UTILITY SOLUTIONS GROUP

Model 461-X57 Regulator

Installation & Maintenance Manual

USG-IMM-030

Contents

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Introduction

461-X57 Regulator

The Model 461-X57 is a unique high-pressure, large-capacity, spring-operated regulator. 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 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 as a monitor to 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.

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.)

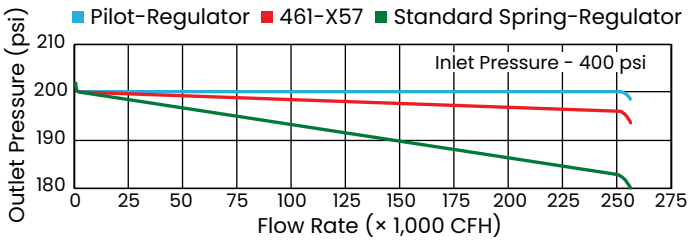
The action of the "Roll-Out" diaphragm differs from that of the conventional diaphragm in the manner which the change in effective area occurs. Where the effective area of a conventional diaphragm would increase as the regulator opens, the "Roll-Out" area decreases. Conversely, where the area of the conventional diaphragm decreases during closing, the "Roll-Out" area increases. The following explanation and the graph below show how this affects 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 additionally offers further advantages of simplicity, dependability, freedom from freeze-up, and exceptionally fast response.



Installation and Start-Up

NOTE: Do not install sideways. The diaphragm should be horizontal.

1. Ensure the inlet and outlet connections are correct. High-pressure connects to the regulator inlet. The flow arrow on the body must point downstream.
2. Tighten flanged joints evenly.

CAUTION

It is the user's responsibility to ensure that all regulator vents and/or vent lines exhaust to a non-hazardous location away from ANY POTENTIAL sources of ignition. Where vent lines are used, it is the user's responsibility to ensure that each regulator is individually vented and that common vent lines ARE NOT used.

3. Before beginning start-up, ensure the regulator is correctly connected, adequately supported, and pipe joints are tight.
4. Document the factory adjusted set-point. The regulator is factory adjusted to the set-point specified on the order.

NOTE: "Set-point" is the outlet pressure the regulator is adjusted to deliver). Only adjust set-point when gas is flowing through the regulator. Flow should be small (10% of maximum regulator capacity or less). Do not adjust if regulator is locked-up (tight shutoff).

CAUTION

During start-up a pressure gauge must be used on the piping at the regulator outlet and closely monitored. While inlet pressure enters the regulator, outlet pressure must not exceed set-point by more than the small amount needed for lock-up (tight shutoff). If outlet pressure continues to increase above this, close the inlet shutoff valve. The regulator is not closing properly. Make necessary corrections before resuming start-up. Regulator must be fully capable of tight lock-up.

5. After completing start-up, make sure there are no leaks.

CAUTION

The diaphragm case vent must be positioned to protect against flooding, drain water, ice formation, traffic, tampering, etc. The vent must be protected against nest-building animals, bees, insects, etc., to prevent vent blockage and minimize chances for foreign material collecting in the vent side of the regulator diaphragm.

6. From the ¼" union (**20**), extend pipe or tubing to the control connection into the outlet piping.

NOTE: Control piping should not be less than ¼" in size and should be adequately protected against breakage. Regulators will go wide open if the control line is broken.

CAUTION

Interior of both the control line and its connections should be clean and smooth to minimize turbulence. Remove any rough edges, welding debris, etc. It should be located on the top or side of the pipe, and the line pitched to drain away from the regulator into the outlet pipe.

Where outlet piping increases in size near the regulator, it is recommended to locate the control connection in the larger size. Keep pipe dope and all other foreign substances out of the control line.

The ¼" union (20) contains a small orifice, approximately 1/16" diameter. This orifice should not be removed. Ensure this orifice is open and free of foreign material.

NOTE: The regulator will work to deliver the adjusted pressure at the point in the outlet piping where the control connection is located. Control connection should be at least eight pipe diameters from the regulator and should be in as straight a run of pipe as possible.

7. Check all connections for leaks.
8. Put the regulator into operation as follows: (see "Typical Installation" illustration on Page 7)
   a. Slowly open the downstream control line valve A.
   b. Slowly open the downstream block valve B.
   c. Very slowly open the upstream block valve C.

