January 2014

299H Series Pressure Reducing Regulators

- **Inlet Pressure up to 175 psig / 12.1 bar**
- **Compact**
- **Integral Pilot**
- **±1% Accuracy for Fixed Factor Billing (PFM)**
- **Rugged Construction**
- **Easy to Maintain**

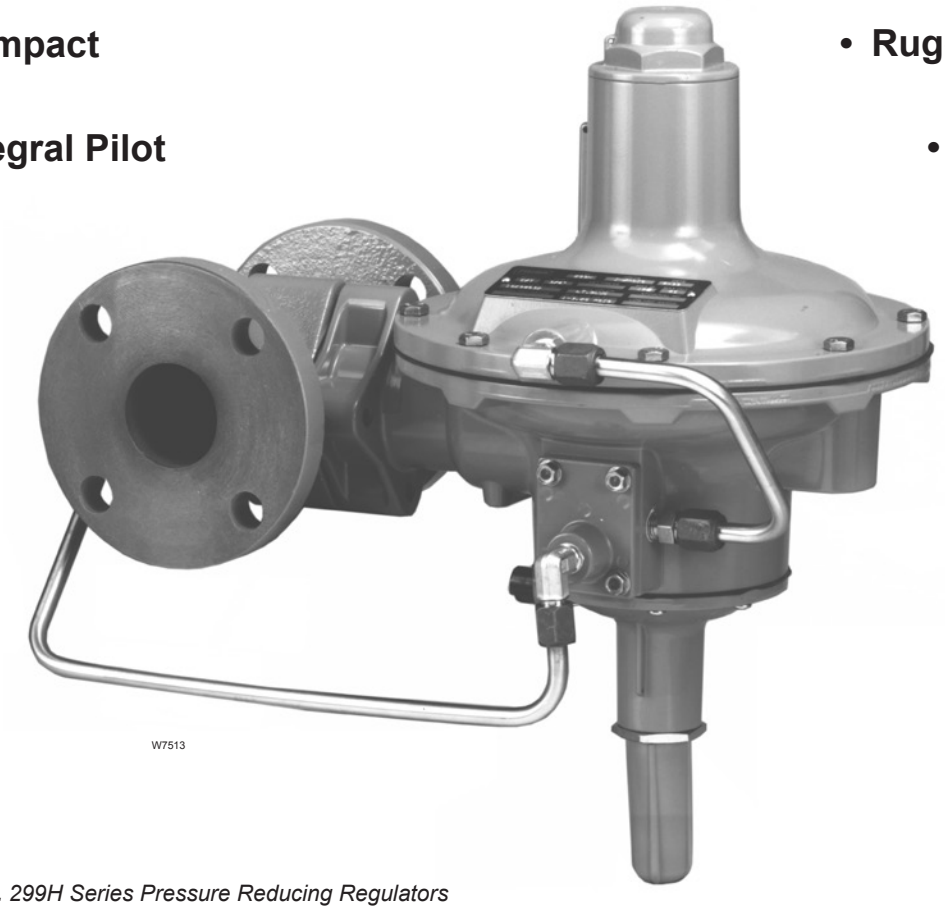

Figure 1. *299H Series Pressure Reducing Regulators*

- **Optional Slam-Shut Configuration**
- **High Capacity**
- **Robust**
- **Outlet Pressures up to 60 psig / 4.1 bar**
- **No Bleed Monitor**
- **External, Internal or Dual Registration**
- **Optional Token Relief**

D102683X012

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Specifications

Specifications for 299H Series constructions are given below. Some specifications for a given regulator as it originally comes from the factory are stamped on a nameplate located on the actuator upper casing.

Available Constructions

Type 299H: Pilot-operated pressure reducing regulator with a pilot integrally mounted to the actuator casing.

Type 299HR: A Type 299H with a token internal relief valve to relieve minor overpressure caused by thermal expansion.

Type 299HS: Same as the Type 299H with a Type VSX-2 slam-shut valve which provides overpressure or overpressure and underpressure protection.

Type 299HSR: Same as the Type 299HS with an internal token relief valve.

Body Size and End Connection Styles

See Table 1

Maximum Operating Inlet Pressure by Orifice Size(1)

1/4 x 3/8 inch / 6.4 x 9.5 mm	175 psig / 12.1 bar
3/8 inch / 9.5 mm	175 psig / 12.1 bar
1/2 inch / 13 mm	175 psig / 12.1 bar
3/4 inch / 19 mm	150 psig / 10.3 bar
7/8 inch / 22 mm(5)	125 psig / 8.6 bar
1 inch / 25 mm(5)	100 psig / 6.9 bar
1-3/16 inch / 30 mm(5)	80 psig / 5.5 bar

Maximum Casing and Emergency Outlet Pressure(1)

66 psig / 4.5 bar

Outlet (Control) Pressure Ranges(1)(2)

See Table 2

Maximum Set Pressure for Type 299HS(1)

16 psig / 1.1 bar

Maximum Set Pressure for Slam-Shut Device(1)

23 psig / 1.6 bar

Minimum and Maximum Trip Pressure Ranges

See Table 4

Type VSX-2 Sensing Line Connection

1/4 NPT

Flow Coefficients

See Table 3

Flow Capacities

See Tables 5 through 10

Pressure Control Accuracy (Fixed Factor) (PFM)

±1%(3) of absolute control pressure

Minimum Differential Pressure For Full Stroke

1.5 psid / 0.10 bar d

Control Line Connections

3/4 NPT; See Figures 8 and 9

Temperature Capabilities(1)

-20 to 150°F / -29 to 66°C

Approximate Weight

21 pounds / 10 kg

Pressure Registration

Internal, External or Dual Registration
See Figure 3

Fixed Restriction Sizes

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

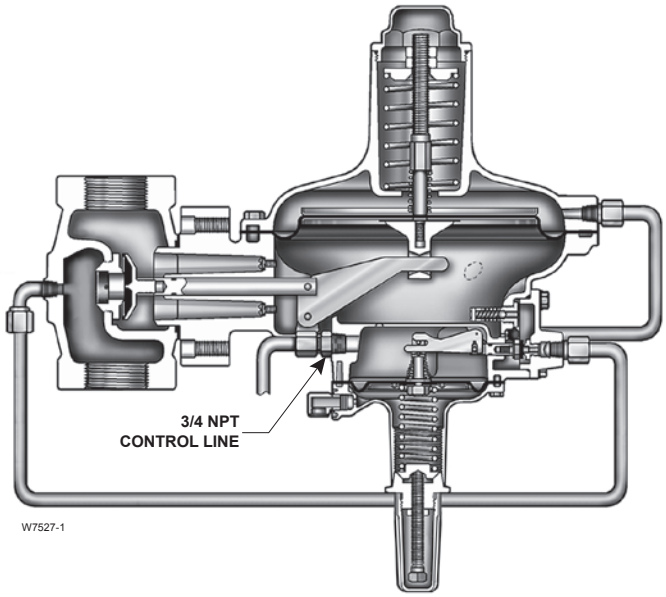
Options

- **Filter(3):** A P590 Series filter installed in the pilot supply tubing between main body and pilot
- **Filtered pilot supply regulator(3)(4):** A Type 67CF supply regulator with integral 5 micron Polyethylene filter

