Model 461-X57 Regulator Brochure

UTILITY SOLUTIONS GROUP

Introduction

Who We Are

Utility Solutions Group is a manufacturer of natural gas regulators and relief valves based in Columbus, OH. All products are made in the USA and compliant with the requirements of the Build America, Buy America Act. Utility Solutions Group's Quality Management System is certified to ISO 9001 by Smithers Quality Assessments.

461-X57 Regulator

The Model 461-X57 regulator is a unique high-pressure, large-capacity, spring-operated regulators. This high-pressure regulator incorporates the same roll-out diaphragm principal that is widely used in the 461-57S and 441-57S models.

This regulator offers pilot-type performance with spring-operated regulator simplicity. The action of the roll-out diaphragm makes the regulators exceptional performance possible by reducing droop, the falloff in outlet pressure as a spring regulator opens to increase flow, to a minimum.

The Model 461-X57 features a fast response and ease of installation. It is also simple to adjust and service. The 461-X57 is perfect for most high-pressure, large-capacity applications. This includes high-pressure regulator sets, gas distribution systems, town border stations, transmission systems and most industrial applications.

The 461-X57 regulator can also be used to monitor and quickly assume control if a failure in the operating regulator allows the outlet pressure to exceed its set-point. No modifications are required for use as a monitor, even if used as a monitor for other types of regulators.

Construction Materials

Diaphragm Housing, Spring Cage	Cast Iron (ASTM A126-71 Class B)
Bottom Diaphragm Housing	Steel (ASTM A216-70a gr WCB)
Housing Cover (Spring Cage Cap)	Ductile Iron (ASTM A395-71 gr 60-40-18)
Upper Diaphragm Plate and O-ring Piston	Stainless Steel
Diaphragm	Buna-N with Dacron Reinforcement
Diaphragm Stud	Stainless Steel
Removable Seats (Orifices)	Stainless Steel
Valve Stems	Stainless Steel
Soft-Seat Valve Material	Polyurethane, Pressure Molded in holder
Holder for Molded Valve	Steel
Valve Retainer	Stainless Steel
Bodies	Ductile Iron or Cast Steel

Maximum Differential and Inlet Pressure for Various Soft-Seated Valve Materials

The differential and inlet pressures given below are only to be used as general guidelines. In all cases, pressures must always remain within the ranges specified in Utility Solutions Group literature. For any given regulator, do not exceed the specified maximum pressures.

Valve Material	Maximum Pressure Differential	Maximum Inlet Pressure
Buna-N (Black, 50 to 55 duro)	250 psi	575 psi
Polyurethane (Red, 65 to 75 duro)	400 psi	720 psi
Polyurethane (Tan, 85 to 95 duro)	600 psi	1,200 psi

NOTE: The maximum temperature for the above materials are 150°F. Viton, if used, has a maximum temperature rating of 300°F and a maximum pressure differential of 250 psi.

Body Pressure Ratings and Maximum Inlet Pressures

Regulator Body Type	Body Material	Maximum Pressure of Body	Maximum Inlet Pressure
Flanged ANSI 250 lb. RF	Ductile Iron	575 psi	575 psi
Flanged ANSI 300 lb. RF	Cast Steel	720 psi	720 psi
Flanged ANSI 600 lb. RF	Cast Steel	1,200 psi	1,000 psi

Spring Ranges

Outlet Pressure Min. to Max.	Spring Color	Nominal Diaphragm Size (I.D.)
75 to 100 psi	Red	2 ½" Diaphragm All Ranges
100 to 175 psi	Brown	
150 to 250 psi	Black	

Roll-Out Diaphragm

The heart of the Model 461-X57 is the "Roll-Out" diaphragm. The 461-X57 is a spring regulator with performance which approximates that of a pilot operated regulator. The "Roll-out" Diaphragm makes this exceptional performance possible because its action reduces "droop" to a minimum ("droop" being fall off in outlet pressure as a spring regulator opens to increase flow.)