CAUTION

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

   d. Set the adjusting screw (**2**) for the required outlet pressure. Turn it clockwise to increase the pressure and counterclockwise to decrease it. Only make this adjustment when gas is actually flowing through the regulator.
   e. After adjustment is complete, the lock-nut (**3**) should be tightened firmly and the seal cap (**1**) replaced.
9. To shut down, carefully close valves C, B, and A in that order.

Servicing and Adjustment

(See "Model 461-X57 Illustration" on Page 7 for emboldened numbers.)

General Notes

1. Ensure the regulator is entirely depressurized before servicing. Pressure must be fully released from the inlet, the outlet and the control line connection. Failure to adequately depressurize the regulator could result in serious personal injury.

WARNING

Even at only 10 psi outlet pressure, the force exerted on the adjustment screw by spring compression can be great. As a result, failure from worn threads could result in serious personal injury. Therefore, adjustment screw lubrication and thread condition must be given careful attention.

2. Carefully note the location and position of all disassembled parts to ensure proper reassembly. Inspect each part carefully and replace any that are worn, damaged, or otherwise unsatisfactory. Where there is evidence of thread wear, such as a loose fit or excessive side play, the worn parts must be replaced.
3. Adjustment screw lubrication should be checked whenever the regulator is serviced. Ensure the threads are fully coated with lubricant.
4. Ensure that the regulator installation is entirely free of leaks after completion of service.
5. A quick visual inspection of the valve can be made by removing inspection plates (**33**) from the sides of the body. They also provide greatly improved access to the valve when servicing or adjusting.
6. The diaphragm (**11d**), springs (**14**), all other parts from the lower diaphragm plate (**11e**), and parts listed above are interchangeable with the 441-X57.
7. Valve and body parts are interchangeable with other 461 Regulators (461-S and 461-57S)

8. Use lubricants sparingly and with care to avoid exposing tacky surfaces to the gas stream. Such surfaces could cause accumulation of dirt on close clearance parts. Only moly or silicone-type lubricants. Avoid the use of petroleum base type.

   It is best to avoid lubricating stem (**12b**) or guide (**12j**). However, as mall amount of lubricant on stem O-ring (**12a**) and O-ring (**12n**) will help ensure free movement and a tight seal. An application of lubricant to the other O-rings and the tetraseals in the regulator will help ensure a tight seal.

9. When using double-seat balanced valve assembly, bushing (**13**) must be screwed firmly into place. When using single-seat balanced valve assembly, bushing (**13**) must be removed.

CAUTION

Regulators are pressure control devices with numerous moving parts subject to wear that is independent upon particular operating conditions. To ensure continuous satisfactory operation, a periodic inspection schedule must be adhered with the frequency of inspection determined by the severity of service and applicable laws and regulations.

Servicing Double-Seat Balanced Valve Assembly

1. Remove seal cap (**1**), back off adjusting screw (**2**), remove housing cover (**6**), part (**7**), spring (**9**) and assembly (**31**).
2. Remove bottom inspection plate (**14**), and unscrew valve assembly intact from diaphragm assembly, (**12b**) unscrews from (**11h**).
3. Unscrew orifice (**18**) with socket wrench 1 ½" hex deep socket (**50**). Remove (**18**) and valve assembly intact through bottom opening.

NOTE: If valve assembly is intact, replace without disturbing set screw (**12g**). The top end of (**12b**) screws onto (**11h**) until it bottoms out, then be backed off one-half to one full turn.

If new parts are needed, disassemble valve assembly by loosening set screw (**12g**) and unscrewing (**12h**) from (**12b**). Then unscrew nut (**12e**) and part (**12j**).

4. Replace parts as required, then reassemble upper half valve assembly parts (**12a**), (**12b**), (**12c**), (**12d**), (**12e**) and lower half parts (**12f**), (**12g**), (**12h**), (**12c**), (**12d**), (**12j**).
5. Insert through bottom opening:
   a. Upper half valve assembly screw (**12b**) onto (**11h**) until it bottoms then back off one-half to one turn.
   b. Orifice (**18**) screw firmly into place.
   c. Lower half valve assembly screws onto upper half by 3 or 4 turns, (**12h**) screws onto (**12b**).
6. Make the valve lock-up adjustment. Seat the upper valve against orifice (**19**) while screwing the lower half valve assembly upward, (**12h**) screws onto (**12b**), until the lower valve is seated against (**18**). Then, firmly tighten set screw (**12g**).
   a. Seat the upper valve against orifice (**19**) either by reaching it through the body side opening or removing the diaphragm assembly and pulling the top end of stem (**12b**) upwards.
   b. Tighten (**12g**) with screwdriver through body side opening. If necessary, turn the entire valve assembly (carefully do not disturb adjustment) to face (**12g**) toward side opening.
   c. (**12g**) must tighten against flat area at the top of (**12h**) to correctly lock the adjustment.
7. Screw entire valve assembly upward, top of (**12b**) screws onto lower end of (**11h**), until it bottoms. Then back off one-half to one full turn.
8. Complete assembly per steps 6 through 10 under "Assembling 461-X57."

