HOLLAND SUPPLY COMPANY 8225 Green Meadows Drive N | Lewis Center, OH 43035 | 740.549.6550 | hollandsupplycompany.com

Sensus Model 461 Field Regulator

Model 461 Sizing & Specifications Sheet

Model 461-S

Model 461-57S

Model 461-X57

SENSUS
a xylem brand

Ref: SSS 15.1.1

SPECIFICATION SELECTION SHEET

MODEL 461S, 461-57S, 461-X57
INDUSTRIAL AND DISTRIBUTION REGULATOR

461 Models	Description	Code
461-S (8 ½")	Balanced Valve, Spring Type Regulator with Cast Iron Diaphragm Case	A1
461-S (12")	Balanced Valve, Spring Type Regulator with Cast Iron Diaphragm Case	A2
461-8S	Balanced Valve, Spring Type Regulator with Aluminum Diaphragm Case	A3
461-12S	Balanced Valve, Spring Type Regulator with Aluminum Diaphragm Case	A4
461-57S	"Roll-Out" Diaphragm Regulator	A5
461-X57	High Pressure "Roll-Out" Diaphragm Regulator	A6

Spring Color (See chart)	Code
Aluminum	B1
Green	B2
Yellow	B3
Gray	B4
Blue	B5
Red	B6
Orange	B7
Black	B8
Cadmium	B9
Cadmium/White	B10

Body Type	Working Pressure psi	Code
Screwed End 2"	250	C1
Flanged ANSI 125 FF	175	C2
Flanged ANSI 250 RF	575	C3
Flanged ANSI 300 RF	720	C4
Flanged ANSI 600 RF	1200	C5

Valve Seat	Material	Code
Single	Stainless Steel	D1
Double	Stainless Steel	D2

Valve Type	Code
Standard	E1
V-Port*	E2

* 1" Valves Only

Valve Size	Code
1"	F1
11/16"	F2

Travel Indicator	Code
No	G1
Yes	G2

Pressure	PSIG, kPa, BAR
Inlet	
Outlet (Min)	
Outlet (Max)	

Special Instructions:

Reference the following pages for full specification details: 461-S, 461-57S, 461-X57
Please circle your choice in each category or include code choices on your purchase order. ANSI 49 Gray paint finish only.
Standard Construction and Testing at Manufacturer's Recommended settings will apply unless otherwise specified above.

Purchase Order No.	

Ref: SSS 15.1.1

SPECIFICATION SELECTION SHEET

MODEL 461S, 461-57S, 461-X57
INDUSTRIAL AND DISTRIBUTION REGULATOR

Model	Outlet Pressure Range	Spring Color	Diaphragm Case
461-S	2” wc – 10” wc	Aluminum	12” Cast Iron
461-S	4” wc – 16” wc	Green	12” Cast Iron
461-S	7” wc – 29” wc	Yellow	12” Cast Iron
461-S	.5 psig – 1.75 psig	Gray	12” Cast Iron
461-S	1 psig – 3.5 psig	Blue	12” Cast Iron
461-12S	3.5” wc – 6.5” wc	Red	12” Aluminum
461-12S	5” wc – 8.5” wc	Blue	12” Aluminum
461-12S	6” wc – 14” wc	Green	12” Aluminum
461-12S	12” wc – 28” wc	Orange	12” Aluminum
461-12S	1 psig – 2 psig	Black	12” Aluminum
461-12S	1.5 psig – 3 psig	Cadmium	12” Aluminum
461-S	3 psig – 6 psig	Blue	8-1/2” Cast Iron
461-S	5 psig – 10 psig	Red	8-1/2” Cast Iron
461-8S	1 psig – 2 psig	Orange	8” Aluminum
461-8S	2 psig – 4.25 psig	Black	8” Aluminum
461-8S	3 psig – 6.5 psig	Cadmium	8” Aluminum
461-8S	6 psig – 10 psig	Cadmium (outer) White (inner)	8” Aluminum
461-57S	3 psig – 6 psig	Yellow	5” Cast Iron
461-57S	5 psig – 9 psig	Gray	5” Cast Iron
461-57S	7-1/2 psig – 6 psig	Yellow	5” Cast Iron
461-57S	3 psig – 15 psig	Blue	5” Cast Iron
461-57S	12-1/2 psig – 30 psig	Red	5” Cast Iron
461-57S	25 psig – 55 psig	Brown	5” Cast Iron
461-57S	50 psig – 75 psig	Black	5” Cast Iron
461-57S	70 psig – 100 psig	Brown + White inner spring	5” Cast Iron
461-X57	75 psig – 100 psig	Red	2-1/2” Cast Iron
461-X57	100 psig – 175 psig	Brown	2-1/2” Cast Iron
461-X57	150 psig – 250 psig	Black	2-1/2” Cast Iron

Reference the following pages for full specification details: 461-S, 461-57S, 461-X57

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Purchase Order No.	

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SPECIFICATION SELECTION SHEET

MODEL 461S, 461-57S, 461-X57
INDUSTRIAL AND DISTRIBUTION REGULATOR

Reference the following pages for full specification details: 461-S, 461-57S, 461-X57
Please circle your choice in each category or include code choices on your purchase order. ANSI 49 Gray paint finish only.
Standard Construction and Testing at Manufacturer's Recommended settings will apply unless otherwise specified above.

Purchase Order No.	

