter, long vent lines. Use the rule of thumb of the next nominal pipe size every 10 ft. / 3.1 m of vent line and 3 ft. / 0.9 m of vent line for every elbow in the line.

30. Fixed factor measurement (or PFM) requires the regulator to maintain outlet pressure within ±1% of absolute pressure. For example: Setpoint of 2 psig + 14.7 psia = 16.7 psia x 0.01 = ±0.167 psi. (Setpoint of 0.14 bar + 1.01 bar = 1.15 bar x 0.01 = ±0.0115 bar.)

31. Regulating C_g (coefficient of flow) can only be used for calculating flow capacities on pilot-operated regulators. Use capacity tables or flow charts for determining a direct-operated regulator's capacity.

32. Do not make the setpoints of the regulator/monitor too close together. The monitor can try to take over if the setpoints are too close, causing instability and reduction of capacity. Set them at least one proportional band apart.

33. Consider a butt-weld end regulator where available to lower costs and minimize flange leakages.

34. Do not use needle valves in control lines; use full-open valves. Needle valves can cause instability.

35. Burying regulators is not recommended. However, if you must, the vent should be protected from ground moisture and plugging.

Conversions, Equivalents and Physical Data

Pressure Equivalents

TO OBTAIN / BY / MULTIPLY NUMBER OF	KG PER SQUARE CM	PSI	ATMOSPHERE	BAR	IN. OF MERCURY	KPA	IN. W.C.	FT. OF W.C.
Kg per square cm	1	14.22	0.9678	0.98067	28.96	98.067	394.05	32.84
Psi	0.07031	1	0.06804	0.06895	2.036	6.895	27.7	2.309
Atmosphere	1.0332	14.696	1	1.01325	29.92	101.325	407.14	33.93
Bar	1.01972	14.5038	0.98692	1	29.53	100	402.156	33.513
Inches of Mercury	0.03453	0.4912	0.03342	0.033864	1	3.3864	13.61	1.134
Kilopascals	0.0101972	0.145038	0.0098696	0.01	0.2953	1	4.02156	0.33513
In. of Water	0.002538	0.0361	0.002456	0.00249	0.07349	0.249	1	0.0833
Ft. of Water	0.3045	0.4332	0.02947	0.029839	0.8819	2.9839	12	1

1 ounce per square in. = 0.0625 psi

Pressure Conversion - Psi to Bar(1)

PSI	0	1	2	3	4	5	6	7	8	9
	Bar									
0	0.000	0.069	0.138	0.207	0.276	0.345	0.414	0.482	0.552	0.621
10	0.689	0.758	0.827	0.896	0.965	1.034	1.103	1.172	1.241	1.310
20	1.379	1.448	1.517	1.586	1.655	1.724*	1.793	1.862	1.931	1.999
30	2.068	2.137	2.206	2.275	2.344	2.413	2.482	2.551	2.620	2.689
40	2.758	2.827	2.896	2.965	3.034	3.103	3.172	3.241	3.309	3.378
50	3.447	3.516	3.585	3.654	3.723	3.792	3.861	3.930	3.999	4.068
60	4.137	4.275	4.275	4.344	4.413	4.482	4.551	4.619	4.688	4.758
70	4.826	4.964	4.964	5.033	5.102	5.171	5.240	5.309	5.378	5.447
80	5.516	5.585	5.654	5.723	5.792	5.861	5.929	5.998	6.067	6.136
90	6.205	6.274	6.343	6.412	6.481	6.550	6.619	6.688	6.757	6.826
100	6.895	6.964	7.033	7.102	7.171	7.239	7.308	7.377	7.446	7.515

1. To convert to kilopascals, move decimal point two positions to the right; to convert to megapascals, move decimal point one position to the left.
*Note: Round off decimal points to provide no more than the desired degree of accuracy.
To use this table, see the shaded example.
25 psig (20 from the left column plus five from the top row) = 1.724 bar

Volume Equivalents

TO OBTAIN / BY / MULTIPLY NUMBER OF	DM^3 (L)	IN^3	FT^3	U.S. QUART	U.S. GAL.	IMPERIAL GAL.	U.S. BARREL (PETROLEUM)
Dm^3 (L)	1	61.0234	0.03531	1.05668	0.264178	0.220083	0.00629
$In.^3$	0.01639	1	5.787×10^{-4}	1.01732	0.004329	0.003606	0.000103
$Ft.^3$	28.317	1728	1	29.9221	7.48055	6.22888	0.1781
U.S. Quart	0.94636	57.75	0.03342	1	0.25	0.2082	0.00595
U.S. Gal.	3.78543	231	0.13368	4	1	0.833	0.02381
Imperial Gal.	4.54374	277.274	0.16054	4.80128	1.20032	1	0.02877
U.S. Barrel (Petroleum)	158.98	9702	5.6146	168	42	34.973	1

1 m^3 = 1,000,000 cm^3
1 l = 1000 ml = 1000 cm^3

EMERSON
Process Management

Volume Rate Equivalents

MULTIPLY NUMBER OF / BY / TO OBTAIN	L/MIN	M^3/H	FT^3/H	L/H	U.S. GAL./MIN	U.S. BARRELS/DAY
l/m	1	0.06	2.1189	60	0.264178	9.057
m^3/h	16.667	1	35.314	1000	4.403	151
Ft^3/h	0.4719	0.028317	1	28.317	0.1247	4.2746
l/h	0.016667	0.001	0.035314	1	0.004403	0.151
U.S. Gal./Min	3.785	0.2273	8.0208	227.3	1	34.28
U.S. Barrels/Day	0.1104	0.006624	0.23394	6.624	0.02917	1

Mass Conversion - Lbs to kg

LBS	0	1	2	3	4	5	6	7	8	9
	Kg									
0	0.00	0.45	0.91	1.36	1.81	2.27	2.72	3.18	3.63	4.08
10	4.54	4.99	5.44	5.90	6.35	6.80	7.26	7.71	8.16	8.62
20	9.07	9.53	9.98	10.43	10.89	11.34*	11.79	12.25	12.70	13.15
30	13.61	14.06	14.52	14.97	15.42	15.88	16.33	16.78	17.24	17.69
40	18.14	18.60	19.05	19.50	19.96	20.41	20.87	21.32	21.77	22.23
50	22.68	23.13	23.59	24.04	24.49	24.95	25.40	25.86	26.31	26.76
60	27.22	27.67	28.12	28.58	29.03	29.48	29.94	30.39	30.84	31.30
70	31.75	32.21	32.66	33.11	33.57	34.02	34.47	34.93	35.38	35.83
80	36.29	36.74	37.20	37.65	38.10	38.56	39.01	39.46	39.92	40.37
90	40.82	41.28	41.73	42.18	42.64	43.09	43.55	44.00	44.45	44.91

1 lb = 0.4536 kg
*NOTE: To use this table, see the shaded example.
25 lbs (20 from the left column plus five from the top row) = 11.34 kg

Area Equivalents

MULTIPLY NUMBER OF / BY / TO OBTAIN	M^2	IN^2	FT^2	MI^2	KM^2
M^3	1	1549.99	10.7639	3.861×10^{-7}	1×10^{-6}
In^2	0.0006452	1	6.944×10^{-3}	2.491×10^{-10}	6.452×10^{-10}
Ft^2	0.0929	144	1	3.587×10^{-8}	9.29×10^{-8}
Mi^2	2,589,999	----	27,878,400	1	2.59
Km^2	1,000,000	----	10,763,867	0.3861	1

1 m^2 = 10,000 cm^2
1 ml^2 = 0.01 cm^2 = 0.00155 in^2

Temperature Conversion Formulas

TO CONVERT FROM	TO	SUBSTITUTE IN FORMULA
Degrees Celsius	Degrees Fahrenheit	(°C x 9/5) + 32
Degrees Celsius	Kelvin	(°C + 273.16)
Degrees Fahrenheit	Degrees Celsius	(°F - 32) x 5/9
Degrees Fahrenheit	Degrees Rankine	(°F + 459.69)

Kinematic-Viscosity Conversion Formulas

VISCOSITY SCALE	RANGE OF *t*, SEC	KINEMATIC VISCOSITY, STROKES
Saybolt Universal	$32 < t < 100$ $t > 100$	$0.00226t - 1.95/t$ $0.00220t - 1.35/t$
Saybolt Furol	$25 < t < 40$ $t > 40$	$0.0224t - 1.84/t$ $0.0216t - 0.60/t$
Redwood No. 1	$34 < t < 100$ $t > 100$	$0.00226t - 1.79/t$ $0.00247t - 0.50/t$
Redwood Admiralty	----	$0.027t - 20/t$
Engler	----	$0.00147t - 3.74/t$

Conversions, Equivalents and Physical Data

Conversion Units

MULTIPLY	BY	TO OBTAIN
Volume		
cm^3	0.06103	In^3
Ft^3	7.4805	Gal. (US)
Ft^3	28.316	L
Ft^3	1728	In^3
Gal. (US)	0.1337	Ft^3
Gal. (US)	3.785	L
Gal. (US)	231	In^3
L	1.057	Quarts (US)
L	2.113	Pints (US)
Miscellaneous		
BTU	0.252	Calories
Decitherm	10,000	BTU
kg	2.205	lbs
kWh	3412	BTU
Oz	28.35	g
Lbs	0.4536	kg
Lbs	453.5924	g
Lbs	21,591	LPG BTU
Therm	100,000	BTU
API Bbls	42	Gal. (US)
Gal. of Propane	26.9	KWH
HP	746	KWH
HP (Steam)	42,418	BTU
Pressure		
g/cm^2	0.0142	Psi
in. of mercury	0.4912	Psi
in. of mercury	1.133	ft. of water
in. of water	0.0361	Psi
in. of water	0.0735	in. of mercury
in. of water	0.5781	oz/in^2
in. of water	5.204	lbs/ft
kPa	100	Bar
kg/cm^2	14.22	Psi
kg/m^2	0.2048	lbs/ft^2
Psi	0.06804	Atmospheres
Psi	0.07031	kg/cm^2
Psi	0.145	KPa
Psi	2.036	in. of mercury
Psi	2.307	ft. of water
Psi	14.5	Bar
Psi	27.67	in. of water
Length		
cm	0.3937	in.
ft.	0.3048	m
ft.	30.48	cm
ft.	304.8	mm
in.	2.540	cm
In.	25.40	mm
km	0.6214	mi
m	1.094	Yards
m	3.281	ft
m	39.37	in.
mi (nautical)	1853	m
mi (statute)	1609	m
Yards	0.9144	m
Yards	91.44	cm

Other Useful Conversions

TO CONVERT FROM	TO	MULTIPLY BY
ft^3 of methane	BTU	1000 (approximate)
ft^3 of water	lbs. of water	62.4
Degrees	Radians	0.01745
Gal.	lbs. of water	8.336
g	oz.	0.0352
hp (mechanical)	ft. lbs./min	33,000
hp (electrical)	Watts	746
kg	lbs.	2.205
kg/m^3	lbs/ft^3	0.06243
kW	hp	1.341
Lbs	kg	0.4536
lbs. of Air (14.7 psia and 60°F)	ft^3 of air	13.1
lbs/ft^3	kg/m^3	16.0184
lbs/hr (gas)	SCFH	13.1 ÷ Specific Gravity
lbs/hr (water)	Gal./min	0.002
lbs/sec (gas)	SCFH	46,160 ÷ Specific Gravity
Radians	Degrees	57.3
SCFH Air	SCFH Propane	0.81
SCFH Air	SCFH Butane	0.71
SCFH Air	SCFH 0.6 Natural Gas	1.29
SCFH	m^3/hr	0.028317

Converting Volumes of Gas

CFH TO CFH OR CFM TO CFM		
Multiply Flow of	**By**	**To Obtain Flow of**
Air	0.707	Butane
	1.290	Natural Gas
	0.808	Propane
Butane	1.414	Air
	1.826	Natural Gas
	1.140	Propane
Natural Gas	0.775	Air
	0.547	Butane
	0.625	Propane
Propane	1.237	Air
	0.874	Butane
	1.598	Natural Gas

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Process Management

Fractional In. to mm

IN.	0	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16
	mm															
0	0.0	1.6	3.2	4.8	6.4	7.9	9.5	11.1	12.7	14.3	15.9	17.5	19.1	20.6	22.2	23.8
1	25.4	27.0	28.6	30.2	31.8	33.3	34.9	36.5	38.1	39.7	41.3	42.9	44.5	46.0	47.6	49.2
2	50.8	52.4	54.0	55.6	57.2	58.7	60.3	61.9	63.5	65.1	66.7	68.3	69.9	71.4	73.0	74.6
3	76.2	77.8	79.4	81.0	82.6	84.1	85.7	87.3	88.9	90.5	92.1	93.7	95.3	96.8	98.4	100.0
4	101.6	103.2	104.8	106.4	108.0	109.5	111.1	112.7	114.3	115.9	117.5	119.1	120.7	122.2	123.8	125.4
5	127.0	128.6	130.2	131.8	133.4	134.9	136.5	138.1	139.7	141.3	142.9	144.5	146.1	147.6	149.2	150.8
6	152.4	154.0	155.6	157.2	158.8	160.3	161.9	163.5	165.1	166.7	168.3	169.9	171.5	173.0	174.6	176.2
7	177.8	179.4	181.0	182.6	184.2	185.7	187.3	188.9	190.5	192.1	193.7	195.3	196.9	198.4	200.0	201.6
8	203.2	204.8	206.4	208.0	209.6	211.1	212.7	214.3	215.9	217.5	219.1	220.7	222.3	223.8	225.4	227.0
9	228.6	230.2	231.8	233.4	235.0	236.5	238.1	239.7	241.3	242.9	244.5	246.1	247.7	249.2	250.8	252.4
10	254.0	255.6	257.2	258.8	260.4	261.9	263.5	265.1	266.7	268.3	269.9	271.5	273.1	274.6	276.2	277.8

1 in. = 25.4 mm
NOTE: To use this table, see the shaded example.
2-1/2 in. (2 from the left column plus 1/2 from the top row) = 63.5 mm

Length Equivalents

TO OBTAIN / BY / MULTIPLY NUMBER OF	M	IN.	FT.	MM	MI.	KM
m	1	39.37	3.2808	1000	0.0006214	0.001
In.	0.0254	1	0.0833	25.4	0.00001578	0.0000254
Ft.	0.3048	12	1	304.8	0.0001894	0.0003048
mm	0.001	0.03937	0.0032808	1	0.0000006214	0.000001
Mi.	1609.35	63.360	5.280	1,609,350	1	1.60935
Km	1000	39.370	3280.83	1,000,000	0.62137	1

1 m = 100 cm = 1000 mm = 0.001 km = 1,000,000 micrometers

Whole In.-mm Equivalents

IN.	0	1	2	3	4	5	6	7	8	9
	mm									
0	0.00	25.4	50.8	76.2	101.6	127.0	152.4	177.8	203.2	228.6
10	254.0	279.4	304.8	330.2	355.6	381.0	406.4	431.8	457.2	482.6
20	508.0	533.4	558.8	584.2	609.6	635.0	660.4	685.8	711.2	736.6
30	762.0	787.4	812.8	838.2	863.6	889.0	914.4	939.8	965.2	990.6
40	1016.0	1041.4	1066.8	1092.2	1117.6	1143.0	1168.4	1193.8	1219.2	1244.6
50	1270.0	1295.4	1320.8	1346.2	1371.6	1397.0	1422.4	1447.8	1473.2	1498.6
60	1524.0	1549.4	1574.8	1600.2	1625.6	1651.0	1676.4	1701.8	1727.2	1752.6
70	1778.0	1803.4	1828.8	1854.2	1879.6	1905.0	1930.4	1955.8	1981.2	2006.6
80	2032.0	2057.4	2082.8	2108.2	2133.6	2159.0	2184.4	2209.8	2235.2	2260.6
90	2286.0	2311.4	2336.8	2362.2	2387.6	2413.0	2438.4	2463.8	2489.2	2514.6
100	2540.0	2565.4	2590.8	2616.2	2641.6	2667.0	2692.4	2717.8	2743.2	2768.6

Note: All values in this table are exact, based on the relation 1 in. = 25.4 mm.
To use this table, see the shaded example.
25 in. (20 from the left column plus five from the top row) = 635 mm

Metric Prefixes and Symbols

MULTIPLICATION FACTOR	PREFIX	SYMBOL
1,000,000,000,000,000,000 = 10^{18}	exa	E
1,000,000,000,000,000 = 10^{15}	peta	P
1,000,000,000,000 = 10^{12}	tera	T
1,000,000,000 = 10^{9}	giga	G
1,000,000 = 10^{6}	mega	M
1,000 = 10^{3}	kilo	k
100 = 10^{2}	hecto	h
10 = 10^{1}	deka	da
0.1 = 10^{-1}	deci	d
0.01 = 10^{-2}	centi	c
0.001 = 10^{-3}	milli	m
0.000 01 = 10^{-6}	micro	m
0.000 000 001 = 10^{-9}	nano	n
0.000 000 000 001 = 10^{-12}	pico	p
0.000 000 000 000 001 = 10^{-15}	femto	f
0.000 000 000 000 000 001 = 10^{-18}	atto	a

Greek Alphabet

CAPS	LOWER CASE	GREEK NAME	CAPS	LOWER CASE	GREEK NAME	CAPS	LOWER CASE	GREEK NAME
A	α	Alpha	I	ι	Iota	P	ρ	Rho
B	β	Beta	K	κ	Kappa	Σ	σ	Sigma
Γ	γ	Gamma	Λ	λ	Lambda	T	τ	Tau
Δ	δ	Delta	M	μ	Mu	Y	υ	Upsilon
E	ε	Epsilon	N	ν	Nu	Φ	φ	Phi
Z	ζ	Zeta	Ξ	ξ	Xi	X	χ	Chi
H	η	Eta	O	ο	Omicron	Ψ	ψ	Psi
Θ	θ	Theta	Π	π	Pi	Ω	ω	Omega

Conversions, Equivalents and Physical Data

Length Equivalents - Fractional and Decimal In. to mm

IN.		mm	IN.		mm	IN.		mm	IN.		mm
Fractions	Decimals		Fractions	Decimals		Fractions	Decimals		Fractions	Decimals	
	0.00394	0.1		0.23	5.842	1/2	0.50	12.7		0.77	19.558
	0.00787	0.2	15/64	0.234375	5.9531		0.51	12.954		0.78	19.812
	0.01	0.254		0.23622	6.0		0.51181	13.0	25/32	0.78125	19.8438
	0.01181	0.3		0.24	6.096	33/64	0.515625	13.0969		0.78740	20.0
1/64	0.015625	0.3969	1/4	0.25	6.35		0.52	13.208		0.79	20.066
	0.01575	0.4		0.26	6.604		0.53	13.462	51/64	0.796875	20.2406
	0.01969	0.5	17/64	0.265625	6.7469	17/32	0.53125	13.4938		0.80	20.320
	0.02	0.508		0.27	6.858		0.54	13.716		0.81	20.574
	0.02362	0.6		0.27559	7.0	35/64	0.546875	13.8906	13/64	0.8125	20.6375
	0.02756	0.7		0.28	7.112		0.55	13.970		0.82	20.828
	0.03	0.762	9/32	0.28125	7.1438		0.55118	14.0		0.82677	21.0
1/32	0.03125	0.7938		0.29	7.366		0.56	14.224	53/64	0.828125	21.0344
	0.0315	0.8	19/64	0.296875	7.5406	9/16	0.5625	14.2875		0.83	21.082
	0.13543	0.9		0.30	7.62		0.57	14.478		0.84	21.336
	0.03937	1.0		0.31	7.874	37/64	0.578125	14.6844	27/32	0.84375	21.4312
	0.04	1.016	5/16	0.3125	7.9375		0.58	14.732		0.85	21.590
3/64	0.046875	1.1906		0.31496	8.0		0.59	14.986	55/64	0.859375	21.8281
	0.05	1.27		0.32	8.128		0.5905	15.0		0.86	21.844
	0.06	1.524	21/64	0.328125	8.3344	19/32	0.59375	15.0812		0.86614	22.0
1/16	0.0625	1.5875		0.33	8.382		0.60	15.24		0.87	22.098
	0.07	1.778		0.34	8.636	39/64	0.609375	15.4781	7/8	0.875	22.225
5/64	0.078125	1.9844	11/32	0.34375	8.7312		0.61	15.494		0.88	22.352
	0.07874	2.0		0.35	8.89		0.62	15.748		0.89	22.606
	0.08	2.032		0.35433	9.0	5/8	0.625	15.875	57/64	0.890625	22.6219
	0.09	2.286	23/64	0.359375	9.1281		0.62992	16.0		0.90	22.860
3/32	0.09375	2.3812		0.36	9.144		0.63	16.002		0.90551	23.0
	0.1	2.54		0.37	9.398		0.64	16.256	29/32	0.90625	23.0188
7/64	0.109375	2.7781	3/8	0.375	9.525	41/64	0.640625	16.2719		0.91	23.114
	0.11	2.794		0.38	9.652		0.65	16.510		0.92	23.368
	0.11811	3.0		0.39	9.906	21/32	0.65625	16.6688	59/64	0.921875	23.1456
	0.12	3.048	25/64	0.390625	9.9219		0.66	16.764		0.93	23.622
1/8	0.125	3.175		0.39370	10.0		0.66929	17.0	15/16	0.9375	23.8125
	0.13	3.302		0.40	10.16		0.67	17.018		0.94	23.876
	0.14	3.556	13/32	0.40625	10.3188	43/64	0.671875	17.0656		0.94488	24.0
9/64	0.140625	3.5719		0.41	10.414		0.68	17.272		0.95	24.130
	0.15	3.810		0.42	10.668	11/16	0.6875	17.4625	61/64	0.953125	24.2094
5/32	0.15625	3.9688	27/64	0.421875	10.7156		0.69	17.526		0.96	24.384
	0.15748	4.0		0.43	10.922		0.70	17.78	31/32	0.96875	24.6062
	0.16	4.064		0.43307	11.0	45/64	0.703125	17.8594		0.97	24.638
	0.17	4.318	7/16	0.4375	11.1125		0.70866	18.0		0.98	24.892
11/64	0.171875	4.3656		0.44	11.176		0.71	18.034		0.98425	25.0
	0.18	4.572		0.45	11.430	23/32	0.71875	18.2562	63/64	0.984375	25.0031
3/16	0.1875	4.7625	29/64	0.453125	11.5094		0.72	18.288		0.99	25.146
	0.19	4.826		0.46	11.684		0.73	18.542	1	1.00000	25.4000
	0.19685	5.0	15/32	0.46875	11.9062	47/64	0.734375	18.6531			
	0.2	5.08		0.47	11.938		0.74	18.796			
13/64	0.203125	5.1594		0.47244	12.0		0.74803	19.0			
	0.21	5.334		0.48	12.192	3/4	0.75	19.050			
7/32	0.21875	5.5562	31/64	0.484375	12.3031		0.76	19.304			
	0.22	5.588		0.49	12.446	49/64	0.765625	19.4469			

Note: Round off decimal points to provide no more than the desired degree of accuracy.

EMERSON
Process Management

Temperature Conversions

°C	TEMP. IN °C OR °F TO BE CONVERTED	°F	°C	TEMP. IN °C OR °F TO BE CONVERTED	°F	°C	TEMP. IN °C OR °F TO BE CONVERTED	°F	°C	TEMP. IN °C OR °F TO BE CONVERTED	°F
-273.16	-460	-796	-90.00	-130	-202.0	-17.8	0	32.0	21.1	70	158.0
-267.78	-450	-778	-84.44	-120	-184.0	-16.7	2	35.6	22.2	72	161.6
-262.22	-440	-760	-78.89	-110	-166.0	-15.6	4	39.2	23.3	74	165.2
-256.67	-430	-742	-73.33	-100	-148.0	-14.4	6	42.8	24.4	76	168.8
-251.11	-420	-724	-70.56	-95	-139.0	-13.3	8	46.4	25.6	78	172.4
-245.56	-410	-706	-67.78	-90	-130.0	-12.2	10	50.0	26.7	80	176.0
-240.00	-400	-688	-65.00	-85	-121.0	-11.1	12	53.6	27.8	82	179.6
-234.44	-390	-670	-62.22	-80	-112.0	-10.0	14	57.2	28.9	84	183.2
-228.89	-380	-652	-59.45	-75	-103.0	-8.89	16	60.8	30.0	86	186.8
-223.33	-370	-634	-56.67	-70	-94.0	-7.78	18	64.4	31.1	88	190.4
-217.78	-360	-616	-53.89	-65	-85	-6.67	20	68.0	32.2	90	194.0
-212.22	-350	-598	-51.11	-60	-76.0	-5.56	22	71.6	33.3	92	197.6
-206.67	-340	-580	-48.34	-55	-67.0	-4.44	24	75.2	34.4	94	201.2
-201.11	-330	-562	-45.56	-50	-58.0	-3.33	26	78.8	35.6	96	204.8
-195.56	-320	-544	-42.78	-45	-49.0	-2.22	28	82.4	36.7	98	208.4
-190.00	-310	-526	-40.00	-40	-40.0	-1.11	30	86.0	37.8	100	212.0
-184.44	-300	-508	-38.89	-38	-36.4	0	32	89.6	43.3	110	230.0
-178.89	-290	-490	-37.78	-36	-32.8	1.11	34	93.2	48.9	120	248.0
-173.33	-280	-472	-36.67	-34	-29.2	2.22	36	96.8	54.4	130	266.0
-169.53	-273	-459.4	-35.56	-32	-25.6	3.33	38	100.4	60.0	140	284.0
-168.89	-272	-457.6	-34.44	-30	-22.0	4.44	40	104.0	65.6	150	302.0
-167.78	-270	-454.0	-33.33	-28	-18.4	5.56	42	107.6	71.1	160	320.0
-162.22	-260	-436.0	-32.22	-26	-14.8	6.67	44	111.2	76.7	170	338.0
-156.67	-250	-418.0	-31.11	-24	-11.2	7.78	46	114.8	82.2	180	356.0
-151.11	-240	-400.0	-30.00	-22	-7.6	8.89	48	118.4	87.8	190	374.0
-145.56	-230	-382.0	-28.89	-20	-4.0	10.0	50	122.0	93.3	200	392.0
-140.00	-220	-364.0	-27.78	-18	-0.4	11.1	52	125.6	98.9	210	410.0
-134.44	-210	-356.0	-26.67	-16	3.2	12.2	54	129.2	104.4	220	428.0
-128.89	-200	-328.0	-25.56	-14	6.8	13.3	56	132.8	110.0	230	446.0
-123.33	-190	-310.0	-24.44	-12	10.4	14.4	58	136.4	115.6	240	464.0
-117.78	-180	-292.0	-23.33	-10	14.0	15.6	60	140.0	121.1	250	482.0
-112.22	-170	-274.0	-22.22	-8	17.6	16.7	62	143.6	126.7	260	500.0
-106.67	-160	-256.0	-21.11	-6	21.2	17.8	64	147.2	132.2	270	518.0
-101.11	-150	-238.0	-20.00	-4	24.8	18.9	66	150.8	137.8	280	536.0
-95.56	-140	-220.0	-18.89	-2	28.4	20.0	68	154.4	143.3	290	665.0

- continued -

Temperature Conversions (continued)

°C	TEMP. IN °C OR °F TO BE CONVERTED	°F	°C	TEMP. IN °C OR °F TO BE CONVERTED	°F	°C	TEMP. IN °C OR °F TO BE CONVERTED	°F
21.1	70	158.0	204.4	400	752.0	454.0	850	1562.0
22.2	72	161.6	210.0	410	770.0	460.0	860	1580.0
23.3	74	165.2	215.6	420	788.0	465.6	870	1598.0
24.4	76	168.8	221.1	430	806.0	471.1	880	1616.0
25.6	78	172.4	226.7	440	824.0	476.7	890	1634.0
26.7	80	176.0	232.2	450	842.0	482.2	900	1652.0
27.8	82	179.6	237.8	460	860.0	487.8	910	1670.0
28.9	84	183.2	243.3	470	878.0	493.3	920	1688.0
30.0	86	186.8	248.9	480	896.0	498.9	930	1706.0
31.1	88	190.4	254.4	490	914.0	504.4	940	1724.0
32.2	90	194.0	260.0	500	932.0	510.0	950	1742.0
33.3	92	197.6	265.6	510	950.0	515.6	960	1760.0
34.4	94	201.2	271.1	520	968.0	521.1	970	1778.0
35.6	96	204.8	276.7	530	986.0	526.7	980	1796.0
36.7	98	208.4	282.2	540	1004.0	532.2	990	1814.0
37.8	100	212.0	287.8	550	1022.0	537.8	1000	1832.0
43.3	110	230.0	293.3	560	1040.0	543.3	1010	1850.0
48.9	120	248.0	298.9	570	1058.0	548.9	1020	1868.0
54.4	130	266.0	304.4	580	1076.0	554.4	1030	1886.0
60.0	140	284.0	310.0	590	1094.0	560.0	1040	1904.0
65.6	150	302.0	315.6	600	1112.0	565.6	1050	1922.0
71.1	160	320.0	321.1	610	1130.0	571.1	1060	1940.0
76.7	170	338.0	326.7	620	1148.0	576.7	1070	1958.0
82.2	180	356.0	332.2	630	1166.0	582.2	1080	1976.0
87.8	190	374.0	337.8	640	1184.0	587.8	1090	1994.0
93.3	200	392.0	343.3	650	1202.0	593.3	1100	2012.0
98.9	210	410.0	348.9	660	1220.0	598.9	1110	2030.0
104.4	220	428.0	354.4	670	1238.0	604.4	1120	2048.0
110.0	230	446.0	360.0	680	1256.0	610.0	1130	2066.0
115.6	240	464.0	365.6	690	1274.0	615.6	1140	2084.0
121.1	250	482.0	371.1	700	1292.0	621.1	1150	2102.0
126.7	260	500.0	376.7	710	1310.0	626.7	1160	2120.0
132.2	270	518.0	382.2	720	1328.0	632.2	1170	2138.0
137.8	280	536.0	287.8	730	1346.0	637.8	1180	2156.0
143.3	290	665.0	393.3	740	1364.0	643.3	1190	2174.0

- continued -

EMERSON
Process Management

Temperature Conversions (continued)

°C	TEMP. IN °C OR °F TO BE CONVERTED	°F	°C	TEMP. IN °C OR °F TO BE CONVERTED	°F	°C	TEMP. IN °C OR °F TO BE CONVERTED	°F	°C	TEMP. IN °C OR °F TO BE CONVERTED	°F
148.9	300	572.0	315.6	600	1112.0	482.2	900	1652.0	648.9	1200	2192.0
154.4	310	590.0	321.1	610	1130.0	487.8	910	1670.0	654.4	1210	2210.0
160.0	320	608.0	326.7	620	1148.0	493.3	920	1688.0	660.0	1220	2228.0
165.6	330	626.0	332.2	630	1166.0	498.9	930	1706.0	665.6	1230	2246.0
171.1	340	644.0	337.8	640	1184.0	504.4	940	1724.0	671.1	1240	2264.0
176.7	350	662.0	343.3	650	1202.0	510.0	950	1742.0	676.7	1250	2282.0
182.2	360	680.0	348.9	660	1220.0	515.6	960	1760.0	682.2	1260	2300.0
187.8	370	698.0	354.4	670	1238.0	521.1	970	1778.0	687.8	1270	2318.0
189.9	380	716.0	360.0	680	1256.0	526.7	980	1796.0	693.3	1280	2336.0
193.3	390	734.0	365.6	690	1274.0	532.2	990	1814.0	698.9	1290	2354.0
204.4	400	752.0	371.1	700	1292.0	537.8	1000	1832.0	704.4	1300	2372.0
210.0	410	770.0	376.7	710	1310.0	543.3	1010	1850.0	710.0	1310	2390.0
215.6	420	788.0	382.2	720	1328.0	548.9	1020	1868.0	715.6	1320	2408.0
221.1	430	806.0	287.8	730	1346.0	554.4	1030	1886.0	721.1	1330	2426.0
226.7	440	824.0	393.3	740	1364.0	560.0	1040	1904.0	726.7	1340	2444.0
232.2	450	842.0	398.9	750	1382.0	565.6	1050	1922.0	732.2	1350	2462.0
237.8	460	860.0	404.4	760	1400.0	571.1	1060	1940.0	737.8	1360	2480.0
243.3	470	878.0	410.0	770	1418.0	576.7	1070	1958.0	743.3	1370	2498.0
248.9	480	896.0	415.6	780	1436.0	582.2	1080	1976.0	748.9	1380	2516.0
254.4	490	914.0	421.1	790	1454.0	587.8	1090	1994.0	754.4	1390	2534.0
260.0	500	932.0	426.7	800	1472.0	593.3	1100	2012.0	760.0	1400	2552.0
265.6	510	950.0	432.2	810	1490.0	598.9	1110	2030.0	765.6	1410	2570.0
271.1	520	968.0	437.8	820	1508.0	604.4	1120	2048.0	771.1	1420	2588.0
276.7	530	986.0	443.3	830	1526.0	610.0	1130	2066.0	776.7	1430	2606.0
282.2	540	1004.0	448.9	840	1544.0	615.6	1140	2084.0	782.2	1440	2624.0
287.8	550	1022.0	454.4	850	1562.0	621.1	1150	2102.0	787.0	1450	2642.0
293.3	560	1040.0	460.0	860	1580.0	626.7	1160	2120.0	793.3	1460	2660.0
298.9	570	1058.0	465.6	870	1598.0	632.2	1170	2138.0	798.9	1470	2678.0
304.4	580	1076.0	471.1	880	1616.0	637.8	1180	2156.0	804.4	1480	2696.0
310.0	590	1094.0	476.7	890	1634.0	643.3	1190	2174.0	810.0	1490	2714.0

Conversions, Equivalents and Physical Data

A.P.I. and Baumé Gravity Tables and Weight Factors

A.P.I. Gravity	Baumé Gravity	Specific Gravity	Lbs/U.S. Gal.	U.S. Gal/ Lb	A.P.I. Gravity	Baumé Gravity	Specific Gravity	Lbs/U.S. Gal.	U.S. Gal/ Lb	A.P.I. Gravity	Baumé Gravity	Specific Gravity	Lbs/U.S. Gal.	U.S. Gal/ Lb	A.P.I. Gravity	Baumé Gravity	Specific Gravity	Lbs/U.S. Gal.	U.S. Gal/ Lb
0	10.247	1.0760	8.962	0.1116	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
1	9.223	1.0679	8.895	0.1124	31	30.78	0.9808	7.251	0.1379	61	60.46	0.7351	6.119	0.1634	81	80.25	0.6659	5.542	0.1804
2	8.198	1.0599	8.828	0.1133	32	31.77	0.8654	7.206	0.1388	62	61.45	0.7313	6.087	0.1643	82	81.24	0.6628	5.516	0.1813
3	7.173	1.0520	8.762	0.1141	33	32.76	0.8602	7.163	0.1396	63	62.44	0.7275	6.056	0.1651	83	82.23	0.6597	5.491	0.1821
4	6.148	1.0443	8.698	0.1150	34	33.75	0.8550	7.119	0.1405	64	63.43	0.7238	6.025	0.1660	84	83.22	0.6566	5.465	0.1830
5	5.124	1.0366	8.634	0.1158	35	34.73	0.8498	7.075	0.1413	65	64.42	0.7201	6.994	0.1668	85	84.20	0.6536	5.440	0.1838
6	4.099	1.0291	8.571	0.1167	36	35.72	0.8448	7.034	0.1422	66	65.41	0.7165	5.964	0.1677	86	85.19	0.6506	5.415	0.1847
7	3.074	1.0217	8.509	0.1175	37	36.71	0.8398	6.993	0.1430	67	66.40	0.7128	5.934	0.1685	87	86.18	0.6476	5.390	0.1855
8	2.049	1.0143	8.448	0.1184	38	37.70	0.8348	6.951	0.1439	68	67.39	0.7093	5.904	0.1694	88	87.17	0.6446	5.365	0.1864
9	1.025	1.0071	8.388	0.1192	39	38.69	0.8299	6.910	0.1447	69	68.37	0.7057	5.874	0.1702	89	88.16	0.6417	5.341	0.1872
10	10.00	1.0000	8.328	0.1201	40	39.68	0.8251	6.870	0.1456	70	69.36	0.7022	5.845	0.1711	90	89.15	0.6388	5.316	0.1881
11	10.99	0.9930	8.270	0.1209	41	40.67	0.8203	6.830	0.1464	71	70.35	0.6988	5.817	0.1719	91	90.14	0.6360	5.293	0.1889
12	11.98	0.9861	8.212	0.1218	42	41.66	0.8155	6.790	0.1473	72	71.34	0.6953	5.788	0.1728	92	91.13	0.6331	5.269	0.1898
13	12.97	0.9792	8.155	0.1226	43	42.65	0.8109	6.752	0.1481	73	72.33	0.6919	5.759	0.1736	93	92.12	0.6303	5.246	0.1906
14	13.96	0.9725	8.099	0.1235	44	43.64	0.8063	6.713	0.1490	74	73.32	0.6886	5.731	0.1745	94	93.11	0.6275	5.222	0.1915
15	14.95	0.9659	8.044	0.1243	45	44.63	0.8017	6.675	0.1498	75	74.31	0.6852	5.703	0.1753	95	94.10	0.6247	5.199	0.1924
16	15.94	0.9593	7.989	0.1252	46	45.62	0.7972	6.637	0.1507	76	75.30	0.6819	5.676	0.1762	96	95.09	0.6220	5.176	0.1932
17	16.93	0.9529	7.935	0.1260	47	50.61	0.7927	6.600	0.1515	77	76.29	0.6787	5.649	0.1770	97	96.08	0.6193	5.154	0.1940
18	17.92	0.9465	7.882	0.1269	48	50.60	0.7883	6.563	0.1524	78	77.28	0.6754	5.622	0.1779	98	97.07	0.6166	5.131	0.1949
19	18.90	0.9402	7.930	0.1277	49	50.59	0.7839	6.526	0.1532	79	78.27	0.6722	5.595	0.1787	99	98.06	0.6139	5.109	0.1957
20	19.89	0.9340	7.778	0.1286	50	50.58	0.7796	6.490	0.1541	80	79.26	0.6690	5.568	0.1796	100	99.05	0.6112	5.086	0.1966
21	20.88	0.9279	7.727	0.1294	51	50.57	0.7753	6.455	0.1549										
22	21.87	0.9218	7.676	0.1303	52	51.55	0.7711	6.420	0.1558										
23	22.86	0.9159	7.627	0.1311	53	52.54	0.7669	6.385	0.1566										
24	23.85	0.9100	7.578	0.1320	54	53.53	0.7628	6.350	0.1575										
25	24.84	0.9042	7.529	0.1328	55	54.52	0.7587	6.136	0.1583										
26	25.83	0.8984	7.481	0.1337	56	55.51	0.7547	6.283	0.1592										
27	26.82	0.8927	7.434	0.1345	57	56.50	0.7507	6.249	0.1600										
28	27.81	0.8871	7.387	0.1354	58	57.49	0.7467	6.216	0.1609										
29	28.80	0.8816	7.341	0.1362	59	58.48	0.7428	6.184	0.1617										
30	29.79	0.8762	7.296	0.1371	60	59.47	0.7389	6.151	0.1626										

The relation of degrees Baume or A.P.I. to Specific Gravity is expressed by these formulas:

For liquids lighter than water:

Degrees Baume = $\frac{140}{G} - 130$ $G = \frac{140}{130 + \text{Degrees Baume}}$

Degrees A.P.I. = $\frac{141}{5} - 131.5$ $G = \frac{141.5}{131.5 + \text{Degrees A.P.I.}}$

For liquids heavier than water:

Degrees Baume = $145 - \frac{145}{5}$ $G = \frac{145}{145 - \text{Degrees Baume}}$

G = Specific Gravity = ratio of weight of a given volume of oil at 60°F to the weight of the same volume of water at 60°F.