Servicing Single-Seat Balanced Valve Assembly

1. Remove seal cap (**1**), back off adjusting screw (**2**), remove housing cover (**6**), part (**7**), spring (**9**) and assembly (**31**).
2. Remove bottom inspection plate (**14**).
3. Remove lock nut (**12e**), then slip off valve (**12d**) and retainer (**12c**). Unscrew orifice (**18**) with socket wrench 1 ½" hex deep socket (**50**). Reassemble in reverse order.

NOTE: If it is necessary to remove stem (**12b**) or valve guide (**30**), do so by first removing lower diaphragm case (**21**) (refer to steps 2 through 4 of "Disassembling 461-X57"). Use socket wrench for (**30**) (1 ½" hex deep socket (**50**).

Single-seat balanced valve does not require any lock-up adjustment.

Orifice (**18**) must be same size as stem guide (**30**) (1" (**18**) with 1" (**30**) and 11/16" (**18**) with 11/16" (**30**)) Do not use 11/16" size of one with 1" size of the other.

4. Replace parts as required, then reassemble upper half valve assembly parts (**12a**), (**12b**), (**12c**), (**12d**), (**12e**) and lower half parts (**12f**), (**12g**), (**12h**), (**12c**), (**12d**), (**12j**).
5. Reassemble per applicable steps under "Assembling 461-X87" on Page 6.

Changing Spring

(See "Spring Ranges" table below for spring identification and selection.)

1. Remove seal cap (**1**), back off adjusting screw (**2**), and housing cover (**6**).
2. Grasp top of rod (**31a**) and lift out entire spring assembly. Remove part (**7**) and spring (**9**). Install new spring, replace (**7**), and ensure spring is correctly nested into (**7**) and (**31d**).
3. Look down through top opening of diaphragm case (**10**) and visually inspect diaphragm (**11d**). The visible roll of the diaphragm should be uniformly in place. Use a flashlight if necessary.
4. Ensure the end of the travel indicator bracket (**36h**) is fully inserted into hole in diaphragm plate (**11c**).
5. Grasp top of rod (**31a**) and lower spring assembly into place. Bottom end of (**31c**) inserts into place in (**11h**) until it rests on top of ball (**11j**).
6. To complete reassembly, refer to steps 9 and 10 of section "Assembling 461-X57").

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	

Servicing Diaphragm

1. Remove seal cap (**1**), back off adjusting screw (**2**), remove housing cover (**6**), part (**7**), spring (**9**) and assembly (**31**).
2. Remove bolts (**23**) and carefully remove upper diaphragm case (**10**).
3. Turn diaphragm assembly counterclockwise until (**11h**) unscrews from (**12b**). Remove assembly and inspect diaphragm.
4. If a new diaphragm (**11d**) is required, remove nut (**11a**) and disassemble.

NOTE: Mark diaphragm plate (**11c**) and stud (**11h**), and position them the same to each other on reassembly. This will simplify insertion of bracket (**36h**) into hole (**11c**).

During reassembly, ensure fabric side of diaphragm faces toward the vent side of the regulator and the rubber side of the diaphragm faces toward the pressure side. The gasket is always placed on the spring side of the diaphragm.

5. Screw diaphragm assembly back into place, (**11h**) screws into (**12b**) until it bottoms and then back it off one-half to one-full turn

NOTE: Ensure stainless steel ball (**11j**) is in place. Position diaphragm assembly for travel indicator bracket (**36h**). End of (**36h**) fits into hole in diaphragm plate 11c.

6. Fold roll into roll-out diaphragm (**11d**) and carefully reinstall upper diaphragm case (**10**). Then tighten bolts (**23**) and (**22**) evenly.

NOTE: Roll-out loop must be uniformly full and even. It should be in place as shown on the cross-section drawing, (see "Model 461-X57 Illustration" on Page 8).

Diaphragm must not be pinched between upper case (**10**) and lower case (**21**).