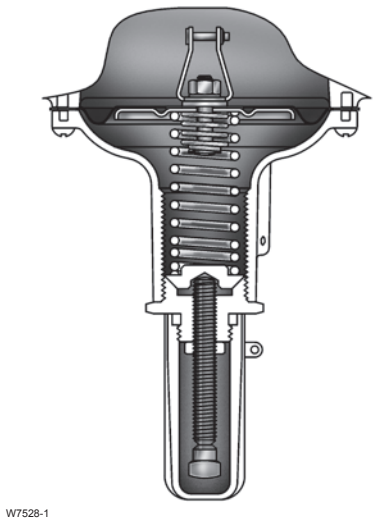
Construction Materials

Actuator Upper Casings: Aluminum
Actuator Lower Casing: Aluminum
Pilot Spring Case: Aluminum
Actuator Diaphragm: Nitrile (NBR)
Pilot Diaphragm: Nitrile (NBR)
Pilot Inlet Screen: Stainless steel
Valve Body: Cast iron, Ductile iron or Steel
Orifice and Valve Stem: Aluminum
Disk Holder: Aluminum holder with Nitrile (NBR) disk
Main Disk Construction: Nitrile (NBR)
Metal Trim Parts For Pilot: Aluminum
Pilot Disk Construction: Nitrile (NBR)
O-rings: Nitrile (NBR)
Fittings: Steel (**standard**) or Stainless steel
Tubing: Stainless steel

1. The pressure/temperature limits in this Bulletin and any applicable standard or code limitation should not be exceeded.
2. For optimum performance, a pilot supply regulator may be installed in the pilot supply tubing between the main valve and pilot.
3. 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.
4. For inch w.c., use a pilot supply regulator if actual inlet pressure varies more than ±20 psi / ±1.4 bar and published accuracy is required.
5. This orifice size is not available for Types 299HS and 299HSR.



TYPE 299H WITH EXTERNAL REGISTRATION



TYPE 299HR PILOT WITH OPTIONAL TOKEN RELIEF

Figure 2. *299H Series Sectional Views*

Features

- **Compact in Size—**Small envelope because of the built-in pilot and internal registration.
- **Unique No Bleed Monitor System—**Flexible worker/monitor system setup that allows for bleed to be piped to the intermediate piping thus eliminating downstream bleed which reduces lost and unaccounted for gas. Another advantage of this configuration is that the system lockup pressure is that of the worker instead of the monitor.
- **Not an Adaptation of Existing Regulators—** New design of integrated cases and internal registration ports.
- **Wide Variety of Applications—**Natural gas distribution systems, gas supply to industrial boilers, furnaces, ovens, mixers, plant air service.
- **Highest Quality—** Designed and manufactured to ISO 9001 standards.
- **Accuracy—**Keeps constant inlet pressures to downstream equipment by accurately controlling distribution system pressures at widely varying flow rates and supply pressures for maximum efficiency and best operation or by eliminating the need for pressure-compensating meters by holding a steady pressure to the meter inlet.
- **Optional Token Relief—**The Types 299HR and 299HSR with an integral token relief in the pilot is designed to relieve minor overpressure caused by thermal expansion.
- **High-Capacity Pressure Control—**Actuator diaphragm responds quickly to downstream pressure change, causing immediate correction in main valve position. Pilot responds simultaneously and controls final positioning of main valve. This action permits full main valve travel, resulting in higher capacity than could be obtained without an external pilot regulator.
- **Easy Registration Conversion—**Two screws and O-rings change internal registration to external or dual registration.
- **Easy Startup—**No special procedure required.
- **Easy to Maintain—**Main valve disk and orifice can be inspected without removing body from pipeline. Easy access two bolt flange permits quick removal of actuator and pilot from body.
- **Economical, Labor-Saving Installation—**Supply pressure to pilot is factory-piped directly from inlet side of main regulator body, thus requiring no upstream pilot supply line on standard installations.
- **Rugged Construction—**With a two bolt connection of the regulator to the body and no union ring, the 299H Series regulators are designed for longer service life with minimal maintenance requirements.
- **No gaskets—**Reusable O-rings at all serviceable joints.
- **Startup Protection—**The main valve and the pilot are designed with reverse pressure mechanisms to prevent damage during startup or sudden increase in downstream pressure.
- **Fewer Parts—**Fewer recommended parts needed for spare parts inventory.

Introduction

Description

WARNING

Since a pilot-operated regulator is constructed of both a pilot and a main valve, do not exceed the maximum inlet pressure shown on the nameplate.

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.

Options

P590 Series Pilot Supply Filter

The optional P590 Series pilot supply filter prevents pipeline debris from entering the pilot; a primary cause of pilot clogging. When the upstream system is free of debris, the 299H Series regulators may be installed without a pilot supply filter.

Type 67CF Filtered Pilot Supply Regulator

When it is necessary to install a pilot supply regulator, an optional Type 67CF filtered pilot supply regulator may be installed. For example, on applications with inches of water column setpoints and inlet pressure variations of more than ±20 psig / ±1.4 bar it may be necessary to install a Type 67CF to maintain published accuracy.

