Sizing Regulators and Relief Valves for Natural Gas

Brian Nutter
Sr. BDM/ Pressure Management
Applied Control – Denver, CO
For: Western Gas Measurement Short Course
2024

Regulator Sizing / Selection Guidelines

What is a Regulator?

- Any self-contained valve and actuator combination

Purpose of a Regulator?

- To match the downstream demand while keeping the downstream pressure constant

Types of Regulators?

- Self-Operated (Self-Op) and Pilot Operated (Pilot-Op)

Regulator Sizing / Selection Guidelines

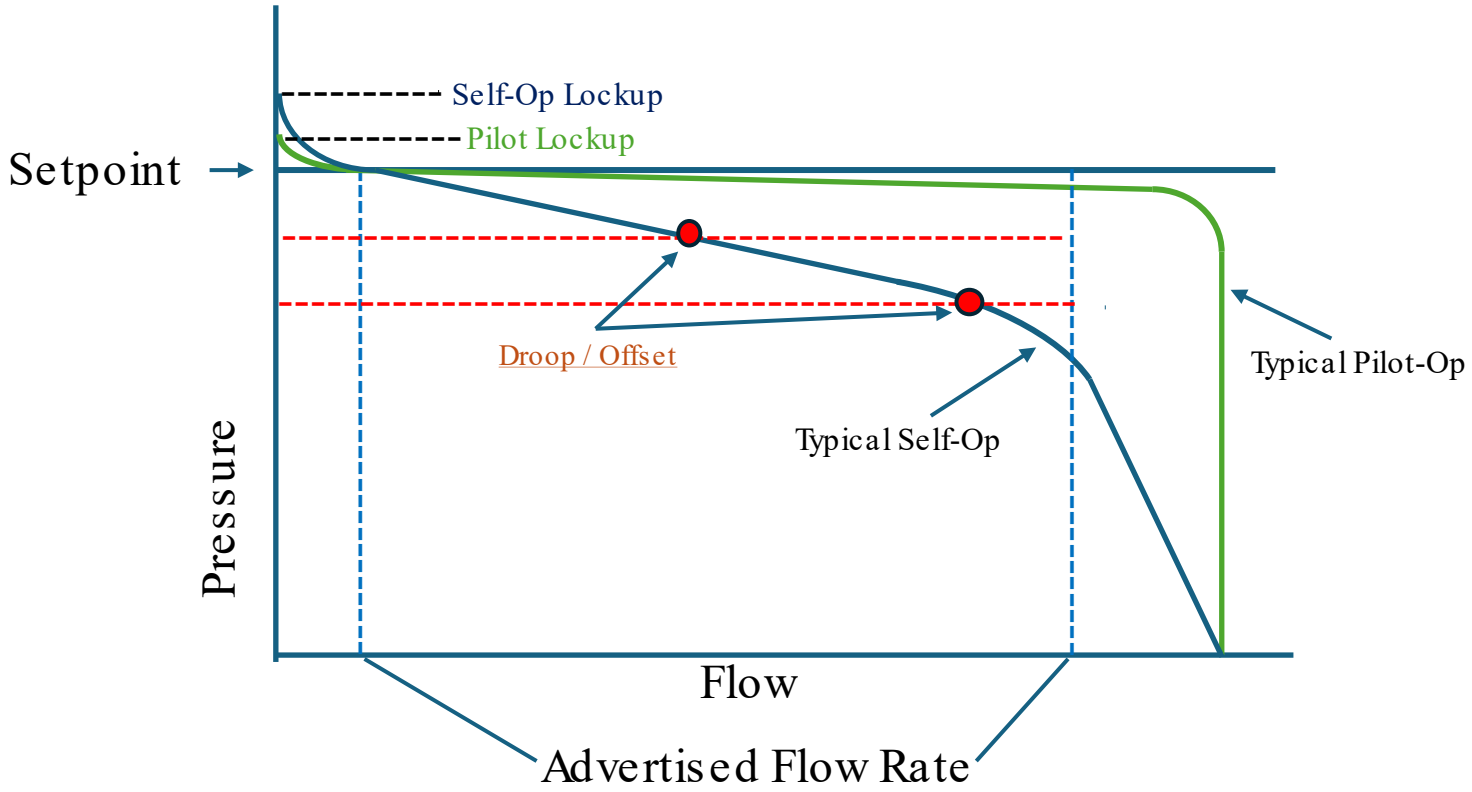
Self-Op Regulators

Pilot-Op Regulators

Regulator Sizing / Selection Guidelines

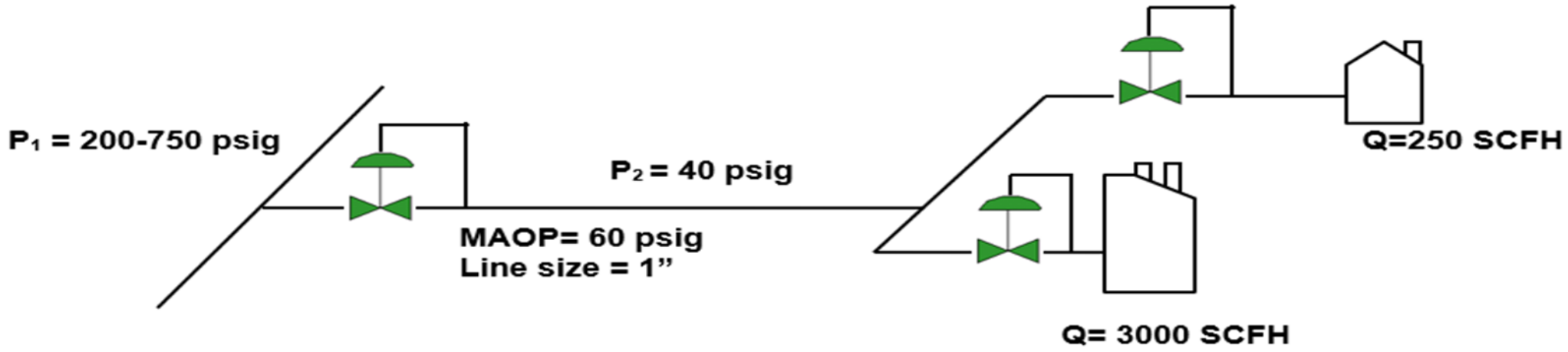
Terminology:

- Setpoint – Pressure setpoint of the downstream regulator pressure
- Droop / Offset / Accuracy / Proportional Band – Deviation of the actual pressure below ideal pressure to achieve a certain flow rate, illustrated as a % or pressure difference.
- Lockup / Lockup Tail – Amount of offset above setpoint to obtain complete shutoff (lockup).
- Critical Flow – Max flow for a given restriction. Dependent on P1 and orifice size. (Sub-sonic and sonic velocities).



Regulator Sizing / Selection Guidelines

The following application is reducing pressure from a Natural Gas Transmission line for use by a local farmer and small dryers. This is an initial pressure reduction off the transmission line which requires a "rough-cut" regulator (accuracy is not critical). The gas has a Specific Gravity of 0.6 and a Temperature of 60 °F. From your experience, the customer values ease of maintenance and the most economical solution.