461-S, 461-8S and 461-12S Regulators

Brochure

Introduction

The Sensus Models 461-S, 461-8S and 461-12S are balanced valve, spring type regulators designed for distribution and industrial applications where a single seat regulator is too small and the usual 2" balanced valve regulators are too large. They are made in 2" pipe sizes only and are used for:

Inlet Pressures to 175 psi
Outlet Pressures of 0 to 10 psi

Contoured body passages for reducing turbulence and large exit areas give them a broad capacity capability thus making them applicable to a wide variety of load handling requirements.

Their outstanding control characteristics are illustrated by the curves on Page 3. Capacities are provided on Page 4.

The 461-S and 461-12S are unusually dependable regulators. Their design is simple, the construction is sturdy. Servicing and adjustment are easy, response is fast. The overall operation is stable and sensitive, and they provide exceptionally precise regulation.

The 461-S, 461-8S and 461-12S are excellent regulators for general usage. They also make an excellent choice for such special applications as snap action on-off loads and monitoring service.

Maximum Inlet Pressure

Diaphragm Size I.D.	Diaphragm Case Material	Maximum Inlet Pressure*
12"	Cast Iron	100 psi
8½"	Cast Iron	175 psi
12"	Aluminum	100 psi
8"	Aluminum	175 psi

*The regulator should not be used for pressures exceeding the recommended maximum inlet.

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

Valve Material	Maximum Pressure Differential	Maximum Inlet Pressure
Buna-N (black, 50 to 55 duro)	250 psi	575 psig
Polyurethane (red, 65 to 75 duro)	400 psi	720 psig
Polyurethane (tan, 85 to 95 duro)	600 psi	1200 psig

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

The maximum temperature for the above materials is 150°F.

Vitron valve material has a maximum temperature rating of 300°F and a maximum pressure differential of 250 psi.

Body Pressure Ratings

Regulator Body Type	Maximum Working Pressure of Body*
Screwed End	250 psi
Flanged ANSI 125 lb. FF	175 psi
Flanged ANSI 250 lb. RF	575 psi
Flanged ANSI 300 lb. RF	720 psi

*This only applies to the body. The regulator should not be used for inlet pressures that exceed the maximums specified in the Maximum Inlet Pressure table above.

Spring Ranges

Outlet Pressure Minimum	Outlet Pressure Maximum	Size (I.D.) and Case Material	Spring Colors†
2" w.c.*	10" w.c.	12" Cast Iron	Aluminum
4" w.c.	16" w.c.	12" Cast Iron	Green
7" w.c.	29" w.c.	12" Cast Iron	Yellow
0.5 psi	1.75 psi	12" Cast Iron	Gray
1 psi	3.5 psi	12" Cast Iron	Blue
3½" w.c.	6½" w.c.	12" Aluminum	Red
5" w.c.	8½" w.c	12" Aluminum	Blue
6" w.c.	14" w.c.	12" Aluminum	Green
12" w.c.	28" w.c.	12" Aluminum	Orange
1 psi	2 psi	12" Aluminum	Black
1.5 psi	3 psi	12" Aluminum	Cadmium
3 psi	6 psi	8½" Cast Iron	Blue
5 psi	10 psi	8½" Cast Iron	Red
1 psi	2 psi	8" Aluminum	Orange
2 psi	4.25 psi	8" Aluminum	Black
3 psi	6.5 psi	8" Aluminum	Cadmium
6 psi	10 psi	8" Aluminum	Cadmium (outer) White (inner)

For outlet pressures above 3 psi refer also to:
Model 461-57S - a direct operated spring regulator for 100 psi maximum outlet (Bulletin R-1331).
Model 1100 - a pilot operated regulator for 150 psi maximum outlet (Bulletin R-1341).

* For pressures below 2" w.c. install regulator in inverted position.
† Springs are colored for identification. When shipped, the regulator is equipped with the lightest possible spring suitable for the maximum outlet pressure specified on order. If outlet conditions change, replace spring according to table for best operation.

*This document replaces R-1330-R9

SENSUS

Temperature Limits

The 461-S, 461-8S and 461-12S regulators may be used for flowing gas temperatures from -20º to 150ºF.

Buried Service

The 461-S, 461-8S and 461-12S regulators are **not** recommended for buried service.

Construction Features

Regulator self contained – no exposed parts-top moisture sealed-safe for pits by extending vent line.