Principle of Operation

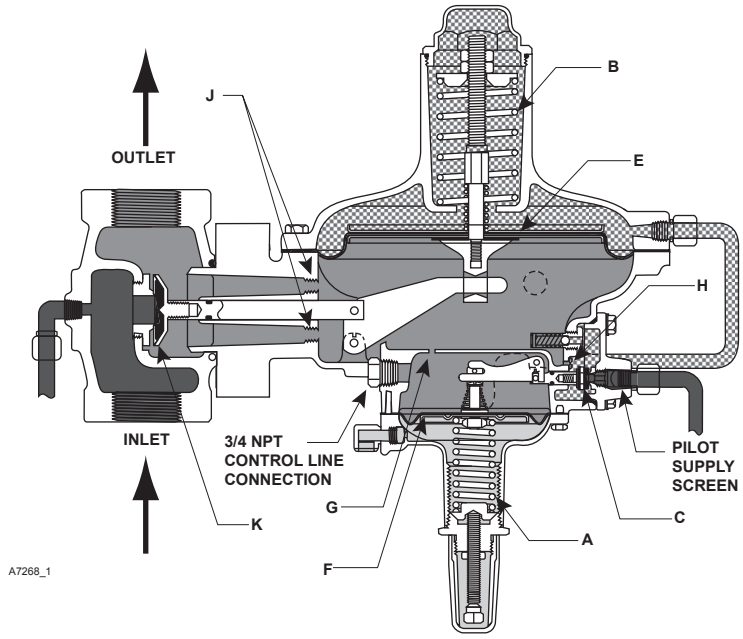
Letter keys in this section refer to Figure 3 unless otherwise noted. Fast response and accuracy are made possible by the amplifying effect of the pilot and by the two-path control system. The function of the pilot is to sense change in the controlled outlet pressure and amplify it into a larger change in the loading pressure. Any changes in outlet pressure act quickly on both the actuator diaphragm and the loading pilot, thus providing the precise pressure control and fast speed of response that is characteristic of a two-path system.

Upstream or inlet pressure is utilized as the operating medium, which is reduced through pilot operation to load the main diaphragm chamber. Tubing connects the inlet pressure to the pilot. Downstream or outlet pressure registers underneath main diaphragm (E) and on top of pilot diaphragm (F). There are three different versions of pressure registration for the Type 299H.

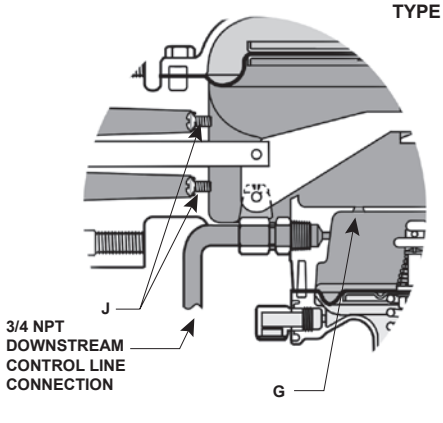
Internal registration (screws and O-rings (J) removed)—Outlet pressure is registered through the throat to the main diaphragm chamber and through a small port (G) to the top of the pilot diaphragm. Internal registration is used for ease of installation. Capacity is somewhat limited because of droop and/or boost associated with sensing pressure within the body.

External registration—Screws and O-rings (J) block the throat and a downstream control line is connected to the pilot diaphragm chamber which is connected to the lower main diaphragm chamber by a small port (G). The other end of the control line connects to the downstream pipeline. External registration is used for higher capacity and/or the upstream regulator in a monitor set. It also allows monitoring for inlet pressures over 66 psig / 4.5 bar. Capacity is increased because of better registration of pipeline pressure when a control line is used. The alternate 3/4 NPT control line connection (on the side of the pilot) can be used for piping convenience, see Figures 8 and 9.

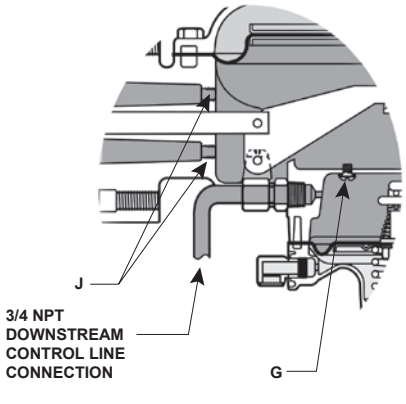
Dual registration (screws and O-rings (J) removed)—The lower main diaphragm chamber registers outlet pressure through the throat and the pilot diaphragm chamber registers downstream pressure by use of a downstream control line. The port (G) between the chambers is blocked by inserting a screw and O-ring (J) that was removed from the throat and the control line runs from the pilot to the downstream pipeline. Dual registration, with its larger orifice (control line must be piped to the primary 3/4 NPT connection on the side of the pilot), provides an improved performance as compared to internal pressure registration when used in low flow rate and high pressure drop applications. It is also used for no downstream bleed monitoring systems with inlet pressures up to 66 psig / 45 bar.