Regulator Sizing / Selection Guidelines

Gathering the necessary data

- P1 = Inlet Pressure (Min and Max Conditions)
- P2 = Regulator Downstream Setpoint required
- Q = Fluid Flow Rate (Min and Max Conditions)
- T = Temperature of the fluid (Natural Gas)
- SG = Specific Gravity (SG of Pipeline Natural Gas is 0.6)
- Line Size / Swage Ratio if the piping is reduced or enlarged
- Fluid and material specifications
- Accuracy requirements (Droop / Proportional Band)

Regulator Sizing / Selection Guidelines

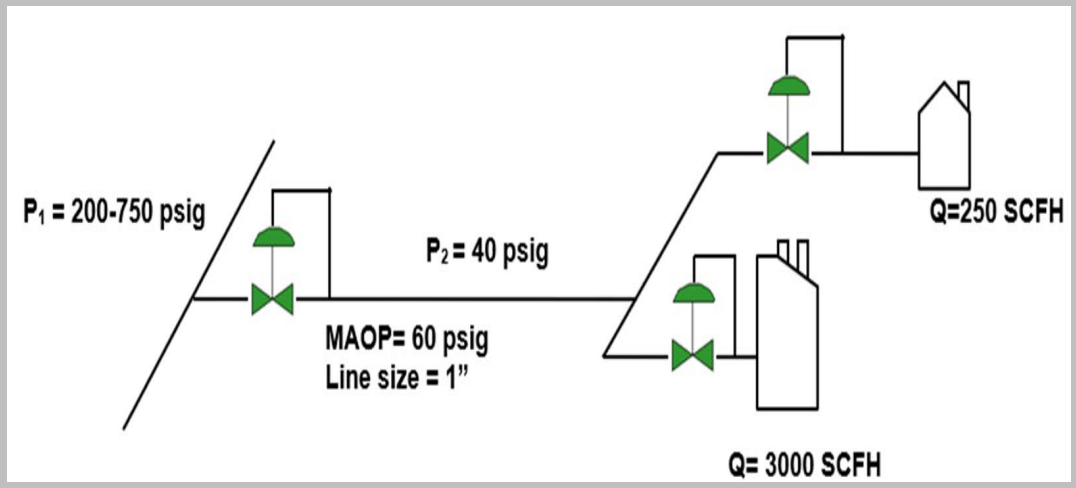
Regulator Selection: Conditions			
Process Conditions			
Inlet Pressure	200psi		750psi
Set Pressure	40psi		
Flow Rate	250scfh		3250scfh
Temperature	60 °F		
Accuracy	Rough Cut – 20% Droop Allowable		
Process Fluid/SG	Natural Gas / SG = 0.6		
Line Size	1" NPT		
Application	Farm Tap		

Note: When sizing a pressure reducing regulator to meet flow, we need to account for the worst case conditions. In this case, we would size for the maximum amount of flow using the lowest pressure drop.

$P1_{min}$ = 200psi
Setpoint = 40psi

or

~~$P1_{max}$ = 750psi~~
~~Setpoint = 40psi~~



Tools To Narrow the Search

Regulator Sizing / Selection Guidelines

Use Manufacturers Quick Selection Guides

Natural Gas Quick Selection Guide

Farm Tap / Field

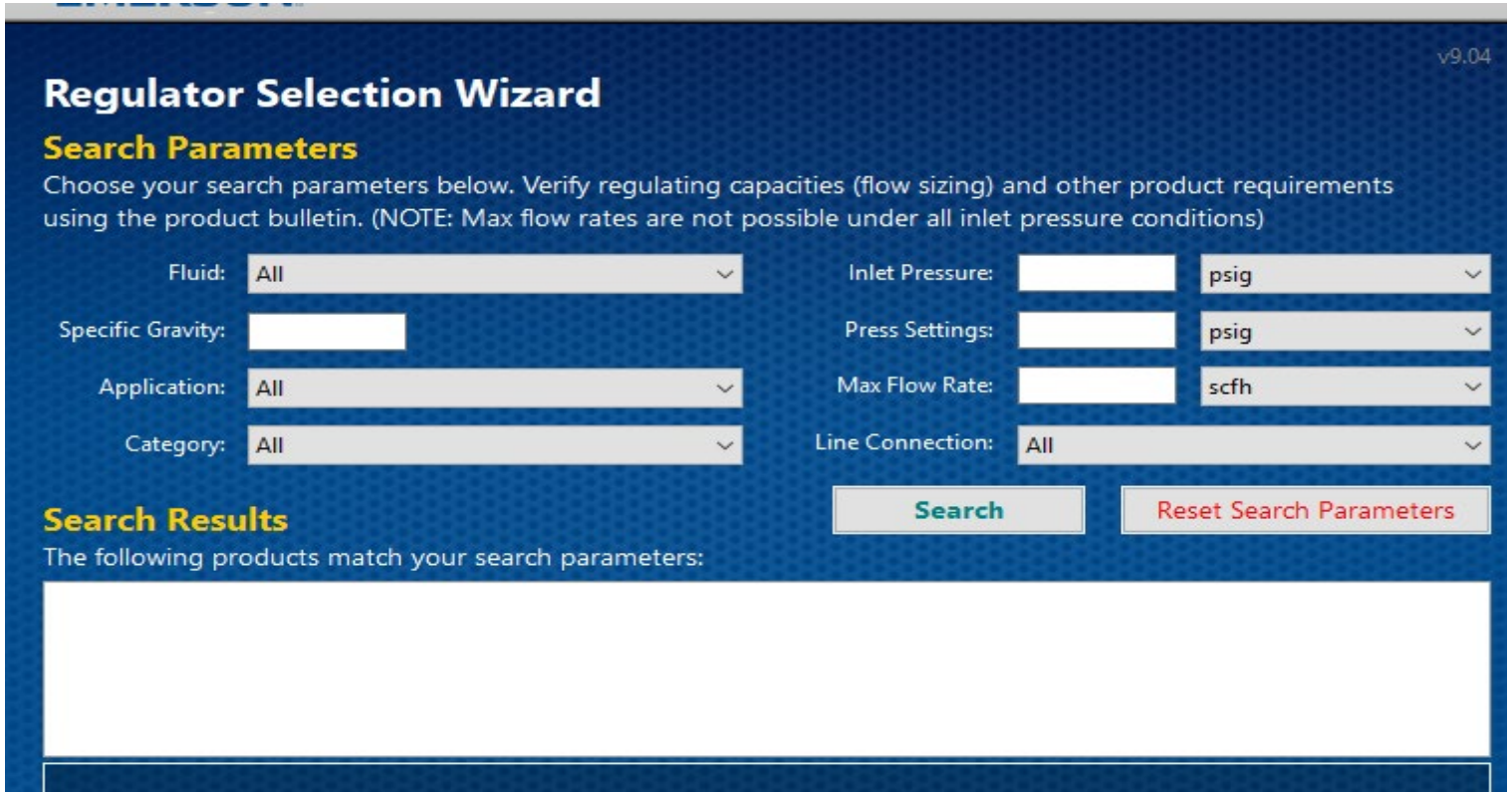
Maximum Inlet Pressure	Outlet Pressure Range	Maximum Capacity		Type Number
1500 psig / 103 bar	3 to 500 psig / 0.21 to 34.5 bar	130,000 SCFH / 3480 Nm³/h		**Type 630** Page 152
2000 psig / 138 bar	5 to 500 psig / 0.34 to 34.5 bar	179,000 SCFH / 4797 Nm³/h		**627 Series** Page 120

Tools To Narrow the Search

Regulator Sizing / Selection Guidelines

Use Manufacturers Selection Wizards Guides

- Available on some manufacturers websites
- Information is the latest and is updated when new products or changes are made to existing products



Tools To Narrow the Search

Regulator Sizing / Selection Guidelines

Use Manufacturers Offered Sizing Tools

- Available on some manufacturers websites

$$Cv = \frac{Cg}{C1}$$

$$Cv = 0.402$$

$$C1 = 29.4$$

$$Cg = (Cv)0.402\ x\ (C1)29.4$$

$$Cg = 11.81$$

Name	Units	Max Flow Cond / P1min
Warnings:		NO
SIZING INPUTS		
Gas		NATURAL GAS (0.60 SG)
Volumetric Flow Rate Gas	scfh	3250.000
Inlet Pressure	psig	200.000
Outlet Pressure	psig	40.000
Inlet Temperature	deg F	60.0000
Molecular Weight / Specific Gravity	M	17.380
Ratio of specific heats		1.300
Critical Pressure	psia	671.000
Critical Temperature	deg F	-101.6700
Pressure drop ratio factor (xt)		0.547
IEC NOISE INPUTS		
Outlet temperature	deg F	59.4000
Valve Diameter	in	1.000
Valve/Trim for aerodynamic noise		Regulator-Standard
Aerodynamic distance Rn	m	1.00
Valve style modifier (Fd)		0.500
Recovery Factor (Fl)		0.790
Upstream pipe size	in	1
Upstream pipe schedule		80
Downstream pipe size	in	1
Downstream pipe schedule		80
Valve Outlet Area	in2	2.460
SIZING OUTPUTS		
Flow Coefficient (Cv)		0.402
Pressure differential	psi	160.000
Valve dP/P1 pressure ratio		0.745
Mass Flow Rate Gas	lb/h	148.935
Inlet Compressibility Factor		0.965
IEC NOISE OUTPUTS		
Whisper III Trim Level		
Trim LpA at 1m	dB(A)	55
Outlet LpA at 1m	dB(A)	< 50