7. Insert end of (**36h**) into hole in (**11c**).
8. Reinstall spring assembly, (see steps 7 through 10 under "Assembling 461-X57").

Assembling 461-X57

1. Install valve parts as required through top opening, (guide (**30**) with stem (**12b**) plus pin (**12m**) or orifice (**19**)).
2. Install lower diaphragm case (**21**).
3. Install valve assembly and orifice (**18**) per previous instructions on servicing valve assemblies. Make lock-up adjustment on double-seat valve.
4. Screw diaphragm assembly back into place. Part (**11h**) screws into (**12b**) until it bottoms, then back off one-half to one full turn.
5. Install upper diaphragm case per Steps 7 and 8 under "Servicing Diaphragm".
6. Replace bottom inspection plate (**14**).

NOTE: With double-seat valve, engage pin in (**13**) with slot in lower end of (**12j**), then rotate (**14**) until holes line up to install cap screws (**16**).

7. Install (**31d**) onto rod (**31a**), then install spring (**9**) and upper plate (**7**).

NOTE: Ensure spring is correctly nestled onto (**31d**) and (**7**).

8. Grasp top of rod (**31a**) and lower spring assembly into plate. Bottom end of (**31c**) inserts into hole in (**11h**) until it rests on top of ball (**11j**).
9. Install housing cover (**6**).

NOTE: Ensure the lower end of adjustment screw (**2**) goes into the recess in button (**7**).

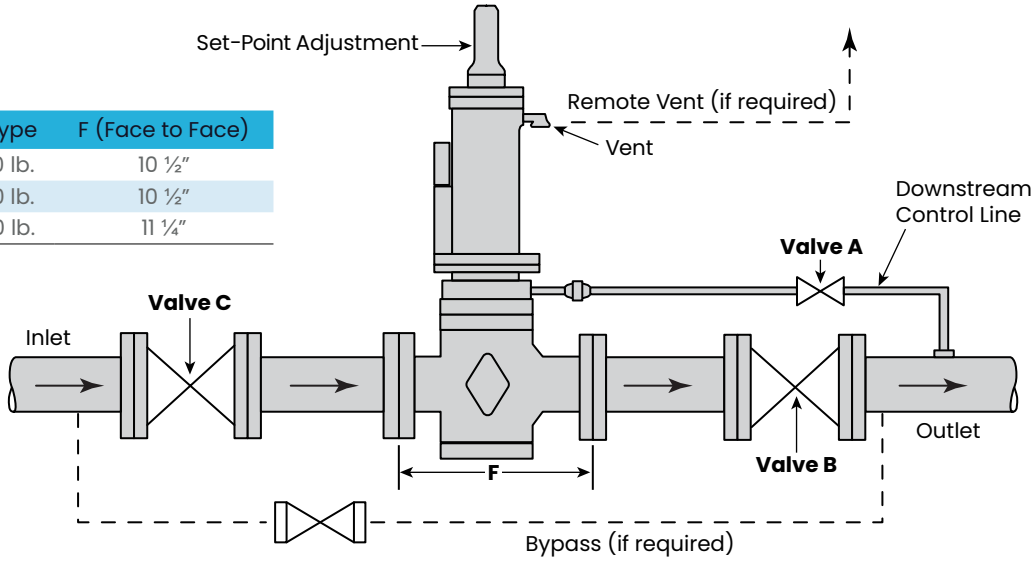
10. Set adjusting screw (**2**) for desired outlet pressure, firmly tighten nut (**3**) and replace seal cap (**1**).

Disassembling 461-X57

1. Remove seal cap (**1**), back off adjusting screw (**2**), remove housing cover (**6**), part (**7**), spring (**9**) and assembly (**31**).
2. Remove bolts (**23**) and carefully remove upper diaphragm case (**10**).
3. Unscrew diaphragm assembly (**11**) from stem (**12b**).
4. Remove cap screws (**26**) and lower diaphragm case (**21**).
5. Remove valve assembly and orifice (**18**) per previous sections on servicing valve assemblies.
6. Remove guide (**30**) (or inlet orifice (**19**)) through top opening using 1 ½" socket wrench (**50**).

Typical Installation

Regulator Body Type	F (Face to Face)
Flanged ANSI 250 lb.	10 ½"
Flanged ANSI 300 lb.	10 ½"
Flanged ANSI 600 lb.	11 ¼"



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.