TYPE 299H WITH INTERNAL REGISTRATION



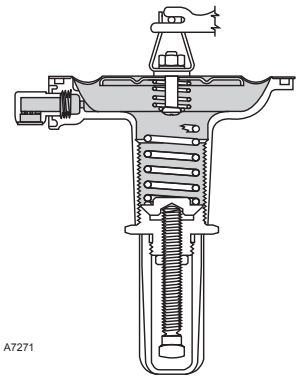
EXTERNAL REGISTRATION



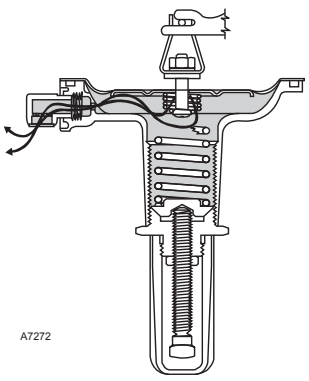
DUAL REGISTRATION

INLET PRESSURE
OUTLET PRESSURE
ATMOSPHERIC PRESSURE
LOADING PRESSURE

Figure 3. *Type 299H Operational Schematic*



TOKEN RELIEF CLOSED



TOKEN RELIEF OPEN

Figure 4. *Type 299HR Operational Schematic*

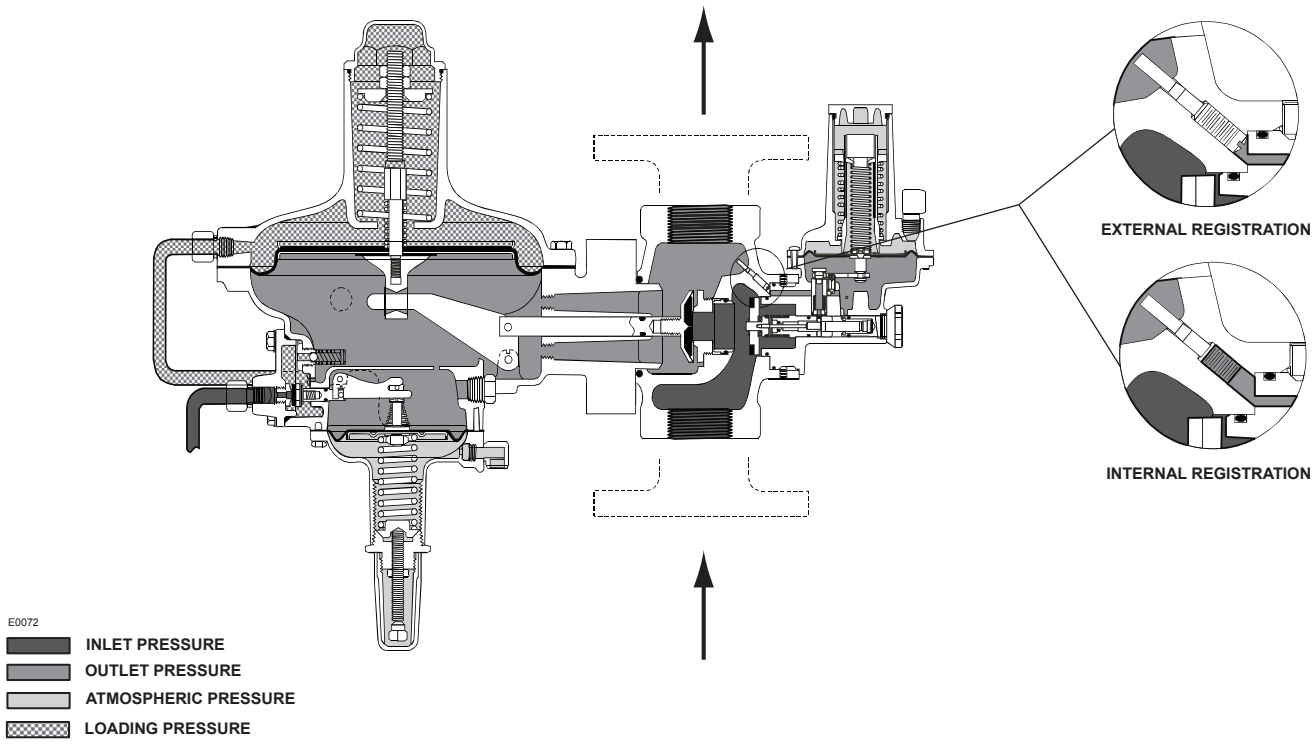


Figure 5. *Type 299HS Operational Schematic*

Type 299H

In operation, assume the outlet pressure is less than the setting of pilot control spring (A). The top side of pilot diaphragm assembly (F) will have a lower pressure than the setting of spring (A). Spring (A) forces the diaphragm assembly upward, opening the pilot orifice (C). Additional loading pressure is supplied to the top side of the main diaphragm (E).

This creates a higher pressure on the top side of main diaphragm (E) than on the bottom side, forcing the diaphragm downward. This motion is transmitted through a lever, which pulls the valve disk (K) open, allowing more gas to flow through the valve.

When the gas demand in the downstream system has been satisfied, the outlet pressure increases. The increased pressure is transmitted through the downstream control line (for external or dual registration) or through the port (G) (for internal registration) and acts on top of the pilot diaphragm (F). This pressure exceeds the pilot spring setting and forces the diaphragm down, closing the orifice (C). The loading pressure acting on main diaphragm (E) bleeds to the downstream system through a bleed restriction (H).

With a decrease in loading pressure on top of main diaphragm (E), main spring (B) exerts an upward force on the diaphragm post connected to main diaphragm (E), pulling it upward. This moves the main valve disk (K) toward its seat, decreasing flow to the downstream system.

Type 299HR

Refer to Figure 4. The Type 299HR provides an integral token relief valve. During an overpressure condition the spring on the pilot post will allow the diaphragm head to travel to the spring case. As the diaphragm head moves a small amount of gas is relieved.

Note

The Type 299HR is not a full capacity relief device. Approximate start-to-discharge pressure is dependent on set pressure, see Figure 7.

During normal operation the Type 299HR performance is identical to the Type 299H. If an overpressure condition occurs, the pilot diaphragm head will separate from the pilot diaphragm post and travel until it contacts the pilot spring case. The movement of the diaphragm head creates a path and a token or noticeable amount of gas will be released.

When the overpressure condition ceases, the pilot diaphragm head will return to the diaphragm post and the regulator will return to normal operation.

Table 1. *Body Sizes and End Connection Styles*

BODY SIZE, NPS / DN	BODY MATERIAL AND END CONNECTION STYLES		
	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 inches / 191 or 254 mm.

Table 2. *Outlet Pressure Ranges*

OUTLET (CONTROL) PRESSURE RANGE		TYPE		PILOT CONTROL SPRING					
		299H	299HR, 299HS and 299HSR	Part Number	Color	Free Length		Wire Diameter	
Inch w.c.	mbar					Inch	mm	Inch	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.

Type 299HS

Refer to Figure 5. The Type VSX-2 slam-shut device on the Type 299HS regulator is a fast acting slam-shut valve which provides overpressure or overpressure and underpressure protection by completely shutting off the flow of gas to the downstream system. The slam-shut module's actions are independent of the Type 299HS main regulator and of variations to the inlet pressure. The Type VSX-2 has internal or external registration. External registration requires a downstream sensing line.

The slam-shut disk is held in the open position (reset position) by a small ball holding the disk stem. If the pressure below the diaphragm increases (or decreases) reaching the Type VSX-2 setpoint, the diaphragm will travel upwards (or downwards) operating a lever which in turn releases the ball.

Once the ball is released, the spring force on the stem will push the stem and disk to the closed position against the seat shutting off all gas flow. The pilot supply pressure is also shut off when the Type VSX-2 is closed. The manual reset has an internal bypass to equalize the reset pressure on either side on the slam-shut disk.

In order for the Underpressure Shutoff (UPSO) of any slam shut to be triggered, the downstream pipe pressure must drop below the UPSO setpoint. In the case of a downstream line break, numerous factors can prevent the downstream pipe pressure from decreasing below the slam-shut UPSO setpoint. These factors include the distance of pipe to the break, the diameter of the pipe, size of the break and the number of restrictions, such as valves, elbows and bends, downstream of the regulator and/or slam-shut device. Due to these factors additional protections should be installed to stop flow in the event of a line break.

Overpressure Protection

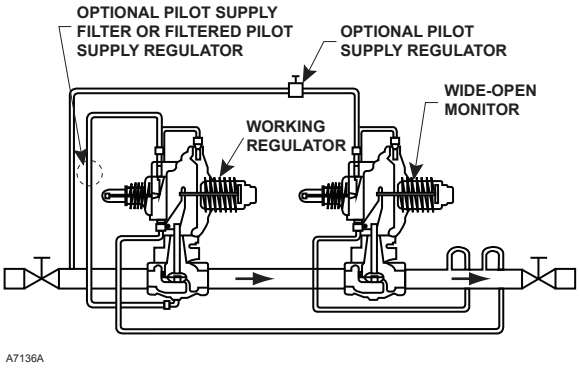
Like most regulators, the Type 299H has outlet pressure ratings lower than the inlet pressure ratings. Complete downstream overpressure protection is needed if the actual inlet pressure exceeds the outlet pressure rating.

