Model 461-57S 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.

461-57S Regulator

The 461-57S medium pressure regulator is a spring-operated model that incorporate a "roll-out" diaphragm, similar to the performance found in pilot-operated regulators.

The action of the roll-out diaphragm reduces "droop," which is the fall off in outlet pressure as a spring regulator opens to increase flow. This makes the regulators' exceptional performance possible. By offering near-pilot-operated regulator performance without a pilot, the 57S-series offers simplicity, dependability, and exceptionally fast response.

The 461-57S is perfect for most intermediate capacity applications:

- Gas distribution systems
- District regulator sets
- City gate stations
- Town border stations
- Monitoring
- A wide variety of industrial applications.

Construction Materials

Diaphragm Housing, Spring Cage	Cast Iron (ASTM A126-71 Class B)
Housing Cover (Spring Cage Cap)	Ductile Iron (ASTM A395-71 gr 60-40-18)
Upper Diaphragm Plate	Die Cast Aluminum
Lower Diaphragm Plate	Cast Iron
Diaphragm	Buna-N with Dacron Reinforcement
Diaphragm Stud	Stainless Steel
Removable Seats (Orifices)	Brass or Stainless Steel
Valve Stems	Brass or Stainless Steel
Stem Bushing	Anti-Friction Bushing
Valve Seat Material	Buna-N, Viton, Polyurethane or Nylon molded in holder
Holder for Valve Material	Steel for Soft Seat, Stainless Steel for Nylon Seat
Valve Retainer	Brass or Stainless Steel
Bodies	See "Body Pressure Ratings" table
Body (Threaded or Flanged ANSI 125 lb. FF)	Cast Iron (ASTM A126-71 Class B)
Body Flanged ANSI 250 lb. RF	Ductile Iron(ASTM A395-71 GR 60-40-18)
Body Flanged ANSI 600 lb. RF	Cast Steel (ASTM A2 16-70A GR WCB)

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 Body Pressure	Maximum Inlet Pressure
Threaded	Cast Iron	250 psi	250 psi
Flanged ANSI 125 lb. FF	Cast Iron	175 psi	175 psi
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	Spring Part Number
3 to 6 psi	Yellow	091-00-021-05
5 to 9 psi	Gray	091-00-021-04
7.5 to 15 psi	Blue	091-00-021-03
12.5 to 30 psi	Red	091-00-021-02
25 to 55 psi	Brown	091-00-021-01
50 to 75 psi	Black	091-00-021-00
70 to 100 psi	Brown plus White	091-00-021-01 091-00-021-08*

* White colored spring is nested inside brown.

Roll-Out Diaphragm

The heart of the Model 461-57S is the "Roll-Out" diaphragm. The 461-57S 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.)

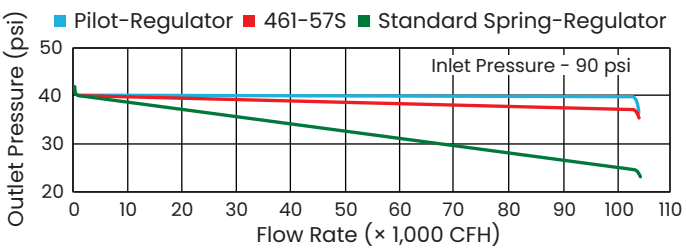
The action of the "Roll-Out" diaphragm differs from that of the conventional diaphragm in the manner in which the change in effective area occurs. Where the effective area of a conventional diaphragm would increase as the regulator opens, the "Roll-Out" area decreases. Conversely, where the area of the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

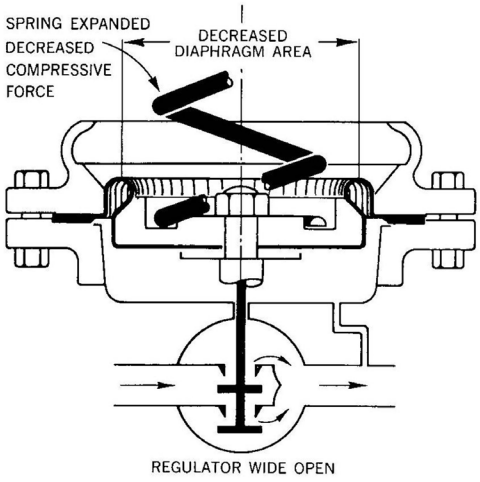
Spring type regulators are operated by the inter-action between spring and diaphragm. The compressive force of the spring works to open the regulator and is balanced by the opposing force of outlet pressure on the diaphragm which provides the closing force.