The above tables are based on the weight of 1 gal. (U.S.) of oil with a volume of 231 in^3 at 60°F in air at 760 mm pressure and 50% relative humidity. Assumed weight of 1 gal. of water at 60°F in air is 8.32828 lbs.

To determine the resulting gravity by mixing oils of different gravities:

$$D = \frac{md_1 + md_2}{m + n}$$

D = Density or Specific Gravity of mixture
m = Proportion of oil of d_1 density
n = Proportion of oil of d_2 density
d_1 = Specific gravity of m oil
d_2 = Specific gravity of n oil

EMERSON
Process Management

Characteristics of the Elements

ELEMENT	SYMBOL	ATOMIC NUMBER	MASS NUMBER[1]	MELTING POINT (°C)	BOILING POINT (°C)	ELEMENT	SYMBOL	ATOMIC NUMBER	MASS NUMBER[1]	MELTING POINT (°C)	BOILING POINT (°C)
Actinium	Ac	89	(227)	1600†		Neon	Ne	10	20	-248.67	-245.9
Aluminum	Al	13	27	659.7	2057	Neptunium	Np	93	(237)		
Americum	Am	95	(243)			Nickel	Ni	28	58	1455	2900
Antimony (Stibium)	Sb	51	121	630.5	1380	Niobium	Nb	41	93	2500±50	3700
Argon	Ar	18	40	-189.2	-185.7	Nitrogen	N	7	14	-209.86	-195.8
Arsenic	As	33	75	sublimes at 615	sublimes at 615	Nobelium	No	102	(253)		
Astatine	At	85	(210)			Osmium	Os	76	192	2700	>5300
Barium	Ba	56	138	850	1140	Oxygen	O	8	16	-218.4	-182.86
Berkelium	Bk	97	(247)			Palladium	Pd	46	106	1549.4	2000
Beryllium	Be	4	9	1278±5	2970	Phosphorus	P	15	31		
Bismuth	Bi	83	209	271.3	1560±5	Platinum	Pt	78	195	1773.5	4300
Boron	B	5	11	2300	2550	Plutonium	Pu	94	(242)		
Bromine	Br	35	79	-7.2	58.78	Polonium	Po	84	(209)		
Cadmium	Cd	48	114	320.9	767±2	Potassium	K	19	39	53.3	760
Calcium	Ca	20	40	842±8	1240	Praseodymium	Pr	59	141	940	
Californium	Cf	98	(249)			Promethium	Pm	61	(145)		
Carbon	C	6	12	>3550	4200	Protactinium	Pa	91	(231)		
Cerium	Ce	58	140	804	1400	Radium	Ra	88	(226)	700	
Cesium	Cs	55	133	28.5	670	Radon	Rn	86	(222)	-71	1140
Chlorine	Cl	17	35	-103±5	-34.6	Rhenium	Re	75	187	3167±60	-61.8
Chromium	Cr	24	52	1890	2480	Rhodium	Rh	45	103	1966±3	>2500
Cobalt	Co	27	59	1495	2900	Rubidium	Rb	37	85	38.5	700
Copper	Cu	29	63	1083	2336	Ruthenium	Ru	44	102	2450	2700
Curium	Cm	96	(248)			Samarium	Sm	62	152	>1300	
Dysprosium	Dy	66	164			Scandium	Sc	21	45	1200	2400
Einsteinium	Es	99	(254)			Selenium	Se	34	80	217	688
Erbium	Er	68	166			Silicon	Si	14	28	1420	2355
Europium	Eu	63	153	1150±50		Silver	Ag	47	107	960.8	1950
Fermium	Fm	100	(252)			Sodium	Na	11	23	97.5	880
Fluourine	F	9	19	-223	-188	Strontium	Sr	38	88	800	1150
Francium	Fr	87	(223)			Sulfur	S	16	32		
Gadolinium	Gd	64	158			Tantalum	Ta	73	180	2996±50	c.4100
Gallium	Ga	31	69	29.78	1983	Technetium	Tc	43	(99)		
Germanium	Ge	32	74	958.5	2700	Tellurium	Te	52	130	452	1390
Gold	Au	79	197	1063	2600	Terbium	Tb	65	159	327±5	
Hafnium	Hf	72	180	1700[2]	>3200	Thallium	Tl	81	205	302	1457±10
Helium	He	2	4	-272	-268.9	Thorium	Th	90	232	1845	4500
Holmium	Ho	67	165			Thulium	Tm	69	169		
Hydrogen	H	1	1	-259.14	-252.8	Tin	Sn	50	120	231.89	2270
Indium	In	49	115	156.4	2000±10	Titanium	Ti	22	48	1800	>3000
Iodine	I	53	127	113.7	184.35	Tungsten (Wolfram)	W	74	184	3370	5900
Iridium	Ir	77	193	2454	>4800	Uranium	U	92	238	c.1133	
Iron	Fe	26	56	1535	3000	Vanadium	V	23	51	1710	3000
Krypton	Kr	36	84	-156.6	-152.9	Xenon	Xe	54	132	-112	-107.1
Lanthanum	La	57	139	826		Ytterbium	Yb	70	174	1800	
Lawrencium	Lw	103	(257)			Yttrium	Y	39	89	1490	2500
Lead	Pb	82	208	327.43	1620	Zinc	Zn	30	64	419.47	907
Lithium	Li	3	7	186	1336±5	Zirconium	Zr	40	90	1857	>2900
Lutetium	Lu	71	175								
Magnesium	Mg	12	24	651	1107						
Manganese	Mn	25	55	1260	1900						
Mendelevium	Mv	101	(256)								
Mercury	Hg	80	202	-38.87	356.58						
Molybdenum	Mo	42	98	2620±10	4800						
Neodymium	Nd	60	142	840							

1. Mass number shown is that of stable isotope most common in nature. Mass numbers shown in parentheses designate the isotope with the longest half-life (slowest rate of radioactive decay) for those elements having an unstable isotope.
2. Calculated

> Greater than

Recommended Standard Specifications for Valve Materials Pressure-Containing Castings

1 Carbon Steel ASTM A216 Grade WCC Temperature Range = -20 to 800°F Composition (Percent) C 0.25 maximum Mn 1.20 maximum P 0.04 maximum S 0.04 maximum Si 0.60 maximum	2 Carbon Steel ASTM A216 Grade WCB Temperature Range = -20 to 1000°F Composition (Percent) C 0.30 maximum Mn 1.00 maximum P 0.05 maximum S 0.06 maximum Si 0.60 maximum	11 Type 304 Stainless Steel ASTM A351 Grade CF-8 Temperature Range = -425 to 1500°F Composition (Percent) C 0.08 maximum Mn 1.50 maximum Si 2.00 maximum S 0.04 maximum P 0.04 maximum Cr 18.00 to 21.00 Ni 8.00 to 11.00	12 Type 316 Stainless Steel ASTM A351 Grade CF-8M Temperature Range = -425 to 1500°F Composition (Percent) C 0.08 maximum Mn 1.50 maximum Si 2.00 maximum P 0.04 maximum S 0.04 maximum Cr 18.00 to 21.00 Ni 9.00 to 12.00 Mo 2.00 to 3.00
3 Carbon Steel ASTM A352 Grade LCC Temperature Range = -50 to 650°F Composition: same as ASTM A216 Grade WCC	4 Carbon Steel ASTM A352 Grade LCB Temperature Range = -50 to 650°F Composition: same as ASTM A216 Grade WCB	13 Cast Iron ASTM A126 Class B Temperature Range = -150 to 450°F Composition (Percent) P 0.75 maximum S 0.12 maximum	14 Cast Iron ASTM A126 Class C Temperature Range = -150 to 450°F Composition (Percent) P 0.75 maximum S 0.12 maximum
5 Chrome Moly Steel ASTM A217 Grade C5 Temperature Range = -20 to 1100°F Composition (Percent) C 0.20 maximum Mn 0.40 to 0.70 P 0.05 maximum S 0.06 maximum Si 0.75 maximum Cr 4.00 to 6.50 Mo 0.45 to 0.65	6 Carbon Moly Steel ASTM A217 Grade WC1 Temperature Range = -20 to 850°F Composition (Percent) C 0.25 Mn 0.50 to 0.80 P 0.05 maximum S 0.06 maximum Si 0.60 maximum Mo 0.45 to 0.65	15 Ductile Iron ASTM A395 Type 60-45-15 Temperature Range = -20 to 650°F Composition (Percent) C 3.00 minimum Si 2.75 maximum P 0.80 maximum	16 Ductile Ni-Resist* Iron ASTM A439 Type D-2B Temperature Range = -20 to 750°F Composition (Percent) C 3.00 maximum Si 1.50 to 3.00 Mn 0.70 to 1.25 P 0.08 maximum Ni 18.00 to 22.00 Cr 2.75 to 4.00
7 Chrome Moly Steel ASTM A217 Grade WC6 Temperature Range = -20 to 1000°F Composition (Percent) C 0.20 maximum Mn 0.50 to 0.80 P 0.05 maximum S 0.06 maximum Si 0.60 maximum Cr 1.00 to 1.50 Mo 0.45 to 0.65	8 Chrome Moly Steel ASTM A217 Grade WC9 Temperature Range = -20 to 1050°F Composition (Percent) C 0.18 maximum Mn 0.40 to 0.70 P 0.05 maximum Si 0.60 maximum Cr 2.00 to 2.75 Mo 0.90 to 1.20	17 Standard Valve Bronze ASTM B62 Temperature Range = -325 to 450°F Composition (Percent) Cu 84.00 to 86.00 Sn 4.00 to 6.00 Pb 4.00 to 6.00 Zn 4.00 to 6.00 Ni 1.00 maximum Fe 0.30 maximum P 0.05 maximum	18 Tin Bronze ASTM B143 Alloy 1A Temperature Range = -325 to 400°F Composition (Percent) Cu 86.00 to 89.00 Sn 9.00 to 11.00 Pb 0.30 maximum Zn 1.00 to 3.00 Ni 1.00 maximum Fe 0.15 maximum P 0.05 maximum
9 3.5% Nickel Steel ASTM A352 Grade LC3 Temperature Range = -150 to 650°F Composition (Percent) C 0.15 maximum Mn 0.50 to 0.80 P 0.05 maximum S 0.05 maximum Si 0.60 maximum Ni 3.00 to 4.00	10 Chrome Moly Steel ASTM A217 Grade C12 Temperature Range = -20 to 1100°F Composition (Percent) C 0.20 maximum Si 1.00 maximum Mn 0.35 to 0.65 Cr 8.00 to 10.00 Mo 0.90 to 1.20 P 0.05 maximum S 0.06 maximum	19 Manganese Bronze ASTM B147 Alloy 8A Temperature Range = -325 to 350°F Composition (Percent) Cu 55.00 to 60.00 Sn 1.00 maximum Pb 0.40 maximum Ni 0.50 maximum Fe 0.40 to 2.00 Al 0.50 to 1.50 Mn 1.50 maximum Zn Remainder	20 Aluminum Bronze ASTM B148 Alloy 9C Temperature Range = -325 to 500°F Composition (Percent) Cu 83.00 minimum Al 10.00 to 11.50 Fe 3.00 to 5.00 Mn 0.50 Ni 2.50 maximum Minimum total named elements = 99.5

- continued -

Recommended Standard Specifications for Valve Materials Pressure-Containing Castings (continued)

21 Mondel* Alloy 411
(Weldable Grade)

Temperature Range = -325 to 900°F
Composition (Percent)

Ni	60.00 minimum
Cu	26.00 to 33.00
C	0.30 maximum
Mn	1.50 maximum
Fe	3.50 maximum
S	0.015 maximum
Si	1.00 to 2.00
Nb	1.00 to 3.00

22 Nickel-Moly Alloy "B"
ASTM A494 (Hastelloy® "B" †)

Temperature Range = -325 to 700°F
Composition (Percent)

Cr	1.00 maximum
Fe	4.00 to 6.00
C	0.12 maximum
Si	1.00 maximum
Co	2.50 maximum
Mn	1.00 maximum
V	0.20 to 0.60
Mo	26.00 to 30.00
P	0.04 maximum
S	0.03 maximum
Ni	Remainder

31 Type 302 Stainless Steel
ASTM A276 Type 302

Composition (Percent)

C	0.15 maximum
Mn	2.00 maximum
P	0.045 maximum
S	0.030 maximum
Si	1.00 maximum
Cr	17.00 to 19.00
Ni	8.00 to 10.00

32 Type 304 Stainless Steel
ASTM A276 Type 304

Composition (Percent)

C	0.08 maximum
Mn	2.00 maximum
P	0.045 maximum
S	0.030 maximum
Si	1.00 maximum
Cr	18.00 to 20.00
Ni	8.00 to 12.00

23 Nickel-Moly-Chrome Alloy "C"
ASTM A494 (Hastelloy® "C" †)

Temperature Range = -325 to 1000°F
Composition (Percent)

Cr	15.50 to 17.50
Fe	4.50 to 7.50
W	3.75 to 5.25
C	0.12 maximum
Si	1.00 maximum
Co	2.50 maximum
Mn	1.00 maximum
V	0.20 to 0.40
Mo	16.00 to 18.00
P	0.04
S	0.03
Ni	Remainder

24 Cobalt-based Alloy No.6
Stellite † No. 6

Composition (Percent)

C	0.90 to 1.40
Mn	1.00
W	3.00 to 6.00
Ni	3.00
Cr	26.00 to 32.00
Mo	1.00
Fe	3.00
Se	0.40 to 2.00
Co	Remainder

33 Type 316 Stainless Steel
ASTM A276 Type 316

Composition (Percent)

C	0.08 maximum
Mn	2.00 maximum
P	0.045 maximum
S	0.030 maximum
Si	1.00 maximum
Cr	16.00 to 18.00
Ni	10.00 to 14.00
Mo	2.00 to 3.00

34 Type 316L Stainless Steel
ASTM A276 Type 316L

Composition (Percent)

C	0.03 maximum
Mn	2.00 maximum
P	0.045 maximum
S	0.030 maximum
Si	1.00 maximum
Cr	16.00 to 18.00
Ni	10.00 to 14.00
Mo	2.00 to 3.00

25 Aluminum Bar
ASTM B211 Alloy 20911-T3

Composition (Percent)

Si	0.40 maximum
Fe	0.70 maximum
Cu	5.00 to 6.00
Zn	0.30 maximum
Bi	0.20 to 0.60
Pb	0.20 to 0.60
	Other Elements 0.15 maximum
Al	Remainder

26 Yellow Brass Bar
ASTM B16 1/2 Hard

Composition (Percent)

Cu	60.00 to 63.00
Pb	2.50 to 3.70
Fe	0.35 maximum
Zn	Remainder

35 Type 410 Stainless Steel
ASTM A276 Type 410

Composition (Percent)

C	0.15 maximum
Mn	1.00 maximum
P	0.040 maximum
S	0.030 maximum
Si	1.00 maximum
Cr	11.50 to 13.50
Al	0.10 to 0.30

36 Type 17-4PH Stainless Steel
ASTM A461 Grade 630

Composition (Percent)

C	0.07 maximum
Mn	1.00 maximum
Si	1.00 maximum
P	0.04 maximum
S	0.03 maximum
Cr	15.50 to 17.50
Nb	0.05 to 0.45
Cu	3.00 to 5.00
Ni	3.00 to 5.00
Fe	Remainder

27 Naval Brass Bar
ASTM B21 Allow 464

Composition (Percent)

Cu	59.00 to 62.00
Sn	0.50 to 1.00
Pb	0.20 maximum
Zn	Remainder

28 Leaded Steel Bar
AISI 12L14

Composition (Percent)

C	0.15 maximum
Mn	0.80 to 1.20
P	0.04 to 0.09
S	0.25 to 0.35
Pb	0.15 to 0.35

37 Nickel-Copper Alloy Bar
Alloy K500 (K Monel®*)

Composition (Percent)

Ni	63.00 to 70.00
Fe	2.00 maximum
Mn	1.50 maximum
Si	1.00 maximum
C	0.25 maximum
S	0.01 maximum
Al	2.00 to 4.00
Ti	0.25 to 1.00
Cu	Remainder

38 Nickel-Moly Alloy "B" Bar
ASTM B335 (Hastelloy® "B" †)

Composition (Percent)

Cr	1.00 maximum
Fe	4.00 to 6.00
C	0.04 maximum
Si	1.00 maximum
Co	2.50 maximum
Mn	1.00 maximum
V	0.20 to 0.40
Mo	26.00 to 30.00
P	0.025 maximum
S	0.030 maximum
Ni	Remainder

29 Carbon Steel Bar
ASTM A108 Grade 1018

Composition (Percent)

C	0.15 to 0.20
Mn	0.60 to 0.90
P	0.04 maximum
S	0.05 maximum

30 AISI 4140 Chrome-Moly Steel
(Suitable for ASTM A193
Grade B7 bolt material)

Composition (Percent)

C	0.38 to 0.43
Mn	0.75 to 1.00
P	0.035 maximum
S	0.04 maximum
Si	0.20 to 0.35
Cr	0.80 to 1.10
Mo	0.15 to 0.25
Fe	Remainder

39 Nickel-Moly-Chrome Alloy "C" Bar
ASTM B336 (Hastelloy® "C" †)

Composition (Percent)

Cr	14.50 to 16.50
Fe	4.00 to 7.00
W	3.00 to 4.50
C	0.08 maximum
Si	1.00 maximum
Co	2.50 maximum
Mn	1.00 maximum
Va	0.35 maximum
Mo	15.00 to 17.00
P	0.04
S	0.03
Ni	Remainder

Conversions, Equivalents and Physical Data

Recommended Standard Specifications for Valve Materials Pressure-Containing Castings

MATERIAL CODE AND DESCRIPTION			MINIMUM PHYSICAL PROPERTIES				MODULUS OF ELASTICITY AT 70°F (psi x 10^6)	APPROXIMATE BRINELL HARDNESS
			Tensile (psi)	Yield Point (psi)	Elong. in 2 in. (%)	Reduction of Area (%)		
1	Carbon Steel	ASTM A 216 Grade WCC	70,000	40,000	22	35	30.4	137 to 187
2	Carbon Steel	ASTM A 216 Grade WCB	70,000	36,000	22	35	27.9	137 to 187
3	Carbon Steel	ASTM A 352 Grade LCC	70,000	40,000	22	35	29.9	137 to 187
4	Carbon Steel	ASTM A 352 Grade LCB	65,000	35,000	24	35	27.9	137 to 187
5	Chrome Moly Steel	ASTM A217 Grade C5	90,000	60,000	18	35	27.4	241 Maximum
6	Carbon Moly Steel	ASTM A217 Grade WC1	65,000	35,000	24	35	29.9	215 Maximum
7	Chrome Moly Steel	ASTM A217 Grade WC6	70,000	40,000	20	35	29.9	215 Maximum
8	Chrome Moly Steel	ASTM A217 Grade WC9	70,000	40,000	20	35	29.9	241 Maximum
9	3.5% Nickel Steel	ASTM A352 Grade LC3	65,000	40,000	24	35	27.9	137
10	Chrome Moly Steel	ASTM A217 Grade C12	90,000	60,000	18	35	27.4	180 to 240
11	Type 304 Stainless Steel	ASTM A351 Grade CF8	65,000	28,000	35	----	28.0	140
12	Type 316 Stainless Steel	ASTM A351 Grade CF8M	70,000	30,000	30	----	28.3	156 to 170
13	Cast Iron	ASTM A126 Class B	31,000	----	----	----	----	160 to 220
14	Cast Iron	ASTM A126 Class C	41,000	----	----	----	----	160 to 220
15	Ductile Iron	ASTM A395 Type 60-45-15	60,000	45,000	15	----	23-26	143 to 207
16	Ductile Ni-Resist Iron[1]	ASTM A439 Type D-2B	58,000	30,000	7	----	----	148 to 211
17	Standard Valve Bronze	ASTM B62	30,000	14,000	20	17	13.5	55 to 65*
18	Tin Bronze	ASTM B143 Alloy 1A	40,000	18,000	20	20	15	75 to 85*
19	Manganese Bronze	ASTM B147 Alloy 8A	65,000	25,000	20	20	15.4	98*
20	Aluminum Bronze	ASTM B148 Alloy 9C	75,000	30,000	12 minimum	12	17	150
21	Mondel Alloy 411	(Weldable Grade)	65,000	32,500	25	----	23	120 to 170
22	Nickel-Moly Alloy "B"	ASTM A494 (Hastelloy® "B")	72,000	46,000	6	----	----	----
23	Nickel-Moly-Chrome Alloy "C"	ASTM A494 (Hastelloy® "C")	72,000	46,000	4	----	----	----
24	Cobalt-base Alloy No.6	Stellite No. 6	121,000	64,000	1 to 2	----	30.4	----
25	Aluminum Bar	ASTM B211 Alloy 20911-T3	44,000	36,000	15	----	10.2	95
26	Yellow Brass Bar	ASTM B16-1/2 Hard	45,000	15,000	7	50	14	----
27	Naval Brass Bar	ASTM B21 Alloy 464	60,000	27,000	22	55	----	----
28	Leaded Steel Bar	AISI 12L14	79,000	71,000	16	52	----	163
29	Carbon Steel Bar	ASTM A108 Grade 1018	69,000	48,000	38	62	----	143
30	AISI 4140 Chrome-Moly Steel	(Suitable for ASTM A193 Grade B7 bolt material)	135,000	115,000	22	63	29.9	255
31	Type 302 Stainless Steel	ASTM A276 Type 302	85,000	35,000	60	70	28	150
32	Type 304 Stainless Steel	ASTM A276 Type 304	85,000	35,000	60	70	----	149
33	Type 316 Stainless Steel	ASTM A276 Type 316	80,000	30,000	60	70	28	149
34	Type 316L Stainless Steel	ASTM A276 Type 316L	81,000	34,000	55	----	----	146
35	Type 410 Stainless Steel	ASTM A276 Type 410	75,000	40,000	35	70	29	155
36	Type 17-4PH Stainless Steel	ASTM A461 Grade 630	135,000	105,000	16	50	29	275 to 345
37	Nickel-Copper Alloy Bar	Alloy K500 (K Monel®)	100,000	70,000	35	----	26	175 to 260
38	Nickel-Moly Alloy "B" Bar	ASTM B335 (Hastelloy® "B")	100,000	46,000	30	----	----	----
39	Nickel-Moly Alloy "C" Bar	ASTM B336 (Hastelloy® "C")	100,000	46,000	20	----	----	----

1. 500 kg load.

Physical Constants of Hydrocarbons

NO.	COMPOUND	FORMULA	MOLECULAR WEIGHT	BOILING POINT AT 14.696 psia (°F)	VAPOR PRESSURE AT 100°F (psia)	FREEZING POINT AT 14.696 PSIA (°F)	CRITICAL CONSTANTS		SPECIFIC GRAVITY AT 14.696 PSIA	
							Critical Temperature (°F)	Critical Pressure (psia)	Liquid[3][4], 60°F/60°F	Gas at 60°F (Air = 1)[1]
1	Methane	CH_4	16.043	-258.69	5000[2]	-296.46[5]	-116.63	667.8	0.3000[8]	0.5539
2	Ethane	C_2H_6	30.070	-127.48	800[2]	-297.89[5]	90.09	707.8	0.3564[7]	1.0382
3	Propane	C_3H_8	44.097	-43.67	190	-305.84[5]	206.01	616.3	0.5077[7]	1.5225
4	n-Butane	C_4H_{10}	58.124	31.10	51.6	-217.05	305.65	550.7	0.5844[7]	2.0068
5	Isobutane	C_4H_{10}	58.124	10.90	72.2	-255.29	274.98	529.1	0.5631[7]	2.0068
6	n-Pentane	C_5H_{12}	72.151	96.92	15.570	-201.51	385.7	488.6	0.6310	2.4911
7	Isopentane	C_5H_{12}	72.151	82.12	20.44	-255.83	369.10	490.4	0.6247	2.4911
8	Neopentane	C_5H_{12}	72.151	49.10	35.9	2.17	321.13	464.0	0.5967[7]	2.4911
9	n-Hexane	C_6H_{14}	86.178	155.72	4.956	-139.58	453.7	436.9	0.6640	2.9753
10	2-Methylpentane	C_6H_{14}	86.178	140.47	6.767	-244.63	435.83	436.6	0.6579	2.9753
11	3-Methylpentane	C_6H_{14}	86.178	145.89	6.098	----	448.3	453.1	0.6689	2.9753
12	Neohexane	C_6H_{14}	86.178	121.52	9.856	-147.72	420.13	446.8	0.6540	2.9753
13	2,3-Dimethylbutane	C_6H_{14}	86.178	136.36	7.404	-199.38	440.29	453.5	0.6664	2.9753
14	n-Heptane	C_7H_{16}	100.205	209.17	1.620	-131.05	512.8	396.8	0.6882	3.4596
15	2-Methylhexane	C_7H_{16}	100.205	194.09	2.271	-180.89	495.00	396.5	0.6830	3.4596
16	3-Methylhexane	C_7H_{16}	100.205	197.32	2.130	----	503.78	408.1	0.6917	3.4596
17	3-Ethylpentane	C_7H_{16}	100.205	200.25	2.012	-181.48	513.48	419.3	0.7028	3.4596
18	2,2-Dimethylpentane	C_7H_{16}	100.205	174.54	3.492	-190.86	477.23	402.2	0.6782	3.4596
19	2,4-Dimethylpentane	C_7H_{16}	100.205	176.89	3.292	-182.63	475.95	396.9	0.6773	3.4596
20	3,3-Dimethylpentane	C_7H_{16}	100.205	186.91	2.773	-210.01	505.85	427.2	0.6976	3.4596
21	Triptane	C_7H_{16}	100.205	177.58	3.374	-12.82	496.44	428.4	0.6946	3.4596
22	n-Octane	C_8H_{18}	114.232	258.22	0.537	-70.18	564.22	360.6	0.7068	3.9439
23	Disobutyl	C_8H_{18}	114.232	228.39	1.101	-132.07	530.44	360.6	0.6979	3.9439
24	Isooctane	C_8H_{18}	114.232	210.63	1.708	-161.27	519.46	372.4	0.6962	3.9439
25	n-Nonane	C_9H_{20}	128.259	303.47	0.179	-64.28	610.68	332	0.7217	4.4282
26	n-Decane	$C_{10}H_{22}$	142.286	345.48	0.0597	-21.36	652.1	304	0.7342	4.9125
27	Cyclopentane	C_5H_{10}	70.135	120.65	9.914	-136.91	461.5	653.8	0.7504	2.4215
28	Methylcyclopentane	C_6H_{12}	84.162	161.25	4.503	-224.44	499.35	548.9	0.7536	2.9057
29	Cyclohexane	C_6H_{12}	84.162	177.29	3.264	43.77	536.7	591	0.7834	2.9057
30	Methylcyclohexane	C_7H_{14}	98.189	213.68	1.609	-195.98	570.27	503.5	0.7740	3.3900
31	Ethylene	C_2H_4	28.054	-154.62	----	-272.45[5]	48.58	729.8	----	0.9686
32	Propene	C_3H_6	42.081	-53.90	226.4	-301.45[5]	196.9	669	0.5220[7]	1.4529
33	1-Butene	C_4H_8	56.108	20.75	63.05	-301.63[5]	295.6	583	0.6013[7]	1.9372
34	Cis-2-Butene	C_4H_8	56.108	38.69	45.54	-218.06	324.37	610	0.6271[7]	1.9372
35	Trans-2-Butene	C_4H_8	56.108	33.58	49.80	-157.96	311.86	595	0.6100[7]	1.9372
36	Isobutene	C_4H_8	56.108	19.59	63.40	-220.61	292.55	580	0.6004[7]	1.9372
37	1-Pentene	C_5H_{10}	70.135	85.93	19.115	-265.39	376.93	590	0.645[7]	2.4215
38	1,2-Butadiene	C_4H_6	54.092	51.56	20[2]	-213.16	339[2]	653[2]	0.658[7]	1.8676
39	1,3-Butadiene	C_4H_6	54.092	24.06	60[2]	-164.02	306	628	0.6272[7]	1.8676
40	Isoprene	C_5H_8	68.119	93.30	16.672	-230.74	412[2]	558.4[2]	0.6861	2.3519
41	Acetylene	C_2H_2	26.038	-119[6]	----	-114[5]	95.31	890.4	0.615[9]	0.8990
42	Benzene	C_6H_6	78.114	176.17	3.224	41.96	552.22	710.4	0.8844	2.6969
43	Toluene	C_7H_8	92.141	231.13	1.032	-138.94	605.55	595.9	0.8718	3.1812
44	Ethylbenzene	C_8H_{10}	106.168	277.16	0.371	-138.91	651.24	523.5	0.8718	3.6655
45	o-Xylene	C_8H_{10}	106.168	291.97	0.264	-13.30	675.0	541.4	0.8848	3.6655
46	m-Xylene	C_8H_{10}	106.168	282.41	0.326	-54.12	651.02	513.6	0.8687	3.6655
47	p-Xylene	C_8H_{10}	106.168	281.05	0.342	55.86	649.6	509.2	0.8657	3.6655
48	Styrene	C_8H_8	104.152	293.29	0.24[2]	-23.10	706.0	580	0.9110	3.5959
49	Isopropylbenzane	C_9H_{12}	120.195	306.34	0.188	-140.82	676.4	465.4	0.8663	4.1498

1. Calculated values.
2. ( ) - Estimated values.
3. Air saturated hydrocarbons.
4. Absolute values from weights in vacuum.
5. At saturation pressure (- - - -).
6. Sublimation point.
7. Saturation pressure at 60°F.
8. Apparent value for methane at 60°F.
9. Specific gravity, 119°F/60°F (sublimation point).