Regulator Sizing / Selection Guidelines
Finding the Right Regulator

Manufacturers Flow Coefficients

Table 16. *Flow Coefficients*

ORIFICE SIZE, IN. / mm	NPS 3/4 / DN 20 BODY			NPS 1 / DN 25 BODY			NPS 1-1/4 / DN 32 BODY			NPS 2 / DN 50 BODY		
	Wide-Open C_g for External Relief Sizing	Wide-Open C_v for External Relief Sizing	C_1	Wide-Open C_g for External Relief Sizing	Wide-Open C_v for External Relief Sizing	C_1	Wide-Open C_g for External Relief Sizing	Wide-Open C_v for External Relief Sizing	C_1	Wide-Open C_g for External Relief Sizing	Wide-Open C_v for External Relief Sizing	C_1
3/32 / 2.4	6.9	0.24	29.2	6.9	0.24	28.5	7.0	0.23	30.7	6.9	0.23	29.7
1/8 / 3.2	12.5	0.43	29.1	12.5	0.43	29.4	12.1	0.43	28.0	12.5	0.42	29.5
3/16 / 4.8	29	1.01	28.6	29	0.93	31.2	26	0.92	28.7	29	1.02	28.5
1/4 / 6.4	50	1.63	30.6	50	1.71	29.3	43	1.45	30.0	52	1.66	31.3
3/8 / 9.5	108	2.99	36.1	108	3.42	31.6	96	3.33	28.9	115	3.39	33.9
1/2 / 13	190	4.87	39.0	190	5.29	35.9	168	5.18	32.4	200	5.01	39.9
9/16 / 14.3	----	----	----	211.6	5.6	37.8	----	----	----	219.3	6.0	36.0

Table 17. *IEC Sizing Coefficients*

ORIFICE SIZE, IN. / mm	X_T			F_D	F_L
	NPS 3/4 / DN 20 Body	NPS 1 / DN 25 Body	NPS 2 / DN 50 Body		
3/32 / 2.4	0.539	0.514	0.558	0.50	0.85
1/8 / 3.2	0.536	0.547	0.539		0.79
3/16 / 4.8	0.517	0.616	0.514		0.85
1/4 / 6.4	0.592	0.543	0.620		0.87
3/8 / 9.5	0.824	0.632	0.727		0.89
1/2 / 13	0.962	0.815	1.01		0.86
9/16 / 14.3	----	0.906	0.823		0.89

Tools To Narrow the Search

Regulator Sizing / Selection Guidelines

Use Manufacturers Offered Sizing Tools Capacity Tables

Table 7. *Types 627, 627M, 627MR, 627BM, 627BMR, 627OSX and 627BMOSX Capacities for NPS 1 / DN 25 Body Size*[1][4]

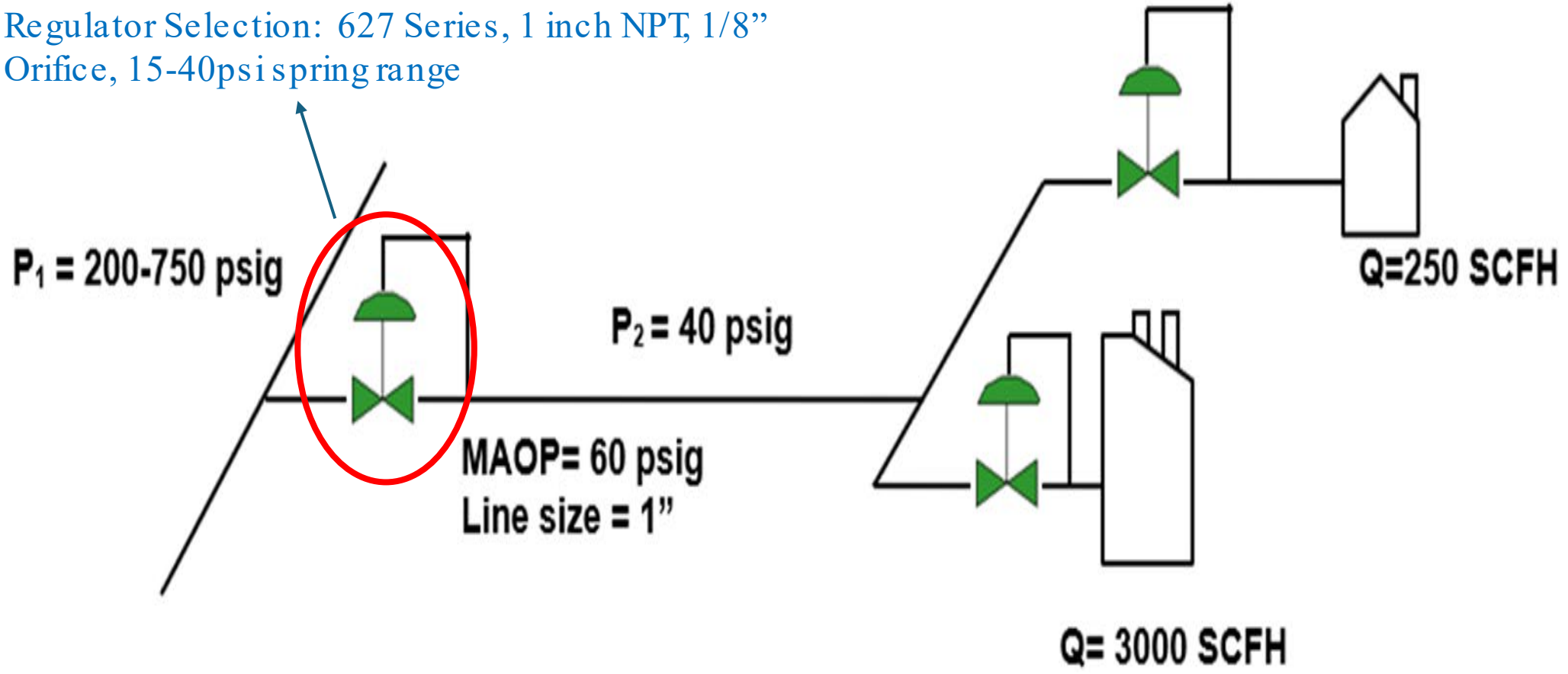
OUTLET PRESSURE RANGE, SPRING PART NUMBER AND COLOR CODE	OUTLET PRESSURE SETTING[2], psig / bar	INLET PRESSURE, psig / bar	CAPACITIES IN SCFH / Nm³/h OF 0.6 SPECIFIC GRAVITY NATURAL GAS						
			Orifice Size, in. / mm						
			For All Types Except Types 627BM and 627BMR						For Types 627BM and 627BMR only
			3/32 / 2.4	1/8 / 3.2	3/16 / 4.8	1/4 / 6.4	3/8 / 9.5	1/2 / 13	9/16 / 14.3
	5 / 0.34[3]	10 / 0.69	170 / 4.6	330 / 8.8	710 / 19.0	1100 / 29.5	1900 / 50.9	2500 / 67.0	1570 / 42.1
		15 / 1.0	240 / 6.4	390 / 10.5	890 / 23.9	1600 / 42.9	2500 / 67.0	3350 / 89.8	1780 / 47.7
		20 / 1.4	290 / 7.8	500 / 13.4	1160 / 31.1	2060 / 55.2	3400 / 91.1	4450 / 119	1980 / 53.0
		30 / 2.1	380 / 10.2	670 / 18.0	1560 / 41.8	2800 / 75.0	4750 / 127	6900 / 185	2940 / 78.8
		60 / 4.1	640 / 17.2	1170 / 31.4	2600 / 69.7	4710 / 126	8140 / 218	13,700 / 367	5790 / 155
		75 / 5.2	770 / 20.6	1410 / 37.8	3150 / 84.4	5710 / 153	9790 / 262	14,500 / 389	8020 / 215
		100 / 6.9	990 / 26.5	1800 / 48.2	4070 / 109	7310 / 196	12,500 / 335	16,000 / 429	11,700 / 313
		15 / 1.0	210 / 5.6	375 / 10.1	880 / 23.6	1590 / 42.6	2480 / 66.5	3300 / 88.4	2880 / 77.2
		2000 / 138	14,000 / 375						
15 to 40 psig / 1.0 to 2.8 bar 10B3077X012 Green	40 / 2.8	60 / 4.1	610 / 16.3	1090 / 29.2	2530 / 67.8	4510 / 121	9290 / 249	9420 / 252	14,400 / 386
		75 / 5.2	760 / 20.4	1370 / 36.7	3080 / 82.5	5640 / 151	10,800 / 289	16,500 / 442	18,800 / 504
		100 / 6.9	990 / 26.5	1790 / 48.0	4070 / 109	7310 / 196	14,700 / 394	21,900 / 587	26,000 / 697
		150 / 10.3	1420 / 38.1	2580 / 69.1	5850 / 157	10,500 / 281	20,500 / 549	34,500 / 925	40,500 / 1085
		200 / 13.8	1850 / 49.6	3370 / 90.3	7630 / 204	13,700 / 367	27,100 / 726	46,400 / 1244	48,100 / 1289
		300 / 20.7	2700 / 72.4	4910 / 132	11,200 / 300	20,100 / 539	40,100 / 1075	67,100 / 1798	63,400 / 1698
		500 / 34.5	4400 / 118	8090 / 217	18,300 / 490	32,900 / 882	63,900 / 1713		66,800 / 1790
		750 / 51.7	6600 / 177	12,000 / 322	27,200 / 729	39,400 / 1056			69,000 / 1849
		1000 / 69.0	8700 / 233	16,000 / 429	36,100 / 967				71,100 / 1905
		1250 / 86.2	11,000 / 295	19,000 / 509					71,500 / 1915
		1500 / 103	13,000 / 348	22,000 / 590					71,900 / 1926
		1750 / 121	15,000 / 402						
		2000 / 138	17,000 / 456						