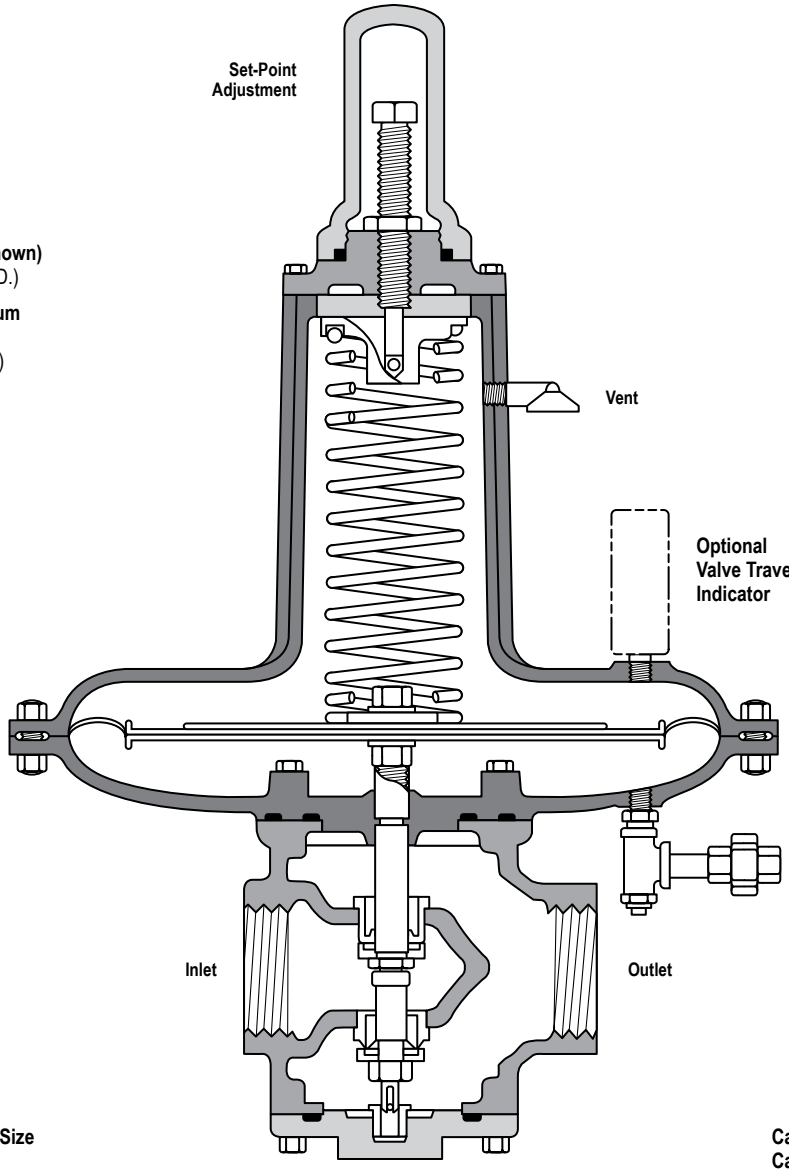
Flow contoured body – large gas exit area reduces turbulence, increased capacity.

Side inspection plates – O-ring sealed-for visual valve inspection or adjustment.

Balanced valve – permits higher inlet pressures – eliminates variation effect – gives greater capacity.

Soft seat valves – tight lock-up at zero flow. Molded discs resist blow out. Adjustment valve spacing. Renewable orifices – two interchangeable sizes.

Springs color coded – self-aligning adjustment – easily changed through gasketed top opening.



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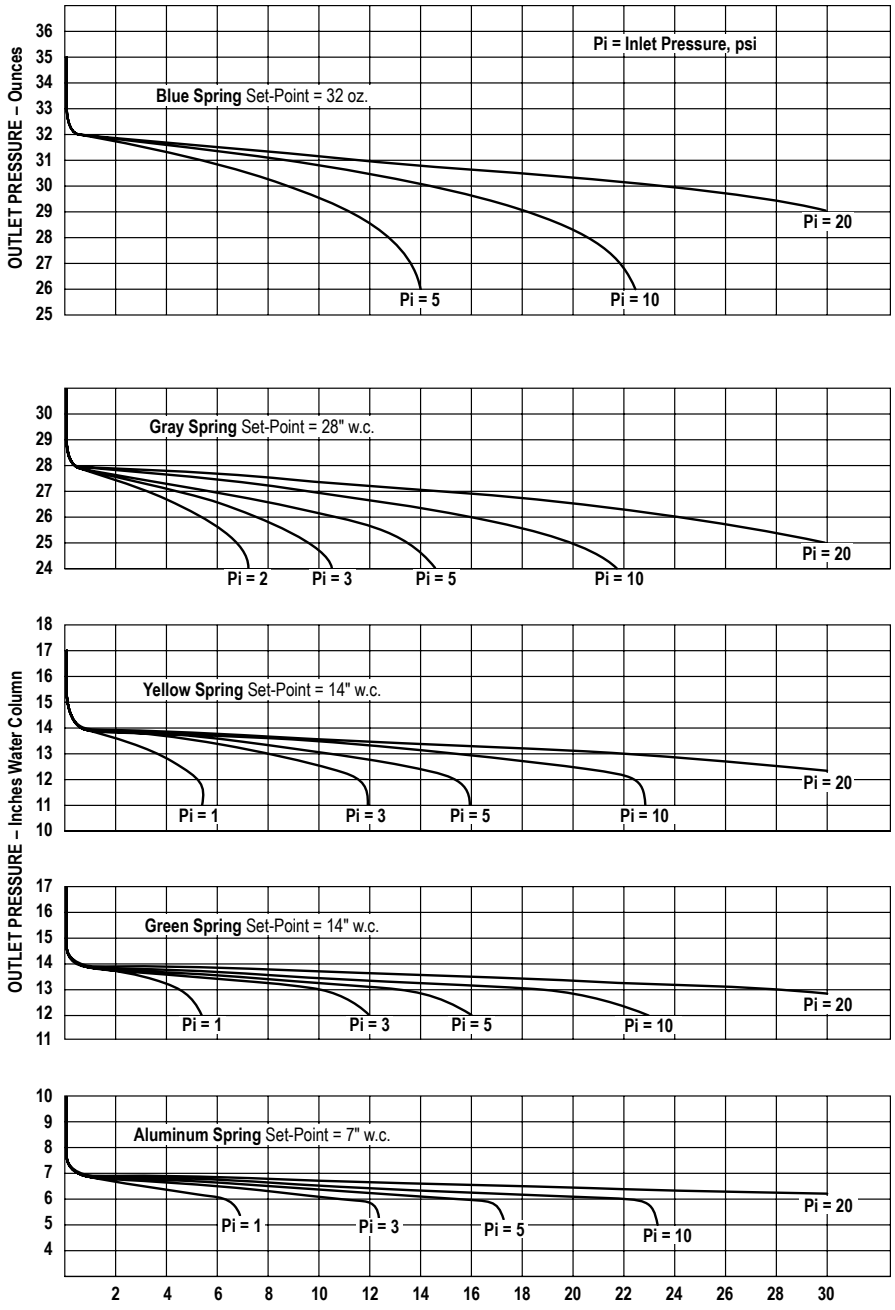
461-S, 461-8S AND 461-12S GAS PRESSURE REGULATORS

Typical Performance Curves

Performance

These performance curves are typical for the Model 461-S. The outlet pressure for each chart was set under the stated conditions and was not further adjusted during changes in inlet pressure or flow. Settings in general were made at an inlet of 5 psi. Set-point to lock-up at zero flow requires a pressure increase of not more than 3" w.c.