Conversions, Equivalents and Physical Data

Physical Constants of Various Fluids

FLUID	FORMULA	MOLECULAR WEIGHT	BOILING POINT (°F AT 14.696 psia)	VAPOR PRESSURE AT 70°F (psig)	CRITICAL TEMPERATURE (°F)	CRITICAL PRESSURE (psia)	SPECIFIC GRAVITY	
							Liquid 60°F/60°F	Gas
Acetic Acid	$HC_2H_3O_3$	60.06	245	----	----	----	1.05	----
Acetone	C_3H_6O	58.08	133	----	455	691	0.79	2.01
Air	N_2O_2	28.97	-317	----	-221	547	0.86‡	1.0
Alcohol, Ethyl	C_2H_6O	46.07	173	2.3(2)	470	925	0.794	1.59
Alcohol, Methyl	CH_4O	32.04	148	4.63(2)	463	1174	0.796	1.11
Ammonia	NH_3	17.03	-28	114	270	1636	0.62	0.59
Ammonium Chloride(1)	NH_4Cl	----	----	----	----	----	1.07	----
Ammonium Hydroxide(1)	NH_4OH	----	----	----	----	----	0.91	----
Ammonium Sulfate(1)	$(NH_4)_2SO_4$	----	----	----	----	----	1.15	----
Aniline	C_6H_7N	93.12	365	----	798	770	1.02	----
Argon	A	39.94	-302	----	-188	705	1.65	1.38
Bromine	Br_2	159.84	138	----	575	----	2.93	5.52
Calcium Chloride(1)	$CaCl_2$	----	----	----	----	----	1.23	----
Carbon Dioxide	CO_2	44.01	-109	839	88	1072	0.801(3)	1.52
Carbon Disulfide	CS_2	76.1	115	----	----	----	1.29	2.63
Carbon Monoxide	CO	28.01	-314	----	-220	507	0.80	0.97
Carbon Tetrachloride	CCl_4	153.84	170	----	542	661	1.59	5.31
Chlorine	Cl_2	70.91	-30	85	291	1119	1.42	2.45
Chromic Acid	H_2CrO_4	118.03	----	----	----	----	1.21	----
Citric Acid	$C_6H_8O_7$	192.12	----	----	----	----	1.54	----
Copper Sulfate(1)	$CuSO_4$	----	----	----	----	----	1.17	----
Ether	$(C_2H_5)_2O$	74.12	34	----	----	----	0.74	2.55
Ferric Chloride(1)	$FeCl_3$	----	----	----	----	----	1.23	----
Fluorine	F_2	38.00	-305	300	-200	809	1.11	1.31
Formaldehyde	H_2CO	30.03	-6	----	----	----	0.82	1.08
Formic Acid	HCO_2H	46.03	214	----	----	----	1.23	----
Furfural	$C_5H_4O_2$	96.08	324	----	----	----	1.16	----
Glycerine	$C_3H_8O_3$	92.09	554	----	----	----	1.26	----
Glycol	$C_2H_6O_2$	62.07	387	----	----	----	1.11	----
Helium	He	4.003	-454	----	-450	33	0.18	0.14
Hydrochloric Acid	HCl	36.47	-115	----	----	----	1.64	----
Hydrofluoric Acid	HF	20.01	66	0.9	446	----	0.92	----
Hydrogen	H_2	2.016	-422	----	-400	188	0.07(3)	0.07
Hydrogen Chloride	HCl	36.47	-115	613	125	1198	0.86	1.26
Hydrogen Sulfide	H_2S	34.07	-76	252	213	1307	0.79	1.17
Isopropyl Alcohol	C_3H_8O	60.09	180	----	----	----	0.78	2.08
Linseed Oil	----	----	538	----	----	----	0.93	----

1. Aqueous Solution - 25% by weight of compound.
2. Vapor pressure in psia at 100°F.
3. Density of liquid, gm/ml at normal boiling point.

- continued -

EMERSON
Process Management

Physical Constants of Various Fluids (continued)

FLUID	FORMULA	MOLECULAR WEIGHT	BOILING POINT (°F AT 14.696 psia)	VAPOR PRESSURE AT 70°F (psig)	CRITICAL TEMPERATURE (°F)	CRITICAL PRESSURE (psia)	SPECIFIC GRAVITY	
							Liquid 60°F/60°F	Gas
Magnesium Chloride[1]	$MgCl_2$	----	----	----	----	----	1.22	----
Mercury	Hg	200.61	670	----	----	----	13.6	6.93
Methyl Bromide	CH_3Br	94.95	38	13	376	----	1.73	3.27
Methyl Chloride	CH_3Cl	50.49	-11	59	290	969	0.99	1.74
Naphthalene	$C_{10}H_8$	128.16	424	----	----	----	1.14	4.43
Nitric Acid	HNO_3	63.02	187	----	----	----	1.5	----
Nitrogen	N_2	28.02	-320	----	-233	493	0.81[3]	0.97
Oil, Vegetable	----	----	----	----	----	----	0.91 to 0.94	----
Oxygen	O_2	32	-297	----	-181	737	1.14[3]	1.105
Phosgene	$COCl_2$	98.92	47	10.7	360	823	1.39	3.42
Phosphoric Acid	H_3PO_4	98.00	415	----	----	----	1.83	----
Potassium Carbonate[1]	K_2CO_3	----	----	----	----	----	1.24	----
Potassium Chloride[1]	KCl	----	----	----	----	----	1.16	----
Potassium Hydroxide[1]	KOH	----	----	----	----	----	1.24	----
Refrigerant 11	CCl_3F	137.38	75	13.4	388	635	----	5.04
Refrigerant 12	CCl_2F_2	120.93	-22	70.2	234	597	----	4.2
Refrigerant 13	$CClF_3$	104.47	-115	458.7	84	561	----	----
Refrigerant 21	$CHCl_2F$	102.93	48	8.4	353	750	----	3.82
Refrigerant 22	$CHClF_2$	86.48	-41	122.5	205	716	----	----
Refrigerant 23	CHF_3	70.02	-119	635	91	691	----	----
Sodium Chloride[1]	NaCl	----	----	----	----	----	1.19	----
Sodium Hydroxide[1]	NaOH	----	----	----	----	----	1.27	----
Sodium Sulfate[1]	Na_2SO_4	----	----	----	----	----	1.24	----
Sodium Thiosulfate[1]	Na_2SO_3	----	----	----	----	----	1.23	----
Starch	$(C_6H_{10}O_5)x$	----	----	----	----	----	1.50	----
Sugar Solutions[1]	$C_{12}H_{22}O_{11}$	----	----	----	----	----	1.10	----
Sulfuric Acid	H_2SO_4	98.08	626	----	----	----	1.83	----
Sulfer Dioxide	SO_2	64.6	14	34.4	316	1145	1.39	2.21
Turpentine	----	----	320	----	----	----	0.87	----
Water	H_2O	18.016	212	0.9492[2]	706	3208	1.00	0.62
Zinc Chloride[1]	$ZnCl_2$	----	----	----	----	----	1.24	----
Zinc Sulfate[1]	$ZnSO_4$	----	----	----	----	----	1.31	----

1. Aqueous Solution - 25% by weight of compound.
2. Vapor pressure in psia at 100°F.
3. Density of liquid, gm/ml at normal boiling point.

Conversions, Equivalents and Physical Data

Properties of Water

TEMPERATURE OF WATER (°F)	SATURATION PRESSURE (POUNDS PER SQUARE INCH ABSOLUTE)	WEIGHT (POUNDS PER GALLON)	SPECIFIC GRAVITY 60°F/60°F	CONVERSION FACTOR(1), LBS/HR TO GPM
32	0.0885	8.345	1.0013	0.00199
40	0.1217	8.345	1.0013	0.00199
50	0.1781	8.340	1.0007	0.00199
60	0.2653	8.334	1.0000	0.00199
70	0.3631	8.325	0.9989	0.00200
80	0.5069	8.314	0.9976	0.00200
90	0.6982	8.303	0.9963	0.00200
100	0.9492	8.289	0.9946	0.00201
110	1.2748	8.267	0.9919	0.00201
120	1.6924	8.253	0.9901	0.00200
130	2.2225	8.227	0.9872	0.00202
140	2.8886	8.207	0.9848	0.00203
150	3.718	8.182	0.9818	0.00203
160	4.741	8.156	0.9786	0.00204
170	5.992	8.127	0.9752	0.00205
180	7.510	8.098	0.9717	0.00205
190	9.339	8.068	0.9681	0.00206
200	11.526	8.039	0.9646	0.00207
210	14.123	8.005	0.9605	0.00208
212	14.696	7.996	0.9594	0.00208
220	17.186	7.972	0.9566	0.00209
240	24.969	7.901	0.9480	0.00210
260	35.429	7.822	0.9386	0.00211
280	49.203	7.746	0.9294	0.00215
300	67.013	7.662	0.9194	0.00217
350	134.63	7.432	0.8918	0.00224
400	247.31	7.172	0.8606	0.00232
450	422.6	6.892	0.8270	0.00241
500	680.8	6.553	0.7863	0.00254
550	1045.2	6.132	0.7358	0.00271
600	1542.9	5.664	0.6796	0.00294
700	3093.7	3.623	0.4347	0.00460

1. Multiply flow in pounds per hour by the factor to get equivalent flow in gallons per minute. Weight per gallon is based on 7.48 gal/ft³.

Properties of Saturated Steam

ABSOLUTE PRESSURE		VACUUM (IN. OF HG)	TEMP. (°F)	HEAT OF THE LIQUID (BTU/LB.)	LATENT HEAT OF EVAPORATION (BTU/LB.)	TOTAL HEAT OF STEAM HG (BTU/LB.)	SPECIFIC VOLUME (CUBIC FT./LB.)
psia	In. of Hg						
0.20	0.41	29.51	53.14	21.21	1063.8	1085.0	1526.0
0.25	0.51	29.41	59.30	27.36	1060.3	1087.7	1235.3
0.30	0.61	29.31	64.47	32.52	1057.4	1090.0	1039.5
0.35	0.71	29.21	68.93	36.97	1054.9	1091.9	898.5
0.40	0.81	29.11	72.86	40.89	1052.7	1093.6	791.9
0.45	0.92	29.00	76.38	44.41	1050.7	1095.1	708.5
0.50	1.02	28.90	79.58	47.60	1048.8	1096.4	641.4
0.60	1.22	28.70	85.21	53.21	1045.7	1098.9	540.0
0.70	1.43	28.49	90.08	58.07	1042.9	1101.0	466.9
0.80	1.63	28.29	94.38	62.36	1040.4	1102.8	411.7
0.90	1.83	28.09	98.24	66.21	1038.3	1104.5	368.4
1.0	2.04	27.88	101.74	69.70	1036.3	1106.0	333.6
1.2	2.44	27.48	107.92	75.87	1032.7	1108.6	280.9
1.4	2.85	27.07	113.26	81.20	1029.6	1110.8	243.0
1.6	3.26	26.66	117.99	85.91	1026.9	1112.8	214.3
1.8	3.66	26.26	122.23	90.14	1024.5	1114.6	191.8
2.0	4.07	25.85	126.08	93.99	1022.2	1116.2	173.73
2.2	4.48	25.44	129.62	97.52	1020.2	1117.7	158.85
2.4	4.89	25.03	132.89	100.79	1018.3	1119.1	146.38
2.6	5.29	24.63	135.94	103.83	1016.5	1120.3	135.78
2.8	5.70	24.22	138.79	106.68	1014.8	1121.5	126.65
3.0	6.11	23.81	141.48	109.37	1013.2	1122.6	67.24
3.5	7.13	22.79	147.57	115.46	1009.6	1125.1	61.98
4.0	8.14	21.78	152.97	120.86	1006.4	1127.3	57.50
4.5	9.16	20.76	157.83	125.71	1003.6	1129.3	53.64
5.0	10.18	19.74	162.24	130.13	1001.0	1131.1	50.29
5.5	11.20	18.72	166.30	134.19	998.5	1132.7	67.24
6.0	12.22	17.70	170.06	137.96	996.2	1134.2	61.98
6.5	13.23	16.69	173.56	141.47	994.1	1135.6	57.50
7.0	14.25	15.67	176.85	144.76	992.1	1136.9	53.64
7.5	15.27	14.65	179.94	147.86	990.2	1138.1	50.29
8.0	16.29	13.63	182.86	150.79	988.5	1139.3	47.34
8.5	17.31	12.61	185.64	153.57	986.8	1140.4	44.73
9.0	18.32	11.60	188.28	156.22	985.2	1141.4	42.40
9.5	19.34	10.58	190.80	158.75	983.6	1142.3	40.31
10.0	20.36	9.56	193.21	161.17	982.1	1143.3	38.42
11.0	22.40	7.52	197.75	165.73	979.3	1145.0	35.14
12.0	24.43	5.49	201.96	169.96	976.6	1146.6	32.40
13.0	26.47	3.45	205.88	173.91	974.2	1148.1	30.06
14.0	28.50	1.42	209.56	177.61	971.9	1149.5	28.04

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Properties of Saturated Steam (continued)

PRESSURE (psi)		TEMP. (°F)	HEAT OF THE LIQUID (BTU/LB)	LATENT HEAT OF EVAPORATION (BTU/LB)	TOTAL HEAT OF STEAM H_g (BTU/LB)	SPECIFIC VOLUME ∇ (FT^3/LB)	PRESSURE (psi)		TEMP. (°F)	HEAT OF THE LIQUID (BTU/LB)	LATENT HEAT OF EVAPORATION (BTU/LB)	TOTAL HEAT OF STEAM H_g (BTU/LB)	SPECIFIC VOLUME ∇ (FT^3/LB)
Absolute P'	Gauge P						Absolute P'	Gauge P					
14.696	0.0	212.00	180.07	970.3	1150.4	26.80	----	----	---	----	----	----	----
15.0	0.3	213.03	181.11	969.7	1150.8	26.29	75.0	60.3	-307.60	277.43	904.5	1181.9	5.816
16.0	1.3	216.32	184.42	967.6	1152.0	24.72	76.0	61.3	308.50	278.37	903.7	1182.1	5.743
17.0	2.3	219.44	187.56	965.5	1153.1	23.39	77.0	62.3	309.40	279.30	903.1	1182.4	5.673
18.0	3.3	222.41	190.56	963.6	1154.2	22.17	78.0	63.3	310.29	280.21	902.4	1182.6	5.604
19.0	4.3	225.24	193.42	961.9	1155.3	21.08	79.0	64.3	311.16	281.12	901.7	1182.8	5.537
20.0	5.3	227.96	196.16	960.1	1156.3	20.089	80.0	65.3	312.03	282.02	901.1	1183.1	5.472
21.0	6.3	230.57	198.79	958.4	1157.2	19.192	81.0	66.3	312.89	282.91	900.4	1183.3	5.408
22.0	7.3	233.07	201.33	956.8	1158.1	18.375	82.0	67.3	313.74	283.79	899.7	1183.5	5.346
23.0	8.3	235.49	203.78	955.2	1159.0	17.627	83.0	68.3	314.59	284.66	899.1	1183.8	5.285
24.0	9.3	237.82	206.14	953.7	1159.8	16.938	84.0	69.3	315.42	285.53	898.5	1184.0	5.226
25.0	10.3	240.07	208.42	952.1	1160.6	16.303	85.0	70.3	316.25	286.39	897.8	1184.2	5.168
26.0	11.3	242.25	210.62	950.7	1161.3	15.715	86.0	71.3	317.07	287.24	897.2	1184.4	5.111
27.0	12.3	244.36	212.75	949.3	1162.0	15.170	87.0	72.3	317.88	288.08	896.5	1184.6	5.055
28.0	13.3	246.41	214.83	947.9	1162.7	14.663	88.0	73.3	318.68	288.91	895.9	1184.8	5.001
29.0	14.3	248.40	216.86	946.5	1163.4	14.189	89.0	74.3	319.48	289.74	895.3	1185.1	4.948
30.0	15.3	250.33	218.82	945.3	1164.1	13.746	90.0	75.3	320.27	290.56	894.7	1185.3	4.896
31.0	16.3	252.22	220.73	944.0	1164.7	13.330	91.0	76.3	321.06	291.38	894.1	1185.5	4.845
32.0	17.3	254.05	222.59	942.8	1165.4	12.940	92.0	77.3	321.83	292.18	893.5	1185.7	4.796
33.0	18.3	255.84	224.41	941.6	1166.0	12.572	93.0	78.3	322.60	292.98	892.9	1185.9	4.747
34.0	19.3	257.58	226.18	940.3	1166.5	12.226	94.0	79.3	323.36	293.78	892.3	1186.1	4.699
35.0	20.3	259.28	227.91	939.2	1167.1	11.898	95.0	80.3	324.12	294.56	891.7	1186.2	4.652
36.0	21.3	260.95	229.60	938.0	1167.6	11.588	96.0	81.3	324.87	295.34	891.1	1186.4	4.606
37.0	22.3	262.57	231.26	936.9	1168.2	11.294	97.0	82.3	325.61	296.12	890.5	1186.6	4.561
38.0	23.3	264.16	232.89	935.8	1168.7	11.150	98.0	83.3	326.35	296.89	889.9	1186.8	4.517
39.0	24.3	265.72	234.48	934.7	1169.2	10.750	99.0	84.3	327.08	297.65	889.4	1187.0	4.474
40.0	25.3	267.25	236.03	933.7	1169.7	10.498	100.0	85.3	327.81	298.40	888.8	1187.2	4.432
41.0	26.3	268.74	237.55	932.6	1170.2	10.258	101.0	86.3	328.53	299.15	888.2	1187.4	4.391
42.0	27.3	270.21	239.04	931.6	1170.7	10.029	102.0	87.3	329.25	299.90	887.6	1187.5	4.350
43.0	28.3	271.64	240.51	930.6	1171.1	9.810	103.0	88.3	329.96	300.64	887.1	1187.7	4.310
44.0	29.3	273.05	241.95	929.6	1171.6	9.601	104.0	89.3	330.66	301.37	886.5	1187.9	4.271
45.0	30.3	274.44	243.36	928.6	1172.0	9.401	105.0	90.3	331.36	302.10	886.0	1188.1	4.232
46.0	31.3	275.80	244.75	927.7	1172.4	9.209	106.0	91.3	332.05	302.82	885.4	1188.2	4.194
47.0	32.3	277.13	246.12	926.7	1172.9	9.025	107.0	92.3	332.74	303.54	884.9	1188.4	4.157
48.0	33.3	278.45	247.47	925.8	1173.3	8.848	108.0	93.3	333.42	304.26	884.3	1188.6	4.120
49.0	34.3	279.74	248.79	924.9	1173.7	8.678	109.0	94.3	334.10	304.97	883.7	1188.7	4.084
50.0	35.3	281.01	250.09	924.0	1174.1	8.515	110.0	95.3	334.77	305.66	883.2	1188.9	4.049
51.0	36.3	282.26	251.37	923.0	1174.4	8.359	111.0	96.3	335.44	306.37	882.6	1189.0	4.015
52.0	37.3	283.49	252.63	922.2	1174.8	8.208	112.0	97.3	336.11	307.06	882.1	1189.2	3.981
53.0	38.3	284.70	253.87	921.3	1175.2	8.062	113.0	98.3	336.77	307.75	881.6	1189.4	3.947
54.0	39.3	285.90	255.09	920.5	1175.6	7.922	114.0	99.3	337.42	308.43	881.1	1189.5	3.914
55.0	40.3	287.07	256.30	919.6	1175.9	7.787	115.0	100.3	338.07	309.11	880.6	1189.7	3.882
56.0	41.3	288.28	257.50	918.8	1176.3	7.656	116.0	101.3	338.72	309.79	880.0	1189.8	3.850
57.0	42.3	289.37	258.67	917.9	1176.6	7.529	117.0	102.3	339.36	310.46	879.5	1190.0	3.819
58.0	43.3	290.50	259.82	917.1	1176.9	7.407	118.0	103.3	339.99	311.12	879.0	1190.1	3.788
59.0	44.3	291.61	260.96	916.3	1177.3	7.289	119.0	104.3	340.62	311.78	878.4	1190.2	3.758
60.0	45.3	292.71	262.09	915.5	1177.6	7.175	120.0	105.3	341.25	312.44	877.9	1190.4	3.728
61.0	46.3	293.79	263.20	914.7	1177.9	7.064	121.0	106.3	341.88	313.10	877.4	1190.5	3.699
62.0	47.3	294.85	264.30	913.9	1178.2	6.957	122.0	107.3	342.50	313.75	876.9	1190.7	3.670
63.0	48.3	295.90	265.38	913.1	1178.5	6.853	123.0	108.3	343.11	314.40	876.4	1190.8	3.642
64.0	49.3	296.94	266.45	912.3	1178.8	6.752	124.0	109.3	343.72	315.04	875.9	1190.9	3.614
65.0	50.3	297.97	267.50	911.6	1179.1	6.655	125.0	110.3	344.33	315.68	875.4	1191.1	3.587
66.0	51.3	298.99	268.55	910.8	1179.4	6.560	126.0	111.3	344.94	316.31	874.9	1191.2	3.560
67.0	52.3	299.99	269.58	910.1	1179.7	6.468	127.0	112.3	345.54	316.94	874.4	1191.3	3.533
68.0	53.3	300.98	270.60	909.4	1180.0	6.378	128.0	113.3	346.13	317.57	873.9	1191.5	3.507
69.0	54.3	301.96	291.61	908.7	1180.3	6.291	129.0	114.3	346.73	318.19	873.4	1191.6	3.481
70.0	55.3	302.92	272.61	907.9	1180.6	6.206	130.0	115.3	347.32	318.81	872.9	1191.7	3.455
71.0	56.3	303.88	273.60	907.2	1180.8	6.124	131.0	116.3	347.90	319.43	872.5	1191.9	3.430
72.0	57.3	304.83	274.57	906.5	1181.1	6.044	132.0	117.3	348.48	320.04	872.0	1192.0	3.405
73.0	58.3	305.76	275.54	905.8	1181.3	5.966	133.0	118.3	349.06	320.65	871.5	1192.1	3.381
74.0	59.3	306.68	276.49	905.1	1181.6	5.890	134.0	119.3	349.64	321.25	871.0	1192.2	3.357

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Properties of Saturated Steam (continued)

PRESSURE (psi)		TEMP. (°F)	HEAT OF THE LIQUID (BTU/LB)	LATENT HEAT OF EVAPORATION (BTU/LB)	TOTAL HEAT OF STEAM H_g (BTU/LB)	SPECIFIC VOLUME ▽ (FT^3/LB)	PRESSURE (psi)		TEMP. (°F)	HEAT OF THE LIQUID (BTU/LB)	LATENT HEAT OF EVAPORATION (BTU/LB)	TOTAL HEAT OF STEAM H_g (BTU/LB.)	SPECIFIC VOLUME ▽ (CU. FT./LB.)
Absolute P'	Gauge P						Absolute P'	Gauge P					
135.0	120.3	350.21	321.85	870.6	1192.4	3.333	400.0	385.3	444.59	424.0	780.5	1204.5	1.1613
136.0	121.3	350.78	322.45	870.1	1192.5	3.310	420.0	405.3	449.39	429.4	775.2	1204.6	1.1061
137.0	122.3	351.35	323.05	869.6	1192.6	3.287	440.0	425.3	454.02	434.6	770.0	1204.6	1.0556
138.0	123.3	351.91	323.64	869.1	1192.7	3.264	460.0	445.3	458.50	439.7	764.9	1204.6	1.0094
139.0	124.3	352.47	324.23	868.7	1192.9	3.242	480.0	465.3	462.82	444.6	759.9	1204.5	0.9670
140.0	125.3	353.02	324.82	868.2	1193.0	3.220	500.0	485.3	467.01	449.4	755.0	1204.4	0.9278
141.0	126.3	353.57	325.40	867.7	1193.1	3.198	520.0	505.3	471.07	454.1	750.1	1204.2	0.7815
142.0	127.3	354.12	325.98	867.2	1193.2	3.177	540.0	525.3	475.01	458.6	745.4	1204.0	0.8578
143.0	128.3	354.67	326.56	866.7	1193.3	3.155	560.0	545.3	478.85	463.0	740.8	1203.8	0.8265
144.0	129.3	355.21	327.13	866.3	1193.4	3.134	580.0	565.3	482.58	467.4	736.1	1203.5	0.7973
145.0	130.3	355.76	327.70	865.8	1193.5	3.114	600.0	585.3	486.21	471.6	731.6	1203.2	0.7698
146.0	131.3	356.29	328.27	865.3	1193.6	3.094	620.0	605.3	489.75	475.7	727.2	1202.9	0.7440
147.0	132.3	356.83	328.83	864.9	1193.8	3.074	640.0	625.3	493.21	479.8	722.7	1202.5	0.7198
148.0	133.3	357.36	329.39	864.5	1193.9	3.054	660.0	645.3	496.58	483.8	718.3	1202.1	0.6971
149.0	134.3	357.89	329.95	864.0	1194.0	3.034	680.0	665.3	499.88	487.7	714.0	1201.7	0.6757
150.0	135.3	358.42	330.51	863.6	1194.1	3.015	700.0	685.3	503.10	491.5	709.7	1201.2	0.6554
152.0	137.3	359.46	331.61	862.7	1194.3	2.977	720.0	705.3	506.25	495.3	705.4	1200.7	0.6362
154.0	139.3	360.49	332.70	851.8	1194.5	2.940	740.0	725.3	509.34	499.0	701.2	1200.2	0.6180
156.0	141.3	361.52	333.79	860.9	1194.7	2.904	760.0	745.3	512.36	502.6	697.1	1199.7	0.6007
158.0	143.3	362.53	334.86	860.0	1194.9	2.869	780.0	765.3	505.33	506.2	692.9	1199.1	0.5843
160.0	145.3	363.53	335.93	859.2	1195.1	2.834	800.0	785.3	518.23	509.7	688.9	1198.6	0.5687
162.0	147.3	364.53	336.98	858.3	1195.3	2.801	820.0	805.3	521.08	513.2	684.8	1198.0	0.5538
164.0	149.3	365.51	338.02	857.5	1195.5	2.768	840.0	825.3	523.88	516.6	680.8	1197.4	0.5396
166.0	151.3	366.48	339.05	856.6	1195.7	2.736	860.0	845.3	526.63	520.0	676.8	1196.8	0.5260
168.0	153.3	367.45	340.07	855.7	1195.8	2.705	880.0	865.3	529.33	523.3	672.8	1196.1	0.5130
170.0	155.3	368.41	341.09	854.9	1196.0	2.675	900.0	885.3	531.98	526.6	668.8	1195.4	0.5006
172.0	157.3	369.35	342.10	854.1	1196.2	2.645	920.0	905.3	534.59	529.8	664.9	1194.7	0.4886
174.0	159.3	370.29	343.10	853.3	1196.4	2.616	940.0	925.3	537.16	533.0	661.0	1194.0	0.4772
176.0	161.3	371.22	344.09	852.4	1196.5	2.587	960.0	945.3	539.68	536.2	657.1	1193.3	0.4663
178.0	163.3	372.14	345.06	851.6	1196.7	2.559	980.0	965.3	542.17	539.3	653.3	1192.6	0.4557
180.0	165.3	373.06	346.03	850.8	1196.9	2.532	1000.0	985.3	544.61	542.4	649.4	1191.8	0.4456
182.0	167.3	373.96	347.00	850.0	1197.0	2.505	1050.0	1035.3	550.57	550.0	639.9	1189.9	0.4218
184.0	169.3	374.86	347.96	849.2	1197.2	2.479	1100.0	1085.3	556.31	557.4	630.4	1187.8	0.4001
186.0	171.3	375.75	348.92	848.4	1197.3	2.454	1150.0	1135.3	561.86	565.6	621.0	1185.6	0.3802
188.0	173.3	376.64	349.86	847.6	1197.5	2.429	1200.0	1185.3	567.22	571.7	611.7	1183.4	0.619
190.0	175.3	377.51	350.79	846.8	1197.6	2.404	1250.0	1235.3	572.42	578.6	602.4	1181.0	0.3450
192.0	177.3	378.38	351.72	846.1	1197.8	2.380	1300.0	1285.3	577.46	585.4	593.2	1178.6	0.3293
194.0	179.3	379.24	352.64	845.3	1197.9	2.356	1350.0	1335.3	582.35	592.1	584.0	1176.1	0.3148
196.0	181.3	380.10	353.55	844.5	1198.1	2.333	1400.0	1385.3	587.10	598.7	574.7	1173.4	0.3012
198.0	183.3	380.95	354.46	843.7	1198.2	2.310	1450.0	1435.3	591.73	605.2	565.5	1170.7	0.2884
200.0	185.3	381.79	355.36	843.0	1198.4	2.288	1500.0	1485.3	596.23	611.6	556.3	1167.9	0.2765
205.0	190.3	383.86	357.58	841.0	1198.7	2.234	1600.0	1585.3	604.90	624.1	538.0	1162.1	0.2548
210.0	195.3	385.90	359.77	839.2	1199.0	2.183	1700.0	1685.3	613.15	636.3	519.6	1155.9	0.2354
215.0	200.3	387.89	361.91	837.4	1199.3	2.134	1800.0	1785.3	621.03	648.3	501.1	1149.4	0.2179
220.0	205.3	389.86	364.02	835.6	1199.6	2.087	1900.0	1885.3	628.58	660.1	482.4	1142.4	0.2021
225.0	210.3	391.79	366.09	833.8	1199.9	2.0422	2000.0	1985.3	635.82	671.7	463.4	1135.1	0.1878
230.0	215.3	393.68	368.13	832.0	1200.1	1.9992	2100.0	2085.3	642.77	683.3	444.1	1127.4	0.1746
235.0	220.3	395.54	370.14	830.3	1200.4	1.9579	2200.0	2185.3	649.46	694.8	424.4	1119.2	0.1625
240.0	225.3	397.37	372.12	828.5	1200.6	1.9183	2300.0	2285.3	655.91	706.5	403.9	1110.4	0.1513
245.0	230.3	399.18	374.08	826.8	1200.9	1.8803	2400.0	2385.3	662.12	718.4	382.7	1101.1	0.1407
250.0	235.3	400.95	376.00	825.1	1201.1	1.8438	2500.0	2485.3	668.13	730.6	360.5	1091.1	0.1307
255.0	240.3	402.70	377.89	823.4	1201.3	1.8086	2600.0	2585.3	673.94	743.0	337.2	1080.2	0.1213
260.0	245.3	404.42	379.76	821.8	1201.5	1.7748	2700.0	2685.3	679.55	756.2	312.1	1068.3	0.1123
265.0	250.3	406.11	381.60	820.1	1201.7	1.7422	2800.0	2785.3	684.99	770.1	284.7	1054.8	0.1035
270.0	255.3	407.78	383.42	818.5	1201.9	1.7107	2900.0	2885.3	690.26	785.4	253.6	1039.0	0.0947
275.0	260.3	409.43	385.21	816.9	1202.1	1.6804	3000.0	2985.3	695.36	802.5	217.8	1020.3	0.0858
280.0	265.3	411.05	386.98	815.3	1202.3	1.6511	3100.0	3085.3	700.31	825.0	168.1	993.1	0.0753
285.0	270.3	412.65	388.73	813.7	1202.4	1.6228	3200.0	3185.3	705.11	872.4	62.0	934.4	0.0580
290.0	275.3	414.23	390.46	812.1	1202.6	1.5954	3206.2	3191.5	705.40	902.7	0.0	902.7	0.0503
295.0	280.3	415.79	392.16	810.5	1202.7	1.5689	----	----	----	----	----	----	----
300.0	285.3	417.33	393.84	809.0	1202.8	1.5433	----	----	----	----	----	----	----
320.0	305.3	423.29	400.39	803.0	1203.4	1.4485	----	----	----	----	----	----	----
340.0	325.3	428.97	406.66	797.1	1203.7	1.3645	----	----	----	----	----	----	----
360.0	345.3	434.40	412.67	797.4	1204.1	1.2895	----	----	----	----	----	----	----
380.0	365.3	439.60	418.45	785.8	1204.3	1.2222	----	----	----	----	----	----	----

EMERSON
Process Management

Properties of Saturated Steam (Metric)

TEMPERATURE, °K	PRESSURE, BAR	VOLUME, m/kg		ENTHALPY, kJ/kg		ENTROPY, kJ/(kg x °K)	
		Condensed	Vapor	Condensed	Vapor	Condensed	Vapor
150	6.30 to 11	1.073 to 3	9.55 + 9	- 539.6	2273	- 2.187	16.54
160	7.72 to 10	1.074 to 3	9.62 + 8	- 525.7	2291	- 2.106	15.49
170	7.29 to 9	1.076 to 3	1.08 + 8	- 511.7	2310	- 2.026	14.57
180	5.38 to 8	1.077 to 3	1.55 + 7	- 497.8	2328	- 1.947	13.76
190	3.23 to 7	1.078 to 3	2.72 + 6	- 483.8	2347	- 1.868	16.03
200	1.62 to 6	1.079 to 3	5.69 + 5	- 467.5	2366	- 1.789	12.38
210	7.01 to 6	1.081 to 3	1.39 + 5	- 451.2	2384	- 1.711	11.79
220	2.65 to 5	1.082 to 3	3.83 + 4	- 435.0	2403	- 1.633	11.20
230	8.91 to 5	1.084 to 3	1.18 + 4	- 416.3	2421	- 1.555	10.79
240	3.72 to 4	1.085 to 3	4.07 + 3	- 400.1	2440	- 1.478	10.35
250	7.59 to 4	1.087 to 3	1.52 + 3	- 318.5	2459	- 1.400	9.954
255	1.23 to 3	1.087 to 3	956.4	- 369.8	2468	- 1.361	9.768
260	1.96 to 3	1.088 to 3	612.2	- 360.5	2477	- 1.323	9.590
265	3.06 to 3	1.089 to 3	400.4	- 351.2	2486	- 1.281	9.461
270	4.69 to 3	1.090 to 3	265.4	- 339.6	2496	- 1.296	9.255
273.15	6.11 to 3	1.091 to 3	206.3	- 333.5	2502	- 1.221	9.158
273.15	0.00611	1.000 to 3	206.3	0.00	2502	0.000	9.158
275	0.00697	1.000 to 3	181.7	7.80	2505	0.028	9.109
280	0.00990	1.000 to 3	130.4	28.8	2514	0.104	8.890
285	0.01387	1.000 to 3	99.4	49.8	2523	0.178	8.857
290	0.01917	1.001 to 3	69.7	70.7	2532	0.251	8.740
295	0.02617	1.002 to 3	51.94	91.6	2541	0.323	8.627
300	0.03531	1.003 to 3	39.13	112.5	2550	0.393	8.520
305	0.04712	1.005 to 3	27.90	133.4	2559	0.462	8.417
310	0.06221	1.007 to 3	22.93	154.3	2568	0.530	8.318
315	0.08132	1.009 to 3	17.82	175.2	2577	0.597	8.224
320	0.01053	1.011 to 3	13.98	196.1	2586	0.649	8.151
325	0.01351	1.013 to 3	11.06	217.0	2595	0.727	8.046
330	0.01719	1.016 to 3	8.82	237.9	2604	0.791	7.962
335	0.02167	1.018 to 3	7.09	258.8	2613	0.854	7.881
340	0.02713	1.021 to 3	5.74	279.8	2622	0.916	7.804
345	0.3372	1.024 to 3	4.683	300.7	2630	0.977	7.729
350	0.4163	1.027 to 3	3.846	321.7	2639	1.038	7.657
355	0.5100	1.030 to 3	3.180	342.7	2647	1.097	7.588
360	0.6209	1.034 to 3	2.645	363.7	2655	1.156	7.521
365	0.7514	1.038 to 3	2.212	384.7	2663	1.214	7.456
370	0.9040	1.041 to 3	1.861	405.8	2671	1.271	7.394
373.15	1.0133	1.044 to 3	1.679	419.1	2676	1.307	7.356
375	1.0815	1.045 to 3	1.574	426.8	2679	1.328	7.333
380	1.2869	1.049 to 3	1.337	448.0	2687	1.384	7.275
385	1.5233	1.053 to 3	1.142	469.2	2694	1.439	7.210
390	1.794	1.058 to 3	0.980	490.4	2702	1.494	7.163
400	2.455	1.067 to 3	0.731	532.9	2716	1.605	7.058
410	3.302	1.077 to 3	0.553	575.6	2729	1.708	6.959
420	4.370	1.088 to 3	0.425	618.6	2742	1.810	6.865
430	5.699	1.099 to 3	0.331	661.8	2753	1.911	6.775
440	7.333	1.110 to 3	0.261	705.3	2764	2.011	6.689
450	9.319	1.123 to 3	0.208	749.2	2773	2.109	6.607
460	11.71	1.137 to 3	0.167	793.5	2782	2.205	6.528
470	14.55	1.152 to 3	0.136	838.2	2789	2.301	6.451
480	17.90	1.167 to 3	0.111	883.4	2795	2.395	6.377
490	21.83	1.184 to 3	0.0922	929.1	2799	2.479	6.312
500	26.40	1.203 to 3	0.0776	975.6	2801	2.581	6.233
510	31.66	1.222 to 3	0.0631	1023	2802	2.673	6.163
520	37.70	1.244 to 3	0.0525	1071	2801	2.765	6.093
530	44.58	1.268 to 3	0.0445	1119	2798	2.856	6.023
540	52.38	1.294 to 3	0.0375	1170	2792	2.948	5.953
550	61.19	1.323 to 3	0.0317	1220	2784	3.039	5.882
560	71.08	1.355 to 3	0.0269	1273	2772	3.132	5.808
570	82.16	1.392 to 3	0.0228	1328	2757	3.225	5.733
580	94.51	1.433 to 3	0.0193	1384	2737	3.321	5.654
590	108.3	1.482 to 3	0.0163	1443	2717	3.419	5.569
600	123.5	1.541 to 3	0.0137	1506	2682	3.520	5.480
610	137.3	1.612 to 3	0.0115	1573	2641	3.627	5.318
620	159.1	1.705 to 3	0.0094	1647	2588	3.741	5.259
625	169.1	1.778 to 3	0.0085	1697	2555	3.805	5.191
630	179.1	1.856 to 3	0.0075	1734	2515	3.875	5.115
635	190.9	1.935 to 3	0.0066	1783	2466	3.950	5.025
640	202.7	2.075 to 3	0.0057	1841	2401	4.037	4.912
645	215.2	2.351 to 3	0.0045	1931	2292	4.223	4.732
647.31	221.2	3.170 to 3	0.0032	2107	2107	4.443	4.443