— Blank areas indicate where maximum operating inlet pressure for a given orifice is exceeded.
— Shaded areas indicate where a Type 627MR regulator should not be used because unbalanced forces can cause the internal relief valve to start-to-discharge during normal operation. Refer to Table 4.

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

Relief Valve Sizing Guidelines

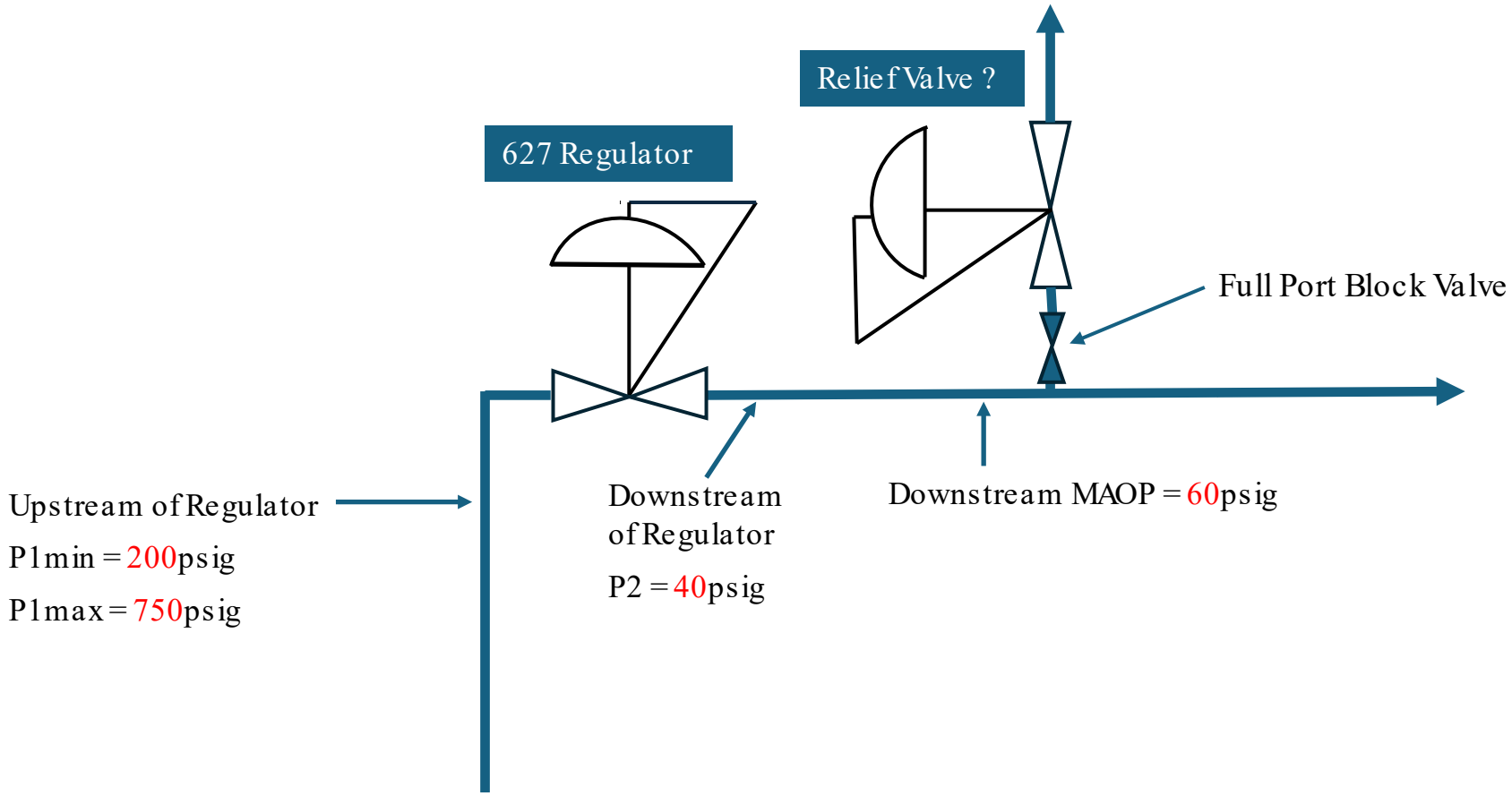
Regulator Selection: 627 Series, 1 inch NPT, 1/8" Orifice, 15-40psi spring range



Sizing Regulators and Relief Valves for Natural Gas

Brian Nutter
Sr. BDM/ Pressure Management
Applied Control – Denver, CO
For: Western Gas Measurement Short Course
2024

Relief Valve Sizing Guidelines



Relief Valve Sizing Guidelines

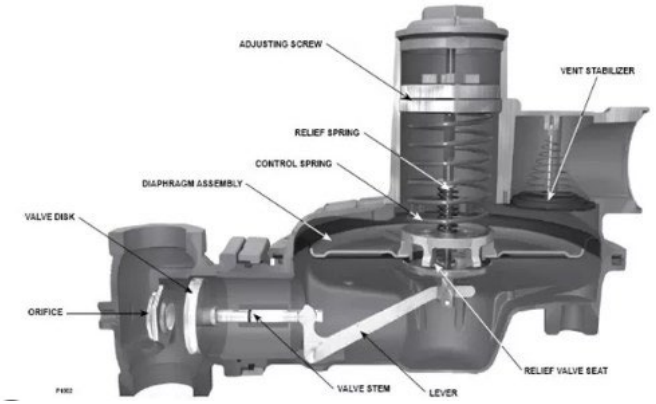
Q: What is the purpose of a relief valve?

A: Relief valves are used to protect piping, equipment and systems from accidental overpressure events.