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. Here 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.

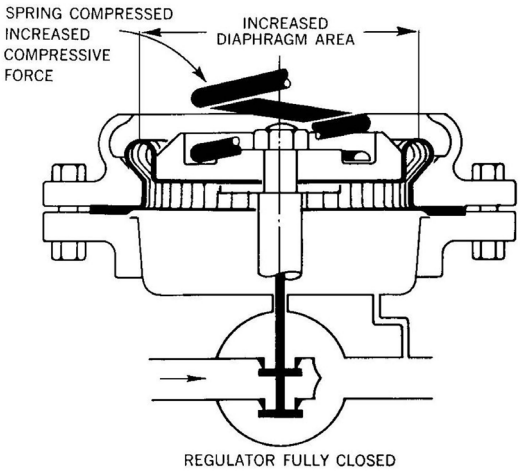
The operation actually is quite simple, yet the action of the "Roll-Out" diaphragm is so effective that "droop" is practically eliminated.

The Model 461-57S provides constant pressure regulation not previously possible in a "pounds to pounds" spring regulator. It approaches pilot performance, and, in addition, offers the further advantages of simplicity, dependability, freedom from freeze-up, and exceptionally fast response.



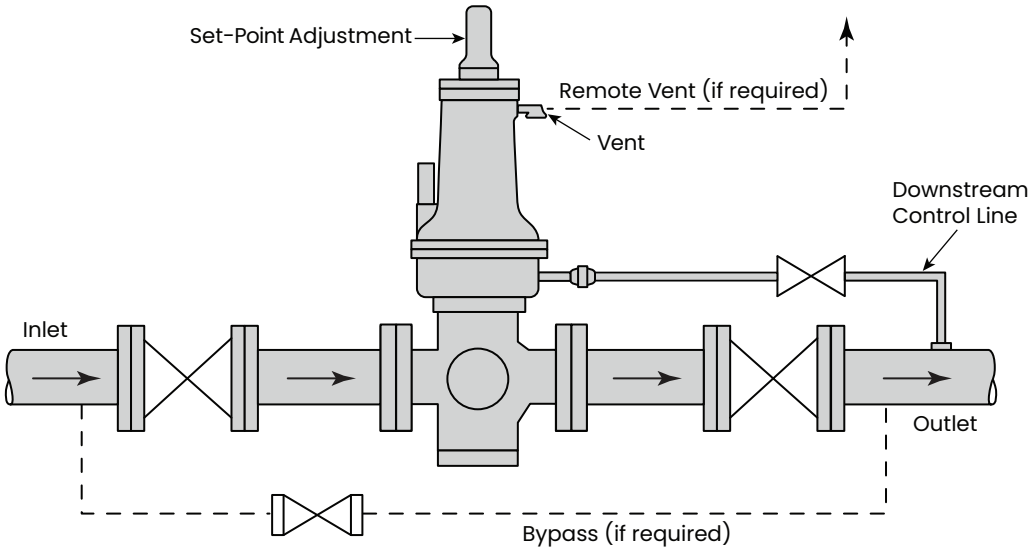


REGULATOR WIDE OPEN



REGULATOR FULLY CLOSED

Typical Installation



Monitoring

The Model 461-57S 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 461-57S 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 461-57S. This makes an unusually neat and compact installation.

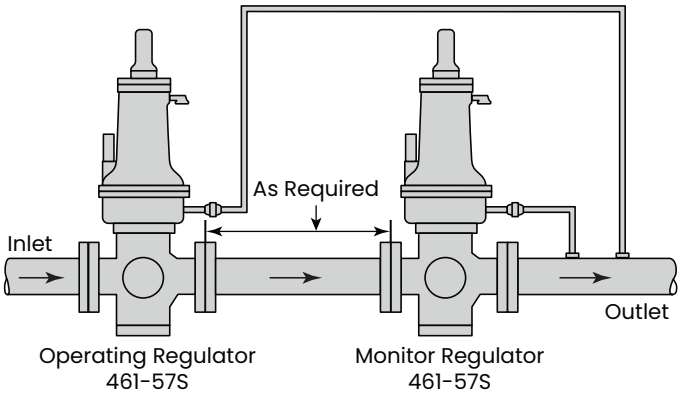
The 461-57S is also used for monitoring other types of regulators. This is shown in the second Illustration. It is excellent for monitoring pilot operated regulators.