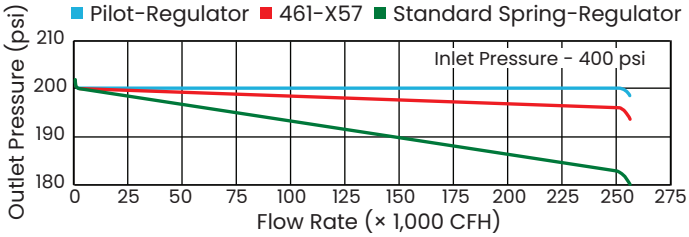
The action of the "Roll-Out" diaphragm differs from that of the conventional diaphragm in the manner in which the change in effective area occurs. Where the effective area of a conventional diaphragm would increase as the regulator opens, the "Roll-Out" area decreases. Conversely, where the area of the conventional diaphragm decreases during closing, the "Roll-Out" area increases. The following explanation and the illustrations below show how this affects regular performance.

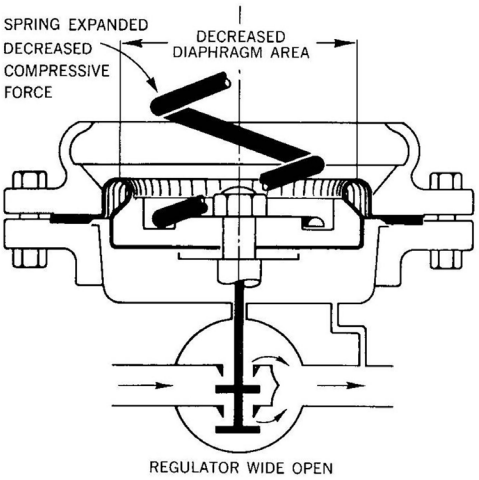
Spring type regulators are operated by the inter-action between spring and diaphragm. The compressive force of the spring works to open the regulator and is balanced by the opposing force of outlet pressure on the diaphragm which provides the closing force.

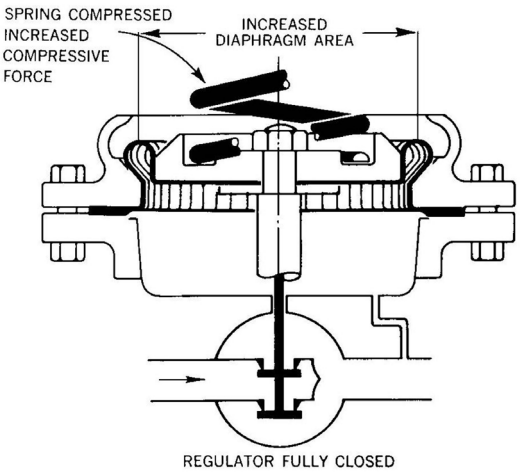
As the regulator opens, the compressive force of the spring decreases. However, as this spring force decreases, there must be a corresponding decrease in the opposing force from the diaphragm. For this opposing diaphragm force to decrease, either the effective area or the outlet pressure must decrease. Herein is the essential difference; with a conventional diaphragm the outlet pressure must decrease, where as with the "Roll-Out" diaphragm it is the effective area that decreases, permitting the outlet pressure to remain constant.

The operation actually is quite simple, yet the action of the "Roll-Out" diaphragm is so effective that "droop" is practically eliminated.

The Model 461-X57 provides constant pressure regulation. It approaches pilot performance, and, in addition, offers the further advantages of simplicity, dependability, freedom from freeze-up, and exceptionally fast response.







Construction Features

Simple Design- Dependable regulation, trouble free operation, and fast response.

Standard Face to Face Dimensions

Standardized 461 Bodies and Inner Valve Assemblies- Easy maintenance, parts are interchangeable with other 461 models.

Simplified Valve Adjustment- Accurate, easy to adjust for tight lock-up.

Molded Soft Seats- Positive tight shut-off, high erosion resistance, and will not blow out.

O-Ring Stem Seal- With removable anti-friction bushing.

Bushing Guided Inner Valve- Accurate stem alignment and valve seating.

Side Inspection Plates- Both sides of body-quickly removable.

O-Ring Body Seals- Eliminates gaskets on upper and lower body openings, and side inspection plates.

Self-Aligning Spring Adjustment- Color-coded springs.