Conversions, Equivalents and Physical Data

Properties of Superheated Steam

PRESSURE (psi)		SAT. TEMP. (°F)	TOTAL TEMPERATURE — °F (t)										
Absolute P'	Gauge P			360°F	400°F	440°F	480°F	500°F	600°F	700°F	800°F	900°F	1000°F	1200°F
14.696	0.0	212.00	∇	33.03	34.68	36.32	37.96	38.78	42.86	46.94	51.00	55.07	59.13	67.25
			h_g	1221.1	1239.9	1258.8	1277.6	1287.1	1334.8	1383.2	1432.3	1482.3	1533.1	1637.5
20.0	5.3	227.96	∇	24.21	25.43	26.65	27.86	28.46	31.47	34.47	37.46	40.45	43.44	49.41
			h_g	1220.3	1239.2	1258.2	1277.1	1286.6	1334.4	1382.9	1432.1	1482.1	1533.0	1637.4
30.0	15.3	250.33	∇	16.072	16.897	17.714	18.528	18.933	20.95	22.96	24.96	26.95	28.95	32.93
			h_g	1218.6	1237.9	1257.0	1276.2	1285.7	1333.8	1382.4	1431.17	1481.8	1532.7	1637.2
40.0	25.3	267.25	∇	12.001	12.628	13.247	13.962	14.168	15.688	17.198	18.702	20.20	21.70	24.69
			h_g	1216.9	1236.5	1255.9	1275.2	1284.8	1333.1	1381.9	1431.3	1481.4	1532.4	1637.0
50.0	35.3	281.01	∇	9.557	10.065	10.567	11.062	11.309	12.532	13.744	14.950	16.152	17.352	19.747
			h_g	1215.2	1235.1	1254.7	1274.2	1283.9	1332.5	1381.4	1430.9	1481.1	1532.1	1636.8
60.0	45.3	292.71	∇	7.927	8.357	8.779	9.196	9.403	10.427	11.441	12.449	13.452	14.454	16.451
			h_g	1213.4	1233.6	1253.5	1273.2	1283.0	1331.8	1380.9	1430.5	1480.8	1531.9	1636.6
70.0	55.3	302.92	∇	6.762	7.136	7.502	7.863	8.041	8.924	9.796	10.662	11.524	12.383	14.097
			h_g	1211.5	1232.1	1252.3	1272.2	1282.0	1331.1	1380.4	1430.1	1480.5	1531.6	1636.3
80.0	65.3	312.03	∇	5.888	6.220	6.544	6.862	7.020	7.797	8.562	9.322	10.077	10.830	12.332
			h_g	1209.7	1230.7	1251.1	1271.1	1281.1	1330.5	1379.9	1429.7	1480.1	1531.3	1636.2
90.0	75.3	320.27	∇	5.208	5.508	5.799	6.084	6.225	6.920	7.603	8.279	8.952	9.623	10.959
			h_g	1207.7	1229.1	1249.8	1270.1	1280.1	1329.8	1379.4	1429.3	1479.8	1531.0	1635.9
100.0	85.3	327.81	∇	4.663	4.937	5.202	5.462	5.589	6.218	6.835	7.446	8.052	8.656	9.860
			h_g	1205.7	1227.6	1248.6	1269.0	1279.1	1329.1	1378.9	1428.9	1479.5	1530.8	1635.7
120.0	105.3	341.25	∇	3.844	4.081	4.307	4.527	4.636	5.165	5.683	6.195	6.702	7.207	8.212
			h_g	1201.6	1224.4	1246.0	1266.9	1277.2	1327.7	1377.8	1428.1	1478.8	1530.2	1635.3
140.0	125.3	353.02	∇	3.258	3.468	3.667	3.860	3.954	4.413	4.861	5.301	5.738	6.172	7.035
			h_g	1197.3	1221.1	1243.3	1264.7	1275.2	1326.4	1376.8	1427.2	1478.2	1529.7	1634.9
160.0	145.3	363.53	∇	----	3.008	3.187	3.359	3.443	3.849	4.244	4.631	5.015	5.396	6.152
			h_g	----	1217.6	1240.6	1262.4	1273.1	1325.0	1375.7	1426.4	1477.5	1529.1	1634.5
180.0	165.3	373.06	∇	----	2.649	2.813	2.969	3.044	3.411	3.964	4.110	4.452	4.792	5.466
			h_g	----	1214.0	1237.8	1260.2	1271.0	1323.5	1374.7	1425.6	1476.8	1528.6	1634.1
200.0	185.3	381.79	∇	----	2.361	2.513	2.656	2.726	3.060	3.380	3.693	4.002	4.309	4.917
			h_g	----	1210.3	1234.9	1257.8	1268.9	1322.1	1373.6	1424.8	1476.2	1528.0	1633.7
220.0	205.3	389.86	∇	----	2.125	2.267	2.400	2.465	2.772	3.066	3.352	3.634	3.913	4.467
			h_g	----	1206.5	1231.9	1255.4	1266.7	1320.7	1372.6	1424.0	1475.5	1527.5	1633.3
240.0	225.3	397.37	∇	----	1.9276	2.062	2.187	2.247	2.533	2.804	3.068	3.327	3.584	4.093
			h_g	----	1202.5	1228.8	1253.0	1264.5	1319.2	1371.5	1432.2	1474.8	1526.9	1632.9
260.0	245.3	404.42	∇	----	----	1.8882	2.006	2.063	2.330	2.582	2.827	3.067	3.305	3.776
			h_g	----	----	1225.7	1250.5	1262.3	1317.7	1370.4	1422.3	1474.2	1526.3	1632.5
280.0	265.3	411.05	∇	----	----	1.7388	1.8512	1.9047	2.156	2.392	2.621	2.845	3.066	3.504
			h_g	----	----	1222.4	1247.9	1260.0	1316.2	1369.4	1421.5	1473.5	1525.8	1632.1
300.0	285.3	417.33	∇	----	----	1.6090	1.7165	1.7675	2.005	2.227	2.442	2.652	2.859	3.269
			h_g	----	----	1219.1	1245.3	1257.6	1314.7	1368.3	1420.6	1472.8	1525.2	1631.7
320.0	305.3	423.29	∇	----	----	1.4950	1.5985	1.6472	1.8734	2.083	2.285	2.483	2.678	3.063
			h_g	----	----	1215.6	1242.6	1255.2	1313.2	1367.2	1419.8	1472.1	1524.7	1631.3
340.0	325.3	428.97	∇	----	----	1.3941	1.4941	1.5410	1.7569	1.9562	2.147	2.334	2.518	2.881
			h_g	----	----	1212.1	1239.9	1252.8	1311.6	1366.1	1419.0	1471.5	1524.1	1630.9
360.0	345.3	343.40	∇	----	----	1.3041	1.4012	1.4464	1.6533	1.8431	2.025	2.202	2.376	2.719
			h_g	----	----	1208.4	1237.1	1250.3	1310.1	1365.0	1418.1	1470.8	1523.5	1630.5

∇ = specific volume, cubic feet per pound
h_g = total heat of steam, BTU per pound

- continued -

Properties of Superheated Steam (continued)

PRESSURE (psi)		SAT. TEMP. °F		TOTAL TEMPERATURE — °F (t)										
Absolute P'	Gauge P			500°F	540°F	600°F	640°F	660°F	700°F	740°F	800°F	900°F	1000°F	1200°F
380.0	365.3	439.60	∇ $\eta\gamma$	1.3616 1247.7	1.4444 1273.1	1.5605 1308.5	1.6345 1331.0	1.6707 1342.0	1.7419 1363.8	1.8118 1385.3	1.9149 1417.3	2.083 1470.1	2.249 1523.0	2.575 1630.0
400.0	385.3	444.59	∇ h_g	1.2851 1245.1	1.3652 1271.0	1.4770 1306.9	1.5480 1329.6	1.5827 1340.8	1.6508 1362.7	1.7177 1384.3	1.8161 1416.4	1.9767 1469.4	2.134 1522.4	2.445 1629.6
420.0	405.3	449.39	∇ h_g	1.2158 1242.5	1.2935 1268.9	1.4014 1305.3	1.4697 1328.3	1.5030 1339.5	1.5684 1361.6	1.6324 1383.3	1.7267 1415.5	1.8802 1468.7	2.031 1521.9	2.327 1629.2
440.0	425.3	454.02	∇ h_g	1.1526 1239.8	1.2282 1266.7	1.3327 1303.6	1.3984 1326.9	1.4306 1338.2	1.4934 1360.4	1.5549 1382.3	1.6454 1414.7	1.7925 1468.1	1.9368 1521.3	2.220 1628.8
460.0	445.3	458.5	∇ h_g	1.0948 1237.0	1.1685 1264.5	1.2698 1302.0	1.3334 1325.4	1.3644 1336.9	1.4250 1359.3	1.4842 1381.3	1.5711 1413.8	1.7124 1467.4	1.8508 1520.7	2.122 1628.4
480.0	465.3	462.82	∇ h_g	1.0417 1234.2	1.1138 1262.3	1.2122 1300.3	1.2737 1324.0	1.3038 1335.6	1.3622 1358.2	1.4193 1380.3	1.5031 1412.9	1.6390 1466.7	1.7720 1520.2	2.033 1628.0
500.0	485.3	467.01	∇ h_g	0.9927 1231.3	1.0633 1260.0	1.1591 1298.6	1.2188 1322.6	1.2478 1334.2	1.3044 1357.0	1.3596 1379.3	1.4405 1412.1	1.5715 1466.0	1.6996 1519.6	1.9504 1627.6
520.0	505.3	471.07	∇ h_g	0.9473 1228.3	1.0166 1257.7	1.1101 1296.9	1.1681 1321.1	1.1962 1332.9	1.2511 1355.8	1.3045 1378.2	1.3826 1411.2	1.5091 1465.3	1.636 1519.0	1.8743 1627.2
540.0	525.3	475.01	∇ h_g	0.9052 1225.3	0.9733 1255.4	1.0646 1295.2	1.1211 1319.7	1.1485 1331.5	1.2017 1354.6	1.2535 1377.2	1.3291 1410.3	1.4514 1464.6	1.5707 1518.5	1.8039 1626.8
560.0	545.3	478.85	∇ h_g	0.8659 1222.2	0.9330 1253.0	1.0224 1293.4	1.0775 1318.2	1.1041 1330.2	1.1558 1353.5	1.2060 1376.1	1.2794 1409.4	1.3978 1463.9	1.5132 1517.9	1.7385 1626.4
580.0	565.3	482.58	∇ h_g	0.8291 1219.0	0.8954 1250.5	0.9830 1291.7	1.0368 1316.7	1.0627 1328.8	1.1331 1352.3	1.1619 1375.1	1.2331 1408.6	1.3479 1463.2	1.4596 1517.3	1.6776 1626.0
600.0	585.3	486.21	∇ h_g	0.7947 1215.7	0.8602 1248.1	0.9463 1289.9	0.9988 1315.2	1.0241 1327.4	1.0732 1351.1	1.1207 1374.0	1.1899 1407.7	1.3013 1462.5	1.4096 1516.7	1.6208 1625.5
620.0	605.0	489.75	∇ h_g	0.7624 1212.4	0.8272 1245.5	0.9118 1288.1	0.9633 1313.7	0.9880 1326.0	1.0358 1349.9	1.0821 1373.0	1.1494 1406.8	1.2577 1461.8	1.3628 1516.2	1.5676 1625.1
640.0	625.3	493.21	∇ h_g	0.7319 1209.0	0.7963 1243.0	0.8795 1296.2	0.9299 1312.2	0.9541 1324.6	1.0008 1348.6	1.0459 1371.9	1.1115 1405.9	1.2168 1461.1	1.3190 1515.6	1.5178 1624.7
660.0	645.3	496.58	∇ h_g	0.7032 1205.4	0.7670 1240.4	0.8491 1284.4	0.8985 1310.6	0.9222 1323.2	0.9679 1347.4	1.0119 1370.8	1.0759 1405.0	1.1784 1460.4	1.2778 1515.0	1.4709 1624.3
680.0	665.3	499.88	∇ h_g	0.6759 1201.8	0.7395 1237.7	0.8205 1282.5	0.8690 1309.1	0.8922 1321.7	0.9369 1346.2	0.9800 1369.8	1.0424 1404.1	1.1423 1459.7	1.2390 1514.5	1.4269 1623.9
700.0	685.3	503.10	∇ h_g	---- ----	0.7134 1235.0	0.7934 1280.6	0.8411 1307.5	0.8639 1320.3	0.9077 1345.0	0.9498 1368.7	1.0108 1403.2	1.1082 1459.0	1.2024 1513.9	1.3853 1623.5
750.	735.3	510.86	∇ h_g	---- ----	0.6540 1227.9	0.7319 1275.7	0.7778 1303.5	0.7996 1316.6	0.8414 1341.8	0.8813 1366.0	0.9391 1400.9	1.0310 1457.2	1.1196 1512.4	1.2912 1622.4
800.0	785.3	518.23	∇ h_g	---- ----	0.6015 1220.5	0.6779 1270.7	0.7223 1299.4	0.7433 1312.9	0.7833 1338.6	0.8215 1363.2	0.8763 1398.6	0.9633 1455.4	1.0470 1511.0	1.2088 1621.4
850.0	835.3	525.26	∇ h_g	---- ----	0.5546 1212.7	0.6301 1265.5	0.6732 1295.2	0.6934 1309.0	0.7320 1335.4	0.7685 1360.4	0.8209 1396.3	0.9037 1453.6	0.9830 1509.5	1.1360 1620.4
90.0	885.3	531.98	∇ h_g	---- ----	0.5124 1204.4	0.5873 1260.1	0.6294 1290.9	0.6491 1305.1	0.6863 1332.1	0.7215 1357.5	0.7716 1393.9	0.8506 1451.8	0.9262 1508.1	1.0714 1619.3
950.0	935.3	538.42	∇ h_g	---- ----	0.4740 1195.5	0.5489 1254.6	0.5901 1286.4	0.6092 1301.1	0.6453 1328.7	0.6793 1354.7	0.7275 1391.6	0.8031 1450.0	0.8753 1506.6	1.0136 1618.3
1000.0	985.3	544.61	∇ h_g	---- ----	---- ----	0.5140 1248.8	0.5546 1281.9	0.5733 1297.0	0.6084 1325.3	0.6413 1351.7	0.6878 1389.2	0.7604 1448.2	0.8294 1505.1	0.9615 1617.3

∇ = specific volume, cubic feet per pound
h_g = total heat of steam, BTU per pound

- continued -

Properties of Superheated Steam (continued)

PRESSURE (psi)		SAT. TEMP. °F		TOTAL TEMPERATURE — °F (t)										
Absolute P'	Gauge			660°F	700°F	740°F	760°F	780°F	800°F	860°F	900°F	1000°F	1100°F	1200°F
1100.0	1085.3	556.31	∇ h_g	0.5110 1288.5	0.5445 1318.3	0.5755 1345.8	0.5904 1358.9	0.6049 1371.7	0.6191 1384.3	0.6601 1420.8	0.6866 1444.5	0.7503 1502.2	0.8117 1558.8	0.8716 1615.2
1200.0	1185.3	567.22	∇ h_g	0.4586 1279.6	0.4909 1311.0	0.5206 1339.6	0.5347 1353.2	0.5484 1366.4	0.5617 1379.3	0.6003 1416.7	0.6250 1440.7	0.6843 1499.2	0.7412 1556.4	0.7967 1613.1
1300.0	1285.3	577.46	∇ h_g	0.4139 1270.2	0.4454 1303.4	0.4739 1333.3	0.4874 1347.3	0.5004 1361.0	0.5131 1374.3	0.5496 1412.5	0.5728 1437.0	0.6284 1496.2	0.6816 1553.9	0.7333 1611.0
1400.0	1385.3	587.10	∇ h_g	0.3753 1260.3	0.4062 1295.5	0.4338 1326.7	0.4468 1341.3	0.4593 1355.4	0.4714 1369.1	0.5061 1408.2	0.5281 1433.1	0.5805 1493.2	0.6305 1551.4	0.6789 1608.9
1500.0	1485.3	596.23	∇ h_g	0.3413 1249.8	0.3719 1287.2	0.3989 1320.0	0.4114 1335.2	0.4235 1349.7	0.4352 1363.8	0.4684 1403.9	0.4893 1429.3	0.5390 1490.1	0.5862 1548.9	0.6318 1606.8
1600.0	1585.3	604.90	∇ h_g	0.3112 1238.7	0.3417 1278.7	0.3682 1313.0	0.3804 1328.8	0.3921 1343.9	0.4034 1358.4	0.4353 1399.5	0.4553 1425.3	0.5027 1487.0	0.5474 1546.4	0.5906 1604.6
1700.0	1685.3	613.15	∇ h_g	0.2842 1226.8	0.3148 1269.7	0.3410 1305.8	0.3529 1322.3	0.3643 1337.9	0.3753 1352.9	0.4061 1395.0	0.4253 1421.4	0.4706 1484.0	0.5132 1543.8	0.5542 1602.5
1800.0	1785.3	621.03	∇ h_g	0.2597 1214.0	0.2907 1260.3	0.3166 1298.4	0.3284 1315.5	0.3395 1331.8	0.3502 1347.2	0.3801 1390.4	0.3986 1417.4	0.4421 1480.8	0.4828 1541.3	0.5218 1600.4
1900.0	1885.3	628.58	∇ h_g	0.2371 1200.2	0.2688 1250.4	0.2947 1290.6	0.3063 1308.6	0.3171 1325.4	0.3277 1341.5	0.3568 1385.8	0.3747 1413.3	0.4165 1477.7	0.4556 1538.8	0.4929 1598.2
2000.0	1985.3	635.82	∇ h_g	0.2161 1184.9	0.2489 1240.0	0.2748 1282.6	0.2863 1301.4	0.2972 1319.0	0.3074 1335.5	0.3358 1381.2	0.3532 1409.2	0.3935 1474.5	0.4311 1536.2	0.4668 1596.1
2100.0	2085.3	642.77	∇ h_g	0.1962 1167.7	0.2306 1229.0	0.2567 1274.3	0.2682 1294.0	0.2789 1312.3	0.2890 1329.5	0.3167 1376.4	0.3337 1405.0	0.3727 1471.4	0.4089 1533.6	0.4433 1593.9
2200.0	2185.3	649.46	∇ h_g	0.1768 1147.8	0.2135 1217.4	0.2400 1265.7	0.2514 1286.3	0.2621 1305.4	0.2721 1323.3	0.2994 1371.5	0.3159 1400.8	0.3538 1468.2	0.3887 1531.1	0.4218 1591.8
2300.0	2285.3	655.91	∇ h_g	0.1575 1123.8	0.1978 1204.9	0.2247 1256.7	0.2362 1278.4	0.2468 1298.4	0.2567 1316.9	0.2835 1366.6	0.2997 1396.5	0.3365 1464.9	0.3703 1528.5	0.4023 1589.6
2400.0	2385.3	662.12	∇ h_g	---- ----	0.1828 1191.5	0.2105 1247.3	0.2221 1270.2	0.2327 1291.1	0.2425 1310.3	0.2689 1361.6	0.2848 1392.2	0.3207 1461.7	0.3534 1525.9	0.3843 1587.4
2500.0	2485.3	668.13	∇ h_g	---- ----	0.1686 1176.8	0.1973 1207.6	0.2090 1261.8	0.2196 1283.6	0.2294 1303.6	0.2555 1356.5	0.2710 1387.8	0.3061 1458.4	0.3379 1523.2	0.3678 1585.3
2600.0	2585.3	673.94	∇ h_g	---- ----	0.1549 1160.6	0.1849 1227.3	0.1967 1252.9	0.2074 1275.8	0.2172 1296.8	0.2431 1351.4	0.2584 1383.4	0.2926 1455.1	0.3236 1520.6	0.3526 1583.1
2700.0	2685.3	679.55	∇ h_g	---- ----	0.1415 1142.5	0.1732 1216.5	0.1853 1243.8	0.1960 1267.9	0.2059 1289.7	0.2315 1346.1	0.2466 1378.9	0.2801 1451.8	0.3103 1518.0	0.3385 1580.9
2800.0	2785.3	684.99	∇ h_g	---- ----	0.1281 1121.4	0.1622 1205.1	0.1745 1234.2	0.1854 1259.6	0.1953 1282.4	0.2208 1340.8	0.2356 1374.3	0.2685 1448.5	0.2979 1515.4	0.3254 1578.7
2900.0	2885.3	690.26	∇ h_g	---- ----	0.1143 1095.9	0.1517 1193.0	0.1644 1224.3	0.1754 1251.1	0.1853 1274.9	0.2108 1335.3	0.2254 1369.7	0.2577 1445.1	0.2864 1512.7	0.3132 1576.5
3000.0	2985.3	695.36	∇ h_g	---- ----	0.0984 1060.7	0.1416 1180.1	0.1548 1213.8	0.1660 1242.2	0.1760 1267.2	0.2014 1329.7	0.2159 1365.0	0.2476 1441.8	0.2757 1510.0	0.3018 1574.3
3100.0	3085.3	700.31	∇ h_g	---- ----	---- ----	0.1320 1166.2	0.1456 1202.9	0.1571 1233.0	0.1672 1259.3	0.1926 1324.1	0.2070 1360.3	0.2382 1438.4	0.2657 1507.4	0.2911 1572.1
3200.0	3185.3	705.11	∇ h_g	---- ----	---- ----	0.1226 1151.1	0.1369 1191.4	0.1486 1223.5	0.1589 1251.1	0.1843 1318.3	0.1986 1355.5	0.2293 1434.9	0.2563 1504.7	0.2811 1569.9
3206.2	3191.5	705.40	∇ h_g	---- ----	---- ----	0.1220 1150.2	0.1363 1190.6	0.1480 1222.9	0.1583 1250.5	0.1838 1317.9	0.1981 1355.2	0.2288 1434.7	0.2557 1504.5	0.2806 1569.8

∇ = specific volume, cubic feet per pound
h_g = total heat of steam, BTU per pound

EMERSON
Process Management

Determine Velocity of Steam in Pipes:

$$\text{Velocity (ft/s)} = \frac{(25)\,(A)}{(V)}$$

Where: A = Nominal pipe section area = $\frac{\pi\,(d)^2}{4}$

d = Diameter

V = Specific volume from steam tables in ft^3/lb (m^3/kg)

Note: Specific volume changes with steam pressure and temperature. Make sure to calculate velocities of inlet and outlet piping of the regulator.

Recommended Steam Pipe Line Velocities

STEAM CONDITION	VELOCITY, FT/SEC / M/SEC
0 to 15 psig / 0 to 1.0 bar, Dry and saturated	100 / 30.5
15 psig / 1.0 bar, Dry and saturated and up	175 / 53.3
200 psig / 13.8 bar, Superheated and up	250 / 76.2

Typical Condensation Rates In Insulated Steam Pipes

PRESSURE		RATES IN LBS/HR / KG/HR PER FOOT OF PIPE WITH 2 IN. OF INSULATION											
		Pipe Diameter in In.											
		3/4		1		1-1/2		2		3		4	
psig	bar	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr
1	0.069	0.02	0.009	0.03	0.014	0.03	0.014	0.04	0.018	0.05	0.023	0.06	0.027
5	0.34	0.03	0.014	0.03	0.014	0.04	0.018	0.04	0.018	0.05	0.023	0.06	0.027
10	0.69	0.03	0.014	0.03	0.014	0.04	0.018	0.04	0.018	0.05	0.023	0.07	0.032
25	1.7	0.03	0.014	0.04	0.018	0.05	0.023	0.05	0.023	0.06	0.027	0.08	0.036
50	3.4	0.04	0.018	0.04	0.018	0.05	0.023	0.06	0.027	0.09	0.041	0.11	0.05
75	5.2	0.04	0.018	0.05	0.023	0.06	0.027	0.07	0.032	0.11	0.05	0.14	0.064
100	6.9	0.05	0.023	0.05	0.023	0.07	0.032	0.08	0.036	0.12	0.054	0.15	0.068
125	8.6	0.05	0.023	0.06	0.027	0.07	0.032	0.08	0.036	0.13	0.059	0.16	0.073
150	10.3	0.06	0.027	0.06	0.027	0.08	0.036	0.09	0.041	0.14	0.064	0.17	0.077
200	13,8	0.06	0.027	0.07	0.032	0.08	0.036	0.09	0.041	0.15	0.068	0.19	0.086

Typical Condensation Rates In Steam Pipes Without Insulation

PRESSURE		RATES IN LBS/HR / KG/HR PER FOOT OF BARE PIPE AT 72°F / 22°C AMBIENT AIR											
		Pipe Diameter in In.											
		3/4		1		1-1/2		2		3		4	
psig	bar	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr	lbs/hr	kg/hr
1	0.069	0.11	0.05	0.15	0.068	0.21	0.095	0.25	0.113	0.38	0.172	0.46	0.209
5	0.34	0.14	0.064	0.16	0.073	0.22	0.1	0.26	0.118	0.41	0.186	0.50	0.227
10	0.69	0.15	0.068	0.18	0.082	0.24	0.109	0.29	0.132	0.44	0.2	0.53	0.24
25	1.7	0.17	0.077	0.22	0.1	0.31	0.141	0.36	0.163	0.53	0.24	0.65	0.295
50	3.4	0.22	0.1	0.27	0.122	0.39	0.177	0.46	0.209	0.66	0.299	0.83	0.376
75	5.2	0.26	0.118	0.31	0.141	0.45	0.204	0.54	0.245	0.77	0.349	1.04	0.472
100	6.9	0.29	0.132	0.35	0.159	0.50	0.227	0.61	0.277	0.86	0.39	1.11	0.503
125	8.6	0.32	0.145	0.39	0.177	0.55	0.249	0.68	0.308	0.94	0.426	1.23	0.558
150	10.3	0.35	0.159	0.42	0.191	0.60	0.272	0.74	0.336	1.03	0.467	1.33	0.603
200	13.8	0.40	0.181	0.49	0.222	0.69	0.313	0.81	0.367	1.19	0.54	1.50	0.68

Flow of Water Through Schedule 40 Steel Pipes

DISCHARGE		PRESSURE DROP PER 100 FT AND VELOCITY IN SCHEDULE 40 PIPE FOR WATER AT 60°F															
Gal/min	Ft^3/Sec	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)
		1/8 In.		1/4 In.													
0.2	0.000446	1.13	1.86	0.616	0.359	3/8 In.		1/2 In.									
0.3	0.000668	1.69	4.22	0.924	0.903	0.504	0.159	0.317	0.061								
0.4	0.000891	2.26	6.98	1.23	1.61	0.672	0.345	0.422	0.086	3/4 In.							
0.5	0.00111	2.82	10.5	1.54	2.39	0.840	0.539	0.528	0.167	0.301	0.033						
0.6	0.00134	3.39	14.7	1.85	3.29	1.01	0.751	0.633	0.240	0.361	0.041						
0.8	0.00178	4.52	25.0	2.46	5.44	1.34	1.25	0.844	0.408	0.481	0.102	1 In.					
1	0.00223	5.65	37.2	3.08	8.28	1.68	1.85	1.06	0.600	0.602	0.155	0.371	0.048	1-1/4 In.			
2	0.00446	11.29	134.4	6.16	30.1	3.36	6.58	2.11	2.10	1.20	0.526	0.743	0.164	0.429	0.044	1-1/2 In.	
3	0.00668			9.25	64.1	5.04	13.9	3.17	4.33	1.81	1.09	1.114	0.336	0.644	0.090	0.473	0.043
4	0.00891			12.33	111.2	6.72	23.9	4.22	7.42	2.41	1.83	1.49	0.565	0.858	0.150	0.630	0.071
5	0.01114	2 In.				8.40	36.7	5.28	11.2	3.01	2.75	1.86	0.835	1.073	0.223	0.788	0.104
6	0.01337	0.574	0.044	2-1/2 In.		10.08	51.9	6.33	15.8	3.61	3.84	2.23	1.17	1.29	0.309	0.943	0.145
8	0.01782	0.765	0.073			13.44	91.1	8.45	27.7	4.81	6.60	2.97	1.99	1.72	0.518	1.26	0.241
10	0.02228	0.956	0.108	0.670	0.046	3 In.		10.56	42.4	6.02	9.99	3.71	2.99	2.15	0.774	1.58	0.361
15	0.03342	1.43	0.224	1.01	0.094					9.03	21.6	5.57	6.36	3.22	1.63	2.37	0.755
20	0.04456	1.91	3.375	1.34	0.158	0.868	0.056	3-1/2 In.		12.03	37.8	7.43	10.9	4.29	2.78	3.16	1.28
25	0.05570	2.39	0.561	1.68	0.234	1.09	0.083	0.812	0.041	4 In.		9.28	16.7	5.37	4.22	3.94	1.93
30	0.06684	2.87	0.786	2.01	0.327	1.30	0.114	0.974	0.056			11.14	23.8	6.44	5.92	4.73	2.72
35	0.07798	3.35	1.05	2.35	0.436	1.52	0.151	1.14	0.071	0.882	0.041	12.99	32.2	7.51	7.90	5.52	3.64
40	0.08912	3.83	1.35	2.68	0.556	1.74	0.192	1.30	0.095	1.01	0.052	14.85	41.5	8.59	10.24	6.30	4.65
45	0.1003	4.30	1.67	3.02	0.668	1.95	0.239	1.46	0.117	1.13	0.064			9.67	12.80	7.09	5.85
50	0.1114	4.78	2.03	3.35	0.839	2.17	0.288	1.62	0.142	1.26	0.076			10.74	15.66	7.88	7.15
60	0.1337	5.74	2.87	4.02	1.18	2.60	0.46	1.95	0.204	1.51	0.107	5 In.		12.89	22.2	9.47	10.21
70	0.1560	6.70	3.84	4.69	1.59	3.04	0.540	2.27	0.261	1.76	0.143	1.12	0.047			11.05	13.71
80	0.1782	7.65	4.97	5.36	2.03	3.47	0.687	2.60	0.334	2.02	0.180	1.28	0.060			12.62	17.59
90	0.2005	8.60	6.20	6.03	2.53	3.91	0.861	2.92	0.416	2.27	0.224	1.44	0.074	6 In.		14.20	22.0
100	0.2228	9.56	7.59	6.70	3.09	4.34	1.05	3.25	0.509	2.52	0.272	1.60	0.090	1.11	0.036	15.778	26.9
125	0.2785	11.97	11.76	8.38	4.71	5.43	1.61	4.06	0.769	3.15	0.415	2.01	0.135	1.39	0.055	19.72	41.4
150	0.3342	14.36	16.70	10.05	6.69	6.51	2.24	4.87	1.08	3.78	0.580	2.41	0.190	1.67	0.077		
175	0.3899	16.75	22.3	11.73	8.97	7.60	3.00	5.68	1.44	4.41	0.774	2.81	0.253	1.94	0.102		
200	0.4456	19.14	28.8	13.42	11.68	8.68	3.87	6.49	1.85	5.04	0.985	3.21	0.323	2.22	0.130	8 In.	
225	0.5013	----	----	15.09	14.63	9.77	4.83	7.30	2.32	5.67	1.23	3.61	0.401	2.50	0.162	1.44	0.043
250	0.557	----	----	----	----	10.85	5.93	8.12	2.84	6.30	1.46	4.01	0.495	2.78	0.195	1.60	0.051
275	0.6127	----	----	----	----	11.94	7.14	8.93	3.40	6.93	1.79	4.41	0.583	3.05	0.234	1.76	0.061
300	0.6684	----	----	----	----	13.00	8.36	9.74	4.02	7.56	2.11	4.81	0.683	3.33	0.275	1.92	0.072
325	0.7241	----	----	----	----	14.12	9.89	10.53	4.09	8.19	2.47	5.21	0.797	3.61	0.320	2.08	0.083
350	0.7798			----	----	----	----	11.36	5.51	8.82	2.84	5.62	0.919	3.89	0.367	2.24	0.095
375	0.8355			----	----	----	----	12.17	6.18	9.45	3.25	6.02	10.5	4.16	0.416	2.40	0.108
400	0.8912			----	----	----	----	12.98	7.03	10.08	3.68	6.42	1.19	4.44	0.471	2.56	0.121
425	0.9469			----	----	----	----	13.80	7.89	10.71	4.12	6.82	1.33	4.72	0.529	2.73	0.136
450	1.003	10 In.		----	----	----	----	14.61	8.80	11.34	4.60	7.22	1.48	5.00	0.590	2.89	0.151
475	1.059	1.93	0.054			----	----	----	----	11.97	5.12	7.62	1.64	5.27	0.653	3.04	0.166
500	1.114	2.03	0.059			----	----	----	----	12.60	5.65	8.02	1.81	5.55	0.720	3.21	0.182
550	1.225	2.24	0.071			----	----	----	----	13.85	6.79	8.82	2.17	6.11	0.861	3.53	0.219
600	1.337	2.44	0.083			----	----	----	----	15.12	8.04	9.63	2.55	6.66	1.02	3.85	0.258
650	1.448	2.64	0.097			----	----	----	----	----	----	10.43	2.98	7.22	1.18	4.17	0.301

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Flow of Water Through Schedule 40 Steel Pipes (continued)

DISCHARGE		PRESSURE DROP PER 100 FT AND VELOCITY IN SCHEDULE 40 PIPE FOR WATER AT 60°F															
Gal/min	Ft³/Sec	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)	Velocity (Ft/Sec)	Pressure Drop (psi)
		10 In.		12 In.								5 In.		6 In.		8 In.	
700	1.560	2.85	0.112	2.01	0.047			----	----	----	----	11.23	3.43	7.78	1.35	4.49	0.343
750	1.671	3.05	0.127	2.15	0.054			----	----	----	----	12.03	3.92	8.33	1.55	4.81	0.392
800	1.782	3.25	0.143	2.29	0.061	14 In.		----	----	----	----	12.83	4.43	8.88	1.75	5.13	0.443
850	1.894	3.46	0.160	2.44	0.068	2.02	0.042	----	----	----	----	13.64	5.00	9.44	1.96	5.45	0.497
900	2.005	3.66	0.179	2.58	0.075	2.13	0.047	----	----	----	----	14.44	5.58	9.99	2.18	5.77	0.554
950	2.117	3.86	0.198	2.72	0.083	2.25	0.052	----	----	----	----	15.24	6.21	10.55	2.42	6.09	0.613
1000	2.228	4.07	0.218	2.87	0.091	2.37	0.057	16 In.		----	----	16.04	6.84	11.10	2.68	6.41	0.675
1100	2.451	4.48	0.260	3.15	0.110	2.61	0.068			----	----	17.65	8.23	12.22	3.22	7.05	0.807
1200	2.674	4.88	0.306	3.44	0.128	2.85	0.800	2.18	0.042	----	----	----	----	13.33	3.81	7.70	0.948
1300	2.896	5.29	0.355	3.73	0.150	3.08	0.093	2.36	0.048	----	----	----	----	14.43	4.45	8.33	1.11
1400	3.119	5.70	0.409	4.01	0.171	3.32	0.107	2.54	0.055	----	----	----	----	15.55	5.13	8.98	1.28
1500	3.342	6.10	0.466	4.30	0.195	3.56	0.122	2.72	0.063	18 In.				16.66	5.85	9.62	1.46
1600	3.565	6.51	0.527	4.59	0.219	3.79	0.138	2.90	0.071					17.77	6.61	10.26	1.65
1800	4.010	7.32	0.663	5.16	0.276	4.27	0.172	3.27	0.088	2.58	0.050			19.99	8.37	11.54	2.08
2000	4.456	8.14	0.808	5.73	0.339	4.74	0.209	3.63	0.107	2.87	0.060			22.21	10.3	12.82	2.55
2500	5.570	10.17	1.24	7.17	0.515	5.93	0.321	4.54	0.163	3.59	0.091	20 In.				16.03	3.94
3000	6.684	12.20	1.76	8.60	0.731	7.11	0.451	5.45	0.232	4.30	0.129	3.46	0.075	24 In.		19.24	5.59
3500	7.798	14.24	2.38	10.03	0.982	8.30	0.607	6.35	0.312	5.02	0.173	4.04	0.101			22.44	7.56
4000	8.912	16.27	3.08	11.47	1.27	9.48	0.787	7.26	0.401	5.74	0.222	4.62	0.129	3.19	0.052	25.65	9.80
4500	10.03	18.31	3.87	12.90	1.60	10.67	0.990	8.17	0.503	6.46	0.280	5.20	0.162	3.59	0.065	28.87	12.2
5000	11.14	20.35	7.71	14.33	1.95	11.85	1.21	9.08	0.617	7.17	0.340	5.77	0.199	3.99	0.079	----	----
6000	13.37	24.41	6.74	17.20	2.77	14.23	1.71	10.89	0.877	8.61	0.483	6.93	0.280	4.79	0.111	----	----
7000	15.60	28.49	9.11	20.07	3.74	16.60	2.31	12.71	1.18	10.04	0.652	8.08	0.376	5.59	0.150	----	----
8000	17.82	----	----	22.93	4.84	18.96	2.99	14.52	1.51	11.47	0.839	9.23	0.488	6.38	0.192	----	----
9000	20.05	----	----	25.79	6.09	21.34	3.76	16.34	1.90	12.91	1.05	10.39	0.608	7.18	0.242	----	----
10,000	22.28	----	----	28.66	7.46	23.71	4.61	18.15	2.34	14.34	1.28	11.54	0.739	7.98	0.294	----	----
12,000	26.74	----	----	34.40	10.7	28.45	6.59	21.79	3.33	17.21	1.83	13.85	1.06	9.58	0.416	----	----
14,000	31.19	----	----	----	----	33.19	8.89	25.42	4.49	20.08	2.45	16.16	1.43	11.17	0.562	----	----
16,000	35.65	----	----	----	----	----	----	29.05	5.83	22.95	3.18	18.47	1.85	12.77	0.723	----	----
18,000	40.10	----	----	----	----	----	----	32.68	7.31	25.82	4.03	20.77	2.32	14.36	0.907	----	----
20,000	44.56	----	----	----	----	----	----	36.31	9.03	28.69	4.93	23.08	2.86	15.96	1.12	----	----

For pipe lengths other than 100 ft., the pressure drop is proportional to the length. Thus, for 50 ft. of pipe, the pressure drop is approximately one half the value given in the table or 300 ft., three times the given value, etc.
Velocity is a function of the cross sectional flow area; thus, it is constant for a given flow rate and is independent of pipe length.
Extracted from Technical Paper No. 410, Flow of Fluids, with permission of Crane Co.