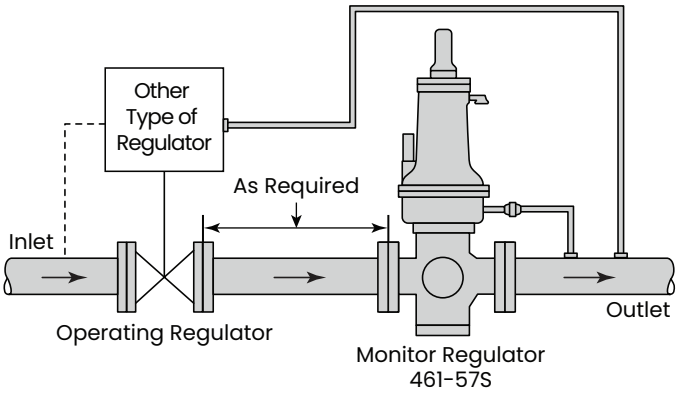
Both illustrations show the monitor in the downstream position. When installed this way, the 461-57S is usually set for an outlet pressure 2 to 4 psi higher than the operating regulator and thus is wide open during normal operation.

The monitor can also be located upstream, and with this arrangement the 461-57S 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 on Page can be used as a guide for the arrangement of these valves.

When identical 461-57S 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.





Construction Features

Simple Design- Dependable regulation, trouble-free operation, and fast response. No pilot, pilot freezing, or pilot maintenance.

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.

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

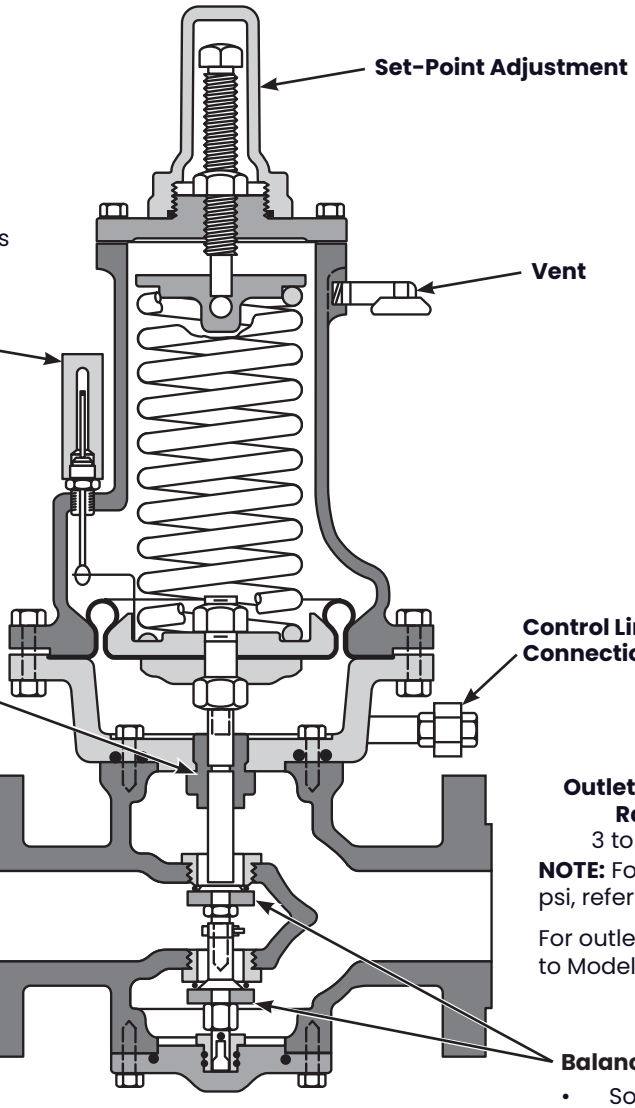
Self-Aligning Spring Adjustment- Color-coded springs.

Removable Seats (Orifices)- Easily changed with standard 1 ½" deep socket wrench.

V-Port Orifice Restrictors- Allows regulator to maintain outlet pressure performance at lower flow rates. (only avaliable on 1" single or 1" double valves)

Large Capacity

- Gas Distribution Systems
- District Regulator Sets
- City Gate Stations
- Town Border Stations
- Monitoring
- Industrial Applications
- Industrial Burners
- Furnace, Ovens, and Boilers



Heavy Duty Construction

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

Inlet Pressures and Capacities
(See Page 4)

Outlet Pressure Range
3 to 100 psi

NOTE: For outlets up to 250 psi, refer to Model 461-X57.