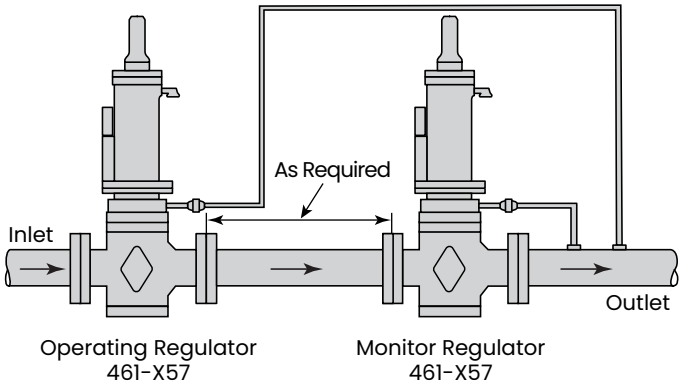
The 461-X57 has a fast rate of response and will take control quickly in case of emergency. It requires no changes or modifications to be used for monitoring. Its simple design and rugged construction make it an exceptionally dependable regulator, and its control accuracy and freedom from "droop" mean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

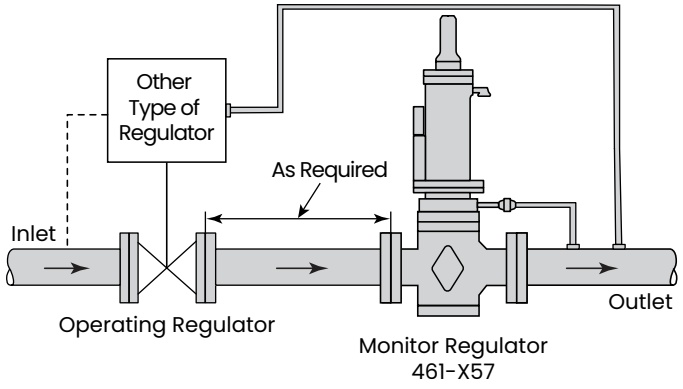
Two monitor set arrangements are shown in the diagrams below. The first shows a set in which the operating regulator and the monitor are both Model 461-X57. This makes a neat and compact installation.

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

Both diagrams 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.

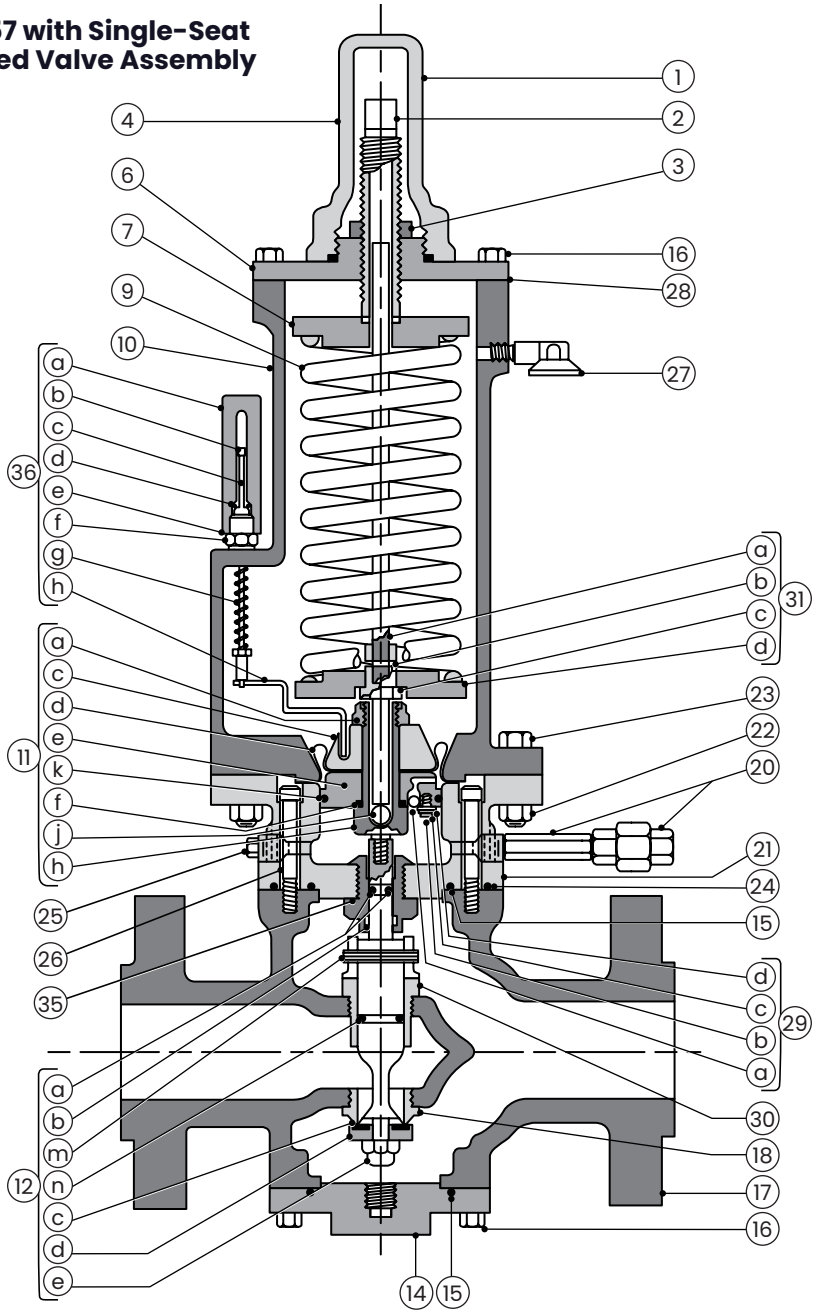
The monitor can also be located upstream, and this arrangement the 461-X57 is usually set for an outlet somewhat higher than the above.