Conversions, Equivalents and Physical Data

Flow of Air Through Schedule 40 Steel Pipes

FREE AIR Q™	COMPRESSED AIR	PRESSURE DROP OF AIR IN PSI PER 100 FT OF SCHEDULE 40 PIPE FOR AIR AT 100 PSIG PRESSURE AND 60°F TEMPERATURE								
Ft³/min at 60°F and 14.7 psia	Ft³/min at 60°F and 100 psig	1/8 In.	1/4 In.	3/8 In.	1/2 In.	3/4 In.	1 In.	1-1/4 In.	1-1/2 In.	2 In.
1	0.128	0.361	0.083	0.018						
2	0.256	1.31	0.285	0.064	0.020					
3	0.384	3.06	0.605	0.133	0.042					
4	0.513	4.83	1.04	0.226	0.071					
5	0.641	7.45	1.58	0.343	0.106	0.027				
6	0.769	10.6	2.23	0.408	0.148	0.037				
8	1.025	18.6	3.89	0.848	0.255	0.062	0.019			
10	0.282	28.7	5.96	1.26	0.356	0.094	0.029			
15	1.922	----	13.0	2.73	0.834	0.201	0.062			
20	2.563	----	22.8	4.76	1.43	0.345	0.102	0.026		
25	3.204	----	35.6	7.34	2.21	0.526	0.156	0.039	0.019	
30	3.845	----	----	10.5	3.15	0.748	0.219	0.055	0.026	
35	4.486	----	----	14.2	4.24	1.00	0.293	0.073	0.035	
40	5.126	----	----	18.4	5.49	1.30	0.379	0.095	0.044	
45	5.767	----	----	23.1	6.90	1.62	0.474	0.116	0.055	
50	6.408			28.5	8.49	1.99	0.578	0.149	0.067	0.019
60	7.690	**2-1/2 In.**		40.7	12.2	2.85	0.819	0.200	0.094	0.027
70	8.971			----	16.5	3.83	1.10	0.270	0.126	0.036
80	10.25	0.019		----	21.4	4.96	1.43	0.350	0.162	0.046
90	11.53	0.023		----	27.0	6.25	1.80	0.437	0.203	0.058
100	12.82	0.029	**3 In.**		33.2	7.69	2.21	0.534	0.247	0.070
125	16.02	0.044			----	11.9	3.39	0.825	0.380	0.107
150	19.22	0.062	0.021		----	17.0	4.87	1.17	0.537	0.151
175	22.43	0.083	0.028	**3-1/2 In.**	----	23.1	6.60	1.58	0.727	0.205
200	25.63	0.107	0.036		----	30.0	8.54	2.05	0.937	0.264
225	28.84	0.134	0.045	0.022		37.9	10.8	2.59	1.19	0.331
250	32.04	0.164	0.055	0.027		----	13.3	3.18	1.45	0.404
275	35.24	0.191	0.066	0.032		----	16.0	3.83	1.75	0.484
300	38.45	0.232	0.078	0.037		----	19.0	4.56	2.07	0.573
325	41.65	0.270	0.090	0.043	**4 In.**	----	22.3	5.32	2.42	0.673
350	44.87	0.313	0.104	0.050		----	25.8	6.17	2.80	0.776
375	48.06	0.356	0.119	0.057	0.030	----	29.6	7.05	3.20	0.887
400	51.26	0.402	0.134	0.064	0.034	----	33.6	8.02	3.64	1.00
425	54.47	0.452	0.151	0.072	0.038	----	37.9	9.01	4.09	1.13
450	57.67	0.507	0.168	0.081	0.042	----	----	10.2	4.59	1.26
475	60.88	0.562	0.187	0.089	0.047		----	11.3	5.09	1.40
500	64.08	0.623	0.206	0.099	0.052		----	12.5	5.61	1.55
550	70.49	0.749	0.248	0.118	0.062		----	15.1	6.79	1.87
600	76.90	0.887	0.293	0.139	0.073	**5 In.**	----	18.0	8.04	2.21
650	83.30	1.04	0.342	0.163	0.086		----	21.1	9.43	2.60
700	89.71	1.19	0.395	0.188	0.099	0.032		24.3	10.9	3.00
750	96.12	1.36	0.451	0.214	0.113	0.036		27.9	12.6	3.44
800	102.5	1.55	0.513	0.244	0.127	0.041		31.8	14.2	3.90
850	108.9	1.74	0.576	0.274	0.144	0.046	**6 In.**	35.9	16.0	4.40
900	115.3	1.95	0.642	0.305	0.160	0.051		40.2	18.0	4.91
950	121.8	2.18	0.715	0.340	0.178	0.057	0.023	----	20.0	5.47
1000	128.2	2.40	0.788	0.375	0.197	0.063	0.025	----	22.1	6.06
1100	141.0	2.89	0.948	0.451	0.236	0.075	0.030	----	26.7	7.29
1200	153.8	3.44	1.13	0.533	0.279	0.089	0.035	----	31.8	8.63
1300	166.6	4.01	1.32	0.626	0.327	0.103	0.041	----	37.3	10.1

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Flow of Air Through Schedule 40 Steel Pipes (continued)

FREE AIR Q_m	COMPRESSED AIR	PRESSURE DROP OF AIR IN PSI PER 100 FT OF SCHEDULE 40 PIPE FOR AIR AT 100 PSIG PRESSURE AND 60°F TEMPERATURE								
Ft^3/min at 60°F and 14.7 psia	Ft^3/min at 60°F and 100 psig	2-1/2 In.	3 In.	3-1/2 In.	4 In.	5 In.	6 In.	8 In.	10 In.	12 In.
1400	179.4	4.65	1.52	0.718	0.377	0.119	0.047			11.8
1500	192.2	5.31	1.74	0.824	0.431	0.136	0.054			13.5
1600	205.1	6.04	1.97	0.932	0.490	0.154	0.061			15.3
1800	230.7	7.65	2.50	1.18	0.616	0.193	0.075			19.3
2000	256.3	9.44	3.06	1.45	0.757	0.237	0.094	0.023		23.9
2500	320.4	14.7	4.76	2.25	1.17	0.366	0.143	0.035		37.3
3000	384.5	21.1	6.82	3.20	1.67	0.524	0.204	0.051	0.016	
3500	448.6	28.8	9.23	4.33	2.26	0.709	0.276	0.068	0.022	
4000	512.6	37.6	12.1	5.66	2.94	0.919	0.358	0.088	0.028	**12 In.**
4500	576.7	47.6	15.3	7.16	3.69	1.16	0.450	0.111	0.035	
5000	640.8	----	18.8	8.85	4.56	1.42	0.552	0.136	0.043	0.018
6000	769.0	----	27.1	12.7	6.57	2.03	0.794	0.195	0.061	0.025
7000	897.1	----	36.9	17.2	8.94	2.76	1.07	0.262	0.082	0.034
8000	1025	----	----	22.5	11.7	3.59	1.39	0.339	0.107	0.044
9000	1153	----	----	28.5	14.9	4.54	1.76	0.427	0.134	0.055
10,000	1282	----	----	35.2	18.4	5.60	2.16	0.526	0.164	0.067
11,000	1410	----	----	----	22.2	6.78	2.62	0.633	0.197	0.081
12,000	1538	----	----	----	26.4	8.07	3.09	0.753	0.234	0.096
13,000	1666	----	----	----	31.0	9.47	3.63	0.884	0.273	0.112
14,000	1794	----	----	----	36.0	11.0	4.21	1.02	0.316	0.129
15,000	1922	----	----	----	----	12.6	4.84	1.17	0.364	0.148
16,000	2051	----	----	----	----	14.3	5.50	1.33	0.411	0.167
18,000	2307	----	----	----	----	18.2	6.96	1.68	0.520	0.213
20,000	2563	----	----	----	----	22.4	8.60	2.01	0.642	0.260
22,000	2820	----	----	----	----	27.1	10.4	2.50	0.771	0.314
24,000	3076	----	----	----	----	32.3	12.4	2.97	0.918	0.371
26,000	3332	----	----	----	----	37.9	14.5	3.49	1.12	0.435
28,000	3588	----	----	----	----	----	16.9	4.04	1.25	0.505
30,000	3845	----	----	----	----	----	19.3	4.64	1.42	0.520

Extracted from Technical Paper No. 410, Flow of Fluids, with permission of Crane Co.

Conversions, Equivalents and Physical Data

Average Properties of Propane

Formula	C_3H_8
Boiling Point, °F / °C	-44 / -42
Specific Gravity of Gas (Air = 1.00)	1.53
Lbs/Gal of Liquid at 60°F / 16°C	4.24
BTU/Gal of Gas at 60°F / 16°C	91,547
BTU/Lb of Gas	21,591
BTU/Ft³ of Gas at 60°F / 16°C	2516
Ft³ of Vapor at 60°F / 16°C per Gal. of Liquid at 60°F / 16°C	36.39
Ft³ of Vapor at 60°F / 16°C per Lb. of Liquid at 60°F / 16°C	8.547
Latent Heat of Vaporization at Boiling Point, BTU per Gallon	785.0
Combustion Data	
Ft³ of Air Required to Burn 1 Ft³ of Gas	23.86
Flash Point, °F / °C	-156 / -104
Ignition Temperature in Air, °F / °C	920 to 1020 / 493 to 549
Maximum Flame Temperature in Air, °F / °C	3595 / 1979
Limits of Inflammability, Percentage of Gas in Air Mixture	
at Lower Limit	2.4%
at Upper Limit	9.6%
Octane Number (ISO Octane = 100)	Over 100

Standard Domestic Propane Tank Specifications

CAPACITY		DIAMETER		LENGTH		TANK WEIGHT	
gal	l	in.	mm	in.	mm	lbs	kg
120	454	24	610	68	1727	288	131
150	568	24	610	84	2134	352	160
200	757	30	762	79	2007	463	210
250	946	30	762	94	2387	542	246
325	1230	30	762	119	3023	672	305
500	1893	37	940	119	3023	1062	482
1000	3785	41	1041	192	4877	1983	900

Approximate Vaporization Capacities of Propane Tanks

BTU PER HOUR WITH 40% LIQUID IN DOMESTIC TANK SYSTEMS		
Tank Size Water Capacity	Prevailing Air Temperature	
	20°F / -7°C	60°F / 16°C
120	235,008	417,792
150	290,304	516,096
200	341,280	606,720
250	406,080	721,920
325	514,100	937,900
500	634,032	1,127,168
1000	1,088,472	1,978,051

Orifice Capacities for Propane

ORIFICE OR DRILL SIZE	ORIFICE CAPACITY BTU PER HOUR, 11 IN. W.C.	ORIFICE OR DRILL SIZE	ORIFICE CAPACITY BTU PER HOUR, 11 IN. W.C.
0.008	519	51	36531
0.009	656	50	39842
0.010	812	49	43361
0.011	981	48	46983
0.012	1169	47	50088
80	1480	46	53296
79	1708	45	54641
78	2080	44	60229
77	2629	43	64369
76	3249	42	71095
75	3581	41	74924
74	4119	40	78029
73	4678	39	80513
72	5081	38	83721
71	5495	37	87860
70	6375	36	92207
69	6934	35	98312
68	7813	34	100175
67	8320	33	103797
66	8848	32	109385
65	9955	31	117043
64	10535	30	134119
63	11125	29	150366
62	11735	28	160301
61	12367	27	168580
60	13008	26	175617
59	13660	25	181619
58	14333	24	187828
57	15026	23	192796
56	17572	22	200350
55	21939	21	205525
54	24630	20	210699
53	28769	19	223945
52	32805	18	233466

BTU/ft³ = 2516
Specific Gravity = 1.52
Pressure at orifice, in. w.c. = 11
Orifice Coefficient = 0.9

EMERSON
Process Management

Pipe and Tubing Sizing

PROPANE PIPE AND TUBING SIZING BETWEEN SINGLE OR SECOND STAGE LOW PRESSURE REGULATORS AND APPLIANCES												
Pipe or Tubing Length, Ft.	Copper Tubing Size, Outside Diameter (Inside Diameter), Type L					Pipe or Tubing Length, Ft.	Nominal Pipe Size, Outside Diameter (Inside Diameter), Schedule 40					
	3/8 / 0.315	1/2 / 0.430	5.8 / 0.545	3/4 / 0.666	7/8 / 0.785		1/2 / 0.622	3.4 / 0.824	1 / 1.049	1-1/4 / 1.380	1-1/2 / 1.610	2 / 2.067
10	49	110	206	348	536	10	291	608	1146	2353	3525	6789
20	34	76	151	239	368	20	200	418	788	1617	2423	4666
30	27	61	114	192	296	30	161	336	632	1299	1946	3747
40	23	52	97	164	253	40	137	282	541	1111	1665	3207
50	20	46	86	146	224	50	122	557	480	985	1476	2842
60	19	42	78	132	203	60	110	231	435	892	1337	2575
70	17	39	72	121	187	80	94	198	372	764	1144	2204
80	16	36	67	113	174	100	84	175	330	677	1014	1954
90	15	34	63	106	163	125	74	155	292	600	899	1731
100	14	32	59	100	154	150	67	141	265	544	815	1569
150	11	26	48	80	----	----	----	----	----	----	----	----

To convert to capacities in cubic feet per hour, divide by 2.5
Note: Maximum undiluted propane capacities listed are based on 11 in. w.c. setting and a 0.5 in. w.c. pressure drop - Capacities in 1000 BTU per hour.

Vapor Pressures of Propane

TEMPERATURE		PRESSURE		TEMPERATURE		PRESSURE		TEMPERATURE		PRESSURE		TEMPERATURE		PRESSURE	
°F	°C	psig	bar	°F	°C	psig	bar	°F	°C	psig	bar	°F	°C	psig	bar
130	54	257	18	70	21	109	8	20	-7	40	2.8	-20	-29	10	0.69
120	49	225	16	65	18	100	6.9	10	-12	31	2	-25	-32	8	0.55
110	43	197	14	60	16	92	6	0	-17	23	2	-30	-34	5	0.34
100	38	172	12	50	10	77	5	-5	-21	20	1.4	-35	-37	3	0.21
90	32	149	10	40	4	63	4	-10	-23	16	1	-40	-40	1	0.069
80	27	128	9	30	-1	51	4	-15	-26	13	1	-44	-42	0	0

Converting Volumes of Gas

CFH TO CFH OR CFM TO CFM		
Multiply Flow of	By	To Obtain Flow of
Air	0.707	Butane
	1.290	Natural Gas
	0.808	Propane
Butane	1.414	Air
	1.826	Natural Gas
	1.140	Propane
Natural Gas	0.775	Air
	0.547	Butane
	0.625	Propane
Propane	1.237	Air
	0.874	Butane
	1.598	Natural Gas

BTU Comparisons

COMMON FUELS	PER GAL.	PER LB
Propane	91,547	21,591
Butane	102,032	21,221
Gasoline	110,250	20,930
Fuel Oil	134,425	16,960

Conversions, Equivalents and Physical Data

Capacities of Spuds and Orifices

DRILL DESIGNATION	DIAMETER, IN.	AREA, IN^2	CAPACITIES IN CFH OF 0.6 GRAVITY HIGH PRESSURE NATURAL GAS AND AN ORIFICE COEFFICIENT OF 1.0																		
			Upstream Pressure, psig																		
			1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	25	30	40	50
80	0.0135	0.000143	1.61	2.26	2.76	3.17	3.52	3.84	4.13	4.40	4.65	4.88	5.31	5.65	6.05	6.44	6.84	7.82	8.80	10.8	12.8
79	0.0145	0.000163	1.85	2.61	3.18	3.65	4.06	4.43	4.77	5.07	5.36	5.63	6.12	6.52	6.98	7.43	7.89	9.02	10.2	12.5	14.7
1/64”	0.0156	0.000191	2.14	3.02	3.68	4.23	4.70	5.13	5.52	5.87	6.20	6.51	7.09	7.55	8.08	8.61	9.13	10.5	11.8	14.4	17.1
78	0.0160	0.000201	2.26	3.18	3.88	4.45	4.94	5.40	5.81	6.18	6.53	6.85	7.46	7.95	8.50	9.05	9.61	11.0	12.4	15.2	17.9
77	0.0180	0.000234	2.85	4.02	4.90	5.62	6.25	6.82	7.34	7.81	8.25	8.66	9.42	10.1	10.8	11.5	12.2	13.9	15.7	19.2	22.7
76	0.0200	0.000314	3.53	4.97	6.05	6.95	7.72	8.43	9.07	9.65	10.2	10.8	11.7	12.5	13.3	14.2	15.0	17.2	19.4	23.7	28.0
75	0.0210	0.000346	3.89	5.48	6.67	7.65	8.51	9.29	10.0	10.7	12.3	11.8	12.9	13.7	14.7	15.6	16.6	19.0	21.3	26.1	30.9
74	0.0225	0.000398	4.47	7.08	7.67	8.80	9.78	10.7	11.5	12.4	13.0	13.6	14.8	15.8	16.9	18.0	19.1	21.8	24.5	30.0	35.5
73	0.0240	0.000452	5.08	7.16	8.71	10.0	11.2	12.2	13.1	13.9	14.7	15.4	16.8	17.9	19.1	20.4	21.6	24.7	27.6	34.1	40.3
72	0.0250	0.000491	5.52	7.78	9.46	10.9	12.1	13.2	14.2	15.1	16.0	16.8	18.3	19.4	20.8	22.1	23.5	26.9	30.3	37.0	43.8
71	0.0260	0.000531	5.97	8.41	10.3	11.8	13.1	14.3	15.4	16.4	17.3	18.1	19.7	21.0	22.5	23.9	25.4	29.1	32.7	40.0	47.3
70	0.0280	0.000616	6.92	9.75	11.9	13.7	15.2	16.6	17.8	19.0	20.0	21.0	22.9	24.4	26.1	27.8	29.5	33.8	38.0	46.4	54.9
69	0.0292	0.000670	7.53	10.6	13.0	14.9	16.5	18.0	19.4	20.0	21.8	22.9	24.9	26.5	28.4	30.2	32.1	36.7	41.3	50.5	59.7
68	0.0310	0.000735	8.48	12.0	14.6	16.7	18.6	20.3	21.9	23.2	24.5	25.8	28.0	29.9	32.0	34.0	36.1	41.3	46.5	56.9	67.3
1/32”	0.0313	0.000765	8.59	12.2	14.8	17.0	18.8	20.6	22.1	23.5	24.9	26.1	28.4	30.3	32.4	34.5	36.6	41.9	47.1	57.7	68.2
67	0.0320	0.000804	9.03	12.8	15.5	17.8	19.8	21.6	23.3	24.7	26.1	27.4	29.9	31.8	34.0	36.2	38.5	44.0	49.5	60.6	71.7
66	0.0330	0.000855	9.60	13.6	16.5	18.9	21.1	23.0	24.7	26.3	27.6	29.2	31.8	33.8	36.2	38.5	40.9	46.8	52.7	64.4	76.2
65	0.0350	0.000962	10.8	15.3	18.6	21.3	23.7	25.9	27.8	29.6	31.3	32.8	35.7	38.1	40.7	43.4	46.0	52.6	59.2	72.5	85.7
64	0.0360	0.001018	11.5	16.2	19.7	22.6	25.1	27.4	29.4	31.3	33.1	34.7	37.8	40.3	42.4	45.9	48.7	55.7	62.7	76.7	90.7
63	0.0370	0.001075	12.1	17.1	20.8	23.8	26.5	28.9	31.1	33.1	34.9	36.7	39.9	42.5	45.5	48.4	51.4	58.8	66.2	81.0	95.8
62	0.0380	0.001134	12.8	18.0	21.9	25.1	27.9	30.5	32.8	34.9	36.8	38.7	42.1	44.8	48.0	51.1	54.2	62.0	69.8	85.4	101
61	0.0390	0.001195	13.5	19.0	23.1	26.5	29.4	32.1	34.6	36.8	38.8	40.8	44.4	47.3	50.6	53.8	57.1	65.4	73.6	90.0	107
60	0.0400	0.001257	14.2	19.9	24.3	27.8	30.9	33.8	36.4	38.7	40.8	42.9	46.7	49.7	53.2	56.6	60.1	68.7	77.4	94.7	112
59	0.0410	0.001320	14.9	20.9	25.5	29.2	32.5	35.5	38.2	40.6	42.9	45.0	49.0	52.2	55.8	59.5	63.1	72.2	81.3	99.5	118
58	0.0420	0.001385	15.6	22.0	26.7	30.7	34.1	37.2	40.0	42.6	45.0	41.2	51.4	54.8	58.6	62.4	66.2	75.7	85.3	105	124
57	0.0430	0.001452	16.3	23.0	28.0	32.1	35.7	39.0	42.0	44.7	47.2	49.5	53.9	57.4	61.4	65.4	69.4	79.4	89.4	110	130
56	0.0465	0.001698	19.1	26.9	32.8	37.6	41.8	45.6	49.1	52.2	55.1	57.9	63.0	67.1	71.8	76.5	81.2	92.8	105	128	152
3/64”	0.0469	0.00173	19.5	27.4	33.4	38.3	42.6	46.5	50.0	53.2	56.2	59.0	64.2	68.4	73.2	77.9	82.7	94.6	107	131	155
55	0.0520	0.00212	23.8	33.6	40.9	46.9	52.1	57.0	61.3	65.2	68.8	72.3	78.7	83.8	89.6	95.5	102	116	131	160	189
54	0.0550	0.00238	26.8	37.7	45.9	52.7	58.5	63.9	68.8	73.2	77.3	81.1	88.3	94.1	101	108	114	132	147	180	212
53	0.0595	0.00278	31.1	44.0	53.6	61.5	68.4	74.7	80.3	85.4	90.3	94.7	104	110	118	126	133	152	172	210	248
1/16”	0.0625	0.00307	34.5	48.6	59.2	67.9	75.5	82.5	88.8	94.4	99.7	105	114	122	130	139	147	168	189	232	274
52	0.0635	0.00317	35.6	50.2	61.1	70.1	78.0	85.1	91.6	97.4	103	108	118	126	134	143	152	174	196	239	283
51	0.0670	0.00353	39.7	55.9	68.0	78.1	86.8	94.8	102	109	115	121	131	140	150	159	169	193	218	266	315
50	0.0700	0.00385	43.3	61.0	74.2	85.2	94.7	104	112	119	125	132	143	153	163	174	184	211	237	290	343
49	0.0730	0.00419	47.1	66.4	80.8	92.7	103	113	121	129	136	143	156	166	178	189	201	229	258	316	374
48	0.0760	0.00454	51.0	71.9	87.5	101	112	122	132	140	148	155	169	180	192	205	217	249	280	342	405
5/64”	0.0781	0.00479	53.8	75.9	92.3	106	118	129	134	148	156	164	178	190	203	216	229	262	295	361	427
47	0.0785	0.00484	54.4	76.6	93.3	107	119	130	140	149	158	165	180	192	205	218	232	265	298	365	432
46	0.0810	0.00515	57.9	81.6	99.2	114	127	139	149	159	168	176	191	204	218	232	246	282	317	388	459
45	0.0820	0.00528	59.3	83.6	102	117	130	141	153	163	172	180	196	209	224	238	253	289	325	398	471
44	0.0860	0.00582	65.3	92.1	113	129	143	157	169	179	189	199	216	230	246	262	278	319	359	439	519
43	0.0890	0.00622	69.9	98.5	120	138	153	167	180	192	202	212	231	246	263	280	298	340	383	469	555
42	0.0935	0.00687	77.2	109	133	152	169	185	199	212	223	234	255	272	291	310	329	376	423	518	612
3/32”	0.0937	0.00690	77.5	110	133	153	170	186	200	212	224	235	256	273	292	311	350	378	425	520	615
41	0.0960	0.00724	81.3	115	140	161	178	195	210	223	235	247	269	287	306	326	346	396	446	546	645
40	0.0980	0.00754	84.7	120	146	167	186	203	218	232	245	257	280	298	319	340	361	413	464	568	672
39	0.0995	0.00778	87.4	124	150	172	192	209	225	239	253	265	289	308	329	351	372	426	479	585	693
38	0.1015	0.00809	90.9	128	156	179	199	218	234	249	263	276	300	320	342	365	387	443	498	610	721
37	0.1040	0.00849	95.4	135	164	188	209	228	246	261	276	290	315	336	359	383	406	464	523	640	757

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EMERSON
Process Management

Capacities of Spuds and Orifices (continued)

DRILL DESIGNATION	DIAMETER, IN.	AREA, IN²	CAPACITIES IN CFH OF 0.6 GRAVITY HIGH PRESSURE NATURAL GAS AND AN ORIFICE COEFFICIENT OF 1.0																		
			Upstream Pressure, psig																		
			1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	25	30	40	50
36	0.1065	0.00891	100	141	172	197	219	240	258	274	290	304	331	352	377	402	426	487	549	671	794
7/64"	0.1094	0.00940	106	149	182	208	231	253	272	289	305	321	349	372	398	424	449	514	579	708	838
35	0.1100	0.00950	107	151	183	210	234	255	275	292	309	324	353	376	402	428	454	520	585	716	847
34	0.1110	0.00968	109	154	187	214	238	260	280	298	315	330	359	383	410	436	463	530	596	729	863
33	0.1130	0.01003	113	159	194	222	247	270	290	309	326	342	372	396	424	452	480	549	618	756	894
32	0.1160	0.01057	119	168	204	234	260	284	306	325	343	360	392	418	447	476	505	578	651	796	942
31	0.1200	0.01131	127	179	218	250	278	304	327	348	367	386	420	447	478	510	541	619	696	852	1010
1/8"	0.1250	0.01227	138	195	237	272	302	330	355	377	399	418	456	485	519	553	587	671	756	924	1100
30	0.1285	0.01296	146	206	250	287	319	348	375	399	421	442	481	512	548	584	620	709	798	976	1160
29	0.1360	0.01433	164	230	280	322	357	390	420	447	472	495	539	575	615	655	695	795	893	1100	1300
28	0.1405	0.01549	174	246	299	343	381	416	448	476	503	528	575	612	655	698	740	847	954	1170	1380
9/64"	0.1406	0.01553	175	246	300	344	382	417	449	478	504	529	576	614	657	700	742	849	956	1170	1390
27	0.1440	0.01629	183	258	314	361	401	438	471	501	529	555	605	644	689	734	779	891	1010	1230	1460
26	0.1470	0.01697	191	269	327	376	417	456	491	522	551	579	630	671	718	764	811	928	1050	1280	1520
25	0.1495	0.01755	197	278	339	388	432	472	507	540	570	598	651	694	742	790	839	960	1080	1330	1570
24	0.1520	0.01815	204	288	350	402	446	490	525	558	589	619	674	718	768	818	867	992	1120	1370	1620
23	0.1540	0.01863	210	295	359	412	458	501	539	573	605	635	691	737	788	839	890	1020	1150	1410	1660
5/32"	0.1562	0.01917	216	304	370	424	472	515	554	589	623	653	711	758	811	863	916	1050	1180	1450	1710
22	0.1570	0.01936	218	307	373	428	476	520	560	595	629	660	713	765	819	872	925	1060	1200	1460	1730
21	0.1590	0.01986	223	315	383	440	488	534	574	611	645	677	737	785	840	894	949	1090	1230	1500	1770
20	0.1610	0.02036	229	323	393	451	501	547	589	626	661	694	756	805	861	917	973	1120	1260	1540	1820
19	0.1660	0.02164	243	343	417	479	532	581	625	665	703	738	803	855	915	975	1040	1190	1340	1630	1930
18	0.1695	0.02256	254	358	435	499	555	606	652	694	733	769	837	892	954	1020	1080	1240	1390	1700	2010
11/64"	0.1719	0.02320	261	368	447	513	571	623	671	713	753	790	861	917	981	1050	1110	1270	1430	1750	2070
17	0.1730	0.02351	264	373	453	520	578	632	680	723	763	801	872	929	994	1060	1130	1290	1450	1770	2100
16	0.1770	0.02461	277	390	475	545	605	661	711	756	799	839	913	973	1040	1110	1180	1350	1520	1860	2200
15	0.1800	0.02345	286	403	491	563	626	684	736	782	826	868	944	1010	1080	1150	1220	1400	1570	1920	2270
14	0.1820	0.02602	293	412	502	576	640	699	752	800	845	887	965	1030	1100	1180	1250	1430	1610	1960	2320
13	0.1850	0.02688	302	426	518	595	661	722	777	826	873	916	997	1060	1140	1210	1290	1470	1660	2030	2400
3/16"	0.1875	0.02761	310	437	532	611	679	742	798	849	896	941	1030	1100	1170	1250	1320	1510	1700	2080	2460
12	0.1890	0.02806	315	445	541	621	690	754	811	862	911	956	1050	1110	1190	1270	1340	1540	1730	2120	2500
11	0.1910	0.02865	322	454	552	634	704	770	828	881	930	976	1070	1140	1220	1290	1370	1570	1770	2160	2560
10	0.1930	0.02940	331	466	567	650	723	790	850	904	955	1010	1090	1170	1250	1330	1410	1610	1810	2220	2620
9	0.1960	0.03017	339	478	582	667	742	810	872	927	980	1030	1120	1200	1270	1360	1450	1650	1860	2280	2690
8	0.1990	0.03110	350	493	600	688	765	835	899	956	1010	1060	1160	1230	1320	1400	1490	1700	1920	2350	2770
7	0.2010	0.03173	357	503	612	702	780	852	917	975	1030	1090	1180	1260	1350	1430	1520	1740	1960	2390	2830
13/64"	0.2031	0.03241	364	513	625	717	797	870	937	996	1060	1110	1210	1290	1370	1460	1550	1780	2000	2450	2890
6	0.2040	0.03269	367	518	630	723	804	878	945	1010	1070	1120	1220	1300	1390	1480	1570	1790	2020	2470	2920
5	0.2055	0.03317	373	525	639	734	816	891	959	1020	1080	1130	1230	1320	1410	1500	1590	1820	2050	2500	2960
4	0.2090	0.03431	386	543	661	739	844	921	991	1060	1120	1170	1280	1360	1450	1550	1640	1880	2120	2590	2770
3	0.2130	0.03563	400	564	687	788	876	959	1030	1100	1160	1220	1330	1410	1510	1610	1710	1950	2200	2690	2830
7/32"	0.2187	0.03758	422	595	724	831	924	1010	1090	1160	1220	1280	1400	1490	1590	1700	1800	2060	2320	2830	2890
2	0.2210	0.03836	431	608	739	849	943	1030	1110	1180	1250	1310	1430	1520	1630	1730	1840	2100	2370	2890	2920
1	0.2280	0.04083	459	647	787	903	1010	1100	1180	1260	1330	1400	1520	1620	1730	1840	1950	2240	2520	3080	2960
A	0.2340	0.04301	483	681	829	951	1060	1160	1250	1330	1400	1470	1600	1700	1820	1940	2060	2360	2650	3240	3060
15/64"	0.2344	0.04314	485	683	831	954	1060	1160	1250	1330	1400	1470	1600	1710	1830	1950	2070	2360	2660	3250	3180
B	0.2380	0.04449	500	705	857	984	1100	1200	1290	1370	1450	1520	1650	1760	1880	2010	2130	2440	2740	3350	3350
C	0.2420	0.04600	517	725	916	1020	1130	1240	1330	1420	1500	1570	1710	1820	1950	2080	2200	2520	2840	3470	3420
D	0.2460	0.04733	534	733	975	1060	1170	1280	1370	1460	1550	1620	1770	1880	2010	2140	2280	2600	2930	3580	3640
E=1/4"	0.2500	0.04909	552	777	946	1090	1210	1320	1420	1510	1600	1680	1830	1940	2080	2210	2350	2690	3030	3700	4380
F	0.2570	0.05187	583	821	1000	1150	1280	1400	1500	1600	1690	1770	1930	2050	2200	2340	2480	2840	3200	3910	4620
G	0.2610	0.05350	601	847	1040	1190	1320	1440	1550	1650	1740	1830	1990	2120	2270	2410	2560	2930	3300	4030	4770
17/64"	0.2656	0.05542	623	878	1070	1230	1370	1490	1610	1710	1810	1890	2060	2190	2350	2500	2650	3030	3410	4180	4940
H	0.2660	0.05557	624	880	1070	1230	1370	1500	1610	1710	1810	1900	2070	2200	2350	2510	2660	3040	3420	4190	4950