Overpressure protection for internal parts is built into the main and pilot diaphragms by means of a small spring on each post. The springs will allow the diaphragm heads to move farther on the posts avoiding damage to or bending of the valve trim.

Overpressuring any portion of a regulator or associated equipment may cause leakage, parts damage or personal injury due to bursting of pressure-containing parts or explosion of accumulated gas. Regulator operation within ratings specified in the Specifications section and on the regulator nameplate does not preclude the possibility of damage from external sources or from debris in the pipeline. A regulator should be inspected for damage periodically and after any overpressure condition. The pilot vent is provided with a 1/4 NPT tapped connection in the spring case.

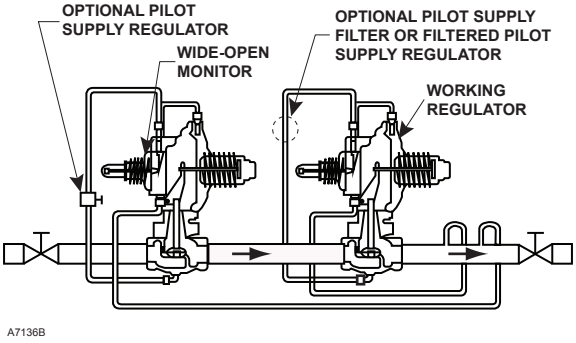
Monitoring Systems

Monitoring regulators serve as overpressure protection devices to limit system pressure in the event of open failure of a working regulator feeding the system.



NOTE: IF USED, THE PILOT SUPPLY REGULATOR SHOULD BE SET TO 3 psig / 0.21 bar ABOVE THE MONITOR OUTLET PRESSURE SETTING.

WIDE-OPEN DOWNSTREAM MONITOR



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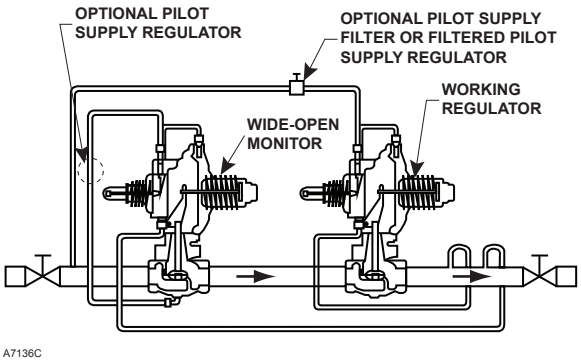
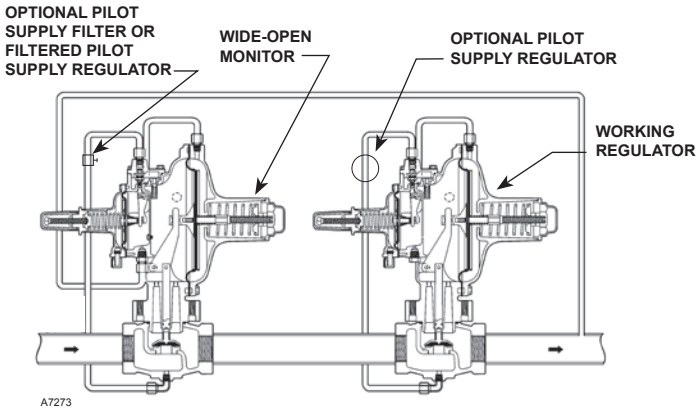
WIDE-OPEN UPSTREAM MONITOR



NOTE: THE PILOT SUPPLY REGULATOR SHOULD BE SET TO 3 psig / 0.21 bar ABOVE THE MONITOR OUTLET PRESSURE SETTING.

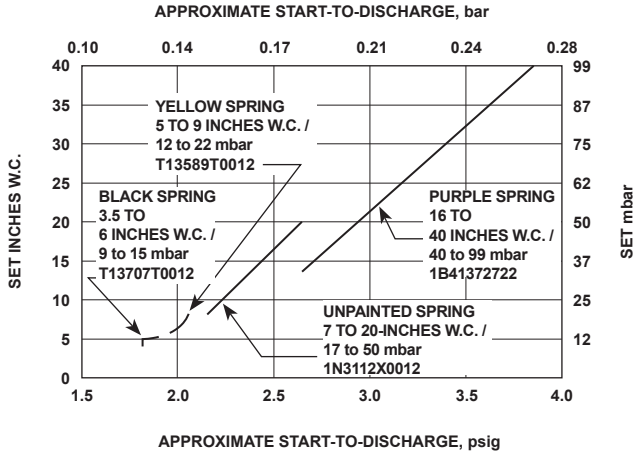
WIDE-OPEN UPSTREAM MONITOR



NOTE: THE PILOT SUPPLY REGULATOR SHOULD BE SET TO 3 psig / 0.21 bar ABOVE THE MONITOR OUTLET PRESSURE SETTING.

NO DOWNSTREAM BLEED MONITOR SYSTEM

Figure 6. *Typical Monitor Installations*



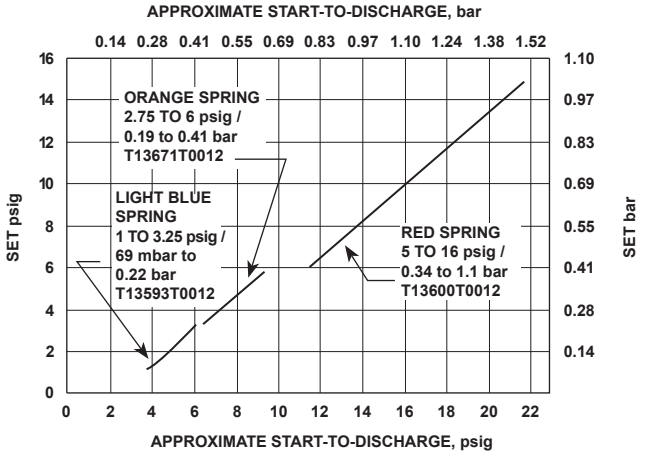


Figure 7. *Type 299HR Approximate Start-to-Discharge*

Table 3. *Flow Coefficients*

TYPE	ORIFICE DIAMETER		WIDE-OPEN		REGULATING[1]		C_1 WHEN ΔP < 10 psi / 0.69 bar	C_1 WHEN ΔP > 10 psi / 0.69 bar
	Inch	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 4. *Type VSX-2 High and Low Trip Pressure Ranges*

RANGE	SLAM-SHUT REGISTRATION	FOR USE WITH MAIN VALVE SPRING RANGE		MINIMUM TO MAXIMUM TRIP PRESSURE		TYPE VSX-2 SPRING PART NUMBER	SPRING FREE LENGTH		SPRING WIRE DIAMETER	
		Inch w.c.	mbar	Inch w.c.	mbar		Inch	mm	Inch	mm
High Pressure Trip	Internal or External	3.5 to 6	9 to 15	12 to 25	30 to 62	T14162T0012	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	T14163T0012	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	T14164T0012	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	T14165T0012	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	T14166T0012	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	T14167T0012	3.15	80.0	0.17	4.32
Low Pressure Trip	External	5 to 9	12 to 22	2 to 12	5 to 30	T14168T0012	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	T14169T0012	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	T14170T0012	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	T14171T0012	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	T14170T0012	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	T14171T0012	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	T14171T0012	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.