For outlets below 3 psi refer to Model 461-S.

Balanced Valve

- Soft Seats
- Double-Seat (shown) or Single-Seat
- Available reduced size valves and V-Port Valves

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
4	3	8.4	4.2	5.4	2.7
5	3	11.8	5.9	7.6	3.8
	4	8.6	4.3	5.6	2.8
6	3	14.4	7.2	9.3	4.6
	4	12.2	6.1	7.9	3.9
	5	8.8	4.4	5.7	2.8
8	3	18.6	9.6	12.1	6.0
	4	17.2	8.6	11.1	5.6
	5	15.2	7.6	9.8	4.9
	6	12.8	6.4	8.3	4.1
10	3	22.2	11.1	14.4	7.2
	4	21.0	10.5	13.6	6.8
	5	19.8	9.9	12.8	6.4
	6	18.0	9.0	11.7	5.8
	8	13.4	6.7	8.7	4.3
12	3	25.2	12.6	16.3	8.2
	4	24.4	12.2	15.8	7.9
	5	23.4	11.7	15.2	7.6
	6	22.2	11.1	14.4	7.2
	8	19.0	9.5	12.3	6.1
	10	14.0	7.0	9.1	4.5
15	3	29.0	14.5	18.8	9.4
	4	28.6	14.3	18.6	9.3
	5	28.0	14.0	18.2	9.1
	6	27.2	13.6	17.6	8.8
	8	25.0	12.5	16.2	8.1
	10	22.2	11.1	14.4	7.2
	12	17.8	8.9	11.5	5.7
20	3	34.6	17.3	22.5	11.2
	4	34.4	17.2	22.3	11.1
	6	34.0	17.0	22.1	11.0
	8	32.8	16.4	21.3	10.6
	10	31.4	15.7	20.4	10.2
	12	29.2	14.6	18.9	9.5
	15	24.2	12.1	15.7	7.8
25	6 or less	39.6	19.8	25.7	12.8
	8	39.2	19.6	25.4	12.7
	10	38.4	19.2	24.9	12.4
	12	37.2	18.6	24.1	12.1
	15	34.4	17.2	22.3	11.1
	20	26.2	13.1	17.0	8.5
30	9 or less	44.4	22.2	28.8	14.4
	10	44.2	22.1	28.7	14.3
	12	43.8	21.9	28.4	14.2
	15	42.0	21.0	27.3	13.6
	20	37.2	18.6	24.1	12.1
	25	28.0	14.0	18.2	9.1
40	14 or less	54.4	27.2	35.3	17.6
	20	52.6	26.3	34.2	17.1
	25	48.6	24.3	31.6	15.8
	30	42.2	21.1	27.4	13.7
	35	31.4	15.7	20.4	10.2
50	20 or less	64.4	32.2	41.8	20.9
	25	62.8	34.1	40.8	20.4
	30	59.6	29.8	38.7	19.3
	35	54.4	27.2	35.3	17.6
	40	46.6	23.3	30.3	15.1
	45	34.4	17.2	22.3	11.1
60	25 or less	74.4	37.2	48.3	24.1
	30	73.2	36.6	47.5	23.8
	40	66.0	33.0	42.9	21.4
	50	50.8	25.4	33.0	16.5
80	35 or less	94.2	47.1	61.2	30.6
	40	93.2	46.6	60.5	30.3
	50	87.8	43.9	57.0	28.5
	60	77.2	38.6	50.1	25.1
	70	58.0	29.0	37.7	18.8
100	45 or less	114	57.2	74.3	37.1
	50	113	56.8	73.8	36.9
	60	109	54.6	70.9	35.5
	70	100	50.3	65.4	32.7
	80	86.8	43.4	56.4	28.2
125	60 or less	139	69.6	90.4	45.2
	70	136	68.2	88.6	44.3
	80	130	65.2	84.7	42.3
	100	107	53.5	69.5	34.7
150	73 or less	164	82.0	106	53.3
	80	162	81.3	105	52.8
	100	151	75.7	98.4	49.2
175	85 or less	189	94.8	123	61.6
	100	185	92.7	120	60.2
200	100 or less	214	107	139	69.6
250		264	132	171	85.9
300		314	157	204	102
350		364	182	236	118
400		414	207	269	134
500		514	257	334	167
600		614	307	399	199
800		814	407	529	264
1,000		1,014	507	659	329
"K" Factors		2,000	1,000	1,300	650

NOTE: For V-Port Valves– Multiply Table Values by 0.75
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 overpressurization 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:

Cast Iron, Threaded ..... 275 psi
Cast Iron, Flanged ANSI 125 lb. ..... 200 psi
Ductile Iron, Flanged ANSI 250 lb. ..... 630 psi
Cast Steel, Flanged ANSI 300 lb. ..... 800 psi
Cast Steel, Flanged ANSI 600 lb. ..... 1,100 psi

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

All 461-57S ..... set-point + 25 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:

All 461-57S ..... 175 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.