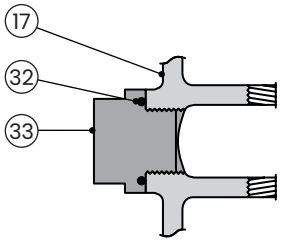


Model 461-X57 Illustration

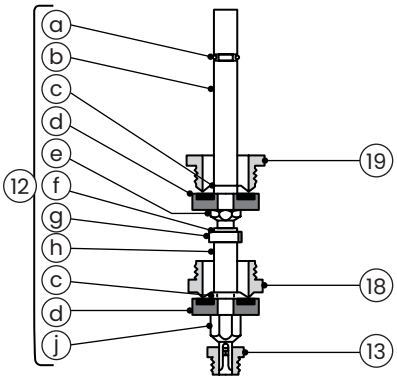
461-X57 with Single-Seat Balanced Valve Assembly



Threaded Side Inspection Plate



Double-Seat Balanced Valve Assembly



Model 461-X57 Condensed Parts List

Illustration Number	Description	Part Number
1	Seal Cap	090-00-005-02
2	Spring Adjustment Screw	091-00-007-50
3	Hex. Steel Jam Nut, ⅞" – 14	922233
4	Tetraseal (or O-Ring), 1 ¾" × 2"	904092
9	Spring, Black, 150 to 250 psi	091-00-021-00
	Spring, Brown, 100 to 175 psi	091-00-021-01
	Spring, Red, 75 to 100 psi	091-00-021-02

Illustration Number	Description	Part Number
11	a. Elastic Stop Nut ¾" – 16 (#52NTF-126A)	903958
	c. Diaphragm Plate Upper	091-00-010-50
	d. Diaphragm 2 ½" Roll-Out	091-00-350-50
	e. Diaphragm Plate Lower	091-00-022-50
	f. O-Ring, ¾" × 1 ⅞"	906611
	h. Diaphragm Stud LRS	091-00-058-50
	j. Thrust Bearing Stainless Steel Ball ⅜" Dia.	930510
	k. O-Ring, 2 ⅛" × 2 ½"	934033

Model 461-X57 Condensed Parts List (Continued)