FLOW RATE – Thousand Cubic Feet Per Hour (0.6 Specific Gravity Gas 14.65 psi Absolute and 60°F).

Model 461-S, 461-8S and 461-12S Capacity Tables

Capacity in 1000 SCFH of Natural Gas
(0.6 Specific Gravity – 14.65 psia – 60ºF)

Inlet Pressure psi	Outlet Pressure psi	Double Seat Balanced		Single Seat Balanced*	
		1" Valve	11/16" Valve	1" Valve	11/16" Valve
¼	4" w.c.	2.5	1.25	—	—
½	4" w.c.	4.5	2.27	—	—
	7" w.c.	3.8	1.9	—	—
1	4" w.c	7.0	3.5	—	—
	7" w.c.	6.6	3.3	—	—
	½ psi	5.4	2.73	—	—
2	4" w.c.	10.4	5.2	—	—
	7" w.c.	10.0	5.0	—	—
	½ psi	9.4	4.7	—	—
	1 psi	7.8	3.9	—	—
3	4" w.c.	12.8	6.4	—	—
	7" w.c.	12.6	6.3	—	—
	½ psi	12.2	6.1	—	—
	1 psi	11.0	5.5	7.1	3.5
	2 psi	8.0	4.0	5.2	2.6
4	4" w.c.	15.0	7.5	—	—
	7" w.c.	14.8	7.4	—	—
	½ psi	14.4	7.2	—	—
	1 psi	13.6	6.8	8.8	4.4
	2 psi	11.4	5.7	7.4	3.7
	3 psi	8.4	4.2	5.4	2.7
5	4" w.c.	16.8	8.4	—	—
	7" w.c.	16.6	8.3	—	—
	½ psi	16.4	8.2	—	—
	1 psi	15.6	7.8	10.1	5.0
	2 psi	14.0	7.0	9.1	4.5
	3 psi	11.8	5.9	7.6	3.8
	4 psi	8.6	4.3	5.6	2.8
6	7" w.c.	18.2	9.1	—	—
	½ psi	18.0	9.0	—	—
	1 psi	17.6	8.8	11.4	5.7
	2 psi	16.2	8.1	10.5	5.2
	3 psi	14.4	7.2	9.3	4.3
	4 psi	12.2	6.1	7.9	3.9
	5 psi	8.8	4.4	5.7	2.8
8	7" w.c.	21.2	10.6	—	—
	½ psi	21.0	10.5	—	—
	1 psi	20.8	10.4	13.5	6.7
	2 psi	19.8	9.9	12.8	6.4
	3 psi	18.6	9.3	12.1	6.0
	4 psi	17.2	8.6	11.1	5.6
	5 psi	15.2	7.6	9.8	4.9
	6 psi	12.8	6.4	8.3	4.1
10	7" w.c.	23.8	11.9	—	—
	½ psi	23.6	11.8	—	—
	1 psi	23.4	11.7	15.2	7.6
	2 psi	23.0	11.5	14.9	7.4
	3 psi	22.2	11.1	14.4	7.2
	4 psi	21.0	10.5	13.6	6.8
	6 psi	18.0	9.0	11.7	5.8
	8 psi	13.4	6.7	8.7	4.3
12	7" w.c.	26.2	13.1	—	—
	½ psi	26.0	13.0	—	—
	1 psi	25.8	12.9	16.7	8.3
	2 psi	25.6	12.8	16.6	8.3
	3 psi	25.2	12.6	16.3	8.2
	4 psi	24.4	12.2	15.8	7.9
	6 psi	22.2	11.1	14.4	7.2
	8 psi	19.0	9.5	12.3	6.1
	10 psi	14.0	7.0	9.1	4.5

Capacity in 1000 SCFH of Natural Gas
(0.6 Specific Gravity – 14.65 psia – 60ºF) (Continued)

Inlet Pressure psi	Outlet Pressure psi	Double Seat Balanced		Single Seat Balanced*	
		1" Valve	11/16" Valve	1" Valve	11/16" Valve
15	1 psi & less	29.4	14.7	19.1	9.5
	2 psi	29.2	14.6	18.9	9.4
	3 psi	29.0	14.5	18.8	9.4
	4 psi	28.6	14.3	18.6	9.3
	6 psi	27.2	13.6	17.6	8.8
	8 psi	25.0	12.5	16.2	8.1
	10 psi	22.2	11.1	14.4	7.2
20	3 psi & less	34.6	17.3	22.5	11.2
	6 psi	34.0	17.0	22.1	11.0
	8 psi	32.8	16.4	21.3	10.6
	10 psi	31.4	15.7	20.4	10.2
25	6 psi & less	39.6	19.8	25.7	12.8
	8 psi	39.2	19.6	25.4	12.7
	10 psi	38.4	19.2	24.9	12.4
30	10 psi & less	44.4	22.2	28.8	14.4
40		54.4	27.2	35.3	17.6
50		64.4	32.2	41.8	20.9
60		74.4	37.2	48.3	24.1
80		94.2	47.1	61.2	30.6
100		114	57.2	74.3	37.1
125		139	69.6	90.4	45.2
150		164	82.0	106	53.3
175		189	94.8	123	61.6
"K" Factors Standard Valves		**2000**	**1000**	**1300**	**650**
"K" Factors For V-Port Valves, Multiply table by:		.750	N/A	.750	N/A

***The single seat balanced valve should not be used for outlet pressures below 1 psi.**

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

If greater capacity is required, refer to Model 441-S (Bulletin R-1350).