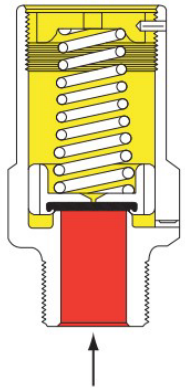
Relief Valve Sizing Guidelines

Different Types of Relief Valves

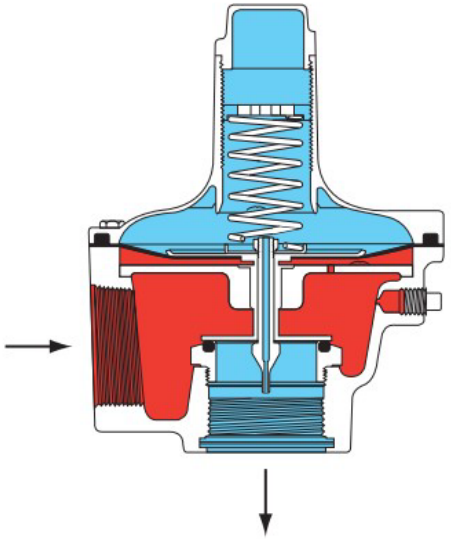
- Relief Valves are designed in many sizes and configurations



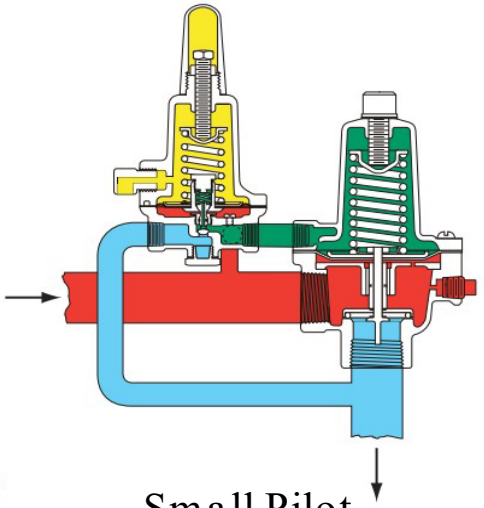
Self-Op Regulator w/Internal Relief



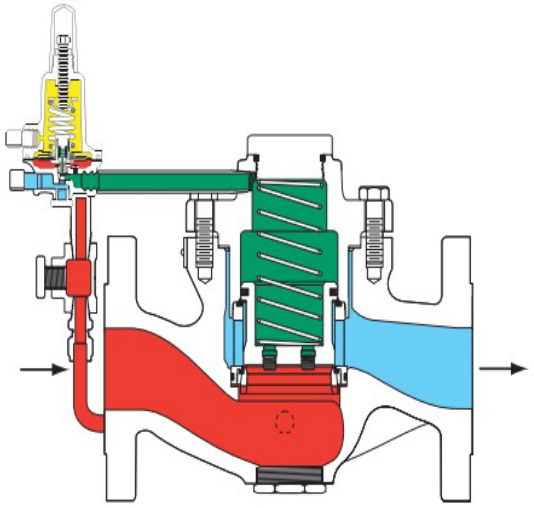
Pop Type Relief Valve



Small Self-Op Relief Valve



Small Pilot Relief Valve



Large Pilot Relief Valve

Relief Valve Sizing Guidelines Codes

Minimum Federal Standards for Over-Pressure Protection:

- (PHMSA) Pipeline and Hazardous Materials Safety Administration
- Part 192 – Transportation of Natural and Other Gases by Pipeline

- 192.195 Protection Against Accidental over pressuring
- 192.199 Requirements for design of pressure relief and limiting devices
- 192.201 Required capacity of pressure relieving and limiting stations
- 192.739 Inspection & testing
- 192.743 Capacity of relief devices

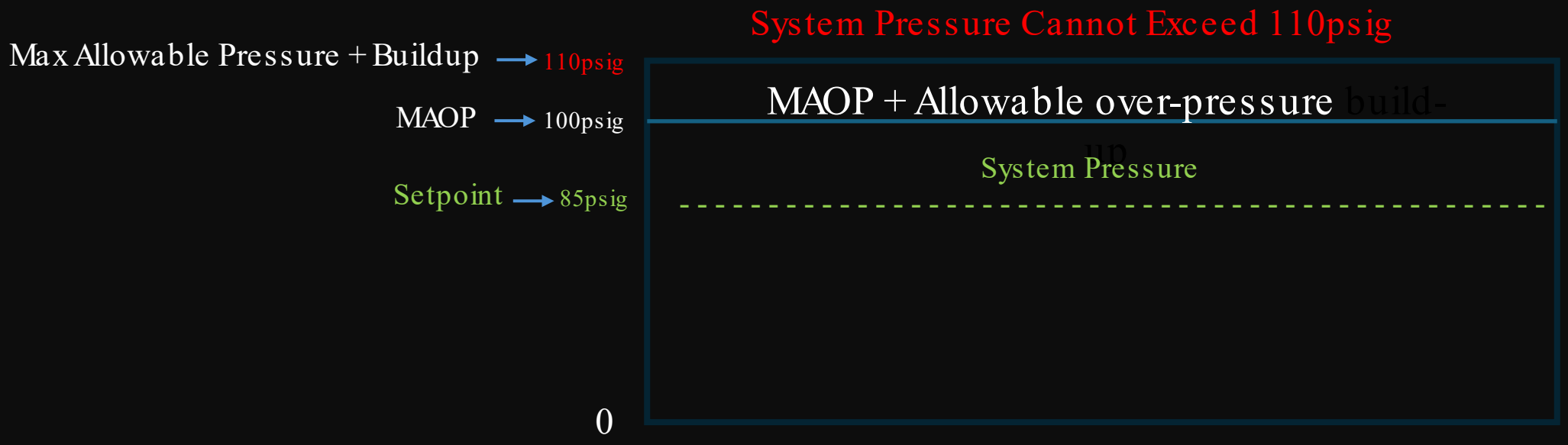
Relief Valve Sizing Guidelines

Part 192 - Rules for Pressure Limitations

MAOP	Allowable Overpressure
≥ 60psi	MAOP + 10% or 75% of the Specified Min Yield Strength (SMYS) which ever is less
≥ 12psi and < 60psig	MAOP + 6psi
< 12psi	MAOP + 50%
Low Pressure	Prevent unsafe operation of any appliance

Relief Valve Sizing Guidelines

Pressure Limitations on system



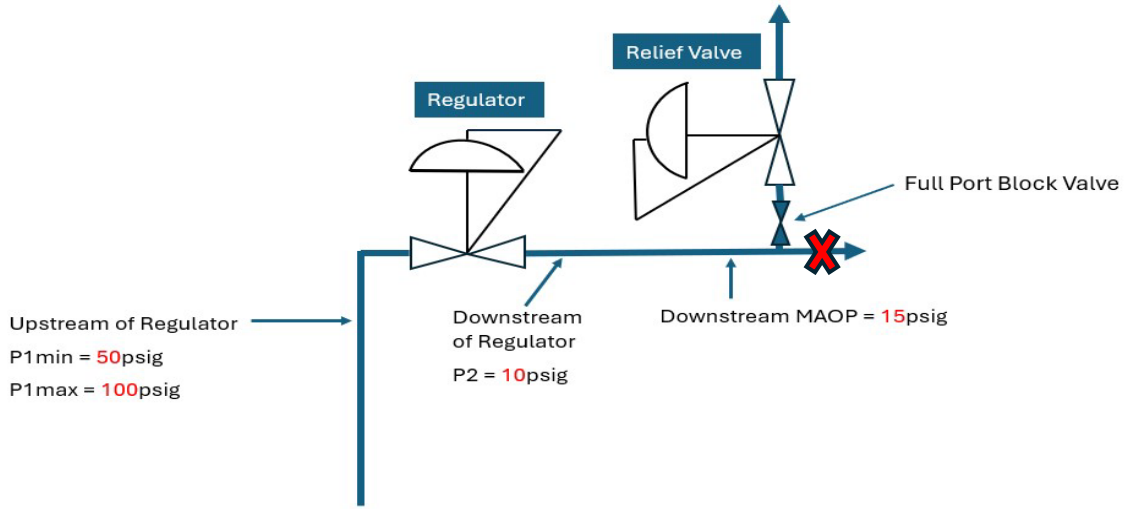
Regulator setpoint (P2) = 85psig

- Overpressure on system
- Normal Operation below the MAOP limit

Relief Valve Sizing Guidelines

Regulator Maximum Capacity

- The regulator capacity to be vented is the maximum capacity based on the maximum inlet pressure (upstream MAOP) and the maximum outlet pressure
- Assume that the regulator has failed wide open using the maximum inlet pressure (MAOP) and no flow is required downstream



Relief Valve Sizing Guidelines

Relief Valve Maximum Capacity

- For relief valve sizing assume that no flow is going into the downstream system. Imagine a block valve was shut-off on the downstream line and all flow was going through the relief valve.