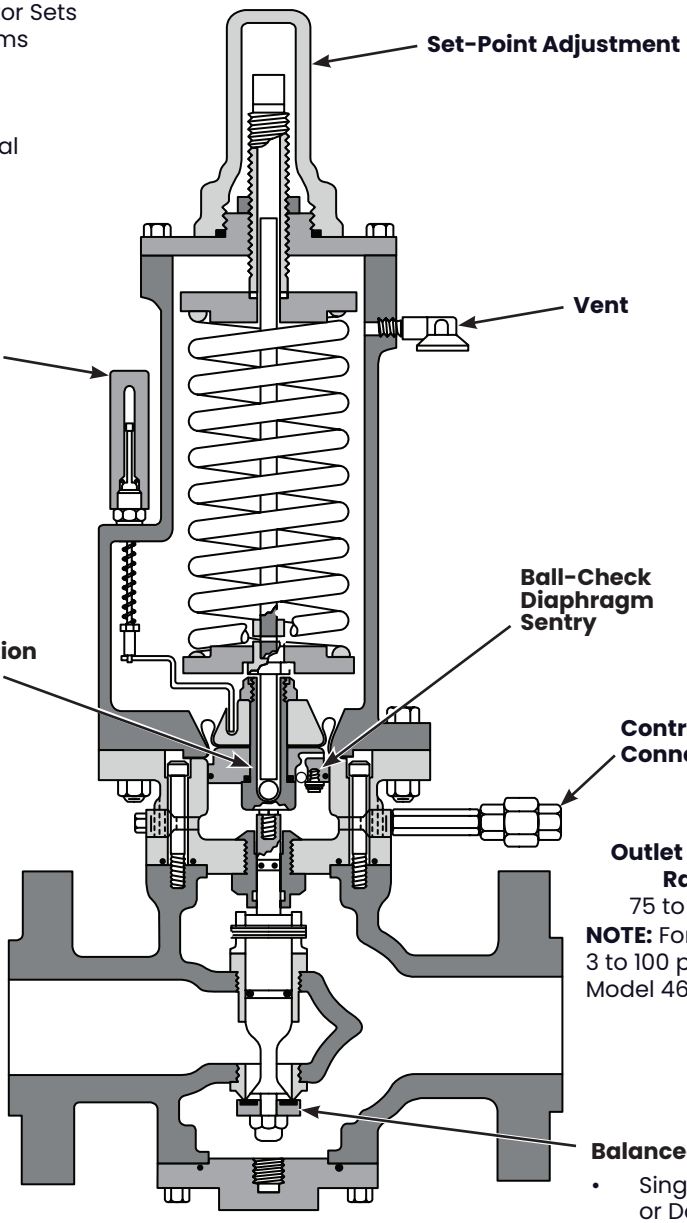
V-Port Orifice Restrictors- Allows regulator to maintain outlet pressure performance at lower flow rates.

Intermediate Capacity

- High-Pressure Regulator Sets
- Gas Distribution Systems
- Town Border Stations
- Transmission Systems
- Monitoring
- High-Pressure Industrial Applications

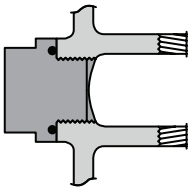
Heavy Duty Construction

- Weather-proof
- Watertight
- For Indoor or Outdoor Installations



Side Inspection Plates

- Located on both sides of the body
- Quickly removable
- Provide easy inspection and servicing of the inner valve



Inlet Pressures and Capacities
(See Page 4)

Outlet Pressure Range
75 to 250 psi
NOTE: For outlets of 3 to 100 psi, refer to Model 461-57S.

Balanced Valve

- Single-Seat (Shown) or Double-Seat

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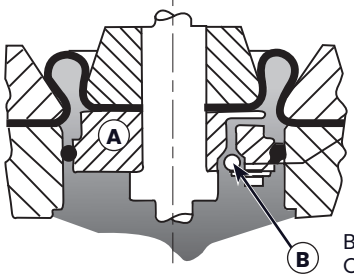
Ball-Check Safety Sentry

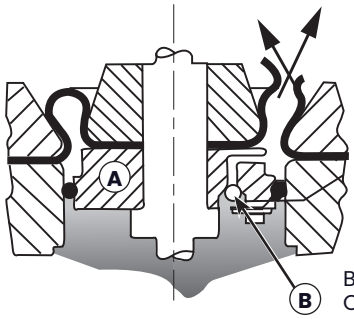
The ball-check diaphragm sentry is a safety device for keeping the regulator in operation in case of diaphragm failure. Refer to illustrations on the right, this is how it works:

1. O-ring piston A holds the Roll-Out diaphragm in correct alignment during normal operation.
2. Ball-check B is normally open to put outlet pressure against the Roll-Out diaphragm.
3. If a break should occur in the diaphragm, outlet pressure gas instantly begins to escape through the break and out the vent to atmosphere. This escaping gas flow immediately closes B. With B closed, outlet pressure is trapped beneath O-ring piston A, which then becomes a substitute for the diaphragm. With A as a substitute for the diaphragm, the regulator continues to operate.
4. The closing of B also prevents the diaphragm break from allowing gas to escape through the vent. Ball-Check Diaphragm Sentry
5. Regulation with the O-ring piston will show increased deviation from set point. This deviation is the warning that a failure has occurred.

Normal Operation



Standby Operation



Monitoring

The Model 461-X57 is also excellent for use as a monitor: a stand-by regulator mounted in series which assumes control if a failure in the operating regulator permits the outlet pressure to rise above its set point.

The 461-X57 has a fast rate of response and, therefore, will take control quickly in case of emergency. It requires no changes or modifications when used for monitoring. Its simple design and rugged construction make it an exceptionally dependable regulator, and its control accuracy and freedom from "droop" mean that it will provide excellent regulation if an emergency calls it into operation.

Two monitor set arrangements are shown in the illustrations below. The first shows a set in which the operating regulator and the monitor are both Model 461-X57. This makes an unusually neat and compact installation.

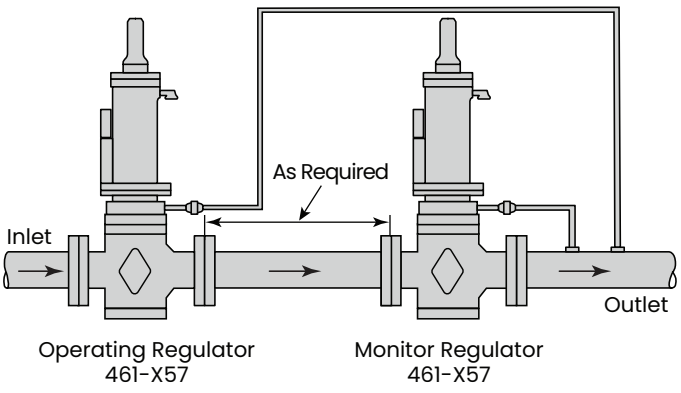
The 461-X57 is also used for monitoring other types of regulators. This is shown in the second Illustration. It is excellent for monitoring pilot operated regulators.

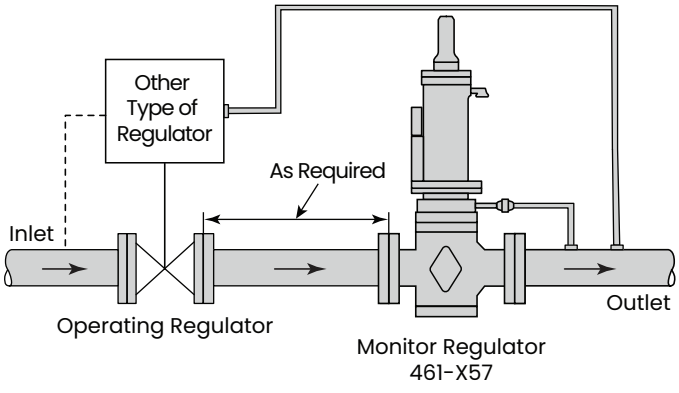
Both illustrations show the monitor in the downstream position. When installed this way, the 461-X57 is usually set for an outlet pressure 4 to 6 psi higher than the operating regulator and thus is wide open during normal operation.

The monitor can also be located upstream, and with this arrangement the 461-X57 is usually set for an outlet somewhat higher than the above.

Shutoff and bypass valving varies with individual practices and requirements. The "Typical Installation" illustration, (see Page 7), can be used as a guide for the arrangement of these valves.

When identical 461-X57 Regulators are used for both the operating regulator and the monitor, the total maximum capacity through both may be figured as 70 percent of the capacity of one of them alone. This applies with the monitor located either downstream or upstream.