Expanded Outlet Line

These flow rates represent the amount of gas the regulator can actually pass at the given pressure reduction. This amount often exceeds the amount a 2" outlet line can take away, and the flow is restricted to the line capacity.

To take advantage of regulator capacity, make certain the outlet line has equal capacity, and increase the line size at the regulator outlet as necessary, to secure adequate capacity.

NOTE

The above performance data is based on normal testing at 70º flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

Relief Valves and Back Pressure Valves

Use Model 461-SR for those applications which require a higher degree of accuracy and sensitivity than is possible with standard poppet type reliefs.

Essentially, it is a regulator arranged to provide inlet pressure control.

When operating as a relief valve, it limits inlet pressure to a set maximum. At pressures below this, it remains closed. If the pressure should attempt to exceed this, it opens and bleeds off the excess.

As a back pressure valve, it prevents gas from exiting from a system until the system pressure reaches the set-point. At set-point it begins to open and then regulates the discharge so as to hold the system at set-point.

Relief Pressure Range

3" w.c. to 10 psi (for range of each spring and diaphragm combination, see table, Page 1).

Installation

1. Install in line as shown with pressure connected to side marked INLET.
2. For gas, pipe outlet to safe discharge point.
3. Connect inlet line to ¼" union.
4. By turning adjustment screw, set valve to open at desired pressure. Turning clockwise increases opening pressure. The 461-SR is the same as the 461-S except that inner valve is reversed, the body is turned around, and the control line is arranged for connection to the inlet sign (upstream).

Model 461-SR offers these advantages: (1) accurate setting and control at low relieving pressure because of large, sensitive diaphragm; (2) tight shutoff without leakage due to soft-seat valve construction; (3) large relieving capacity due to large size double valves.

Over-pressurization Protection

Protect the downstream piping system and the regulator's low pressure chambers against over-pressurization (due to possible regulator malfunction or failure) to achieve complete lockup.

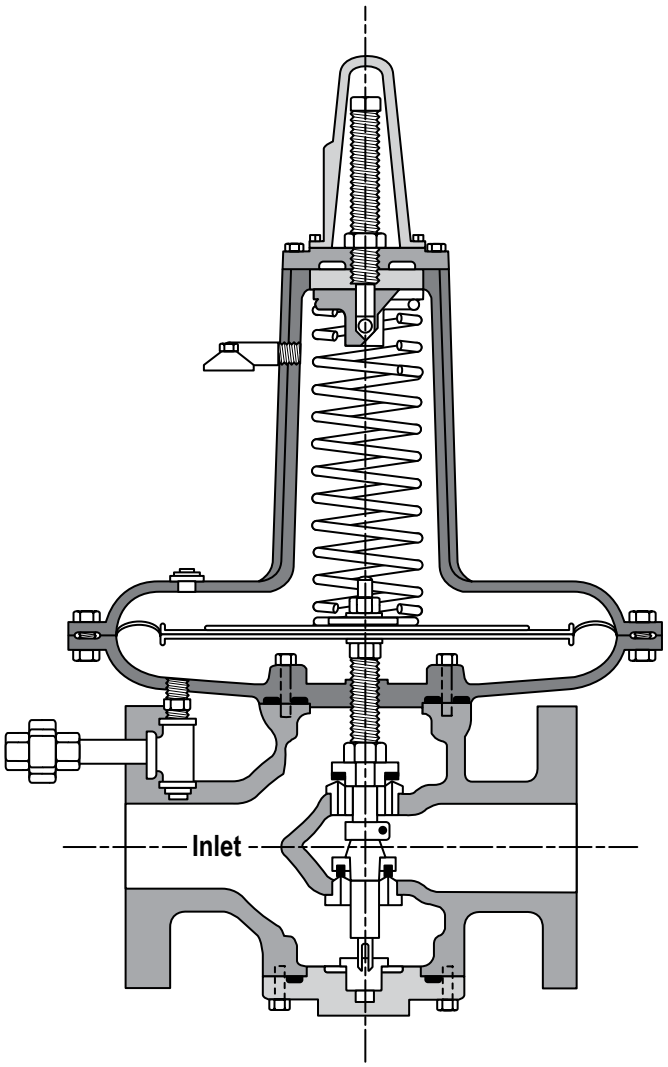
The allowable outlet pressure is the lowest of the maximum pressures permitted by federal codes, state codes, Sensus Bulletin RDS-1498, or other applicable standards.

The method of protection can be a relief valve, monitor regulator, shutoff device, or similar mechanism.

Maximum Emergency Pressures

For complete Maximum Emergency Pressure information for Model 461 regulators, refer to Sensus Bulletin RDS-1498, Regulator Pressure Ratings. If the maximum outlet pressure is exceeded, the regulator must be removed from service and carefully inspected. Damaged or otherwise unsatisfactory parts must be replaced before returning the regulator to service.