Wide-Open Monitor

The control line of the upstream regulator is connected downstream of the second regulator (Figure 6), so that during normal operation the monitoring regulator is standing wide open with the reduction to distribution pressure being taken across the working regulator. Only in case of open failure of the working regulator does the wide-open monitoring regulator take control at its slightly higher setting. A pressure build-up above the monitor set pressure is required for the monitor to take control in the event of an overpressure situation. Installing a pilot supply regulator on the monitor will minimize the pressure build-up. The pilot supply regulator should be set to 3 psig / 0.21 bar above the monitor setpoint.

The minimum set pressure difference between the worker and monitor should be greater than the proportional band. Small set pressure differences may cause the worker and monitor to function independently.

The upstream regulator can easily be field converted or ordered with screws and O-rings in the throat (Figure 6). This seals off the path that otherwise would let line pressure ahead of the working regulator inlet and try to close the wide-open monitoring regulator.

No Downstream Bleed Monitor

The no bleed monitor is a wide-open upstream monitor which works like a conventional wide-open upstream monitor except for registration. The no bleed monitor utilizes a dual registration construction as opposed to the external registration construction of the conventional monitor. This ensures that the lockup of the monitor system is the lockup of the downstream working monitor at zero flow during normal operation.

Installation

Although the actuator and pilot can be mounted in 90° increments relative to the body, the normal installation is with the body in a horizontal run of pipe and the pilot hanging vertically from the bottom of the actuator.

Control and vent lines necessary for installation are not supplied with a Type 299H regulator. Control and vent connection locations are shown in Figures 8 and 9. In many instances good piping practice will require that outlet piping be swaged up above the body size to prevent excessive pressure drop along the outlet line. The piping should be expanded as close to the regulator outlet as possible.

Capacity Information

Tables 5 through 10 give the 299H Series natural gas regulating capacities at selected inlet pressures and outlet pressure settings. Flows are in SCFH (60°F and 14.7 psig) and Nm³/h (0°C and 1.01325 bar) of 0.6 specific gravity natural gas. To determine equivalent capacities for air, propane, butane or nitrogen, multiply the capacity number in the tables by the following appropriate conversion factor: 0.775 for air, 0.628 for propane, 0.548 for butane or 0.789 for nitrogen. For gases of other specific gravities, multiply the given capacity by 0.775 and divide by the square root of the appropriate specific gravity.

For critical flow:

To determine wide-open flow capacities for relief sizing of 0.6 specific gravity natural gas at 60°F at critical pressure drops (absolute outlet pressure equal to approximately one-half or less than one-half of the absolute inlet pressure), use the following formula:

$$Q = P_{1(abs)}(C_g)(1.29)$$

For subcritical flow:

If pressure drops are lower than critical (absolute outlet pressure greater than approximately one-half the absolute inlet pressure), use the following formula and convert according to the factors in the preceding paragraph if necessary:

$$Q = \sqrt{\frac{520}{GT}}\, C_g P_1 \mathrm{SIN}\left(\frac{3417}{C_1}\sqrt{\frac{\Delta P}{P_1}}\right)\mathrm{DEG}$$

where:

C_1 = C_g/C_v (see Table 3)
C_g = Gas sizing coefficient (see Table 3)
G = Gas specific gravity (air = 1.0)
P_1 = Regulator inlet pressure, psia
ΔP = Pressure drop across regulator, psi
Q = Gas flow rate, SCFH
T = Absolute temperature of gas at inlet, °Rankine

Note

Due to boost, the above formulas cannot be used to obtain correct regulating capacities for regulators with internal registration.

The published capacities were obtained using inlet and outlet piping the same size as the regulator body size.

Table 5. *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, Inch / 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 inches w.c. / 9 to 15 mbar 3.5 inches w.c. / 9 mbar -1 to 2 inches 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 inches w.c. / 12 to 22 mbar 7 inches w.c. / 17 mbar -1 to 2 inches 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 inches w.c. / 17 to 50 mbar 14 inches w.c. / 35 mbar ±2 inches 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 inches w.c. / 40 to 99 mbar 28 inches w.c. / 70 mbar ±4 inches 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.

- continued -

Table 5. *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, Inches / 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
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	363
	10	0.69	1550	41.5	3340	89.5	5810	156	12,040	323	14,410	386	18,460	495	22,570	605
	15	1.0	1920	51.4	4360	117	7580	203	15,990	429	18,950	508	25,050	671	30,760	824
	20	1.4	2240	60.0	5150	138	8960	240	19,250	516	24,110	646	30,380	814	37,410	1003
	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								
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	510
	15	1.0	1870	50.1	4190	112	7280	195	15,150	406	17,950	481	23,310	625	28,530	765
	20	1.4	2240	60.0	5090	136	8850	237	18,640	500	22,970	616	29,180	782	35,820	960
	25	1.7	2570	68.9	5890	158	10,250	275	22,030	590	27,110	727	34,550	926	42,530	1140
	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 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	570
	20	1.4	2130	57.1	4720	126	8210	220	17,000	456	20,380	546	25,940	695	31,690	849
	25	1.7	2540	68.1	5710	153	9930	266	20,790	557	24,570	658	32,220	863	39,480	1058
	30	2.1	2890	77.4	6640	178	11,540	309	24,150	647	29,540	792	37,900	1016	46,550	1248
	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 16 psig / 0.34 to 1.1 bar 15 psig / 1.0 ba ±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	626
	25	1.7	2360	63.2	5220	140	9070	243	18,700	501	22,040	591	28,360	760	34,610	928
	30	2.1	2820	75.6	6290	169	10,940	293	22,790	611	27,870	747	35,050	939	42,890	1149
	40	2.8	3530	94.6	8120	218	14,120	378	29,650	795	36,530	979	46,610	1249	57,270	1535
	50	3.4	4180	112	9600	257	16,700	448	35,890	962	44,100	1182	57,080	1530	70,350	1885
	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								
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 5. *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, Inch / 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.