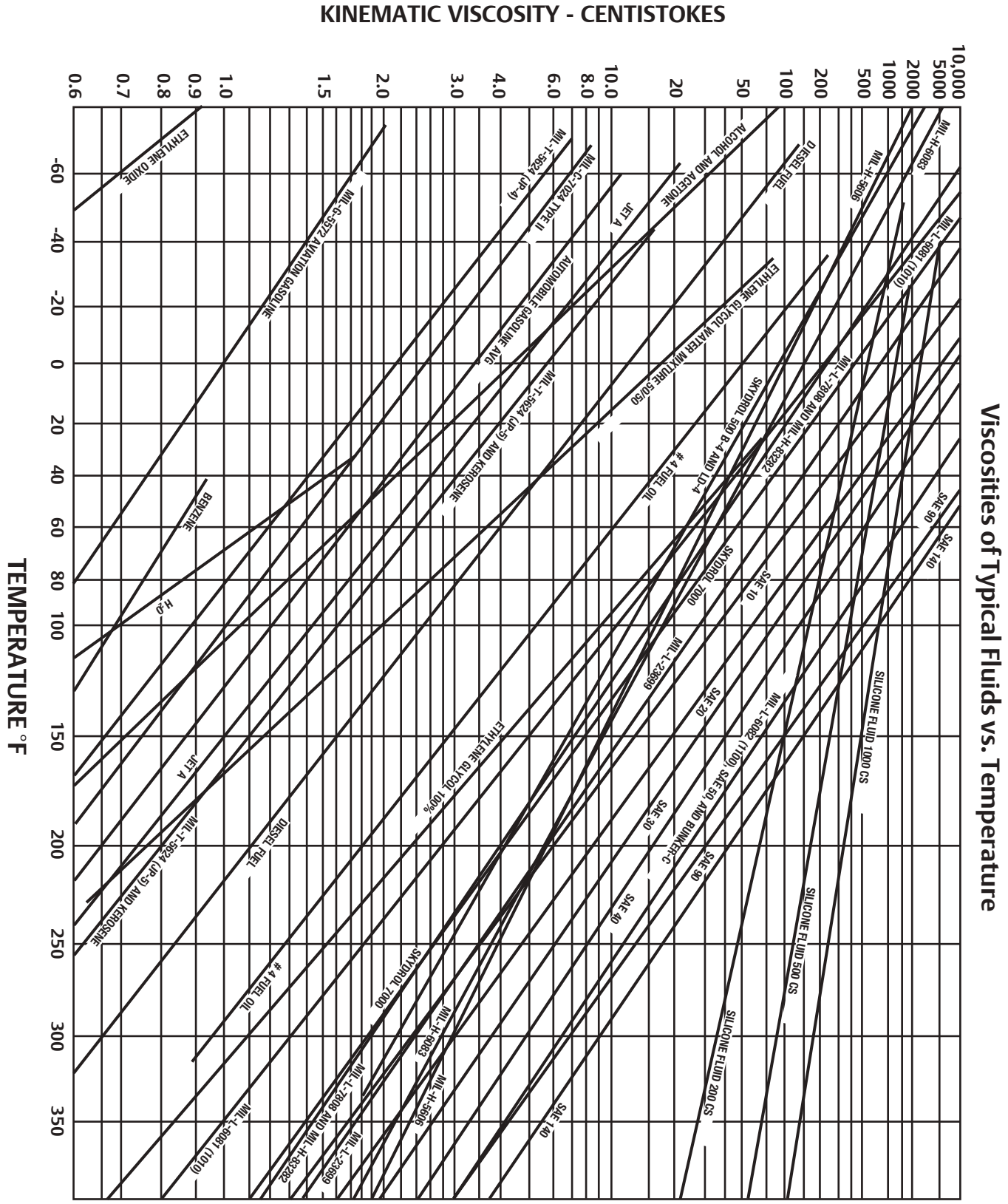
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Conversions, Equivalents and Physical Data

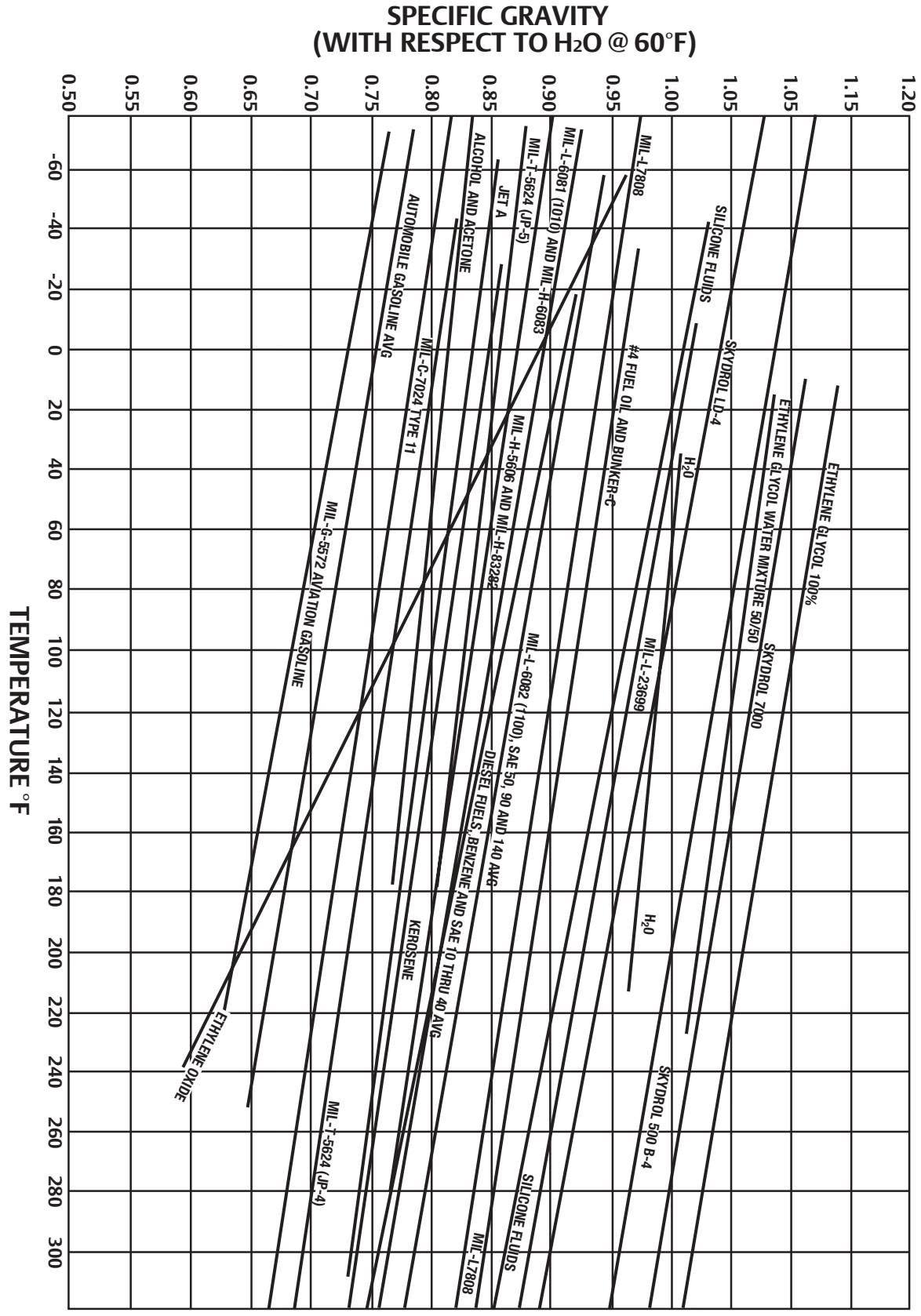
Capacities of Spuds and Orifices (continued)

DRILL DESIGNATION	DIAMETER, IN.	AREA, IN²	CAPACITIES IN CFH OF 0.6 GRAVITY HIGH PRESSURE NATURAL GAS AND AN ORIFICE COEFFICIENT OF 1.0																		
			Upstream Pressure, psig																		
			1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	25	30	40	50
I	0.2720	0.005811	653	916	1120	1290	1430	1560	1680	1790	1890	1980	2160	2300	2460	2620	2780	3180	3580	4380	5180
J	0.2770	0.006026	677	957	1170	1340	1490	1620	1750	1860	1960	2060	2240	2390	2550	2720	2880	3300	3710	4540	5370
K	0.2810	0.006102	697	983	1200	1380	1530	1670	1800	1910	2020	2120	2300	2450	2630	2800	2970	3390	3820	4680	5530
9/32”	0.2812	0.006113	698	984	1200	1380	1530	1670	1800	1910	2020	2120	2310	2460	2630	2800	2970	3400	3830	4680	5540
L	0.2900	0.006605	742	1050	1280	1460	1630	1780	1910	2030	2150	2250	2450	2610	2800	2980	3160	3610	4070	4980	5890
M	0.2930	0.006835	768	1090	1320	1520	1680	1840	1980	2100	2220	2330	2540	2710	2890	3080	3270	3740	4210	5150	6090
19/64”	0.2969	0.006922	778	1100	1340	1530	1710	1860	2000	2130	2250	2360	2570	2740	2930	3120	3310	3790	4260	5220	6170
N	0.3020	0.007163	805	1140	1380	1590	1760	1930	2070	2210	2330	2440	2660	2830	3030	3230	3430	3920	4410	5400	6390
5/16”	0.3125	0.007670	862	1220	1480	1700	1890	2060	2220	2360	2490	2620	2850	3030	3250	3460	3670	4200	4720	5780	6840
O	0.3160	0.007843	881	1250	1520	1740	1930	2110	2270	2410	2550	2660	2910	3100	3320	3540	3750	4290	4830	5910	6990
P	0.3230	0.008194	920	1300	1580	1820	2020	2200	2370	2520	2660	2800	3040	3240	3470	3690	3920	4480	5050	6180	7300
21/64”	0.3281	0.008456	950	1340	1630	1870	2080	2270	2450	2600	2750	2890	3140	3350	3580	3810	4040	4630	5210	6370	7540
Q	0.3320	0.008657	972	1370	1670	1920	2130	2330	2500	2660	2810	2950	3210	3420	3660	3900	4140	4740	5330	6520	7720
R	0.3390	0.009026	1020	1430	1740	2000	2220	2430	2607	2780	2930	3080	3350	3570	3820	4070	4320	4940	5560	6800	8040
11/32”	0.3437	0.009281	1050	1470	1790	2060	2290	2500	2690	2860	3020	3170	3450	3670	3930	4180	4440	5080	5720	6990	8270
S	0.3480	0.09511	1070	1510	1840	2110	2340	2530	2750	2930	3090	3240	3530	3760	4020	4290	4550	5200	5860	7170	8480
T	0.3580	0.1006	1130	1600	1940	2230	2480	2710	2910	3100	3270	3430	3740	4000	4260	4530	4810	5500	6200	7580	8970
23/64”	0.3594	0.1014	1140	1610	1960	2250	2500	2730	2930	3120	3300	3460	3770	4010	4290	4570	4850	5550	6240	7640	9040
U	0.3680	0.1065	1200	1690	2050	2360	2620	2860	3080	3270	3460	3630	3950	4210	4500	4790	5050	5820	6550	8020	9480
3/8”	0.3750	0.1105	1240	1750	2130	2450	2720	2970	3200	3400	3590	3770	4100	4370	4670	4980	5280	6040	6800	8330	9850
V	0.3770	0.1116	1260	1770	2150	2470	2750	3000	3230	3430	3630	3810	4140	4410	4720	5030	5340	6100	6870	8410	9950
W	0.3860	0.1170	1320	1860	2260	2590	2900	3200	3380	3600	3800	3990	4340	4630	5000	5270	5590	6350	7200	8820	10,400
25/64”	0.3960	0.1198	1350	1900	2310	2650	2950	3220	3460	3680	3890	4090	4450	4740	5100	5400	5730	6550	7380	9030	10,700
X	0.3970	0.1238	1390	1960	2390	2740	3050	3330	3580	3810	4020	4220	4600	4900	5240	5580	5920	6770	7620	9330	11,100
Y	0.4040	0.1282	1440	2030	2470	2840	3150	3450	3710	3940	4160	4370	4760	5070	5420	5780	6130	7010	7890	9660	11,500
13/32”	0.4062	0.1295	1460	2060	2500	2870	3190	3480	3750	3990	4210	4420	4810	5120	5480	5840	6200	7090	7980	9760	11,600
Z	0.4130	0.1340	1510	2130	2590	2970	3300	3600	3870	4130	4350	4570	4970	5300	5670	6040	6400	7330	8250	10,100	12,000
27/64”	0.4219	0.1398	1570	2220	2700	3100	3440	3760	4040	4300	4540	4770	5190	5530	5910	6300	6680	7650	8610	10,600	12,500
7/16”	0.4375	0.1503	1690	2380	2900	3330	3700	4040	4350	4620	4880	5120	5580	5940	6360	6770	7200	8220	9250	11,400	13,400
29/64”	0.4531	0.1613	1820	2560	3110	3570	4000	4230	4660	5000	5140	5500	5990	6380	6820	7270	7700	8820	9930	12,200	14,400
15/32”	0.4687	0.1726	1940	2740	3330	3820	4250	4640	4990	5310	5610	5880	6410	6820	7300	7770	8300	9440	10,700	13,000	15,400
31/64”	0.4844	0.1843	2070	3280	3550	4080	4530	4950	5330	5670	5990	6280	6840	7280	7790	8300	8800	10,100	11,400	13,900	16,400
1/2”	0.5000	0.1964	2210	3110	3790	4350	4830	5280	5680	6340	6380	6690	7290	7760	8310	8850	9400	10,800	12,100	14,800	17,500
33/64”	0.5156	0.2088	2350	3310	4030	4620	5140	5610	6040	6420	6780	7120	7750	8250	8490	9400	10,000	11,500	12,900	15,800	18,600
17/32”	0.5313	0.2217	2490	3510	4280	4910	5450	5960	6410	6820	7200	7560	8230	8760	9370	9980	10,600	12,200	13,700	16,700	19,800
35/64”	0.5469	0.2349	2640	3720	4530	5200	5780	6310	6790	7220	7630	8010	8720	9290	9930	10,600	11,300	12,900	14,500	17,700	21,000
9/16”	0.5625	0.2485	2790	3940	4770	5500	6110	6680	7180	7640	8070	8470	9220	9820	10,500	11,200	11,900	13,600	15,300	18,800	22,000
37/64”	0.5781	0.2625	2950	4160	5060	5810	6450	7050	7590	8070	8520	8950	9740	10,370	11,100	11,900	12,600	14,400	16,200	19,800	23,400
19/32”	0.5938	0.2769	3110	4390	5340	6130	6810	7440	8000	8510	8990	9440	10,300	10,940	11,700	12,500	13,300	15,200	17,100	20,900	24,700
39/64”	0.6094	0.2917	3280	4620	5620	6450	7170	7830	8430	8970	9470	9940	10,900	11,600	12,400	13,200	14,000	16,000	18,000	22,000	26,000
5/8”	0.6250	0.3068	3450	4860	5910	6790	7540	8240	8870	9430	9960	10,500	11,400	12,200	12,700	13,900	14,700	16,800	18,900	23,100	27,400
41/64”	0.6406	0.3223	3620	5110	6210	7130	7920	8660	9310	9910	10,500	11,000	12,000	12,800	13,700	14,600	15,400	17,700	19,900	24,300	28,800
21/32”	0.6562	0.3382	3800	5360	6520	7480	8320	9080	9770	10,400	11,000	11,600	12,600	13,400	14,300	15,300	16,200	18,500	20,900	25,500	30,200
43/64”	0.6719	0.3545	3980	5620	6830	7840	8720	9520	10,300	10,900	11,500	12,100	13,200	14,000	15,000	16,000	17,000	19,400	21,900	26,700	31,600
11/16”	0.6875	0.3712	4170	5880	7150	8210	9130	9970	10,600	11,500	12,100	12,700	13,800	14,700	15,700	16,800	17,800	20,300	22,900	28,000	33,100
23/32”	0.7188	0.4057	4560	6430	7820	8970	9970	10,900	11,800	12,500	13,200	13,900	15,100	16,100	17,200	18,300	19,400	22,200	25,000	30,600	36,200
3/4”	0.7500	0.4418	4960	7000	8510	9770	10,900	11,900	12,800	13,600	14,400	15,100	16,400	17,500	18,700	19,900	21,200	24,200	27,200	33,300	39,400
25/32”	0.7812	0.4794	5390	7590	9240	10,600	11,800	12,900	13,900	14,800	15,600	16,400	17,800	19,000	20,300	21,600	22,900	26,200	29,500	36,100	42,800
13/16”	0.8125	0.5185	5830	8210	9990	11,500	12,800	14,000	15,000	16,000	16,900	17,700	19,300	20,500	22,000	23,400	24,800	28,400	32,000	39,100	46,200
27/32”	0.8438	0.5591	6280	8850	10,800	12,400	13,800	15,000	16,200	17,200	18,200	19,100	20,800	22,100	23,700	25,200	26,700	30,600	34,400	42,100	49,800
7/8”	0.8750	0.6013	6760	9520	11,600	13,300	14,800	16,200	17,400	18,500	19,600	20,500	22,300	23,800	25,500	27,100	28,800	32,900	37,000	45,300	53,600
29/32”	0.9062	0.6450	7250	10,200	12,400	14,300	15,900	17,400	18,700	19,000	21,000	22,000	24,000	25,500	26,400	29,100	30,900	35,300	39,700	48,600	57,500
15/16”	0.9375	0.6903	7750	10,900	13,300	15,300	17,000	18,600	20,000	21,200	22,400	23,600	25,600	27,500	29,200	31,100	33,000	37,800	42,500	52,000	61,500
31/32”	0.9688	0.7371	8280	11,700	14,200	16,300	18,200	19,800	21,300	22,700	24,000	25,100	27,400	29,200	31,200	33,200	35,300	40,300	45,400	55,600	65,700
1.0”	1.0000	0.7854	8820	12,400	15,100	17,400	19,300	21,100	22,700	24,200	25,500	26,800	29,200	31,100	33,200	35,400	37,600	43,000	48,400	59,200	70,000

Viscosities of Typical Fluids vs. Temperature

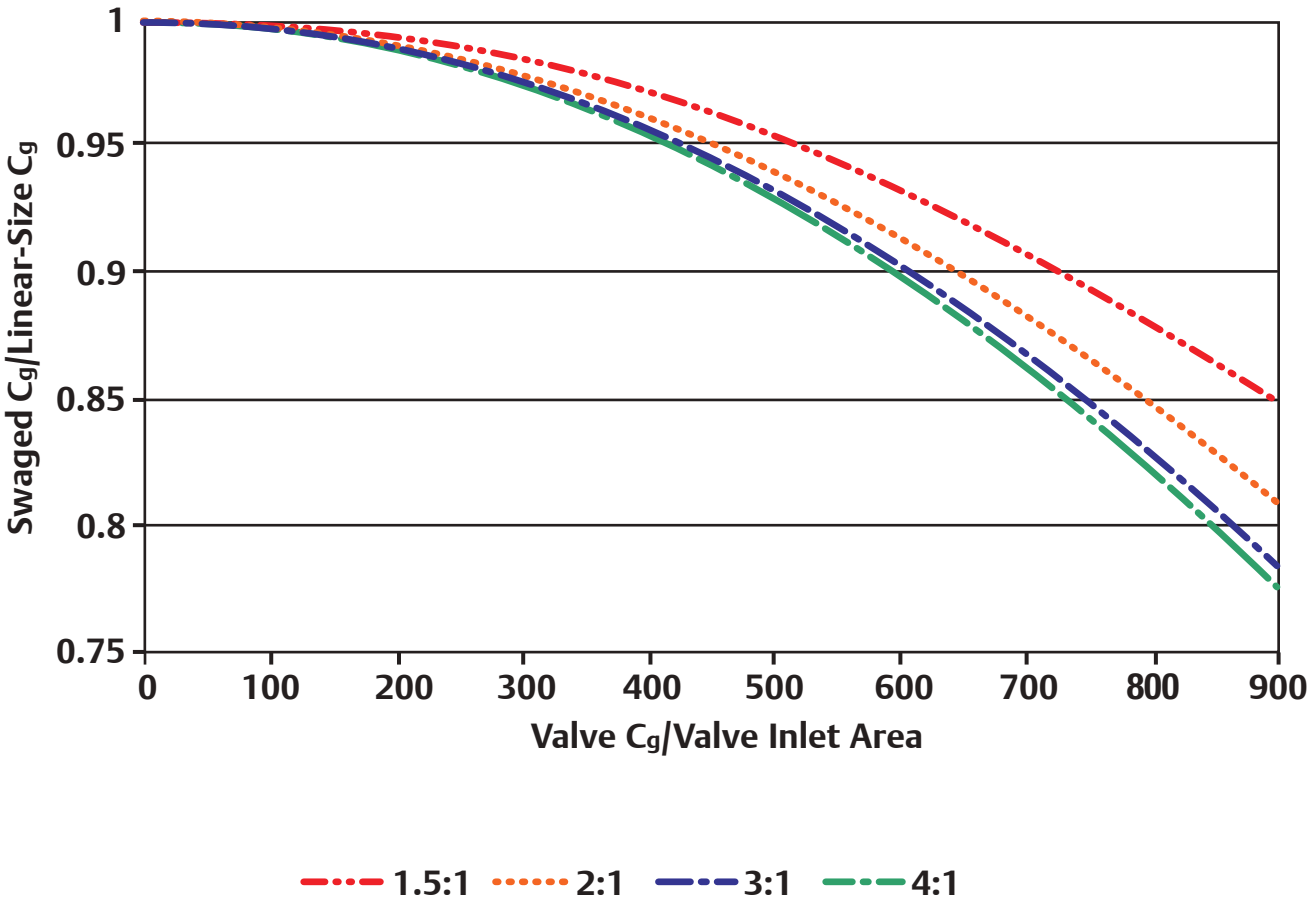


Specific Gravity of Typical Fluids vs. Temperature



EMERSON
Process Management

Effect of Inlet Swage On Critical Flow C_g Requirements



Conversions, Equivalents and Physical Data

Seat Leakage Classifications (In Accordance with ANSI/FCI 70-3-2004)

LEAKAGE CLASS DESIGNATION	DESCRIPTION	MAXIMUM LEAKAGE ALLOWABLE
I	A modification of any Class II, III or IV regulator where the design intent is the same as the basic class, but by agreement between user and supplier, no test is required.	----
II	This class establishes the maximum permissible leakage generally associated with commercial double-seat regulators with metal-to-metal seats.	0.5% of maximum C_v
III	This class establishes the maximum permissible leakage generally associated with Class II, but with a higher degree of seat and seal tightness.	0.1% of maximum C_v
IV	This class establishes the maximum permissible leakage generally associated with commercial unbalanced single-seat regulators with metal-to-metal seats.	0.01% of maximum C_v
VI	This class establishes the maximum permissible seat leakage generally associated with resilient seating regulators either balanced or unbalanced with O-rings or similar gapless seals.	Leakage per following table as expressed in ml per minute versus seat diameter.
VII	This class establishes the maximum permissible seat leakage generally associated with Class VI, but with test performed at the maximum operating differential pressure.	Leakage per following table as expressed in ml per minute versus seat diameter.

Nominal Port Diameter and Leak Rate

NOMINAL PORT DIAMETER		LEAK RATE	
mm	In.	Standard ml per Minute[3]	Bubbles per Minute[1]
≤25[2]	≤1[2]	0.15	1[2]
38	1.5	0.30	2
51	2	0.45	3
64	2.5	0.60	4
76	3	0.90	6
102	4	1.70	11
152	6	4.00	27
203	8	6.75	45
250	10	11.1	----
300	12	16.0	----
350	14	21.6	----
400	16	28.4	----

1. Bubbles per minute as tabulated are an easily measured suggested alternative based on a suitable calibrated measuring device in this case a 0.24 in. / 6 mm O.D. x 0.04 in. / 1 mm wall tube submerged in water to a depth of from 0.12 to 0.24 in. / 3 to 6 mm. The tube end shall be cut square and smooth with no chamfers or burrs and the tube axis shall be perpendicular to the surface of the water. Other apparatus may be constructed and the number of bubbles per minute may differ from those shown as long as they correctly indicate the flow in ml per minute.
2. If valve seat diameter differs by more than 0.08 in. / 2 mm from one of the valves listed, the leakage rate may be obtained by interpolation assuming that the leakage rate varies as the square of the seat diameter.
3. Standard millimeters based on 60°F / 16°C and 14.73 psia / 1.016 bar a.

Flange, Valve Size and Pressure-Temperature Rating Designations

Sizes of ASME flanges are designated as NPS (for "Nominal Pipe Size"). The nominal size is based on inches, but the units are not required in the designation. For example: NPS 2 is the size. Pressure ratings are designated by class. For example, CL150 is the rating. ASME designations replace ANSI designations.

Sizes of EN and ISO flanges are designated with DN (for "Nominal Diameter"). The nominal diameter is based on millimeters, but the units are not included in the designation. For example: DN 50 is the size. Pressure ratings are designated by PN (for "Nominal Pressure"). For example PN 40 is the pressure rating. EN and ISO designations replace DIN designations through PN 100.

ASME B16.5 flanges will mate with EN 1759 flanges but not with EN 1092 flanges (formerly DIN flanges). ASME B16.5 flanges will mate with most ISO 7005 flanges.

Common size designations in wide use are shown in the table below.

A summary of flange terminology is shown in the table below, and equivalency of flanges is shown in the table on the following page.

Pipe Thread Standards

There are three pipe thread standards that are accepted globally:

- NPT, ASME B1.20.1: General-purpose pipe threads (inches).
- G Series, ISO 228-1: Pipe threads for use where pressure-tight joints are not made on the threads. The internal and external threads are not tapered but are parallel or straight.
- R Series, ISO 7/1: Pipe threads for use where pressure-tight joints are made on the threads. The internal thread is parallel (straight) or tapered; external is always tapered.

Notes

Japanese (JIS) valves and flanges are designated according to JIS standards.

European Norm flange types, such as flat-face and raised-face are designated Type A, Type B, Type C. These types do not correspond to the DIN 2526 Form A, Form D, etc., designations.

Common Size Designations

NPS	1/2	3/4	1	1-1/2	2	2-1/2	3	4	6	8	10	12	14	16	18	20	24
DN	15	20	25	40	50	65	80	100	150	200	250	300	350	400	450	500	600

Summary of Flange Terminology

	ASME	EUROPEAN NORM	EXAMPLE OF PRINTED PRESENTATION
Pressure Rating	CLASS	PN	CL300 or CL300, PN 40
Size	NPS	DN	NPS 2, DN 50
Pipe Threads (Internal or External)	NPT	NPT, G (Straight), R (Tapered)	G 1/4, 1/4 NPT, 1/4 NPT Internal (or External)

Conversions, Equivalents and Physical Data

Equivalency Table

	ISO	ASME	DIN	EUROPEAN NORM	LIMITATION
ASME and European Norm Only	----	Class Flanges ASME B16.5	----	EN 1759-1	Specifies ASTM materials but also permits European materials per EN 1092-1.
European Norm Only	----			EN 1092	Through PN 100[1]
DIN Only	----		DIN[2]	----	Above PN 100[1]
ISO and ASME Only	ISO 7005	Class Flanges ASME B16.5	----		A few sizes are compatible to previous DIN standards. An older version contained flange designations that do not appear in the current standard.

1. DIN is no longer used except for pressure ratings above PN 100.
2. DIN standards 2628, 2629, 2638, 2548, 2549, 2550 and 2551.

Standard Pressure-Temperature Ratings for ASME CL150 Valve Bodies[1]

SERVICE TEMPERATURE		WORKING PRESSURE									
		LCB		LCC/WCC		WCB		CF8 or 304		CF8M/CF3M	
°F	°C	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
-20 to 100	-29 to 38	265	18.3	290	20.0	285	19.7	275	19.0	275	19.0
200	93	255	17.6	260	17.9	260	17.9	230	15.9	235	16.2
300	149	230	15.9	230	15.9	230	15.9	205	14.1	215	14.8
400	204	200	13.8	200	13.8	200	13.8	190	13.1	195	13.4
500	260	170	11.7	170	11.7	170	11.7	170	11.7	170	11.7
600	316	140	9.7	140	9.7	140	9.7	140	9.7	140	9.7
650	343	125	8.6	125	8.6	125	8.6	125	8.6	125	8.6
700	371	110	7.6	110	7.6	110	7.6	110	7.6	110	7.6

1. Table information is extracted from the Valve-Flanged, Threaded and Welding End, ASME Standard B16.34-2004. These tables must be used in accordance with the ASME standard.

Standard Pressure-Temperature Ratings for ASME CL300 Valve Bodies[1]

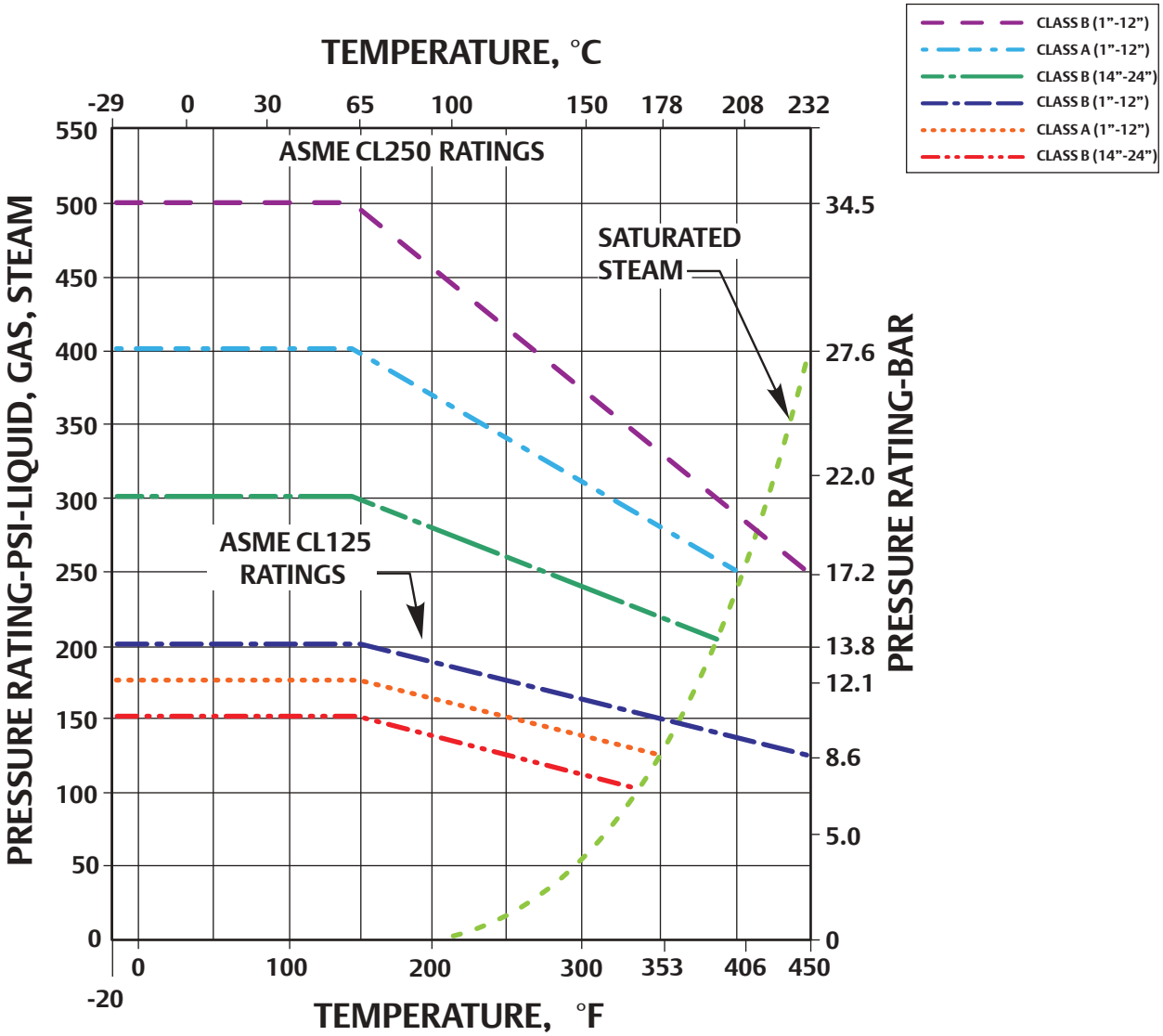
SERVICE TEMPERATURE		WORKING PRESSURE									
		LCB		LCC/WCC		WCB		CF8 or 304		CF8M/CF3M	
°F	°C	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
-20 to 100	-29 to 38	695	47.9	750	51.7	740	51.0	720	49.6	720	49.6
200	93	660	45.5	750	51.7	680	46.9	600	41.4	620	42.7
300	149	640	44.1	730	50.3	655	45.2	540	37.2	560	38.6
400	204	615	42.4	705	48.6	635	43.8	495	34.1	515	35.5
500	260	585	40.3	665	45.9	605	41.7	465	32.1	480	33.1
600	316	550	37.9	605	41.7	570	39.3	440	30.3	450	31.0
650	343	535	36.8	590	40.7	550	38.0	430	29.6	440	30.3
700	371	510	35.2	555	38.3	530	36.5	420	29.0	435	30.0

1. Table information is extracted from the Valve-Flanged, Threaded and Welding End, ASME Standard B16.34-2004. These tables must be used in accordance with the ASME standard.

Standard Pressure-Temperature Ratings for ASME CL600 Valve Bodies[1]

SERVICE TEMPERATURE		WORKING PRESSURE									
		LCB		LCC/WCC		WCB		CF8 or 304		CF8M/CF3M	
°F	°C	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
-20 to 100	-29 to 38	1395	96.2	1500	103	1480	102	1440	99.3	1440	99.3
200	93	1320	91.0	1500	103	1360	93.7	1200	82.7	1240	85.5
300	149	1275	87.9	1455	100	1310	90.3	1075	74.1	1120	77.2
400	204	1230	84.8	1405	97.0	1265	87.2	995	68.6	1025	70.7
500	260	1175	81.0	1330	91.7	1205	83.1	930	64.1	955	65.8
600	316	1105	76.2	1210	83.4	1135	78.3	885	61.0	900	62.1
650	343	1065	73.4	1175	81.0	1100	75.8	865	59.6	885	61.0
700	371	1025	70.7	1110	76.5	1060	73.1	845	58.3	870	60.0

1. Table information is extracted from the Valve-Flanged, Threaded and Welding End, ASME Standard B16.34-2004. These tables must be used in accordance with the ASME standard.