Periodic Inspection: Regulators are pressure control devices with numerous moving parts subject to wear that are dependent upon particular operating conditions. To ensure continuous satisfactory operation, adhere to a periodic inspection schedule with the frequency of inspection determined by the severity of service and applicable laws and regulations. See Bulletin RM-1330 for field service instructions.



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MODEL 461-SR

Materials of Construction

Diaphragm Housing, Spring Case (461-S) ..... Cast Iron (ASTM A126-71 Class B)

Diaphragm Housing, Spring Case (461-8S, 461-12S).....Aluminum

Diaphragm Plates.....Steel

Diaphragm.....Buna-N with Nylon Fabric Reinforcement

Valve Stems.....Brass or Stainless Steel

Removable Seats (Orifice) .....Brass or Stainless Steel

Soft Seat Valve Material ..... Buna-N or Polyurethane pressure molded in holder.

Holder for Molded Valve .....Steel

Valve retainer.....Brass or Stainless Steel

Bodies ..... See table, on Page 9

Monitoring

The 461-S, 461-8S or 461-12S make an excellent monitor; a standby regulator installed in series which assumes control if a failure in the operating regulator permits the outlet pressure to exceed the set-point.

The fast rate of response enables it to take over quickly where necessary, and its outstanding performance means it will provide excellent standby regulation.

It can be located in either the upstream or the downstream position.

When a 461 is used to monitor a regulator with an identical inner valve (another 461, a Model 1100, etc.) the total maximum **capacity** through both can be figured at 70% of the capacity of one of them alone. This applies with the monitor located either upstream or downstream.

Capacities at Other Pressures

Capacity for pressures not listed in the table on Page 4 can be calculated with the following formulae:

Capacity for pressure reductions not listed in the table found in bulletin R-1332 can be calculated with the following formulae:

1. $Q = K\sqrt{P_0(P_1 - P_0)}$

2. $Q = \frac{K\,P_1}{2}$

Q = maximum capacity of the regulator (in SCFH of 0.6 specific gravity natural gas).

K = the **"K" factor**, the regulator constant (from the table)

P_1 = absolute inlet pressure (psia).

P_0 = absolute outlet pressure (psia).

Use formula 1, when $\frac{P_1}{P_0}$ is less than 1.894.

Use formula 2, when $\frac{P_1}{P_0}$ is greater than 1.894.

Metrication

Use the following for Metric Conversions:

std. meters^3/hr. x 35.31 = std. ft.^{3}/hr. (SCFH) std. ft.^{3}/hr. (SCFH) x 0.0283 = std. meters^3/hr.
kilograms/centimeters^2(kg/cm^2) x 14.22 = psig psig x 0.0703 = kilograms/centimeters^2(kg/cm^2)
kilopascals (kPa) x 0.145 = psig psig x 6.90 = kilopascals (kPa)
bars x 14.50 = psig psig x 0.69 = bars
millimeters water (mm H_2O) x .0394 = in. w.c. in. w.c. x 25.4 = millimeters water (mm H_2O)
millimeters mercury (mm Hg) x 0.535 = in w.c. in. w.c. x 1.868 = millimeters mercury (mm Hg)

Other Gases

461-S, 461-8S and 461-12S regulators are mainly used on natural gas. However, they perform equally well on LP gas, nitrogen, dry CO_2, air and others.

Other Gases	Correction Factor
Air (Specific Gravity 1.0)	0.77
Propane (Specific Gravity 1.53)	0.63
1350 BTU Propane-Air Mix (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:

$$\text{CORRECTION FACTOR} = \sqrt{\frac{0.60}{\text{Specific gravity of the gas}}}$$

For use with gases not listed above, please contact your Sensus representative or Industrial Distributor for recommendations.

How to Order

1. 2" Model 461-S, 461-12S or 461-8S.
2. Body Type (see table, on Page 9).
3. Outlet Pressure and Spring (see table, Page 1).
4. Inlet Pressure (also, minimum and maximum inlet pressures, if available).
5. Capacity required (SCFH).
6. Type of Gas (natural gas, propane, etc.).
7. Trim (brass or stainless steel).
8. Valve size (1" or $^{11}/_{16}$").
9. Double seat or single seat (see Page 7) – if not specified, double seat will be furnished.

To Order Parts, Specify:

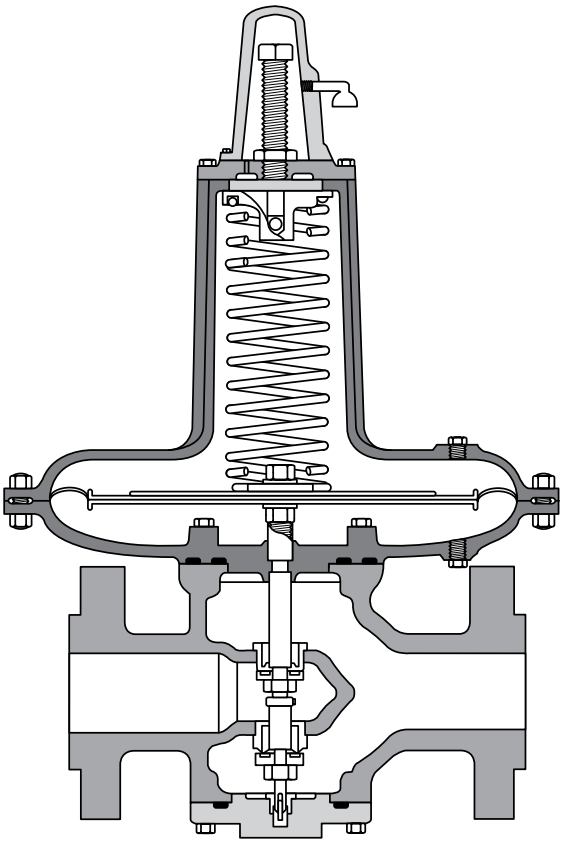
1. Pipe size and model number of regulator.
2. Serial number of regulator (if available) or other identifying information.
3. Part number and name of part.
4. Quantity.
5. For orifices and valve parts, specify size of valve (1" or $^{11}/_{16}$") and trim (brass or stainless steel).
6. For diaphragm, diaphragm plates, or upper or lower covers, specify material and size (12" Al., 8" Al., 12" CI or 8½" CI).
7. For springs, specify color and part number.
   Part numbers and names can be found in Bulletin RM-1330.