Illustration Number	Description	Part Number
12	1" Single-Seat Valve Assembly, Stainless Trim, Red Polyurethane	091-16-515-51
	11/16" Single-Seat Valve Assembly, Stainless Trim, Red Polyurethane	091-16-515-50
	1" Double-Seat Valve Assembly, Stainless Trim, Red Polyurethane	091-16-515-13
	11/16" Single-Seat Valve Assembly, Stainless Trim, Red Polyurethane	091-16-515-12
12a	O-Ring, 3/8" × 1/2"	934007
12b	Valve Stem, Stainless, for 1" Single-Seat Assembly	091-00-016-07
	Valve Stem, Stainless, for 11/16" Single-Seat Assembly	091-00-016-06
	Male Valve Stem, 5 1/16" Lg. Stainless, for 1" & 11/16" Double-Seat Assembly	091-16-116-00
12c	Valve Retainer, Stainless, for 1" Single-Seat or Double-Seat (1 or 2 used)	091-16-018-01
	Valve Retainer, Stainless, for 11/16" Single-Seat or Double-Seat (1 or 2 used)	091-16-018-00
12d	Molded Valve, 1" Double-Seat Polyurethane (Red, 65-75 Duro)	091-16-315-11
	Molded Valve, 11/16" Double-Seat Polyurethane (Red, 65-75 Duro)	091-16-315-10
	Molded Valve, 1" Double-Seat Polyurethane (Tan, 85-95 Duro)	091-16-315-15
	Molded Valve, 11/16" Double-Seat Polyurethane (Tan, 85-95 Duro)	091-16-315-14
	Molded Valve, 1" Double-Seat Viton (65-75 Duro, Stamped V)	091-16-315-13
	Molded Valve, 11/16" Double-Seat Viton (65-75 Duro, Stamped V)	091-16-315-12
	Molded Valve, 1" Single-Seat Polyurethane (Red, 65-75 Duro)	091-16-315-51
	Molded Valve, 11/16" Single-Seat Polyurethane (Red, 65-75 Duro)	091-16-315-50
	Molded Valve, 1" Single-Seat Polyurethane (Tan, 85-95 Duro)	091-16-315-60
	Molded Valve, 11/16" Single-Seat Polyurethane (Tan, 85-95 Duro)	091-16-315-59
	Molded Valve, 1" Single-Seat Viton (65-75 Duro, Stamped V)	091-16-315-58
	Molded Valve, 11/16" Single-Seat Viton (65-75 Duro, Stamped V)	091-16-315-57
	Stainless Valve Nylon disc, 1" Single-Seat (1 used)	091-16-315-52
	Stainless Valve Nylon disc, 11/16" Single-Seat (1 used)	091-16-315-02
	Stainless Valve Nylon disc, 1" Double-Seat (2 used)	091-16-315-04
	Stainless Valve Nylon disc, 11/16" Double-Seat (2 used)	091-16-315-03
12e	Valve Lock nut 3/8" – 24 Crown Nylok, for Single-Seat Assembly	903936
	Valve Lock nut Stainless, for Double-Seat Assembly	091-16-102-01
12f	Valve Stem Locking Ring Stainless, for Double-Seat assembly	091-16-043-01
12g	Hex soc cup pt #12 – 24 × 1/4" Lg.	907694

Illustration Number	Description	Part Number
12h	Female Valve Stem Stainless for Double-Seat Assembly	091-16-016-03
12j	Valve Guide Stainless, for Double-Seat assembly	091-16-012-02
12m	Roll pin 1/4" × 1 1/2" Lg., for Single-Seat Assembly	901707
12n	O-Ring, 9/16" × 3/4", for 1" Single-Seat Assembly	934011
	O-Ring, 3/4" × 1", for 1" Single-Seat Assembly	934015
13	Guide Bushing, Stainless, with pin	091-16-385-03
15	Tetraseal (or O-Ring), 2 3/4" × 3"	904079
16	Hex Cap screw, 120,000 lb Tensile, 5/16" –18 × 1" Lg. (16 used)	910030
18	Outlet Orifice 1" stainless	091-16-029-05
	Outlet Orifice 1 1/16" stainless	091-16-029-04
19	Inlet Orifice 1" stainless	091-16-028-05
	Inlet Orifice 1 1/16" stainless	091-16-028-04
20	Nipple, Orifice Plug, and Union Assembly	091-00-361-03
21	Lower Diaphragm Case	091-00-002-51
22	Hex steel Nut 3/8" – 16, 120,000 lb. Tensile	920853
23	Hex Steel Bolt 3/8" – 16 × 1 3/4" 19 (8 used)	910058
24	Tetraseal (or O-Ring), 4 3/8" × 4 5/8"	904085
26	Soc. Hd. Cap Screw 120,000# Tensile 5/16" – 18 × 2 1/4" Lg. (8 used)	939110
27	Vent Cap 1/4"	137-02-505-02
28	Housing Cover Gasket	091-00-066-30
29a	Stainless Steel. Ball 1/4" Dia.	930506
29b	Soc Hd. Cap Screw #10 – 24 × 3/8" Lg.	939900
29c	#10 Steel Lock Washer	904012
29d	Washer (Ball Retaining)	090-16-178-01
30	Valve Stem Guide stainless, 11/16" Single-Seat Assembly	091-16-012-52
	Valve Stem Guide stainless, 1" Single-Seat Assembly	091-16-012-53
31	Spring Thrust Assembly (includes 31a through 31c)	091-00-358-00
31a	Spring Thrust Rod (Upper)	091-00-062-50
31b	Type 2 Groove Pin 1/8" × 9/16" Lg.	904118
31c	Spring Thrust Rod (Lower)	091-00-158-50
32	Tetraseal (or O-Ring), 1 1/2" × 1 3/4"	904086
35	Guide Bushing	091-16-373-00
36	Travel Indicator Assembly	091-00-365-81
37	Lower Spring Button	091-00-009-51
50	Socket Wrench (not Shown) 1 1/2" Hex. Deep – for parts 18, 19, 30	091-16-328-00