- Relief Valves are sized using:

1. The manufacturer's Capacity Tables
2. The manufacturer's Flow coefficients for relief valve sizing
3. The manufacturer's Sizing Equations

Relief Valve Sizing Guidelines

Regulator Capacity Sizing

❑ **Non-Critical (Sub Sonic) flow** $\frac{\boldsymbol{P_{1,abs}}}{\boldsymbol{P_{2,abs}}} \leq 1.814$

Use Equation: $Q = \frac{\sqrt{1}}{SG} \times \boldsymbol{P_{inlet}} \times sin\left[\left(\frac{3417}{C_1}\right) \times \sqrt{\frac{\boldsymbol{P_{inlet}} - \boldsymbol{P_{outlet}}}{\boldsymbol{P_{inlet}}}}\right]$ deg

---

❑ **Critical (Sonic) Flow** $\frac{\boldsymbol{P_{1,abs}}}{\boldsymbol{P_{2,abs}}} \geq 1.814$

Use Equation: $Q = 1.291 \times C_g \times \boldsymbol{P_{inlet\,(max),abs}}$

Rule of thumb: If the $P_{2,abs}$ pressure is less than ½ of the $P_{1,abs}$ pressure you can use the Critical (Sonic) flow equation.

Relief Valve Sizing Guidelines

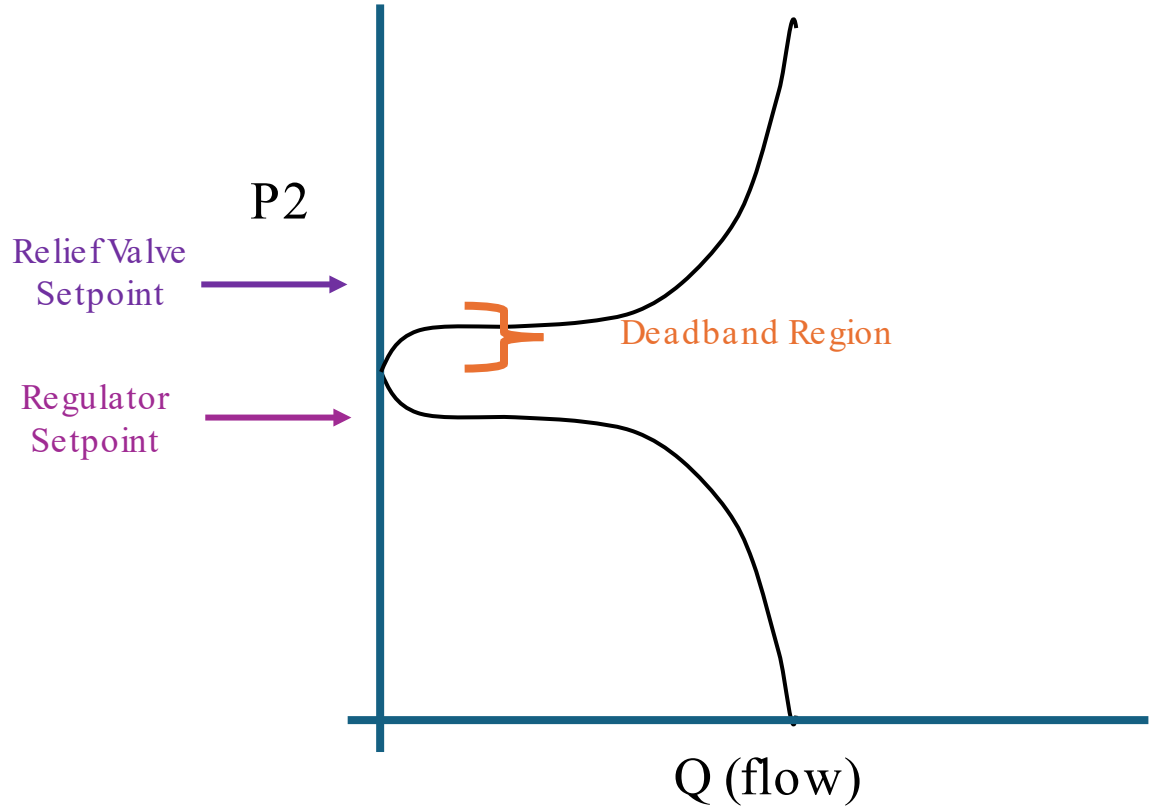
Sizing a relief valve

1) Gather the necessary data
    - Maximum absolute inlet pressure ($P_{1\ (max),abs}$)
    - Regulator Setpoint
    - Wide-open sizing coefficient ($C_{g,wo}$) for the selected regulator
    - MAOP (Max Allowable Operating Pressure)
2) Protect against the worst-case scenario and assume the regulator has failed wide-open and the maximum inlet pressure is being fed to the regulator while no flow is required downstream
3) Calculate the Wide-Open Flow (Q_{wo}) (Determine if the flow is Sub Sonic or Sonic (use appropriate calcs)
4) Determine the Maximum Emergency Downstream Pressure
    - Outlet pressure rating of the regulator
    - MAOP of the downstream piping
    - Inlet pressure rating of the downstream equipment
5) Select a relief valve
    - Select a relief valve using the emergency outlet pressure and the wide open flow (Q_{wo}).
6) Choose a relief valve setpoint and determine the amount of buildup that will be required in order to pass the wide-open flow calculated in Step 3. Make sure that your relief valve setpoint is not in the lockup tail of the pressure reducing regulator.

Relief Valve Sizing Guidelines

Setpoint

- Based off Regulator setpoint
- Deadband region rules of thumb:
  - Mid-way between Regulator setpoint and system MAOP
  - 5 psi for medium/high pressure applications
  - 7 in.w.c. for low pressure applications

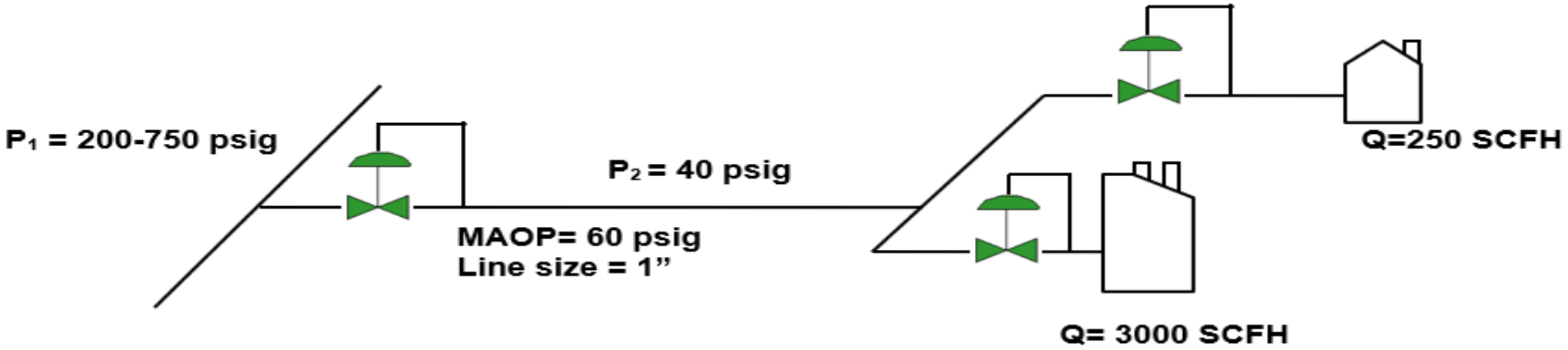


Relief Valve Sizing Guidelines

The following application is reducing pressure from a transmission line for use by a local farmer and small dryers. This is an initial pressure reduction off the transmission line which requires a rough-cut regulator (accuracy is not critical). The gas has a specific gravity of 0.6 and a temperature of 60F. Size the appropriate overpressure protection. Provide overpressure protection by external relief method.