Fully Interchangeable Valve Assemblies

Valve assemblies can be interchanged with the regulator in place in the line.

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. REFER TO RM-1330 FOR MORE DETAILED START-UP PROCEDURES.



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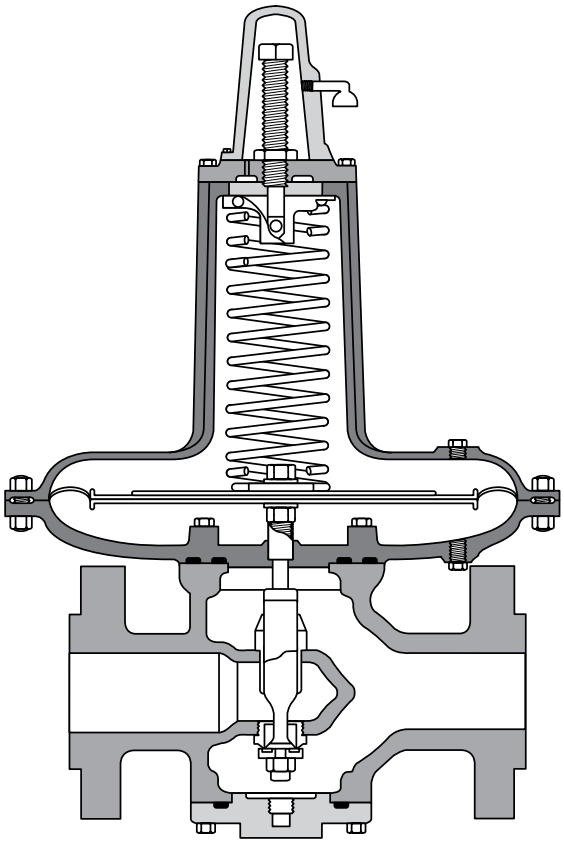
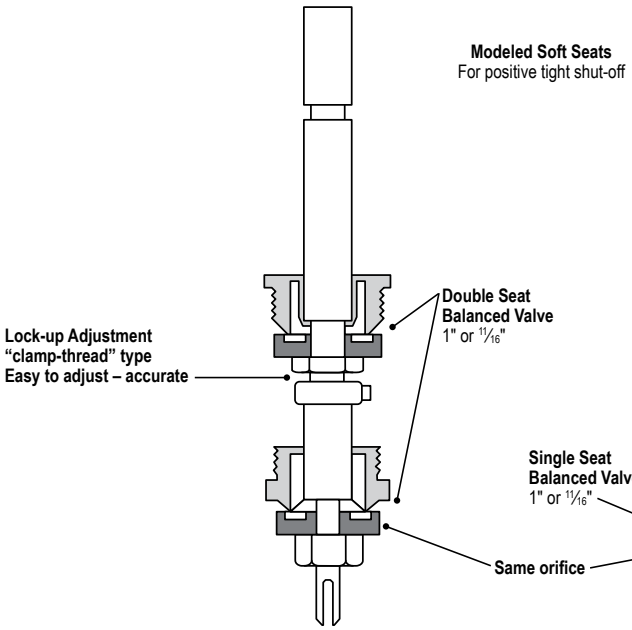
MODEL 461-S WITH DOUBLE SEAT BALANCED VALVE