Capacities Table

Measurements in 1,000 SCFH of Natural Gas (0.6 Specific Gravity - 14.65 psi - 60°F)

Inlet Pressure (psi)	Outlet Pressure (psi)	Double-Seat		Single-Seat	
		1" Valve	11/16" Valve	1" Valve	11/16" Valve
80	75	42.2	21.1	27.4	13.7
85	75	59.8	29.9	38.8	19.4
	80	43.4	21.7	28.2	14.1
90	75	73.2	36.6	47.5	23.8
	80	61.4	30.7	39.9	19.9
	85	44.6	22.3	29.0	14.5
100	75	94.6	47.3	61.5	30.7
	80	86.8	43.4	56.4	28.2
	85	77.2	38.6	50.1	25.1
	90	64.6	32.3	42.0	21.0
110	75	112.0	56.0	72.8	36.4
	80	106.0	53.2	69.1	34.5
	90	91.4	45.7	59.4	29.7
	100	67.6	33.8	43.9	21.9
120	75	127.0	63.5	82.5	41.2
	80	122.0	61.4	79.8	39.9
	90	112.0	56.0	72.8	36.4
	100	95.6	47.8	62.1	31.0
	110	70.6	35.3	45.9	22.9
140	75	152.0	76.3	99.2	49.6
	80	150.0	75.3	97.9	48.9
	90	144.0	72.2	93.8	46.9
	100	135.0	67.6	87.8	3.9
	120	103.0	51.8	67.3	33.6
160	80 or less	174.0	87.2	113.0	56.6
	90	171.0	85.5	111.0	55.5
	100	165.0	82.8	107.0	53.8
	120	146.0	73.3	95.3	47.6
	140	111.0	55.6	72.2	36.1
180	90 or less	194.0	97.2	126.0	63.1
	100	191.0	95.7	124.0	62.2
	120	179.0	89.8	116.0	58.3
	140	157.0	78.6	102.0	51.1
	160	118.0	59.1	76.8	38.4
200	100 or less	214.0	107.0	139.0	69.6
	120	207.0	103.0	134.0	67.4
	140	192.0	96.2	125.0	62.5
	160	167.0	83.5	108.0	54.2
	180	124.0	62.4	81.1	40.5
225	110 or less	239.0	120.0	155.0	77.8
	120	237.0	119.0	154.0	77.2
	140	229.0	114.0	149.0	74.5
	160	213.0	106.0	138.0	69.2
	180	187.0	83.6	121.0	60.8
	200	146.0	73.2	95.1	47.5
250	125 or less	264.0	132.0	171.0	85.9
	140	260.0	130.0	169.0	84.7
	160	250.0	125.0	162.0	81.4
	180	233.0	116.0	151.0	75.8
	200	207.0	103.0	134.0	67.2
	225	154.0	77.3	100.0	50.2
275	140 or less	289.0	144.0	188.0	94.0
	160	283.0	141.0	184.0	92.1
	180	271.0	136.0	176.0	88.3
	200	253.0	126.0	164.0	82.4
	225	218.0	109.0	142.0	71.1
	250	162.0	81.3	105.0	52.8
300	150 or less	314.0	157.0	204.0	102.0
	175	307.0	154.0	200.0	100.0
	200	292.0	146.0	190.0	95.1
	225	268.0	134.0	174.0	87.1
	250	230.0	115.0	146.0	74.7
325	165 or less	339.0	169.0	220.0	110.0
	180	335.0	168.0	218.0	109.0
	200	327.0	163.0	212.0	106.0
	225	309.0	154.0	201.0	100.0
	250	281.0	140.0	183.0	91.5
350	180 or less	365.0	182.0	236.0	118.0
	200	358.0	179.0	233.0	116.0
	225	346.0	173.0	225.0	112.0
	250	325.0	162.0	211.0	105.0
400	200 or less	414.0	207.0	269.0	134.0
	225	409.0	204.0	266.0	133.0
	250	398.0	199.0	258.0	129.0
450	230 or less	464.0	232.0	301.0	151.0
	250	460.0	230.0	299.0	149.0
500	250 or less	514.0	257.0	334.0	167.0
550		564.0	282.0	366.0	183.0
600		614.0	307.0	399.0	199.0
700		714.0	357.0	464.0	232.0
800		814.0	407.0	529.0	264.0
1,000		1,014.0	507.0	659.0	329.0
"K" Factors		2,000	1,000	1,300	650

Size each regulator on the basis of the minimum expected inlet pressure and the maximum outlet pressure.