Remember: To determine the maximum downstream pressure of the system, take three things into consideration:

1. Maximum inlet for the downstream equipment.
2. Maximum allowable operating pressure (MAOP) for the pipeline.
3. Maximum downstream pressure rating for regulator.



Relief Selection: Conditions

Table 16. Flow Coefficients

ORIFICE SIZE, IN. / mm	NPS 3/4 / DN 20 BODY			NPS 1 / DN 25 BODY			NPS 1-1/4 / DN 32 BODY		
	Wide-Open C_g for External Relief Sizing	Wide-Open C_v for External Relief Sizing	C_1	Wide-Open C_g for External Relief Sizing	Wide-Open C_v for External Relief Sizing	C_1	Wide-Open C_g for External Relief Sizing	Wide-Open C_v for External Relief Sizing	C_1
3/32 / 2.4	6.9	0.24	29.2	6.9	0.24	28.5	7.0	0.23	30.7
1/8 / 3.2	12.5	0.43	29.1	12.5	0.43	29.4	12.1	0.43	28.0
3/16 / 4.8	29	1.01	28.6	29	0.93	31.2	26	0.92	28.7
1/4 / 6.4	50	1.63	30.6	50	1.71	29.3	43	1.45	30.0
3/8 / 9.5	108	2.99	36.1	108	3.42	31.6	96	3.33	28.9
1/2 / 13	190	4.87	39.0	190	5.29	35.9	168	5.18	32.4

Relief Selection: Conditions				
Process Conditions	*Minimum*	*Normal*	*Maximum*	
Inlet Pressure	200 psi		750 psi	←Problem Statement
Regulator Selection	1” 627 w/ 1/8” orifice			←Self Op Sizing Example 1
Regulator Set Pressure	40 psi			← Problem Statement
Wide Open Cg/Cv	12.5/0.43			←627 Bulletin Table 16 (Page 32)
Wide Open Flow Rate	$Q_{wo} = (C_{g,wo}) \times (P_{1\,(max),abs}) \times (1.29)$ $=(12.5) \times (750 + 14.7) \times (1.29) = 12340$ scfh NG			← Qwo Equation
MAOP of System	60 psi			← Problem Statement
Process Fluid/SG	Natural Gas (0.6)			← Problem Statement
Application	Farm Tap			← Problem Statement

EMERSON

Quick Selection Guide:

Relief Valve / Backpressure Regulators			
Relief Set Pressure Range	**Maximum Capacity**		**Type Number**
5 in. w.c. to 75 psig / 12 mbar to 5.2 bar	100,000 SCFH / 2680 Nm³/h		289 Series Page 83
10 in. w.c. to 580 psig / 25 mbar to 40.0 bar	102,611 SCFH / 2750 Nm³/h		V Series Page 538
14 in. w.c. to 100 psig / 35 mbar to 6.9 bar	111,000 SCFH / 2975 Nm³/h		Type 289P Page 90
3 to 125 psig / 0.21 to 8.6 bar	298,000 SCFH / 7986 Nm³/h		1808 Series Page 197
5 to 125 psig / 0.34 to 8.6 bar	100,000 SCFH / 2680 Nm³/h		Type 1805 Page 190
10 to 100 psig / 0.69 to 6.9 bar	136,000 SCFH / 3645 Nm³/h		Type 1805P Page 194

Relief Selection: Sizing an 1805

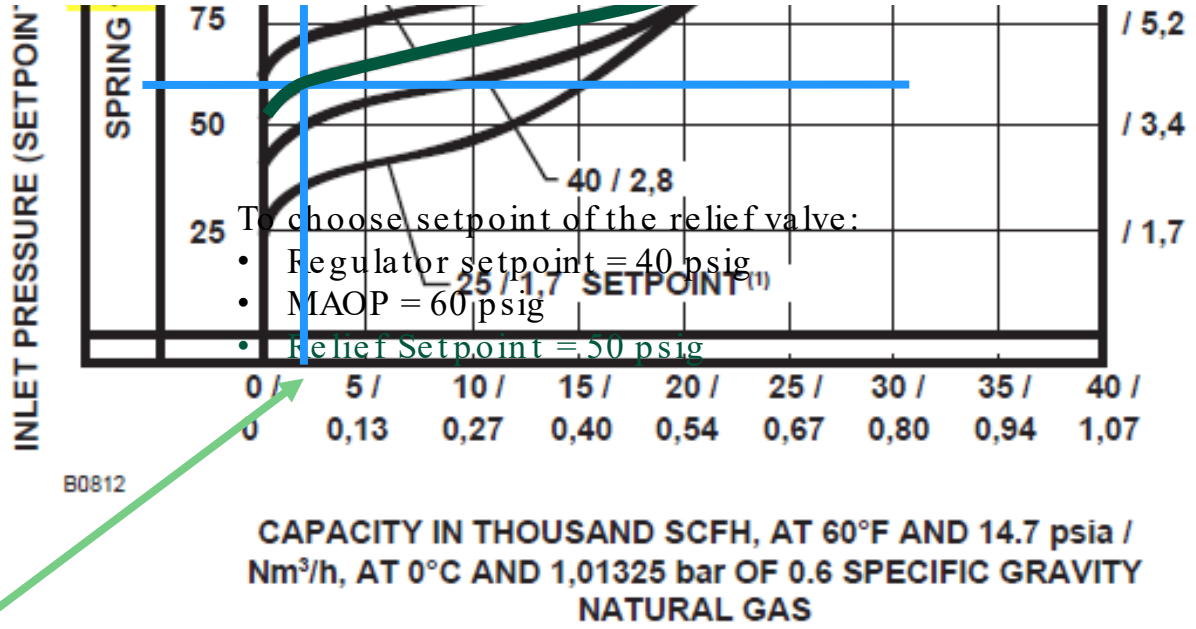
Relief Selection: Sizing	
Selection	1805-2
Body Size	1”
Spring Range/Pilot	n/a
Main Spring	10-60 psi
Actuator Size	n/a
Minimum Differential	n/a
Calculated W/O Flow Rate	12330 scfh NG
Flow Rate at MAOP	4,000 scfh NG
Materials: Elastomers	NBR
Materials: Metal	Aluminum

Bulletin

Won’t meet capacity @ MAOP!

Table 1. *Relief Valve Set Pressure Ranges*

BODY SIZE, NPT	RELIEF PRESSURE RANGE		SPRING PART NUMBER	SPRING COLOR CODE
	psig	bar		
3/4 or 1	5 to 35 10 to 60 20 to 125	0,34 to 2,4 0,69 to 4,1 1,4 to 8,6	1B986027212 1B788327022 1B788427022	Green Silver Blue
1-1/2 or 2	5 to 20 10 to 50 35 to 125	0,34 to 1,4 0,69 to 3,4 2,4 to 8,6	1D892327022 1D665927022 1E543627142	Red Blue Yellow