Table 6. *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, Inch / 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 inches w.c. / 9 to 15 mbar 3.5 inches w.c. / 9 mbar -1 to 2 inches 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 inches w.c. / 12 to 22 mbar 7 inches w.c. / 17 mbar -1 to 2 inches 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 inches w.c. / 17 to 50 mbar 14 inches w.c. / 35 mbar ±2 inches 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 inches w.c. / 40 to 99 mbar 28 inches w.c. / 70 mbar ±4 inches 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.

- continued -

Table 6. *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, Inch / 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.

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Table 6. *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, Inch / 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 7. *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, Inch / 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-inches w.c. / 9 to 15 mbar 3.5-inches w.c. / 9 mbar -1 to 2-inches 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-inches w.c. / 12 to 22 mbar 7-inches w.c. / 17 mbar -1 to 2-inches 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-inches w.c. / 17 to 50 mbar 14-inches w.c. / 35 mbar ±2-inches 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-inches w.c. / 40 to 99 mbar 28-inches w.c. / 70 mbar ±4-inches 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 7. *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 Inch / 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 7. *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, Inch / 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 8. *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, Inch / 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 inches 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 inches w.c. / 9 mbar -1 to 2 inches 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 inches 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 inches w.c. / 17 mbar -1 to 2 inches 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 inches 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 inches w.c. / 35 mbar ±2 inches 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 inches 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 inches w.c. / 70 mbar ±4 inches 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.

- continued -

Table 8. *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, Inch / 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 9. *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, Inch / 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 inches w.c. / 9 to 15 mbar 3.5 inches w.c. / 9 mbar -1 to 2 inches 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	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
	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 inches w.c. / 12 to 22 mbar 7 inches w.c. / 17 mbar -1 to 2 inches 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	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
	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 inches w.c. / 17 to 50 mbar 14 inches w.c. / 35 mbar ±2 inches w.c. / ±5 mbar 1N3112X0012 Unpainted	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
	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 inches w.c. / 40 to 99 mbar 28 inches w.c. / 70 mbar ±4 inches w.c. / ±10 mbar 1B413727222 Purple	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
	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 9. *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, Inch / 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.

Table 10. *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, Inch / 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 inches 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	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
3.5 inches w.c. / 9 mbar -1 to 2 inches w.c. / -2 to 5 mbar T13707T0012 Black	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 inches 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	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
7 inches w.c. / 17 mbar -1 to 2 inches w.c. / -2 to 5 mbar T13589T0012 Yellow	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 inches w.c. / 17 to 50 mbar	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
14 inches w.c. / 35 mbar ±2 inches w.c. / ±5 mbar 1N3112X0012 Unpainted	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 inches w.c. / 40 to 99 mbar	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
28 inches w.c. / 70 mbar ±4 inches w.c. / ±10 mbar 1B413727222 Purple	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 10. *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, Inch / 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.

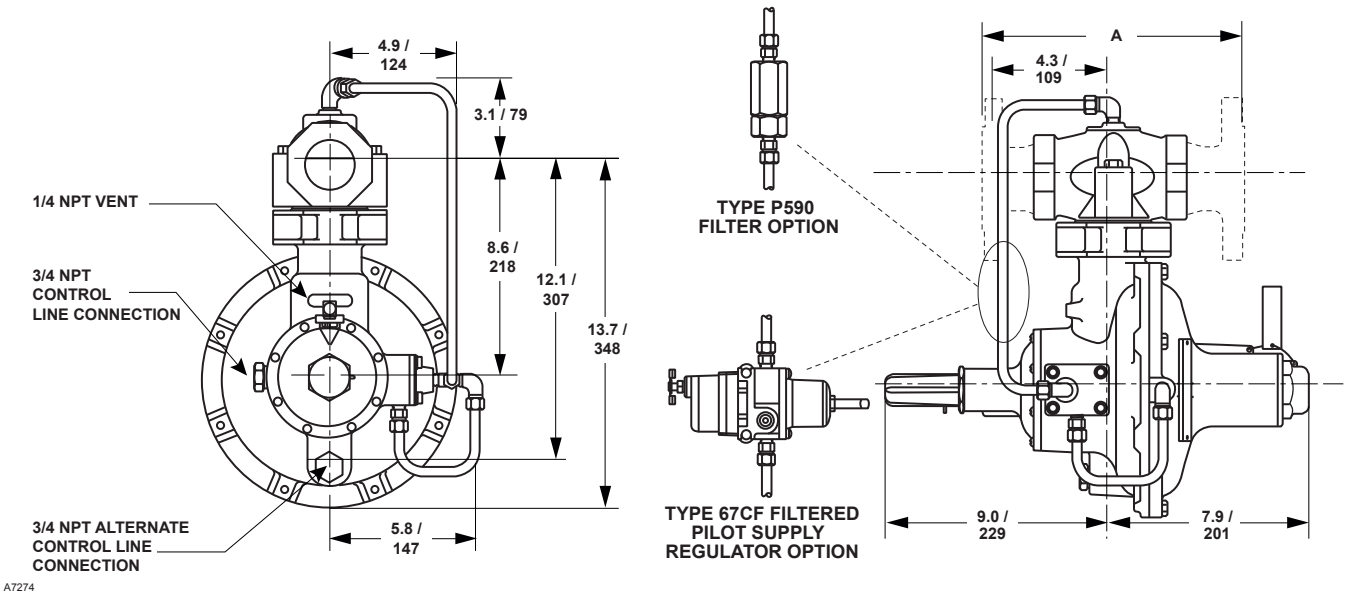

Figure 8. *Types 299H and 299HR Dimensions*

Table 12. *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)	
	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	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.