Pressure/Temperature Ratings for ASTM A126 Cast Iron Valves

Conversions, Equivalents and Physical Data

Diameter of Bolt Circle

NOMINAL PIPE SIZE, IN.	ASME CL125 (CAST IRON) OR CL150 (STEEL)[1]	ASME CL250 (CAST IRON) OR CL300 (STEEL)[2]	ASME CL600	ASME CL900	ASME CL1500	ASME CL2500
1	3.12	3.50	3.50	4.00	4.00	4.25
1-1/4	3.50	3.88	3.88	4.38	4.38	5.12
1-1/2	3.88	4.50	4.50	4.88	4.88	5.75
2	4.75	5.00	5.00	6.50	6.50	6.75
2-1/2	5.50	5.88	5.88	7.50	7.50	7.75
3	6.00	6.62	6.62	7.50	8.00	9.00
4	7.50	7.88	8.50	9.25	9.50	10.75
5	8.50	9.25	10.50	11.00	11.50	12.75
6	39.50	10.62	11.50	12.50	12.50	14.50
8	11.75	13.00	13.75	15.50	15.50	17.25
10	14.25	15.25	17.00	18.50	19.00	21.75
12	17.00	17.75	19.25	21.00	22.50	24.38
14	18.75	20.25	20.75	22.00	25.00	----
16	21.25	22.50	23.75	24.25	27.75	----
18	22.75	24.75	25.75	27.00	30.50	----
20	25.00	27.00	28.50	29.50	32.75	----
24	29.50	32.00	33.00	35.50	39.00	----
30	36.00	39.25	----	----	----	----
36	42.75	46.00	----	----	----	----
42	49.50	52.75	----	----	----	----
48	56.00	60.75	----	----	----	----

1. Sizes 1 through 12 in. also apply to ASME CL150 bronze flanges.
2. Sizes 1 through 8 in. also apply to ASME CL300 bronze flanges.

ASME Face-To-Face Dimensions for Flanged Regulators

BODY SIZE, IN.	ASME CLASS AND END CONNECTIONS (IN. DIMENSIONS ARE IN ACCORDANCE WITH ISA S4.01.1-1997)											
	CL125 FF (Cast Iron) CL150 RF (Steel)		CL250 RF (Cast Iron) CL300 RF (Steel)		CL150 RJT (Steel)		CL300 RJT (Steel)		CL600 RF (Steel)		CL600 RJT (Steel)	
	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1	7.25	184	7.75	197	7.75	197	8.25	210	8.25	210	8.25	210
1-1/4	7.88	200	8.38	213	8.38	213	8.88	226	9.00	229	9.00	229
1-1/2	8.75	222	9.25	235	9.25	235	9.75	248	9.88	251	9.88	251
2	10.00	254	10.50	267	10.50	267	11.12	282	11.25	286	11.38	289
2-1/2	10.88	276	11.50	292	11.38	289	12.12	308	12.25	311	12.38	314
3	11.75	298	12.50	317	12.25	311	13.12	333	13.25	337	13.38	340
4	13.88	353	14.50	368	14.38	365	15.12	384	15.50	394	15.62	397
6	17.75	451	18.62	473	18.25	464	19.25	489	20.00	508	20.12	511
8	21.38	543	22.38	568	21.88	556	23.00	584	24.00	610	24.12	613
10	26.50	673	27.88	708	27.00	686	28.50	724	29.62	752	29.75	756
12	29.00	737	30.50	775	29.50	749	31.12	790	32.25	819	32.38	822
16	40.00	1016	41.62	1057	40.50	1029	42.25	1073	43.62	1108	43.75	1111

FF—Flat-faced, RF—Raised-faced and RTJ—Ring Type Joint

Wear and Galling Resistance Chart of Material Combinations

MATERIAL	304 STAINLESS STEEL	316 STAINLESS STEEL	BRONZE	INCONEL®	MONEL®	HASTELLOY® C	NICKEL
304 Stainless Steel	P	P	F	P	P	F	P
316 Stainless Steel	P	P	F	P	P	F	P
Bronze	F	F	S	S	S	S	S
Inconel®	P	P	S	P	P	F	F
Monel®	P	P	S	P	P	F	F
Hastelloy® C	F	F	S	F	F	F	F
Nickel	P	P	S	P	F	F	P
Alloy 20	P	P	S	F	F	F	P
Type 416 Hard	F	F	F	F	F	F	F
Type 440 Hard	F	F	F	F	F	F	F
17-4PH	F	F	F	F	F	F	F
ENC[1]	F	F	F	F	F	F	F
Cr Plate	F	F	F	F	F	S	S
Al Bronze	F	F	F	S	S	S	S

1. Electroless Nickel Coating
S - Satisfactory F - Fair P - Poor

- continued -

Wear and Galling Resistance Chart of Material Combinations (continued)

MATERIAL	ALLOY 20	TYPE 416 HARD	TYPE 440 HARD	17-4PH	ENC[1]	Cr PLATE	Al BRONZE
304 Stainless Steel	P	F	F	F	F	F	F
316 Stainless Steel	P	F	F	F	F	F	F
Bronze	S	F	F	F	F	F	F
Inconel®	F	F	F	F	F	F	S
Monel®	F	F	F	F	F	F	S
Hastelloy® C	F	F	F	F	F	S	S
Nickel	P	F	F	F	F	F	S
Alloy 20	P	F	F	F	F	F	S
Type 416 Hard	F	F	F	F	S	S	S
Type 440 Hard	F	S	F	S	S	S	S
17-4PH	F	F	S	P	S	S	S
ENC[1]	F	S	S	S	P	S	S
Cr Plate	S	S	S	S	S	P	S
Al Bronze	S	S	S	S	S	S	P

1. Electroless Nickel Coating
S - Satisfactory F - Fair P - Poor

Equivalent Lengths of Pipe Fittings and Valves

TYPE OF FITTING OR VALVE	LENGTHS IN FEET OF STANDARD PIPE																		
	Nominal Pipe Size in In.																		
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4	6	8	10	12	14 O.D.	16 O.D.	18 O.D.	20 O.D.	24 O.D.	30 O.D.
Standard tee with entry or discharge through side	3.4	4.5	5.5	7.5	9.0	12	14	17	22	33	43	55	65	78	85	105	115	135	170
Standard elbow or run[1] of tee reduced 1/2[2]	1.7	2.2	2.7	3.7	4.3	5.5	6.5	8	12	16	20	26	31	36	42	47	52	64	80
Medium sweep elbow or run[1] of tee reduced 1/4[2]	1.3	1.8	2.3	3.0	3.7	4.6	5.4	6.8	9.0	14	18	22	26	30	35	40	43	55	67
Long sweep elbow or run[1] of standard tee or butterfly valve	1	1.3	1.7	2.3	2.7	3.5	4.2	5.3	7	11	14	17	20	23	26	31	34	41	52
45° elbow	0.8	1.0	1.2	1.6	2.0	2.5	3.0	3.7	5.0	7.5	10	12	15	17	20	22	24	30	37
Close return bend	3.7	5.1	6.2	8.5	10	13	15	19	24	37	49	62	75	86	100	110	125	150	185
Globe valve, wide-open	0.6	22	27	40	43	45	65	82	120	170	240	290	340	400	440	500	550	680	850
Angle valve, wide-open	8.2	11	14	18	21	28	33	42	56	85	112	145	165	190	220	250	280	340	420
Swing check valve, wide-open	4.0	5.2	6.6	9.0	11	14	16	19	26	39	52	66	78	92	106	120	130	145	160
Gate valve, wide-open or slight bushing reduction	0.4	0.5	0.6	0.8	0.9	1.2	1.3	1.7	2.3	3.5	4.5	5.7	6.7	8.0	9.0	11	12	14	17

1. A fluid is said to flow through the run of a tee when the flow is straight through the tee with no change of direction.
2. A tee is said to be reduced 1/4 if the internal area of the smaller connecting pipe is 25% less than the internal area of the larger connecting pipe.

Pipe Data: Carbon and Allow Steel—Stainless Steel

NOMINAL PIPE SIZE, IN.	OUTSIDE DIAMETER, IN.	IDENTIFICATION			WALL THICKNESS (t), IN.	INSIDE DIAMETER (d), IN.	AREA OF METAL, IN².	TRANSVERSE INTERNAL AREA		WEIGHT PIPE, LBS/FT	WEIGHT WATER, LBS/FT OF PIPE
		Steel		Stainless Steel Schedule No.				(a), In².	(A), Ft²		
		Iron Pipe Size	Schedule No.								
1/8	0.405	---- STD	---- 40	10S 40S	0.049 0.068	0.307 0.269	0.0548 0.0720	0.0740 0.0568	0.00051 0.00040	0.19 0.24	0.032 0.025
		XS	80	80S	0.095	0.215	0.0925	0.0365	0.00025	0.31	0.016
1/4	0.540	---- STD	---- 40	10S 40S	0.065 0.088	0.410 0.364	0.0970 0.1250	0.1320 0.1041	0.00091 0.00072	0.33 0.42	0.057 0.045
		XS	80	80S	0.119	0.302	0.1574	0.0716	0.00050	0.54	0.031
3/8	0.675	---- STD	---- 40	10S 40S	0.065 0.091	0.545 0.493	0.1246 0.1670	0.2333 0.1910	0.00162 0.00133	0.42 0.57	0.101 0.083
		XS	80	80S	0.126	0.423	0.2173	0.1405	0.00098	0.74	0.061
1/2	0.840	---- ---- STD	---- ---- 40	5S 10S 40S	0.065 0.083 0.109	0.710 0.674 0.622	0.1583 0.1974 0.2503	0.3959 0.3568 0.3040	0.00275 0.00248 0.00211	0.54 0.67 0.85	0.172 0.155 0.132
		XS ---- XXS	80 160 ----	80S ---- ----	0.147 0.187 0.294	0.546 0.466 0.252	0.3200 0.3836 0.5043	0.2340 0.1706 0.050	0.00163 0.00118 0.00035	1.09 1.31 1.71	0.102 0.074 0.022
3/4	1.050	---- ---- STD	---- ---- 40	5S 10S 40S	0.065 0.083 0.113	0.920 0.884 0.824	0.2011 0.2521 0.3326	0.6648 0.6138 0.5330	0.00462 0.00426 0.00371	0.69 0.86 1.13	0.288 0.266 0.231
		XS ---- XXS	80 160 ----	80S ---- ----	0.154 0.219 0.308	0.742 0.612 0.434	0.4335 0.5698 0.7180	0.4330 0.2961 0.148	0.00300 0.00206 0.00103	1.47 1.94 2.44	0.188 0.128 0.064
1	1.315	---- ---- STD	---- ---- 40	5S 10S 40S	0.065 0.109 0.133	1.185 1.097 1.049	0.2553 0.4130 0.4939	1.1029 0.9452 0.8640	0.00766 0.00656 0.00600	0.87 1.40 1.68	0.478 0.409 0.375
		XS ---- XXS	80 160 ----	80S ---- ----	0.065 0.250 0.358	0.957 0.815 0.599	0.6388 0.8365 1.0760	0.7190 0.5217 0.282	0.00499 0.00362 0.00196	2.17 2.84 3.66	0.312 0.230 0.122
1-1/4	1.660	---- ---- STD	---- ---- 40	5S 10S 40S	0.065 0.109 0.140	1.530 1.442 1.380	0.3257 0.4717 0.6685	1.839 1.633 1.495	0.01277 0.01134 0.01040	1.11 1.81 2.27	0.797 0.708 0.649
		XS ---- XXS	80 160 ----	80S ---- ----	0.191 0.250 0.382	1.278 1.160 0.896	0.8815 1.1070 1.534	1.283 1.057 0.630	0.00891 0.00734 0.00438	3.00 3.76 5.21	0.555 0.458 0.273
1-1/2	1.900	---- ---- STD	---- ---- 40	5S 10S 40S	0.065 0.109 0.145	1.770 1.682 1.610	0.3747 0.6133 0.7995	2.461 2.222 2.036	0.01709 0.01543 0.01414	1.28 2.09 2.72	1.066 0.963 0.882
		XS ---- XXS	80 160 ----	80S ---- ----	0.200 0.281 0.400	1.500 1.338 1.100	1.068 1.429 1.885	1.767 1.406 0.950	0.01225 0.00976 0.00660	3.63 4.86 6.41	0.765 0.608 0.42
2	2.375	---- ---- STD	---- ---- 40	5S 10S 40S	0.065 0.109 0.154	2.245 2.157 2.067	0.4717 0.7760 1.075	3.958 3.654 3.355	0.02749 0.02538 0.02330	1.61 2.64 3.65	1.72 1.58 1.45
		XS ---- XXS	80 160 ----	80S ---- ----	0.218 0.344 0.436	1.939 1.687 1.503	1.477 2.190 2.656	2.953 2.241 1.774	0.02050 0.01556 0.01232	5.02 7.46 9.03	1.28 0.97 0.77

Identification, wall thickness and weights are extracted from ASME B36.10 and B39.19.
The notations STD, XS and XXS indicate Standard, Extra Strong and Double Extra Strong pipe, respectively.
Transverse internal area values listed in "square feet" also represent volume in cubic feet per foot of pipe length.

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EMERSON
Process Management

Pipe Data: Carbon and Allow Steel—Stainless Steel (continued)

NOMINAL PIPE SIZE, IN.	OUTSIDE DIAMETER, IN.	IDENTIFICATION			WALL THICKNESS (t), IN.	INSIDE DIAMETER (d), IN.	AREA OF METAL, IN^2.	TRANSVERSE INTERNAL AREA		WEIGHT PIPE, LBS/FT	WEIGHT WATER, LBS/FT OF PIPE
		Steel		Stainless Steel Schedule No.				(a), In^2.	(A), Ft^2.		
		Iron Pipe Size	Schedule No.								
2-1/2	2.875	----	----	5S	0.083	2.709	0.7280	5.764	0.04002	2.48	2.50
		----	----	10S	0.120	2.635	1.039	5.453	0.03787	3.53	2.36
		STD	40	40S	0.203	2.469	1.704	4.788	0.03322	5.79	2.07
		XS	80	80S	0.279	2.323	2.254	4.238	0.02942	7.66	1.87
		----	160	----	0.375	2.125	2.945	3.546	0.02463	10.01	1.54
		XXS	----	----	0.552	1.771	4.028	2.464	0.01710	13.69	1.07
3	3.500	----	----	5S	0.083	3.334	0.8910	8.730	0.06063	3.03	3.78
		----	----	10S	0.120	3.260	1.274	8.347	0.05796	4.33	3.62
		STD	40	40S	0.216	3.068	2.228	7.393	0.05130	7.58	3.20
		XS	80	80S	0.300	2.900	3.016	6.605	0.04587	10.25	2.86
		----	160	----	0.438	2.624	4.205	5.408	0.03755	14.32	2.35
		XXS	----	----	0.600	2.300	5.466	4.155	0.02885	18.58	1.80
3-1/2	4.000	----	----	5S	0.083	3.834	1.021	11.545	0.08017	3.48	5.00
		----	----	10S	0.120	3.760	1.463	11.104	0.07711	4.97	4.81
		STD	40	40S	0.226	3.548	2.680	9.886	0.06870	9.11	4.29
		XS	80	80S	0.318	3.364	3.678	8.888	0.06170	12.50	3.84
4	4.500	----	----	5S	0.083	4.334	1.152	14.75	0.10245	3.92	6.39
		----	----	10S	0.120	4.260	1.651	14.25	0.09898	5.61	6.18
		STD	40	40S	0.237	4.026	3.174	12.73	0.08840	10.79	5.50
		XS	80	80S	0.337	3.826	4.407	11.50	0.07986	14.98	4.98
		----	120	----	0.438	3.624	5.595	10.31	0.0716	19.00	4.47
		----	160	----	0.531	3.438	6.621	9.28	0.0645	22.51	4.02
		XXS	----	----	0.674	3.152	8.101	7.80	0.0542	27.54	3.38
5	5.563	----	----	5S	0.109	5.345	1.868	22.44	0.1558	6.36	9.72
		----	----	10S	0.134	5.295	2.285	22.02	0.1529	7.77	9.54
		STD	40	40S	0.258	5.047	4.300	20.01	0.1390	14.62	8.67
		XS	80	80S	0.375	4.813	6.112	18.19	0.1263	20.78	7.88
		----	120	----	0.500	4.563	7.953	16.35	0.1136	27.04	7.09
		----	160	----	0.625	4.313	9.696	14.61	0.1015	32.96	6.33
		XXS	----	----	0.750	4.063	11.340	12.97	0.0901	38.55	5.61
6	6.625	----	----	5S	0.109	6.407	2.231	32.24	0.2239	7.60	13.97
		----	----	10S	0.134	6.357	2.733	31.74	0.2204	9.29	13.75
		STD	40	40S	0.280	6.065	5.581	28.89	0.2006	18.97	12.51
		XS	80	80S	0.432	5.761	8.405	26.07	0.1810	28.57	11.29
		----	120	----	0.562	5.501	10.70	23.77	0.1650	36.39	10.30
		----	160	----	0.719	5.187	13.32	21.15	0.1469	45.35	9.16
		XXS	----	----	0.864	4.897	15.64	18.84	0.1308	53.16	8.16
9	8.625	----	----	5S	0.109	8.407	2.916	55.51	0.3855	9.93	24.06
		----	----	10S	0.148	8.329	3.941	54.48	0.3784	13.40	23.61
		----	20	----	0.250	8.125	6.57	51.85	0.3601	22.36	22.47
		----	30	----	0.277	8.071	7.26	51.16	0.3553	24.70	22.17
		STD	40	40S	0.322	7.981	8.40	50.03	0.3474	28.55	21.70
		----	60	----	0.406	7.813	10.48	47.94	0.3329	35.64	20.77
		XS	80	80S	0.500	7.625	12.76	45.66	0.3171	43.39	19.78
		----	100	----	0.594	7.437	14.96	43.46	0.3018	50.95	18.83
		----	120	----	0.719	7.187	17.84	40.59	0.2819	60.71	17.59
		----	140	----	0.812	7.001	19.93	38.50	0.2673	67.76	16.68
		XXS	----	----	0.875	6.875	21.30	37.12	0.2578	72.42	16.10
		----	160	----	0.906	6.813	21.97	36.46	0.2532	74.69	15.80
10	10.750	----	----	5S	0.134	10.482	4.36	86.29	0.5992	15.19	37.39
		----	----	10S	0.165	10.420	5.49	85.28	0.5922	18.65	36.95
		----	20	----	0.250	10.250	8.24	82.52	0.5731	28.04	35.76
		----	30	----	0.307	10.136	10.07	80.69	0.5603	34.24	34.96
		STD	40	40S	0.365	10.020	11.90	78.86	0.5475	40.48	34.20
		XS	60	80S	0.500	9.750	16.10	74.66	0.5185	54.74	32.35
		----	80	----	0.594	9.562	18.92	71.84	0.4989	64.43	31.13
		----	100	----	0.719	9.312	22.63	68.13	0.4732	77.03	29.53
		----	120	----	0.844	9.062	26.24	64.53	0.4481	89.29	27.96
		XXS	140	----	1.000	8.750	30.63	60.13	0.4176	104.13	26.06
		----	160	----	1.125	8.500	34.02	56.75	0.3941	115.64	24.59

Identification, wall thickness and weights are extracted from ASME B36.10 and B39.19.
The notations STD, XS and XXS indicate Standard, Extra Strong and Double Extra Strong pipe, respectively.
Transverse internal area values listed in "square feet" also represent volume in cubic feet per foot of pipe length.

Conversions, Equivalents and Physical Data

American Pipe Flange Dimensions

ASME CLASS FLANGE DIAMETER - IN., PER ASME B16.1, B16.5 AND B16.24						
Nominal Pipe Size	125 (Cast Iron) or 150 (Steel)[1]	250 (Cast Iron) or 300 (Steel)[2]	600	900	1500	2500
1	4.25	4.88	4.88	5.88	5.88	6.25
1-1/4	4.62	5.25	5.25	6.25	6.25	7.25
1-1/2	5.00	6.12	6.12	7.00	7.00	8.00
2	6.00	6.50	6.50	8.50	8.50	9.25
2-1/2	7.00	7.50	7.50	9.62	9.62	10.50
3	7.50	8.25	8.25	9.50	10.50	12.00
4	9.00	10.00	10.75	11.50	12.25	14.00
5	10.00	11.00	13.00	13.75	14.75	16.50
6	11.00	12.50	14.00	15.00	15.50	19.00
8	13.50	15.00	16.50	18.50	19.00	21.75
10	16.00	17.50	20.00	21.50	23.00	26.50
12	19.00	20.50	22.00	24.00	26.50	30.00
14	21.00	23.00	23.75	25.25	29.50	----
16	23.50	25.50	27.00	27.75	32.50	----
18	25.00	28.00	29.25	31.00	36.00	----
20	27.50	30.50	32.00	33.75	38.75	----
24	32.00	36.00	37.00	41.00	46.00	----
30	38.75	43.00	----	----	----	----
36	46.00	50.00	----	----	----	----
42	53.00	57.00	----	----	----	----
48	59.50	65.00	----	----	----	----

1. Sizes 1 through 12 in. also apply to ASME CL150 bronze flanges.
2. Sizes 1 through 8 in. also apply to ASME CL300 bronze flanges.

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American Pipe Flange Dimensions (continued)

ASME CLASS, NUMBER OF STUD BOLTS AND HOLE DIAMETER IN IN., PER ASME B16.1, B16.5 AND B16.24												
Nominal Pipe Size	125 (Cast Iron) or 150 (Steel)[1]		250 (Cast Iron) or 300 (Steel)[2]		600		900		1500		2500	
	No.	Ø	No.	Ø	No.	Ø	No.	Ø	No.	Ø	No.	Ø
1	4	0.50	4	0.62	4	0.62	4	0.88	4	0.88	4	0.88
1-1/4	4	0.50	4	0.62	4	0.62	4	0.88	4	0.88	4	1.00
1-1/2	4	0.50	4	0.75	4	0.75	4	1.00	4	1.00	4	1.12
2	4	0.62	8	0.62	8	0.62	8	0.88	8	0.88	8	1.00
2-1/2	4	0.62	8	0.75	8	0.75	8	1.00	8	1.00	8	1.12
3	4	0.62	8	0.75	8	0.75	8	0.88	8	1.12	8	1.25
4	8	0.62	8	0.75	8	0.75	8	0.12	8	1.25	8	1.50
5	8	0.75	8	0.75	8	1.00	8	1.25	8	1.50	8	1.75
6	8	0.75	12	0.75	12	1.00	12	1.12	12	1.38	8	2.00
8	8	0.75	12	0.88	12	1.12	12	1.38	12	1.62	12	2.00
10	12	0.88	16	1.00	16	1.25	16	1.38	12	1.88	12	2.50
12	12	0.88	16	1.12	20	1.25	20	1.38	16	2.00	12	2.75
14	12	1.00	20	1.12	20	1.38	20	1.50	16	2.25	----	----
16	16	1.00	20	1.25	20	1.50	20	1.62	16	2.50	----	----
18	16	1.12	24	1.25	20	1.62	20	1.88	16	2.75	----	----
20	20	1.12	24	1.25	24	1.62	20	2.00	16	3.00	----	----
24	20	1.25	24	1.50	24	1.88	20	2.50	16	3.50	----	----
30	28	1.25	28	1.75	----	----	----	----	----	----	----	----
36	32	1.50	32	2.00	----	----	----	----	----	----	----	----
42	36	1.50	36	2.00	----	----	----	----	----	----	----	----
48	44	1.50	40	2.00	----	----	----	----	----	----	----	----

1. Sizes 1 through 12 in. also apply to ASME CL150 bronze flanges.
2. Sizes 1 through 8 in. also apply to ASME CL300 bronze flanges.

EN 1092-1 Cast Steel Flange Standard-PN 16 (Nominal Pressure 16 bar)

NOMINAL BORE, mm	PIPE THICKNESS, mm	FLANGE, mm			BOLTING, mm		
		Outside Diameter	Thickness	Bolt Circle Diameter	Number of Bolts	Thread	Bolt Hole Diameter
10	6	90	16	60	4	M12	14
15	6	95	16	65	4	M12	14
20	6.5	105	18	75	4	M12	14
25	7	115	18	85	4	M12	14
32	7	140	18	100	4	M16	18
40	7.5	150	18	110	4	M16	18
50	8	165	20	125	4	M16	18
65	8	185	18	145	4	M16	18
80	8.5	200	20	160	8	M16	18
100	9.5	220	20	180	8	M16	18
125	10	250	22	210	8	M16	18
150	11	285	22	240	8	M20	23
175	12	315	24	270	8	M20	23
200	12	340	24	295	12	M20	23
250	14	405	26	355	12	M24	27
300	15	460	28	410	12	M24	27
350	16	520	30	470	16	M24	27
400	18	580	32	525	16	M27	30
500	21	715	36	650	20	M30	33
600	23	840	40	770	20	M33	36
700	24	910	42	840	24	M33	36
800	26	1025	42	950	24	M36	39
900	27	1125	44	1050	28	M36	39
1000	29	1255	46	1170	28	M39	42
1200	32	1485	52	1390	32	M45	48
1400	34	1685	58	1590	36	M45	48
1600	36	1930	64	1820	40	M52	56
1800	39	2130	68	2020	44	M52	56
2000	41	2345	70	2230	48	M56	62
2200	43	2555	74	2440	52	M56	62

EN 1092-1 Cast Steel Flange Standard-PN 25 (Nominal Pressure 25 bar)

NOMINAL BORE, mm	PIPE THICKNESS, mm	FLANGE, mm			BOLTING, mm		
		Outside Diameter	Thickness	Bolt Circle Diameter	Number of Bolts	Thread	Bolt Hole Diameter
10	6	90	16	60	4	M12	14
15	6	95	16	65	4	M12	14
20	6.5	105	18	75	4	M12	14
25	7	115	18	85	4	M12	14
32	7	140	18	100	4	M16	18
40	7.5	150	18	110	4	M16	18
50	8	165	20	125	4	M16	18
65	8.5	185	22	145	8	M16	18
80	9	200	24	160	8	M16	18
100	10	235	24	190	8	M20	23
125	11	270	26	220	8	M24	27
150	12	300	28	250	8	M24	27
175	12	330	28	280	12	M24	27
200	12	360	30	310	12	M24	27
250	14	425	32	370	12	M27	30
300	15	485	34	430	16	M27	30
350	16	555	38	490	16	M30	33
400	18	620	40	550	16	M33	36
500	21	730	44	660	20	M33	36
600	23	845	46	770	20	M36	39
700	24	960	50	875	24	M39	42
800	26	1085	54	990	24	M45	48
900	27	1185	58	1090	28	M45	48
1000	29	1320	62	1210	28	M52	56
1200	32	1530	70	1420	32	M52	56
1400	34	1755	76	1640	36	M56	62
1600	37	1975	84	1860	40	M56	62
1800	40	2195	90	2070	44	M64	70
2000	43	2425	96	2300	48	M64	70

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Process Management

EN 1092-1 Cast Steel Flange Standard–PN 40 (Nominal Pressure 40 bar)

NOMINAL BORE, mm	PIPE THICKNESS, mm	FLANGE, mm			BOLTING, mm		
		Outside Diameter	Thickness	Bolt Circle Diameter	Number of Bolts	Thread	Bolt Hole Diameter
10	6	90	16	60	4	M12	14
15	6	95	16	65	4	M12	14
20	6.5	105	18	75	4	M12	14
25	7	115	18	85	4	M12	14
32	7	140	18	100	4	M16	18
40	7.5	150	18	110	4	M16	18
50	8	165	20	125	4	M16	18
65	8.5	185	22	145	8	M16	18
80	9	200	24	160	8	M16	18
100	10	235	24	190	8	M20	23
125	11	270	26	220	8	M24	27
150	12	300	28	250	8	M24	27
175	13	350	32	295	12	M27	30
200	14	375	34	320	12	M27	30
250	16	450	38	385	12	M30	33
300	17	515	42	450	16	M30	33
350	19	580	46	510	16	M33	36
400	21	660	50	585	16	M36	39
450	21	685	50	610	20	M36	39
500	21	755	52	670	20	M39	42
600	24	890	60	795	20	M45	48
700	27	995	64	900	24	M45	48
800	30	1140	72	1030	24	M52	56
900	33	1250	76	1140	28	M52	56
1000	36	1360	80	1250	28	M52	56
1200	42	1575	88	1460	32	M56	62
1400	47	1795	98	1680	36	M56	62
1600	54	2025	108	1900	40	M64	70

EN 1092-1 Cast Steel Flange Standard–PN 63 (Nominal Pressure 63 bar)

NOMINAL BORE, mm	PIPE THICKNESS, mm	FLANGE, mm			BOLTING, mm		
		Outside Diameter	Thickness	Bolt Circle Diameter	Number of Bolts	Thread	Bolt Hole Diameter
10	10	100	20	70	4	M12	14
15	10	105	20	75	4	M12	14
25	10	140	24	100	4	M16	18
32	12	155	24	110	4	M20	23
40	10	170	28	125	4	M20	22
50	10	180	26	135	4	M20	22
65	10	205	26	160	8	M20	22
80	11	215	28	170	8	M20	22
100	12	250	30	200	8	M24	26
125	13	295	34	240	8	M27	30
150	14	345	36	280	8	M30	33
175	15	375	40	310	12	M30	33
200	16	415	42	345	12	M33	36
250	19	470	46	400	12	M33	36
300	21	530	52	460	16	M33	36
350	23	600	56	525	16	M36	39
400	26	670	60	585	16	M39	42
500	31	800	68	705	20	M45	48
600	35	930	76	820	20	M52	56
700	40	1045	84	935	24	M52	56
800	45	1165	92	1050	24	M56	62
900	50	1285	98	1170	28	M56	62
1000	55	1415	108	1290	28	M64	70
1200	64	1665	126	1530	32	M72X6	78

EN 1092-1 Cast Steel Flange Standard—PN 100 (Nominal Pressure 100 bar)

NOMINAL BORE, mm	PIPE THICKNESS, mm	FLANGE, mm			BOLTING, mm			NOMINAL BORE, mm	PIPE THICKNESS, mm	FLANGE, mm			BOLTING, mm		
		Outside Diameter	Thickness	Bolt Circle Diameter	Number of Bolts	Thread	Bolt Hole Diameter			Outside Diameter	Thickness	Bolt Circle Diameter	Number of Bolts	Thread	Bolt Hole Diameter
10	10	100	20	70	4	M12	14	150	18	355	44	290	12	M30	33
15	10	105	20	75	4	M12	14	175	20	385	48	320	12	M30	33
25	10	140	24	100	4	M16	18	200	21	430	52	360	12	M33	36
32	12	155	24	110	4	M20	23	250	25	505	60	430	12	M36	39
40	10	170	28	125	4	M20	22	300	29	585	68	500	16	M39	42
50	10	195	30	145	4	M24	26	350	32	655	74	560	16	M45	48
65	11	220	34	170	8	M24	26	400	36	715	78	620	16	M45	48
80	12	230	36	180	8	M24	26	500	44	870	94	760	20	M52	56
100	14	265	40	210	8	M27	30	600	51	990	104	875	20	M56	62
125	16	315	40	250	8	M30	33	700	59	1145	120	1020	24	M64	70

EN 1092-1 Pressure/Temperature Ratings for Cast Steel Flanges

PN	MATERIAL GROUP	MAXIMUM ALLOWABLE PRESSURE[1]															
		14 to 212°F / -10 to 100°C		302°F / 150°C		392°F / 200°C		482°F / 250°C		572°F / 300°C		662°F / 350°C		707°F / 375°C		752°F / 400°C	
		psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
16	1C1	232	16.0	226	15.6	219	15.1	209	14.4	194	13.4	186	12.8	180	12.4	157	10.8
	1C2	218	15.0	218	15.0	218	15.0	225	15.5	216	14.9	206	14.2	199	13.7	157	10.8
25	1C1	363	25.0	354	24.4	344	23.7	326	22.5	303	20.9	290	20.0	281	19.4	245	16.9
	1C2	363	25.0	363	25.0	363	25.0	363	25.0	338	23.3	322	22.2	310	21.4	245	16.9
40	1C1	580	40.0	567	39.1	550	37.9	522	36.0	486	33.5	463	31.9	451	31.1	392	27.0
	1C2	580	40.0	580	40.0	580	40.0	580	40.0	540	37.2	516	35.6	496	34.2	392	27.0
63	1C1	914	63.0	892	61.5	864	59.6	824	56.8	764	52.7	730	50.3	711	49.0	616	42.5
	1C2	914	63.0	914	63.0	914	63.0	914	63.0	851	58.7	812	56.0	780	53.8	616	42.5
100	1C1	1450	100	1417	97.7	1374	94.7	1307	90.1	1252	86.3	1157	79.8	1128	77.8	979	67.5
	1C2	1450	100	1450	100	1450	100	1450	100	1350	93.1	1289	88.9	1239	85.4	979	67.5

1. These ratings apply only for flange types 05, 11, 12, 13 and 21 having nominal sizes up and including DN 600.

Conversions, Equivalents and Physical Data

Drill Sizes for Pipe Taps

NOMINAL PIPE SIZE, IN.	TAP DRILL SIZE, IN.	NOMINAL PIPE SIZE, IN.	TAP DRILL SIZE, IN.
1/8	11/32	1-1/2	1-23/32
1/4	7/16	2	2-3/16
3/8	19/32	2-1/2	2-9/16
1/2	23/32	3	3-3/16
3/4	15/16	4	4-3/16
1	1-5/32	5	5-5/16
1-1/4	1-1/2	6	6-5/16

Standard Twist Drill Sizes

DESIGNATION	DIAMETER, IN.	AREA, SQ. IN.	DESIGNATION	DIAMETER, IN.	AREA, SQ. IN.	DESIGNATION	DIAMETER, IN.	AREA, SQ. IN.
1/2	0.5000	0.1963	3	0.213	0.03563	3/32	0.0938	0.00690
31/64	0.4844	0.1843	4	0.209	0.03431	42	0.0935	0.00687
15/32	0.4688	0.1726	5	0.2055	0.03317	43	0.0890	0.00622
29/64	0.4531	0.1613	6	0.204	0.03269	44	0.0860	0.00581
7/16	0.4375	0.1503	13/64	0.2031	0.03241	45	0.0820	0.00528
27/64	0.4219	0.1398	7	0.201	0.03173	46	0.0810	0.00515
Z	0.413	0.1340	8	0.199	0.03110	47	0.0785	0.00484
13/32	0.4063	0.1296	9	0.196	0.03017	5/64	0.0781	0.00479
Y	0.404	0.1282	10	0.1935	0.02940	48	0.0760	0.00454
Z	0.397	0.1238	11	0.191	0.02865	49	0.0730	0.00419
25/64	0.3906	0.1198	12	0.189	0.02806	50	0.0700	0.00385
W	0.386	0.1170	3/16	0.1875	0.02861	51	0.0670	0.00353
V	0.377	0.1116	13	0.185	0.02688	52	0.0635	0.00317
3/8	0.375	0.1104	14	0.182	0.02602	1/16	0.0625	0.00307
U	0.368	0.1064	15	0.1800	0.02554	53	0.0595	0.00278
23/64	0.3594	0.1014	16	0.1770	0.02461	54	0.0550	0.00238
T	0.358	0.1006	17	0.1730	0.02351	55	0.0520	0.00212
S	0.348	0.09511	11/64	0.1719	0.02320	3/64	0.0473	0.00173
11/32	0.3438	0.09281	18	0.1695	0.02256	56	0.0465	0.001698
R	0.339	0.09026	19	0.1660	0.02164	57	0.0430	0.001452
Q	0.332	0.08657	20	0.1610	0.02036	58	0.0420	0.001385
21/64	0.3281	0.08456	21	0.1590	0.01986	59	0.0410	0.001320
P	0.323	0.08194	22	0.1570	0.01936	60	0.0400	0.001257
O	0.316	0.07843	5/32	0.1563	0.01917	61	0.039	0.001195
5/16	0.3125	0.07670	23	0.1540	0.01863	62	0.038	0.001134
N	0.302	0.07163	24	0.1520	0.01815	63	0.037	0.001075
19/64	0.2969	0.06922	25	0.1495	0.01755	64	0.036	0.001018
M	0.295	0.06835	26	0.1470	0.01697	65	0.035	0.000962
L	0.29	0.06605	27	0.1440	0.01629	66	0.033	0.000855
9/32	0.2813	0.06213	9/64	0.1406	0.01553	67	0.032	0.000804
K	0.281	0.06202	28	0.1405	0.01549	1/32	0.0313	0.000765
J	0.277	0.06026	29	0.1360	0.01453	68	0.031	0.000755
I	0.272	0.05811	30	0.1285	0.01296	69	0.0292	0.000670
H	0.266	0.05557	1/8	0.1250	0.01227	70	0.028	0.000616
17/64	0.2656	0.05542	31	0.1200	0.01131	71	0.026	0.000531
G	0.261	0.05350	32	0.1160	0.01057	72	0.025	0.000491
F	0.257	0.05187	33	0.1130	0.01003	73	0.024	0.000452
E 1/4	0.2500	0.04909	34	0.1110	0.00968	74	0.0225	0.000398
D	0.246	0.04753	35	0.1100	0.00950	75	0.021	0.000346
C	0.242	0.04600	7/64	0.1094	0.00940	76	0.020	0.000314
B	0.238	0.04449	36	0.1065	0.00891	77	0.018	0.000254
15/64	0.2344	0.04314	37	0.1040	0.00849	78	0.016	0.000201
A	0.234	0.04301	38	0.1015	0.00809	1/64	0.0156	0.000191
1	0.228	0.04083	39	0.0995	0.00778	79	0.0145	0.000165
2	0.221	0.03836	40	0.0980	0.00754	80	0.0135	0.000143
7/32	0.2188	0.03758	41	0.0960	0.00724	----	----	----

Note: Designations are in fractions of an in., in standard twist drill letters or in standard twist drill numbers, the latter being the same as steel wire gauge numbers.