For best performance of the Model 461-X57, use full table capacity values. For smaller capacities, refer to a Model 441-X57.

NOTE: The above performance data is based on normal testing at 70° F flowing temperature. Changes in performance can occur at extreme low-flowing temperatures.

Overpressurization Protection

Methods of overpressuirzation protection include relief valves, monitor regulators, shutoff devices, or similar mechanisms. These protect the downstream piping system and the regulator's low-pressure chambers against overpressurization due to possible regulator malfunction or failure to achieve complete lockup. The allowable outlet pressure is the lowest of the maximum pressures permitted by federal codes, state codes, and other applicable standards.

CAUTION

Turn gas on slowly. If an outlet stop valve is used, it should be opened first. Do not overload the diaphragm with a sudden surge of inlet pressure. Monitor the outlet pressure during start-up to prevent an outlet pressure overload.

Maximum Emergency Pressures

Before using any of the below data, ensure this entire section is clearly understood.

The following are the maximum inlet pressures which the regulator body may be subjected to under abnormal conditions without causing internal damage are:

Ductile Iron, Flanged ANSI 250 ..... 630 psi
Cast Steel, Flanged ANSI 300 ..... 800 psi
Cast Steel, Flanged ANSI 800 ..... 1,100 psi

The maximum outlet pressure which the diaphragm may be subjected to under abnormal conditions without causing internal damage is:

Maximum Outlet Pressure ..... set-point + 50 psi.

NOTE: The "set-point" is the outlet pressure the regulator is adjusted to deliver.

The maximum pressure that can be safely contained by the diaphragm case is:

Maximum Pressure ..... 350 psi

NOTE: Safely contained means no leakage and no bursting.

CAUTION

If any pressure exceeds the above values the regulator must be removed from service and inspected. Damaged or otherwise unsatisfactory parts must be repaired or replaced before returning the regulator to service.

Other Gases

The Model 461-X57 regulator is mainly used with natural gas. However, they perform equally as well with liquid propane gas (LPG), nitrogen, dry carbon dioxide (CO_2), air and others. When using with other gases, the regulator capacities must be adjusted using the following correction factors:

Type of Gas	Correction Factor
Air (Specific Gravity 1.0)	0.77
Propane (Specific Gravity 1.53)	0.63
1350 BTU Propane-Air Mix (Specific Gravity 1.20)	0.71
Nitrogen (Specific Gravity 0.97)	0.79
Dry Carbon Dioxide (Specific Gravity 1.52)	0.63

For other non-corrosive gases, use the following formula:

$$\text{Correction factor} = \sqrt{\frac{0.60}{\text{Specific gravity of the gas}}}$$

For use with gases not listed above, please contact your Utility Solutions Group representative or Authorized Distributor.

Capacities at Other Pressures

Capacity for pressure reductions not listed on Page 4 can be calculated with the following formula:

$Q = K\sqrt{P_o(P_i - P_o)}$ ..... (for P_i/P_o less than 1.894)

$Q = \frac{K P_i}{2}$ ..... (for P_i/P_o less than 1.894)

Q = Maximum capacity of regulator, in SCFH of 0.6 specific gravity natural gas

K = the "K" factor, the regulator constant (see table below)

P_i = absolute inlet pressure (psi)

P_o = absolute outlet pressure (psi)