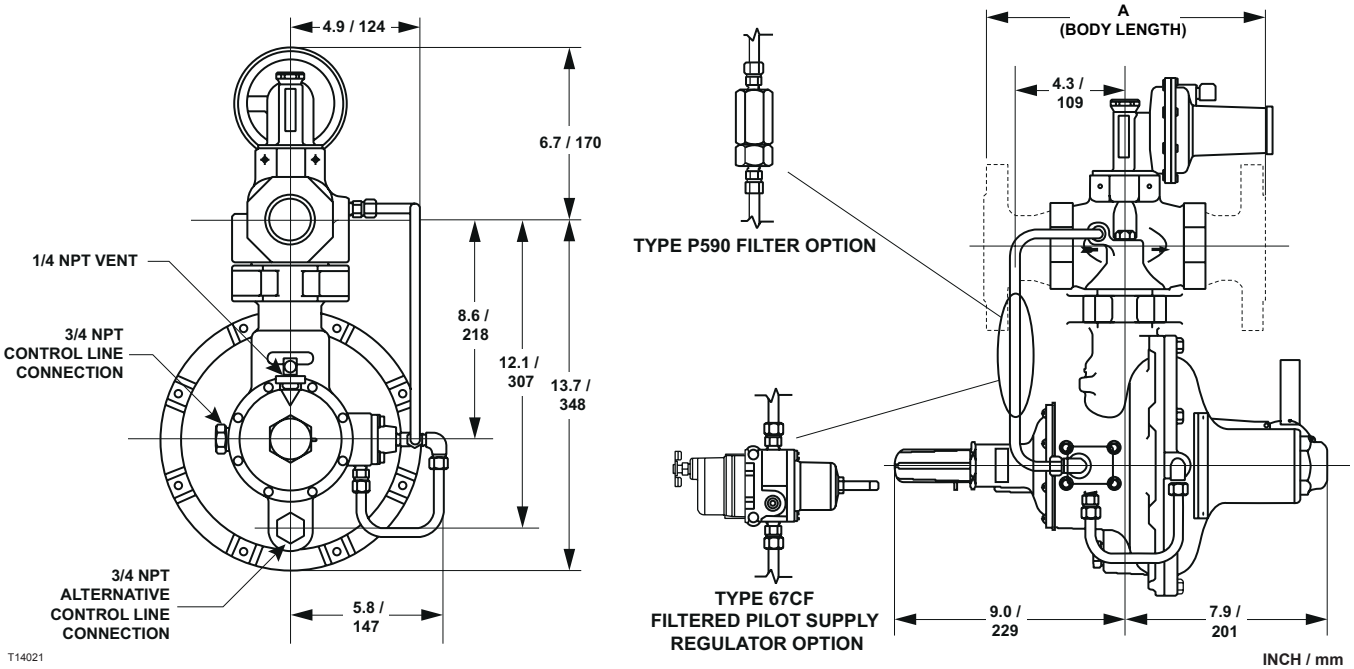

Figure 9. *Types 299HS and 299HSR Dimensions*

Table 13. *Types 299HS and 299HSR Dimensions*

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	
	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
A	6.12 / 155		6.12 / 155		10.00 / 254		10.50 / 267		9.06 / 230	

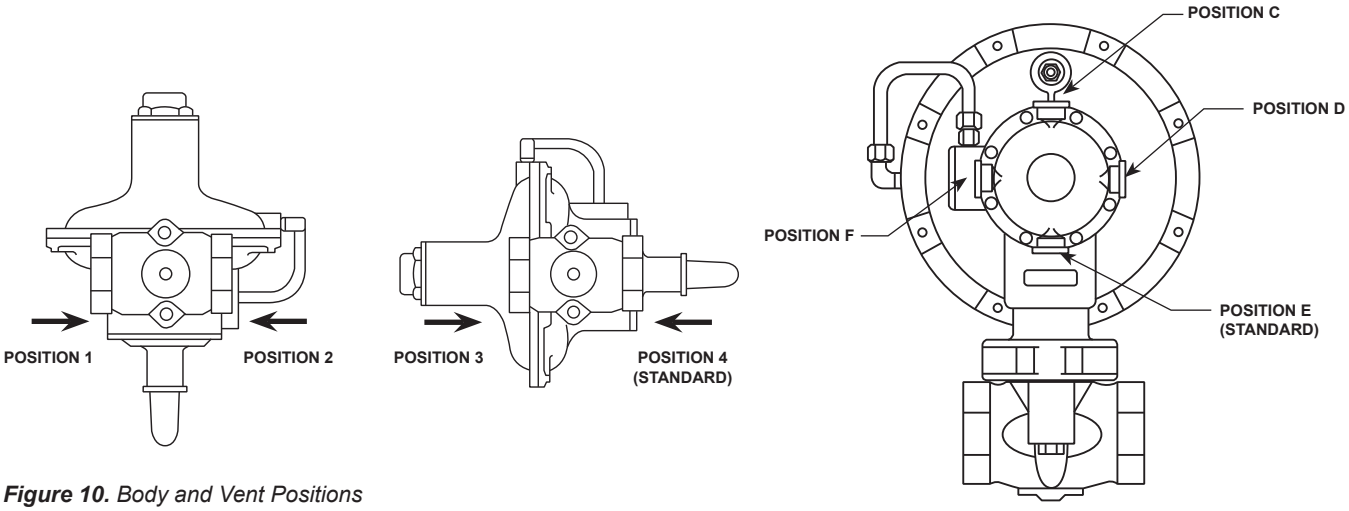

Figure 10. *Body and Vent Positions*

Ordering Information

To order, complete the Ordering Guide on pages 27 and 28. Carefully review the Specifications section on page 2 and specify the desired selection whenever there is a choice to be made.

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 inches / 191 mm***
☐ CL125 FF - 10 inches / 254 mm***

Ductile iron
☐ NPT***
☐ CL125 FF - 10 inches / 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 inch / 6.4 x 9.5 mm***
☐ 3/8 inch / 9.5 mm***
☐ 1/2 inch / 13 mm***
☐ 3/4 inch / 19 mm***
☐ 7/8 inch / 22 mm (For Types 299H and 299HR only)***
☐ 1 inch / 25 mm (For Types 299H and 299HR only)***
☐ 1-3/16 inch / 30 mm (For Types 299H and 299HR only)***

Outlet Pressure Range (Select One)
☐ 3.5 to 6 inches w.c. / 9 to 15 mbar, Black***
☐ 5 to 9 inches w.c. / 12 to 22 mbar, Yellow***
☐ 7 to 20 inches w.c. / 17 to 50 mbar, Unpainted***
☐ 16 to 40 inches 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 inch / 1.1 mm, Red (**standard** gain)***
☐ 0.071 inch / 1.8 mm, Green (low gain)***
☐ 0.082 inch / 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 inches w.c. / 30 to 62 mbar***
☐ 20 to 52 inches 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***

Ordering Guide (continued)

Low Pressure Trip (Select One) (For OPSO/UPSO only)
- ☐ 2 to 12 inches w.c. / 5 to 30 mbar***
- ☐ 4 to 30 inches 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.

Regulators Quick Order Guide	
* * *	Standard - Readily Available for Shipment
* *	Non-Standard - 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 (Please designate units):

Specific Use _____

Line Size _____

Gas Type and Specific Gravity _____

Gas Temperature _____

Does the Application Require Overpressure Protection?

☐ No ☐ Yes, if so, which is preferred:

☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device

Is overpressure protection equipment selection assistance desired? _____

Pressure (Please designate units):

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: _____

_____

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For further information visit www.emersonprocess.com/regulators