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)

Other Gases

The Model 441-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.

Relief Valves and Back Pressure Valves

Where inlet pressure control is required, as with a back pressure valve or relief valve, use the Model 461-57SR.

The 461-57SR is the same as the 461-57S except that the inner valve is reversed, the body is turned around, and the control line is arranged for connection to the inlet side (upstream)

The adjustment is 3 to 90 psi.

Use the table on Pages 5 and 6 for capacities.

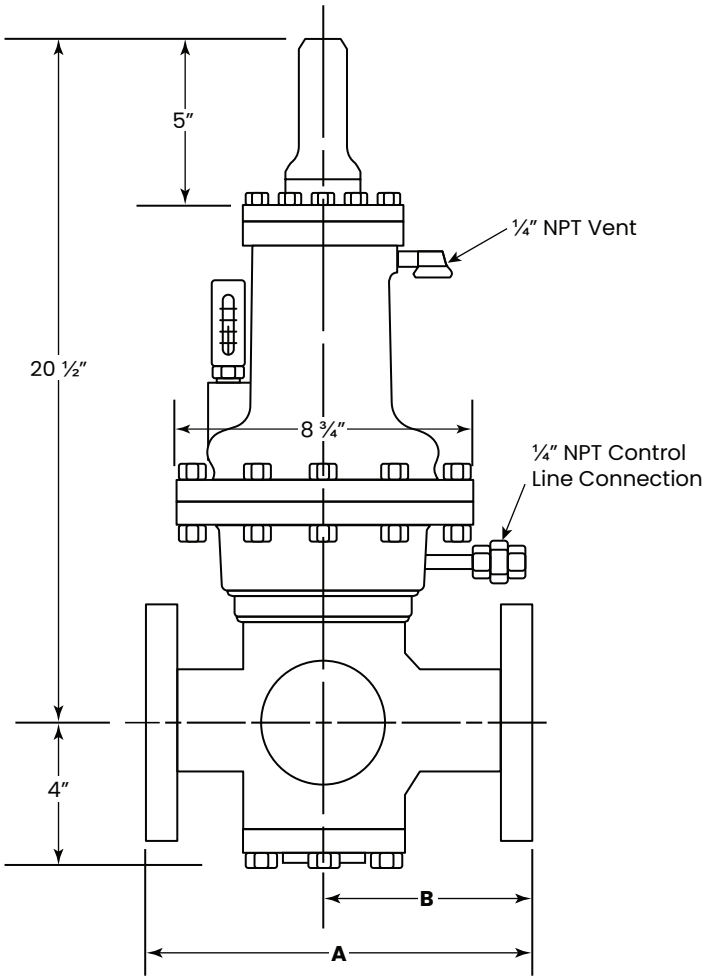
Temperature Limits

The Model 461-57S Regulator can be used for flowing temperatures from -20°F to 150°F.

Buried Service

The Model 461-57S Regulator is not recommended for buried service.

Dimensions



Regular Body Type	A	B	Shipping Weight (lbs.)
Threaded	6 ½″	3 ¾″	70
Flanged ANSI 125 lb.	10″	5 ¼″	80
Flanged ANSI 250 lb.	10 ½″	5 ½″	85
Flanged ANSI 300 lb.	10 ½″	5 ⅝″	88
Flanged ANSI 600 lb.	11 ¼″	6″	90

How to Order

Specify:

1. 2″ Model 461-57S.
2. Piping connections and body material.
3. Outlet pressure and/or spring (see table on Page 1).
4. Inlet pressure (maximum and minimum, if available).
5. Capacity required (SCFH).
6. Kind of gas (natural gas, propane, etc.).
7. Trim (standard or stainless steel).
8. Valve size (1″ or 1 1/16″).
9. Double-seat or single-seat (if not specified, double-seat will be furnished).

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