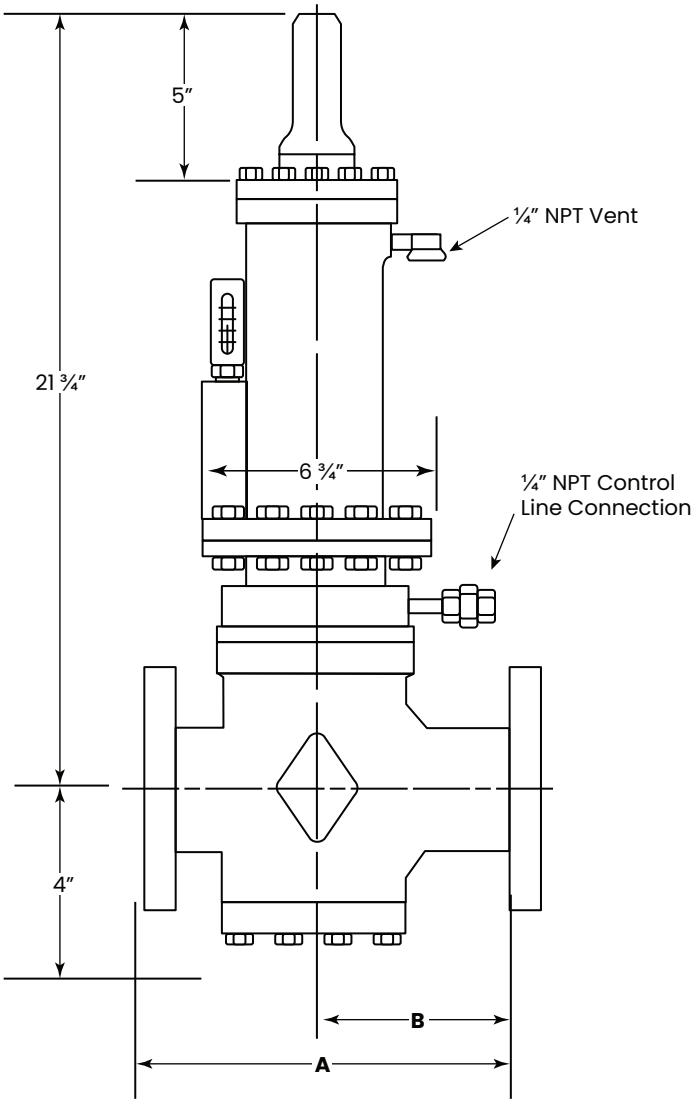
Temperature Limits

The Model 461-X57 Regulator can be used for flowing temperatures from -20°F to 150°F.

Buried Service

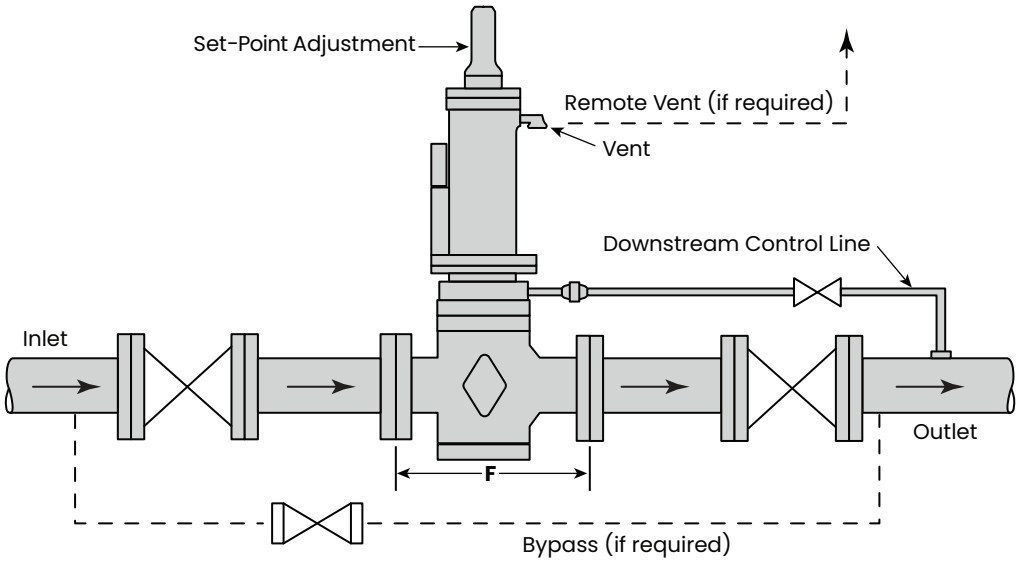
The Model 461-X57 Regulator is not recommended for buried service.

Dimensions



Regular Body Type	A	B	Shipping Weight (lbs)
Flanged ANSI 250 RF	10 ½″	10 ½″	85
Flanged ANSI 300 RF	10 ½″	10 ⅝″	88
Flanged ANSI 600 RF	11 ¼″	6″	90

Typical Installation



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