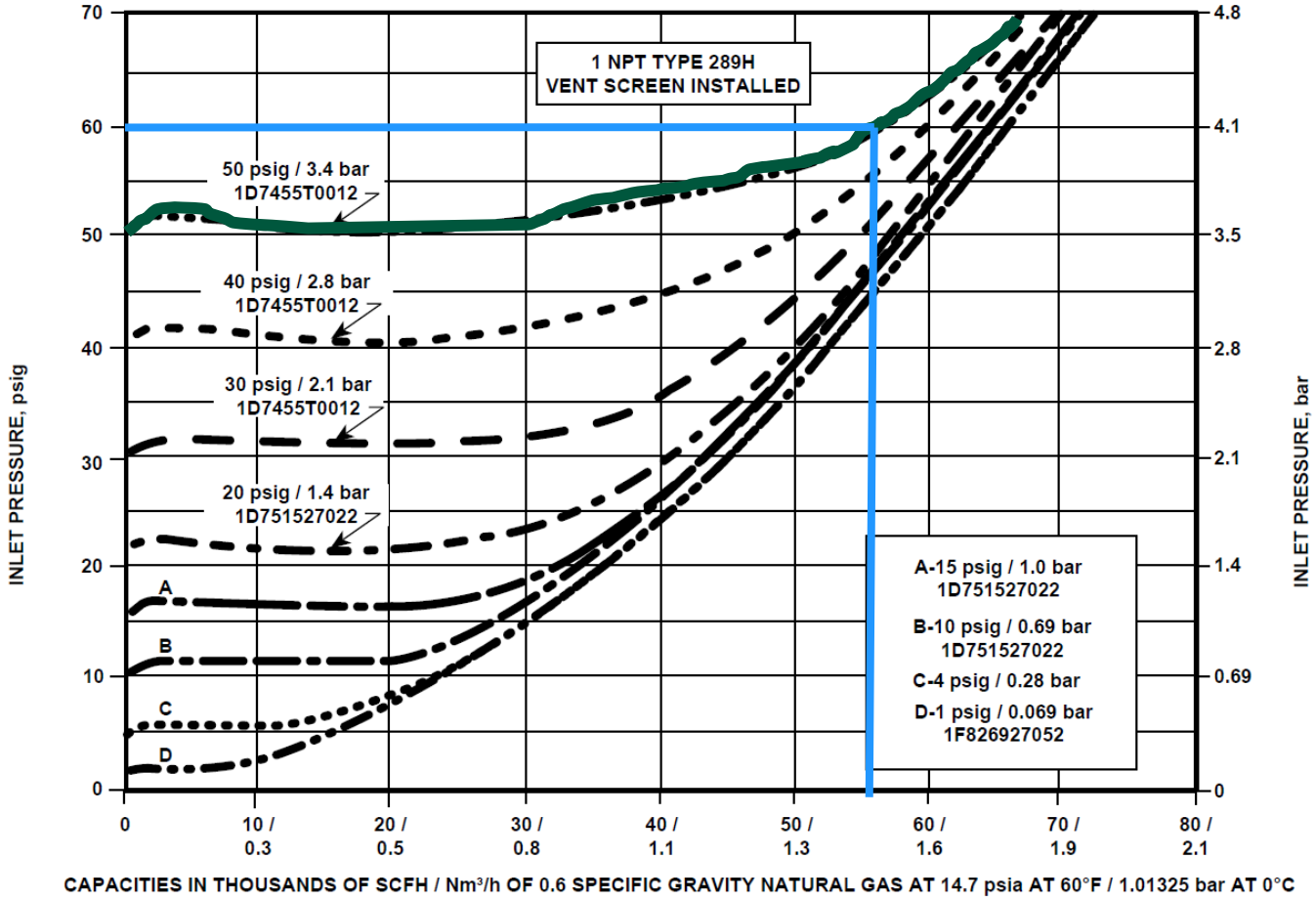


To choose setpoint of the relief valve:

- Regulator setpoint = 40 psig
- MAOP = 60 psig
- Relief Setpoint = 50 psig

Relief Selection: Sizing a 289H

Relief Selection: Sizing	
Selection	289H
Body Size	1”
Spring Range/Pilot	n/a
Main Spring	15-50psi
Actuator Size	n/a
Minimum Differential	n/a
Calculated W/O Flow Rate	12330 scfh NG
Flow Rate at MAOP	56,000 scfh NG
Materials: Elastomers	NBR
Materials: Metal	Aluminum



← 289 Bulletin Figure 3 (Page 4)

←289 Bulletin

←289 Bulletin

EMERSON

289H 1” Bulletin Information

Table 1. *Maximum Allowable Relief (Inlet) Pressure*

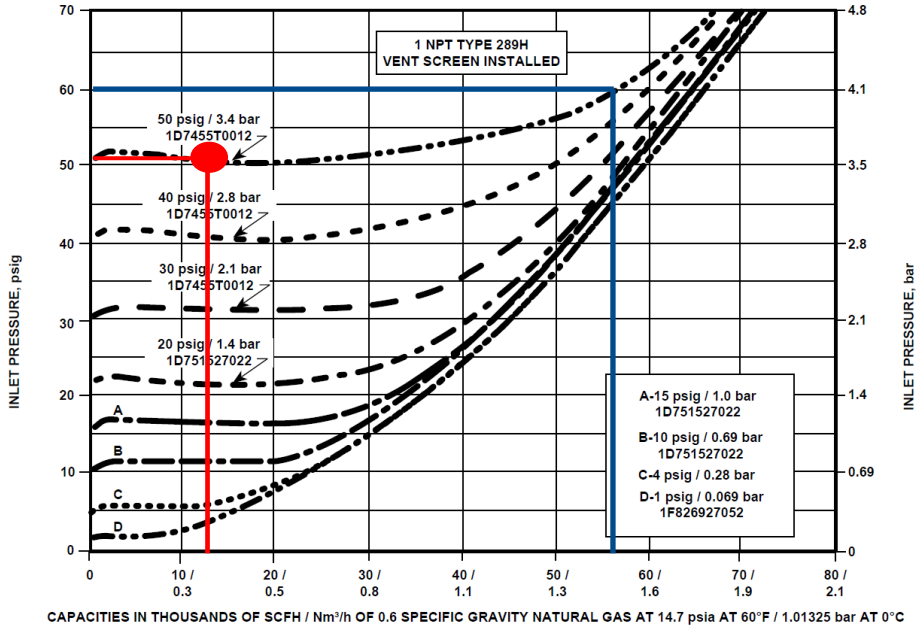
AVAILABLE CONFIGURATION	BODY SIZE, NPT	SPRING PART NUMBER	COLOR CODE	SPRING RANGE (RELIEF PRESSURE SETTINGS)		MAXIMUM ALLOWABLE RELIEF (INLET) PRESSURE[1]	
				psig	bar	psig	bar
Type 289A	1/4	0Z056327022 1B268227022	Silver Silver	3 to 13 11 to 22	0.21 to 0.90 0.76 to 1.5	45	3.1
Type 289H	1	1F826927052 1D892327022 1D751527022 1D7455T0012	Pink Red Silver Green	1 to 4.5 4 to 15 10 to 20 15 to 50	0.07 to 0.31 0.28 to 1.0 0.69 to 1.4 1.0 to 3.5	100	6.9
	2	1B536527052 1B536627052 1B536827062 1B536927052	Dark Blue Gray Dark Green Red Stripe	7 to 18 in. w.c. 0.5 to 2.25 1.75 to 7 4 to 10	17 to 45 mbar 0.03 to 0.16 0.12 to 0.48 0.28 to 0.69	25	1.7
Type 289HH	1	1D7455T0012	Green	45 to 75	3.1 to 5.2	100	6.9
Type 289L	3/4 or 1	13A7917X012 13A7916X012	Silver Red Stripe	10 to 18 in. w.c. 12 to 40 in. w.c.	25 to 45 mbar 30 to 99 mbar	7	0.48
Type 289U	1/4	0V060227022 0F058227022	Silver Silver	5 to 25 in. w.c. 20 in. w.c. to 3 psig	12 to 62 mbar 50 to 207 mbar	10 psig	0.69

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

Check Downstream Regulator Pressure Ratings

- Most Self-Operated regulators have lower casing pressure ratings than inlet ratings on the bodies.
- When sizing relief valves, check the casing and diaphragm ratings against the maximum outlet pressure the downstream piping will rise to including build-up pressure.

In our example using the 289H we would see a maximum pressure of approx. 51psig when the flow requirement of 12,340scfh is met with up to 60,000scfh capacity at full MAOP + Buildup.



This 627 chart shows Max pressure ratings

Table 2. *Maximum Spring and Diaphragm Casing Pressure*[1]

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

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

Our regulator setpoint is 40psig and we can take up to 60psig over setpoint on the casing. That would mean 100psig, but our relief is limiting the pressure to 51psig!

EMERSON

Relief Valve Sizing Guidelines

Brian Nutter
Sr. BDM/ Pressure Management
Applied Control – Denver, CO
For: Western Gas Measurement Short Course 2024

We Made it!

Questions?