EMERSON
Process Management

A

Absolute Pressure (abs press) - Gauge pressure plus barometric pressure. Absolute pressure can be zero only in a perfect vacuum.

Absolute Viscosity (abs visc) - The product of fluid kinematic viscosity times its density. Absolute viscosity is a measure of fluid tendency to resist flow, without regard to its density. Sometimes the term dynamic viscosity is used in place of absolute viscosity. Refer to Viscosity, Absolute.

Accuracy - A measure of how close a regulator can keep downstream pressure (P_2) to the setpoint. Regulator accuracy is expressed as percent droop or proportional band or offset in percent of setpoint or in units of pressure.

ACFH - Actual Cubic Feet per Hour. The actual volume of fluid measured by the meter. This is not SCFH (standard cubic feet per hour).

Active/Working Regulator - A regulator that is in service performing a control function.

Adjusting Screw - A screw used to change the compression setting of a loading spring.

AGA - The American Gas Association or Australian Gas Association.

Airsets - See Filter/Supply Regulators.

ALPGA - Australian Liquefied Petroleum Gas Association, Ltd.

ANSI - American National Standards Institute.

API - American Petroleum Institute.

Appliance (Equipment) - Any device that uses gas as a fuel or raw material to produce light, heat, power, refrigeration or air conditioning.

ASME - American Society of Mechanical Engineers.

Aspirator - Any device using fluid velocity effect to produce a low-pressure zone. Used in regulator control and combustion systems.

Atmospheric Pressure - The pressure exerted by the atmosphere at a given location and time. Sea level pressure is approximately 14.7 psia / 1.0 bar a.

Automatic Control System - A control system that operates without human intervention.

Automatic Cutoff - A device used on some regulators to close the main valve in the event of pressure deviation outside of a preset range. Must be reopened manually.

B

Backpressure Regulator - This is a device that controls and responds to changes in its upstream/inlet pressure. Functions the same as a relief valve in that it opens on increasing upstream pressure.

Barometer - An instrument for measuring atmospheric pressure, usually in inches, centimeters or millimeters of mercury column.

Barometric Pressure - The atmospheric pressure at a specific place according to the current reading of a barometer.

Bellows - A flexible, thin-walled cylinder made up of corrugations one next to the other that can expand or contract under changing pressures.

Bimetallic Thermal System - A device working on the difference in coefficient of expansion between two metals to produce the power to position a valve plug in response to temperature change.

Bleed - Removal of fluid from a higher pressure area to a lower pressure area in a regulator pilot system.

Bode Diagram - A plot of log amplitude ratio and phase values on a log frequency base for a transfer function. (It is a common form of graphically presenting frequency response data.)

Body - Pressure retaining shell enclosing the restricting element.

Boiler - A closed vessel in which a liquid is heated or vaporized.

Bonnet - The regulator component that connects the valve body to the actuator.

Boost - The increase in control pressure above setpoint as flow is increased from low flow to maximum flow. Some regulators exhibit droop instead of boost.

British Thermal Unit (BTU) - The quantity of heat required to raise the temperature of one pound of water from by 1 degree Fahrenheit.

Build-up - In a relief valve, the pressure increase above setpoint required to produce a given flow rate.

BSPT - British Standard Pipe Thread.

C

C_1 - A term used in a sizing equation. It is defined as the ratio of the gas sizing coefficient and the liquid sizing coefficient and provides a numerical indicator of the valve's recovery capabilities.

Cage - A hollow, cylindrical trim element that is a guide to align the movement of a valve plug with a seat ring and/or retains the seat ring in the valve body. The walls of the cage contain openings that usually determine the flow characteristic of the control valve.

Capacity, Flow - The amount of a specified fluid that will flow through a valve, specific length and configuration of tubing, a manifold, fitting or other component at a specified pressure drop in a fixed period of time. (SCFH, gpm, Nm^3/h, Lpm, bph).

Capacity, Rated - The rate of flow through the regulator specified by the manufacturer for a given inlet pressure, outlet pressure, offset and size.

Capacity, Wide-Open - If a wide-open failure occurs, this is the amount a regulator will flow.

Cavitation - A phenomenon whereby liquid flowing through a valve under reduced pressure will form gaseous bubbles that will collapse upon pressure recovery, producing potential trim damage. This is a concern when high-pressure drops exist across the valve.

Glossary of Terms

Centipoise - A unit for measurement of absolute viscosity. One centipoise is equal to one hundredth of a poise, the metric (cgs) unit of absolute viscosity. The absolute viscosity of water at 20°C is approximately one centipoise.

Centistoke - A unit for measurement of kinematic viscosity. One centistoke is equal to one hundredth of a stoke, the metric (cgs) unit of kinematic viscosity. The kinematic viscosity in centistokes times the density equals the absolute viscosity in centipoises.

CFH - Cubic Feet per Hour (ft^3/h). Volumetric measurement of gas flow per hour, generally at line conditions.

C_g (Flow Coefficient) - A term used in gas and steam valve sizing equations. The value of C_g is proportional to flow rate and is used to predict flow based on physical size or flow area.

CGA - Canadian Gas Association.

Coal/Coke Oven Gas - A gas with a high sulfur content that is produced from baking coal. It may also contain tar that can cause sticking in moving parts of a regulator. Regulators with brass or copper parts should not be used with this gas. Often this gas requires the use of fluoroelastomers.

Compressibility Effect - The change in density of gas or air under conditions of compression.

Compression (Spring) - The action on a spring which decreases its length relative to the force to which it is subjected.

Condensate - The liquid resulting when a vapor is cooled and/or when its pressure is increased.

Control Line - The external piping which connects the regulator actuator or pilot to the point on the main line where control is required.

Control Valve - A mechanically, electrically or hydraulically operated valve, using an external power source to effect its operation, that modifies the fluid flow characteristics in a process. It consists of a valve connected to an actuator mechanism that is capable of changing the position of the flow controlling element or closure member in the valve in response to a signal from the controlling device.

Controller - A device that operates automatically to regulate a controlled variable.

Critical Flow - The rate at which a fluid flows through an orifice when the stream velocity at the orifice is equal to the velocity of sound in the fluid. Under such conditions, the rate of flow may be increased by an increase in upstream pressure, but it will not be affected by a decrease in downstream pressure. Critical flow occurs when P_2 is approximately 1/2 of P_1 absolute.

Critical Velocity - The velocity at critical flow. Also called sonic velocity.

CSA - Canadian Standards Association.

C_s (Flow Coefficient) - Steam valve sizing coefficient. At pressures below 1000 psig, a constant relationship exists between the gas sizing coefficient (C_g) and the steam coefficient (C_s). This relationship is expressed: $C_s = C_g \div 20$.

C_v (Flow Coefficient) - Liquid sizing coefficient. It is numerically equal to the number of U.S. Gallons of water at 60°F that will flow through the valve in one minute when the pressure differential across the valve is one pound per square inch.

Control Line - The external piping which connects the regulator actuator or pilot to the point on the main line where control is required.

Control Valve - A mechanically, electrically or hydraulically operated valve, using an external power source to effect its operation, that modifies the fluid flow characteristics in a process. It consists of a valve connected to an actuator mechanism that is capable of changing the position of the flow controlling element or closure member in the valve in response to a signal from the controlling device.

Controller - A device that operates automatically to regulate a controlled variable.

Critical Flow - The rate at which a fluid flows through an orifice when the stream velocity at the orifice is equal to the velocity of sound in the fluid. Under such conditions, the rate of flow may be increased by an increase in upstream pressure, but it will not be affected by a decrease in downstream pressure. Critical flow occurs when P_2 is approximately 1/2 of P_1 absolute.

Critical Velocity - The velocity at critical flow. Also called sonic velocity.

CSA - Canadian Standards Association.

C_s (Flow Coefficient) - Steam valve sizing coefficient. At pressures below 1000 psig, a constant relationship exists between the gas sizing coefficient (C_g) and the steam coefficient (C_s). This relationship is expressed: $C_s = C_g \div 20$.

C_v (Flow Coefficient) - Liquid sizing coefficient. It is numerically equal to the number of U.S. Gallons of water at 60°F that will flow through the valve in one minute when the pressure differential across the valve is one pound per square inch.

D

Dead Band - The range through which an input can be varied without initiating observable response.

Delta P (DP) (ΔP) (Pressure Drop) - The difference between the inlet and outlet pressures.

Demand - The rate at which fluid is delivered to or required by a system, part of a system or a piece of equipment, usually expressed in terms of volume per unit of time.

Density - The weight of a unit volume of a substance. Also called specific weight.

Diaphragm - A flexible membrane used in a regulator or relief valve to sense changes in downstream pressure or upstream pressure and respond to them, thus moving the restricting element or closure member to which it is attached.

Diaphragm Actuated Regulator - A regulator utilizing a diaphragm and actuator to position the valve plug.

Diaphragm Case - A housing used for supporting a diaphragm and establishing one or two pressure chambers.

Diaphragm Effect - The change in effective area of the diaphragm as the regulator strokes from low to high flow.

Diaphragm Plate - A plate used to transmit force in conjunction with a diaphragm and fluid pressure on a spring to the actuator stem or pusher post.

Differential Pressure - The difference in pressure between two points in a system.

Differential Pressure Regulator - A device that maintains a constant differential pressure between a reference pressure and the pressure of the controlled fluid.

Digester Gas - A gas produced by sewage treatment plants. This gas is used to power burners and engines. Because of its high methane content, stainless steel construction might be required.

Disk - A movable part that is positioned in the flow path to modify the rate of flow through the valve. It is often made of an elastomer material to improve shutoff capability.

Downstream - Any site beyond a reference point (often a valve or regulator) in the direction of fluid flow.

Drift - A change in setpoint over an extended period of time.

Droop - The amount a regulator deviates below its setpoint as flow increases. Some regulators exhibit boost instead of droop.

DVGW - Deutscher Verein des Gas - und Wasserfaches e.v. (German approval agency).

Dynamic Unbalance - The force exerted on a valve plug when fluid is flowing through the valve.

E

Effective Area - In a diaphragm actuator, the part of the diaphragm area that generates operating force. The effective area is less than the total area. (The effective area of a diaphragm might change as it is stroked, usually being a maximum at the start and a minimum at the end of the travel range. Molded diaphragms have less change in effective area than flat-sheet diaphragms.)

End Connection - The style of joint used to make a pressure tight connection between the valve body and the pipeline.

Entropy - A thermodynamic quantity that measures the fraction of the total energy of a system that is not available for doing work.

Enthalpy - Total heat content, expressed in BTU per pound, above an arbitrary set of conditions chosen as the base or zero point.

External Pressure Registration - A regulator with a control line. The actuator pressure is isolated from the body outlet pressure within the regulator.

External Static Line - The same as control line.

F

Face-to-Face Dimension - The dimension from the face of the inlet opening to the face of the outlet opening of the regulator.

Fail-Closed - In the event of a regulator failure, a condition wherein the valve port remains closed. All regulators can fail open or closed.

Fail-Open - In the event of a regulator failure, a condition wherein the valve port remains open. All regulators can fail open or closed.

Filter/Supply Regulators - Pressure reducing regulators used in air service to simultaneously filter and reduce pressure. Used to supply process control instruments pneumatic power. Also called airsets.

First-Stage Regulator - A regulator used to reduce inlet pressure to a set value being fed to another regulator in series.

Fixed Factor Measurement - The measurement of gas at a controlled elevated pressure without the use of an automatic correcting device to correct the volume for variation from base or contract pressure. This is accomplished by placing an accurate regulator upstream of the meter. Also known as PFM (Pressure Factor Measurement).

Fixed Restriction - A small diameter hole in the pilot or piloting system that determines gain.

Flange - End connections of regulator valve bodies used for bolting onto another fitting or pipe element.

Flange Facing - The finish on the end connection of valves.

Flashing - A condition when liquid changes to the vapor state caused by pressure reduction inside a valve.

Flow Capacity - The rated flow through a regulator under stated inlet, outlet and droop pressures.

Flow Characteristic - Relationship between flow through the valve and percent rated travel.

Flow Coefficient - See C_v, C_s, C_g, C_1.

Flow Rate - The amount (mass, weight or volume) of fluid flowing through a valve body per unit of time.

Fluid - Materials in a liquid, gas or vapor state, as opposed to a solid.

Fuel Gas - A commonly distributed gas used for fuel, such as natural gas, propane, landfill gas, etc.

Full Capacity Relief - A relief valve that has the capability of maintaining downstream pressure to within certain limits in the event of some type of failure, by venting the excess gas to the atmosphere.

G

Gage Pressure - (psig or bar g) The difference between atmospheric pressure and the pressure being measured. Also written as gauge pressure.

Gas - That state of matter which expands to fill the entire container which holds it. Gas is one of the forms of matter (solid, liquid and gas).

Gas Utilization Equipment - Any device which utilizes gas as a fuel or raw material or both.

Gauge Pressure - Pressure reading as shown on a gauge (psig or bar g). The difference between atmospheric pressure and the pressure the gauge is measuring. Also written as gauge pressure.

Glossary of Terms

Gauge, Pressure - An instrument that measures the pressure of a fluid.

Governor - An attachment to a machine for automatic control or limitation of speed. Also, an archaic term used for a low-pressure, direct-operated, pressure reducing gas regulator.

H

Hard Facing - A material harder than the surface to which it is applied. Used to resist galling or fluid erosion.

Header - A piping configuration where a number of pipes are combined at one location.

Hunting - A condition in which a regulator's outlet pressure slowly fluctuates on either side of a setpoint.

Hysteresis - A deviation from setpoint caused by friction and parts clearance.

I

Impulse Line - See control line.

Inch of Water Column - A unit of pressure measurement. The pressure required to support a column of water one inch high. Typically reported as inches w.c. (water column); 27.68 inches of water column is equal to one pound per square inch (psi).

Inlet Pressure - The pressure at the inlet opening of a valve (P_1).

Inlet Pressure Sensitivity - The increase or decrease in the outlet pressure caused by changes in the inlet pressure which results in differing degrees of force being applied to the seat disk and diaphragm.

Internal Relief Valve - A small, spring-loaded pressure relief valve contained within the regulator at the center of the diaphragm to prevent outlet pressure from exceeding a predetermined pressure.

Isolation Valve - Refer to Valve, Isolation.

I/O - Input/Output -- Electrical inputs and electrical outputs.

J - K

K_m - Value recovery coefficient - used in liquid sizing equations to determine ΔP allowable for cavitation.

Kinematic Viscosity (kin visc) - The relative tendency of fluids to resist flow. The value of the kinematic viscosity includes the effect of the density of the fluid. The kinematic viscosity is equal to the absolute viscosity divided by the density. Refer to Viscosity, Kinematic.

L

LCD - Liquid crystal display; readout panel which displays alphanumeric sequences in digital format.

Landfill Gas - A gas produced by decaying organic matter in a garbage landfill. This gas is used to power burners and engines. This gas has a high methane content and may contain other gases; therefore, stainless steel construction is usually required.

Liquid Expansion Thermal System - A closed system containing liquid whose expansion and contraction in response to temperature changes provides the power to position a valve member.

Liquefied Petroleum Gas (LPG) - Butane, propane or a mixture of the two, obtained from oil or gas wells or as a by-product from the refining of gasoline. It is sold in metal bottles under pressure as a liquid; hence, sometimes called bottled gas.

Loading Element - In a regulator, the means for placing a measured amount of force against the regulator's diaphragm. The loading element is commonly a spring.

Loading Pressure - The pressure employed to position a pneumatic actuator. (This is the pressure that actually works on the actuator diaphragm or piston to change the position of the valve plug.)

Lockup Pressure - Increase over setpoint when the regulator is at no-flow condition.

M

Maximum Allowable Operating Pressure (MAOP) - The maximum pressure that the system may be operated at as determined by its components, taking into account function and a factor of safety based on yield of parts or fracture.

Maximum Operating Pressure - The maximum pressure existing in a piping system during normal operation.

Measuring Element - A diaphragm that senses (measures) changes in downstream pressure and causes the regulator restricting element to move toward the open or closed position.

Meters Cubed per Hour (Normal or Standard) - Refer to Nm^3/h or Sm^3/h.

Minimum Controllable Flow - The lowest flow at which a steady regulated condition of the controlled variable can be maintained.

Modbus - Protocol used for communications between electronic devices developed by Gould Modicon.

N

NACE - National Association of Corrosion Engineers

Natural Gas - A hydrocarbon gas consisting mainly of methane.

Needle Valve - Refer to Valve, Needle.

Nm³/h - meters cubed per hour (normal); measurement of volume rate of a gas at atmospheric pressure and 0°C. Also refer to Sm^3/h.

NPT - National Pipe Thread, a standard for tapered thread used on pipes and pipe fittings.

O

Offset - The deviation from setpoint for a given flow. Negative offset is equivalent to droop.

Operating Pressure - The actual pressure at which a device operates under normal conditions. This pressure may be positive or negative with respect to atmospheric pressure.

Orifice - A fixed opening, normally the inside diameter of a seat ring, through which fluid passes. The term can also refer to the inlet or outlet of a regulator or pilot valve. Also called a port.

Outlet Pressure (Reduced Pressure) - The pressure leaving the outlet opening of a valve (P_2).

Over-Pressure Cut-Off Device - A mechanical device incorporated in a gas pipework system to shutoff the supply of gas when the pressure at the sensing point rises to a predetermined value.

P

P_1 - Inlet or upstream pressure.

P_2 - Outlet or downstream pressure.

PFM (Pressure Factor Measurement) - The measurement of gas at a controlled elevated pressure without the use of an automatic correcting device to correct the volume for variation from base or contract pressure. This is accomplished by placing an accurate regulator upstream of the meter. Also known as Fixed Factor Measurement

PID - Proportional/Intergral/Derivative device. Usually used as a controller.

Pilot (Amplifier) - A relatively small controlling regulator that operates the main regulator. They are used to increase accuracy.

Piston Actuated Regulator - A regulator utilizing a piston rather than a diaphragm actuator.

Pitot Tube - A hollow tube that connects the area beneath the regulator diaphragm with the vena contracta area of gas flow. The pitot tube causes the diaphragm to sense a pressure lower than that which exists downstream of the regulator and thus allows the regulator to open more for any given change in downstream pressure. The result is increased regulator accuracy.

P_L - Loading pressure. Pressure of fluid on the main diaphragm that is controlled by a pilot regulator.

Plug - Piece that throttles against an orifice to increase and decrease flow.

Poise - A metric unit for measuring absolute viscosity. One poise equals one dynesecond per square centimeter or one gram per centimeter second.

Port - A fixed opening, normally the inside diameter of a seat ring, through which fluid passes. The term can also refer to the inlet or outlet of a regulator or pilot valve. Also called an orifice.

Powder Paint Coating - A paint process that uses dry powder with no solvents for surface finish. Dry powder can be reused, thereby reducing waste and pollutants. The powder coating over a clean surface provides better corrosion resistance than liquid coat.

Pressure - Force per unit area.

Pressure Buildup - In a relief valve, the pressure increase above setpoint required to produce a given flow rate.

Pressure Differential - The difference in pressure between two points in a system.

Pressure Drop - The difference between the inlet and outlet pressures.

Pressure Reducing Regulator - A valve that satisfies downstream demand while maintaining a constant reduced pressure. As the pressure decreases, the valve opens to increase flow.

Pressure Relief Valve - A valve that opens and closes to ensure that pressure does not rise above a predetermined value.

Propane - An easily liquefiable hydrocarbon gas. Propane is one of the components of raw natural gas and it is also derived from petroleum refining processes. Its chemical formula is C_3H_8.

Proportional Band (Amount of Deviation) - The amount a regulator deviates from setpoint as the flow increases from minimum to maximum. Also referred to as droop or offset.

psia - pounds per square inch, absolute - The pressure above a perfect vacuum, calculated from the sum of the pressure gauge reading and the (local or ambient) atmospheric pressure (approximately 14.7).

psid - Pounds per square inch, differential.

psig - Pounds per square inch, gauge. The pressure above atmospheric pressure. Near sea level the atmospheric pressure is approximately 14.7 pounds per square inch.

Q - R

Range - The region between the limits within which a quantity is measured, received or transmitted, expressed by stating the lower and upper range values (Example: 3 to 15 psi; -40 to 212°F / -40 to 100°C).

Rangeability - The ratio of maximum rated capacity to the minimum controllable flow within the specified accuracy band.

Rate of Flow - The volume of material passing a given point in a system per unit of time.

Rated Working Pressure - The maximum allowable pressure specified by the manufacturer.

Glossary of Terms

Reduced Pressure - The pressure leaving the outlet opening of a valve (P_2). More commonly called outlet pressure.

Regulator, Direct-Operated - See Pressure Reducing Regulator.

Regulator, Pilot-Operated - Two regulators connected so that one increases the effect of downstream pressure changes on the other. This arrangement is used to provide increased accuracy and flow capacity compared to direct-operated regulators.

Relief Valve - See Pressure Relief Valve.

Relief Valve, Pilot-Operated - Two relief valves connected so that one increases the effect of inlet pressure changes on the other. This arrangement is used to provide increased capacity and reduced buildup compared to other relief valve types.

Relief Valve, Pop Type - A spring-loaded poppet type relief valve.

Repeatability - The closeness of agreement of a regulated value when returned to the same steady-state conditions after upset(s).

Reseat Point - In a relief/backpressure valve which is opened by an increase in inlet pressure, the point where the valve closes.

Restricting Element - The element that restricts and controls fluid flow in a system. In a regulator this element is typically a disk and orifice combination or plug and cage assembly.

RTD - Resistance Temperature Detector. A resistance device used to measure temperature.

RTU - Remote Terminal Unit or Remote Telemetry Unit.

S

SAE Number Viscosity - Refer to Viscosity, SAE Number.

Saybolt Furol - A scale used for measuring the viscosity of heavy oils. The instrument has a larger orifice and is used at a higher temperature than the Saybolt Universal instrument used for lighter oils.

Saybolt Universal - A scale used for measuring the viscosity of oil, expressed in seconds required for a specified amount of oil to flow through an orifice; hence, the larger the number of seconds, Saybolt Universal (SSU), the more viscous the oil.

SCFH - Standard cubic feet per hour. Volumetric gas measurement of flow per hour at standard or at base conditions.

Seat - The portion of the seat ring or valve body which a closure member contacts for shutoff.

Seat Leakage - Flow of fluid past a seat or seal when in the closed position.

Seat Ring - A separate piece inserted in a valve body to form a valve body port. It generally provides a seating surface for a plug or disk.

Self-Contained Regulator - Pressure control device that is powered by the process media pressure and does not require outside energy.

Setpoint - The pressure at which the regulator or relief valve is set to control.

Set Pressure Range - The range of pressures, specified by the manufacturer, within which the device can be adjusted.

Sm^3/h - meters cubed per hour (standard); measurement of volume rate of a gas at atmospheric pressure and 60°F. Also refer to Nm^3/h.

Soft Seat - An elastomeric, plastic or other readily deformable material used either in the valve plug or seat ring to provide tight shutoff with minimal force.

Sonic Velocity - The speed of sound for a particular gas at a given inlet pressure and temperature.

Sour Gas - Gaseous fuel that contains a relatively large proportion of sulfur or sulfur compounds. See the discussion on Sulfide Stress Cracking in the Technical Section.

Specific Gravity - The ratio of weight of a given volume of fluid to the weight of an equal volume of liquid/gas at stated temperature.

Speed of Response (Stroking Speed) - The amount of time it takes the valve plug or disk to travel from completely closed to completely open (0 to 100%).

Spring - Part used as the loading element in a regulator. Length is adjusted to establish setpoint.

Spring Adjustment Screw - A screw used to compress the spring to establish the regulator setpoint.

Spring Rate (K) - Spring rate is defined by the amount of force required to compress a spring a given distance. Spring rate is given in force/length (for example, lbf/in).

Stability - The ability to hold a steady controlled variable within the limits of stated accuracy of regulation.

Standard Atmosphere - The accepted normal atmospheric pressure at sea level, equal to 14.696 pounds per square inch.

Standard Barometer - The reading of a barometer for standard atmospheric pressure; equal to 29.92 inches of mercury column.

Standard Gravity - Standard accepted value for the force of gravity. It is equal to the force which will produce an acceleration of 32.17 feet per second per second.

Standard Pressure - The same as standard atmosphere; equal to a pressure of 14.696 pounds per square inch.

Static Line - See Control Line.

Static Pressure - The pressure in a fluid at rest.

Static Unbalance - The force exerted on a valve plug due to fluid pressure in the non-flowing condition.

Stoke - The cgs unit of kinematic viscosity. One stoke equals one centimeter squared per second.

Supercompressibility - Many gases are more compressible under high pressure at ordinary temperatures than indicated by Boyle's Law. These gases, measured at the high pressures, will occupy a greater volume when the pressure is reduced to near atmospheric pressure.

SUS (or SSU) Viscosity - Refer to Viscosity, SUS (or SSU).

T - U

Therm - 100,000 BTU.

Thermostat - A device that automatically maintains a predetermined temperature in an appliance or component.

Travel - The amount of linear movement of the valve closure member from the closed position to the rated full-open position.

Travel Indicator - An external, visible device used to indicate the travel of the valve plug.

Trim - The replaceable internal parts of a regulator, usually made up of a seat ring or orifice, valve plug or disk and disk holder and stem; other replaceable internal parts may be considered trim.

Under-Pressure Cut-Off Device - A mechanical device incorporated in a gas pipe work system to shutoff the supply of gas when the pressure at the sensing point falls to a predetermined figure.

V

Vacuum Breaker - A valve used to limit an increase in vacuum. An increase in vacuum (decrease in absolute pressure) beyond a certain value registers on the diaphragm. The valve disk will open permitting atmospheric, positive pressure or an upstream vacuum that has a higher absolute pressure than the downstream vacuum, to enter the system and restore to setpoint.

Vacuum Regulator - A device that maintains a vacuum at a setpoint. A decrease in this vacuum (increase in absolute pressure) beyond this value registers underneath the diaphragm and opens the valve. This permits the downstream vacuum of lower absolute pressure than the upstream vacuum to restore the upstream vacuum to its original pressure setting.

Valve - A device used for the control of fluid. It consists of a fluid retaining assembly, one or more parts between end openings and a movable closure member which opens, restricts or closes the port(s).

Valve Body - A pressure retaining housing for internal parts having inlet and outlet flow connections.

Valve Closure Member - The movable part which is positioned in the flow path to modify the rate of flow through the valve, often made of an elastomer material to improve shutoff.

Valve Linkage - A lever or levers connecting the diaphragm to the valve plug or valve plug stem.

Valve Plug - A movable part which provides a variable restriction in a port.

Valve, Needle - A small, adjustable valve in which the position of a pointed plug or needle relative to an orifice or tapered orifice permits or restricts fluid flow.

Valve, Isolation - Simple valves located in the piping system used to isolate individual equipment. They are designed to be operable by hand and installed to be readily accessible to the consumer.

VDC - Volts direct current.

Vena Contracta - The location where cross-sectional area of the flow stream is at its minimum size, where fluid velocity is at its highest level and fluid pressure is at its lowest level. (The vena contracta normally occurs just downstream of the actual physical restriction in a regulator.)

Vent - An opening in the regulator spring case to allow atmospheric pressure access to the diaphragm, thus allowing free movement of the diaphragm during operation.

Viscosity - The tendency of a fluid to resist flow.

Viscosity, Absolute - The product of a fluid's kinematic viscosity times its density. Absolute viscosity is a measure of a fluid's tendency to resist flow, without regard to its density. Sometimes the term dynamic viscosity is used in place of absolute viscosity.

Viscosity, Kinematic - The relative tendency of fluids to resist flow. The value of the kinematic viscosity includes the effect of the density of the fluid. The kinematic viscosity is equal to the absolute viscosity divided by the density.

Viscosity, SAE Number - The Society of Automotive Engineers' arbitrary numbers for classifying fluids according to their viscosities. The numbers in no way indicate the viscosity index of fluids.

Viscosity, SUS (or SSU) - Saybolt Universal Seconds (SUS), which is the time in seconds for 60 milliliters of oil to flow through a standard orifice at a given temperature (ASTM Designation D88.56).

Volume Corrected - The volume metered times metering pressure plus atmospheric pressure/base pressure equals volume corrected.

W

Water Column - A unit of measurement. The pressure required to support a column of water one inch high. Typically reported as in. w.c. (water column); 27.68 inches of water is equal to one pound per square inch (psi).

Weight, Specific - The weight per unit volume of a substance. The same as density.

X - Y - Z

Yoke - A structure by which the diaphragm case or cylinder assembly is supported rigidly on the bonnet assembly.

Index

Products

Type 63EG 34
66 Series 48
67C Series 53
Type 99 61
Type 119 68
133 Series 71
Type 252 81
289 Series 83
Type 289P 90
299H Series 95
Type 310A 118
627 Series 126
Type 627F 144
Type 630 150
634 Series 162
Type 912N 165
971 Series 168
Type 1098-EGR 171
1301 Series 180
1305 Series 184
Type 1367 187
1805 Series 190
Type 1805P 194
1808 Series 197
A/100 Series 201
A/140 Series 204
Type B 207
Type B NG 210
B/240 Series 213
Types BLE and BLX 216
BM5 Series 219
BM6X Series 224
BM7 Series 228
CNF, CN, CF Series 231
CP200 Series 235
CP400 Series 242
Cronos Series 259
CS200 Series 266
CS400 Series 281
CS800 Series 303
CSB400 Series 337
CSB600 Series 345
CSB700 Series 354
Type Dosaodor-D / Electronic Control Unit 363
Type Dosaodor-D / ROC809 369
EZH Series 373
Type EZH Relief 388
EZL Series 393
EZR Series 404
Type EZR Relief 426
FA, FAG Series 436
FL Series 447
Type FL Relief 454
FloBoss™ 103 459
FloBoss™ 104 461
Type H120 463
H200 Series 465
Type HSR 467
M Series 480
MIC, MIF, MIR Series 490
OL Series 495
Type OSE 496
Type P590 501
R Series 502
Type R622 506
Regal 3 Series 511
ROC800 Series 515
RP Series 517
Type RPE 525
Skids 527
Types SR, SRII, SRS, STP, STL and Whisper Trim™ 529
VS100 Series 531
VFA Series 535
V Series 538
Y600A Series 543

Products by Application

Accessories

Butterfly Valve Soft Seated Body

VFA Series 535

Electric Pilot Heater

Type RPE. 525

Filters

Type 252 81

Type P590 501

FA, FAG Series 436

Heat Exchangers

CF, CN, CNF Series 231

Silencers

Types SR, SRII, SRS, STP, STL and Whisper Trim™. 529

Switching Valve

Type 119 68

City Gate / District Station

Type 99 61

133 Series. 71

Type 310A. 118

971 Series 168

Types 1098-EGR and 1098H-EGR 171

Cronos Series 259

EZH Series 373

EZL Series 393

EZR Series. 404

FL Series 447

M Series 480

Commercial / Industrial Service

Type 99 61

133 Series. 71

299H Series 95

627 Series. 126

Type 627F 144

Type 912N 165

Type 1098-EGR 171

A/100 Series 201

A/140 Series 204

B/240 Series 213

CP200 Series 235

CP400 Series 242

Cronos Series 259

CS200 Series 266

CS400 Series 281

CS800 Series 303

CSB400 Series 337

CSB600 345

CSB700 354

EZL Series 393

R Series 502

Regal 3 Series 511

RP Series 517

Y600A Series 543

Electronic Flow and Pressure Measurement

FloBoss™ 103 459

FloBoss™ 104 461

ROC800 Series 515

Farm Tap / Field

627 Series 126

Type 627F 144

Type 630 150

Index

Fixed Factor Billing / Pressure Factor Measurement

Type 99 61
299H Series 95
Type 627F 144
Type 1098-EGR 171
CP200 Series 235
CP400 Series 242
CS200 Series 266
CS400 Series 281
CS800 Series 303
CSB400 Series 337

Fuel Gas Regulators

66 Series 48
Type 99 61
133 Series 71
299H Series 95
Type 912N 165
Type 1098-EGR 171
CS200 Series 266
CS400 Series 281
CS800 Series 303
CSB400 Series 337
Y600A Series 543

Odorizing Systems

Type Dosaodor-D / Electronic Control Unit 363
Type Dosaodor-D / ROC809 369
OL Series 495

Relief Valves / Backpressure Regulators

Type 63EG 34
289 Series 83
Type 289P 90
1805 Series 190
Type 1805P 194
1808 Series 197
Type EZR 404
Type EZH Relief 426

Relief Valves / Backpressure Regulators (continued)

Type FL Relief 454
Type H120 463
H200 Series 465
V Series 538

Residential / Utilization Service

Type B 207
Type B NG 210
Type HSR 467
R Series 502
Type R622 506

Shutoff Devices

634 Series 162
BM5 Series 219
BM6X Series 224
Type BM7 228
Type OSE 496
VS100 Series 531
Skids 527

Supply Regulators

67C Series 53
1301 Series 180
1305 Series 184
Type 1367 187

Transmission

Type 310A 118
Types BLE and BLX 216
Cronos Series 259
EZH Series 373
EZR Series 404
FL Series 447

Underground Modules

M Series 480

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Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

Notes

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