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.

Maximum Emergency Pressures

NOTE: Ensure this entire section is clearly understood before using any of the following data.

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

Ductile Iron, Flanged ANSI 250 ..... 630 psi
Cast Steel, Flanged ANSI 300 ..... 800 psi
Cast Steel, Flanged ANSI 600 ..... 1,100 psi

The maximum outlet pressure the regulator may be subjected to without causing damage to the internal parts is:

All 461-X57 ..... Set-point + 50 psi

NOTE: Set-point is defined as the outlet pressure a regulator is adjusted to deliver.

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

All 461-X57 ..... 350 psi

NOTE: Safely contained means no leakage as well as no bursting.

If any of the above pressure limits are exceeded, the regulator must be taken out of service and inspected. Damaged or otherwise unsatisfactory parts must be repaired or replaced.

Maximum Inlet Pressures

Regulator Body Type	461-X57 Body Material	Maximum Working Body Pressure	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

Full Open Capacity

Use the following formula for the full open capacity of 461-X57 regulators:

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

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

Q = Full open capacity 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 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
1,350 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.

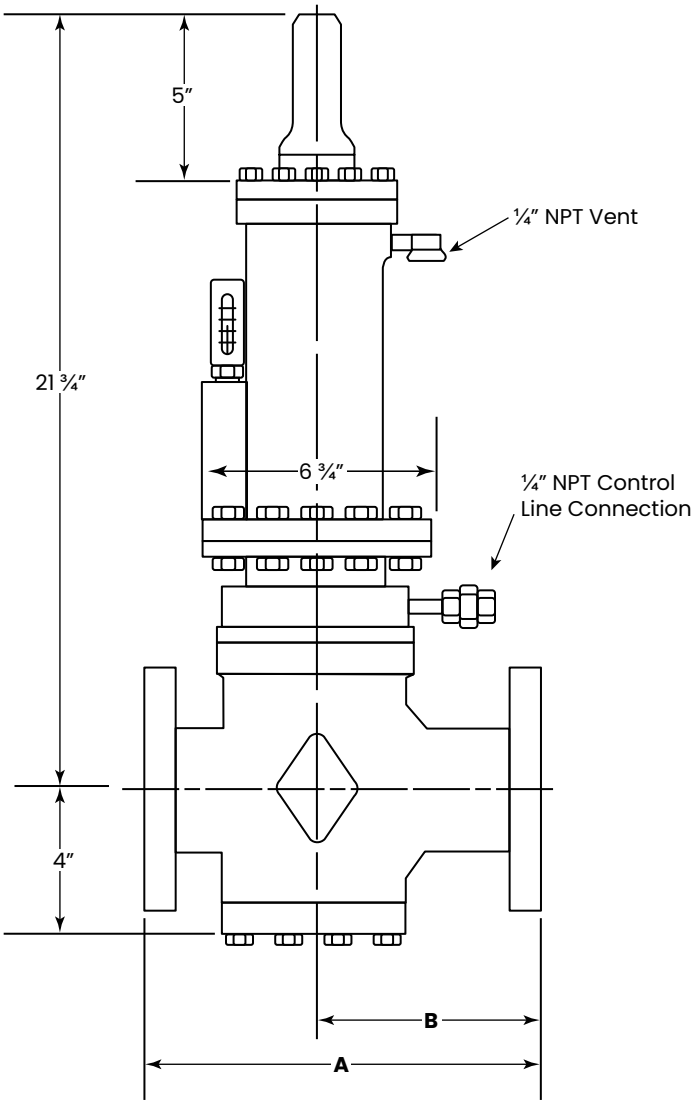
Temperature Limits

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

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