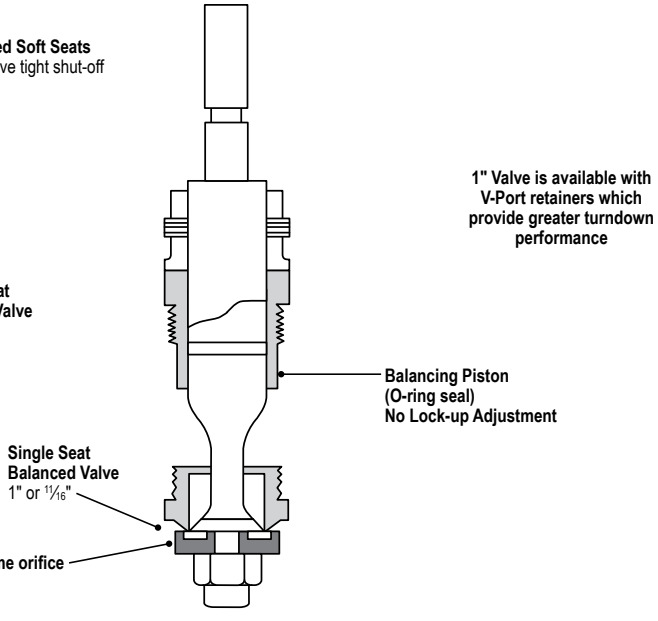


GCD1330-025

MODEL 461-S WITH SINGLE SEAT BALANCED VALVE



GCD1330-030A



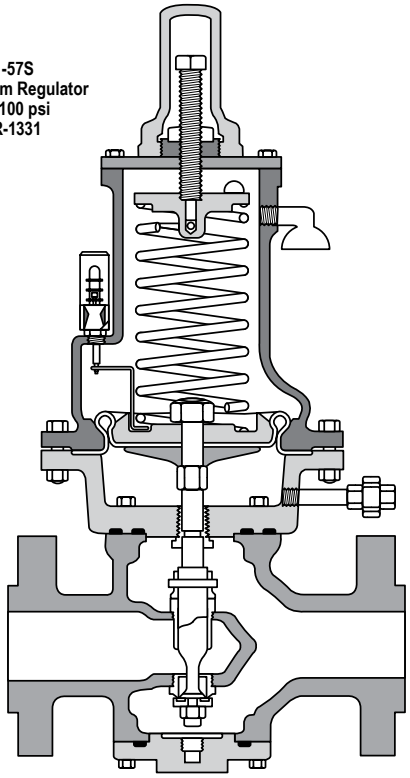
GCD1330-030B

Other 461 Models for Distribution Systems and Industrials

CAUTION

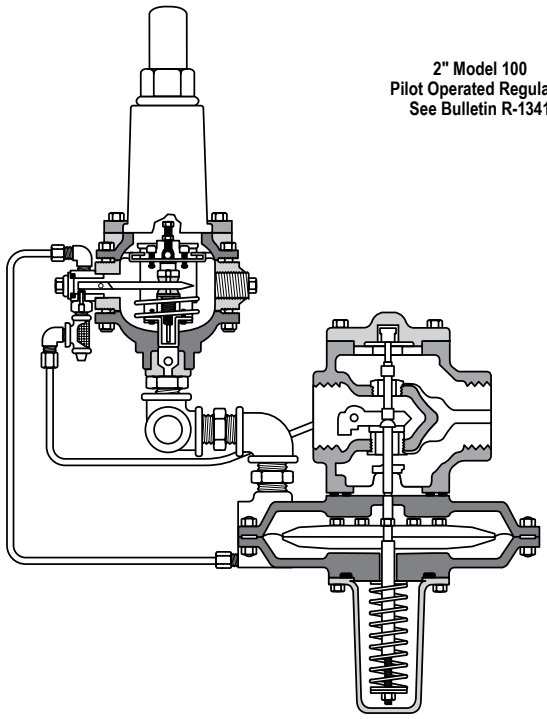
It is the user's responsibility to ensure all regulator vents and/or vent lines exhaust to a nonhazardous location away from any potential sources of ignition. REFER TO SENSUS BULLETIN RM-1330 FOR MORE DETAILED INFORMATION.

2" Model 461-57S
"Roll-Out" Diaphragm Regulator
Outlets of 3 to 100 psi
See Bulletin R-1331



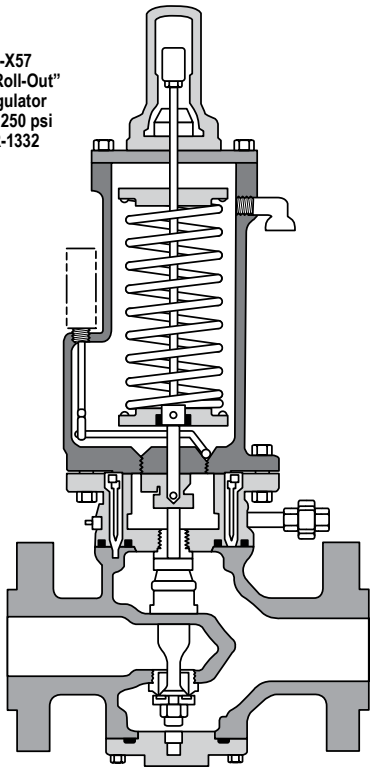
GCD1330-035

2" Model 100
Pilot Operated Regulator
See Bulletin R-1341



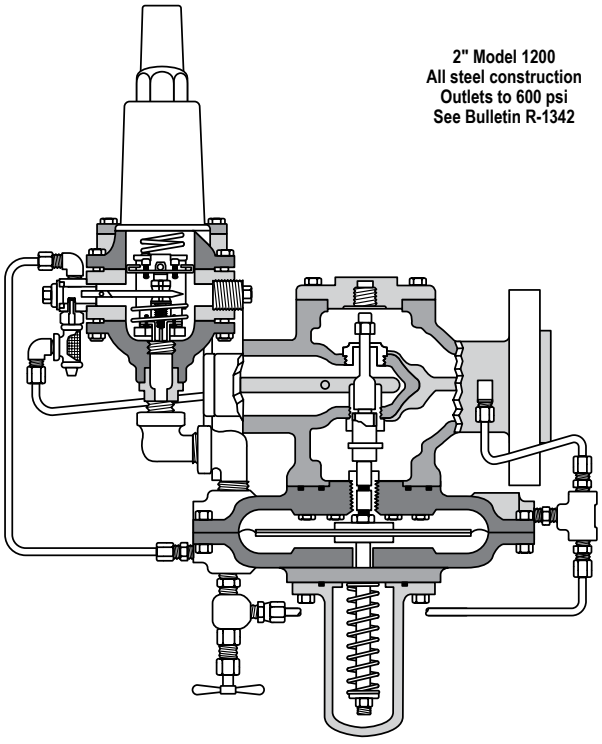
GCD1330-040

2" Model 461-X57
High Pressure "Roll-Out"
Diaphragm Regulator
Outlets of 75 to 250 psi
See Bulletin R-1332



GCD1330-040

2" Model 1200
All steel construction
Outlets to 600 psi
See Bulletin R-1342

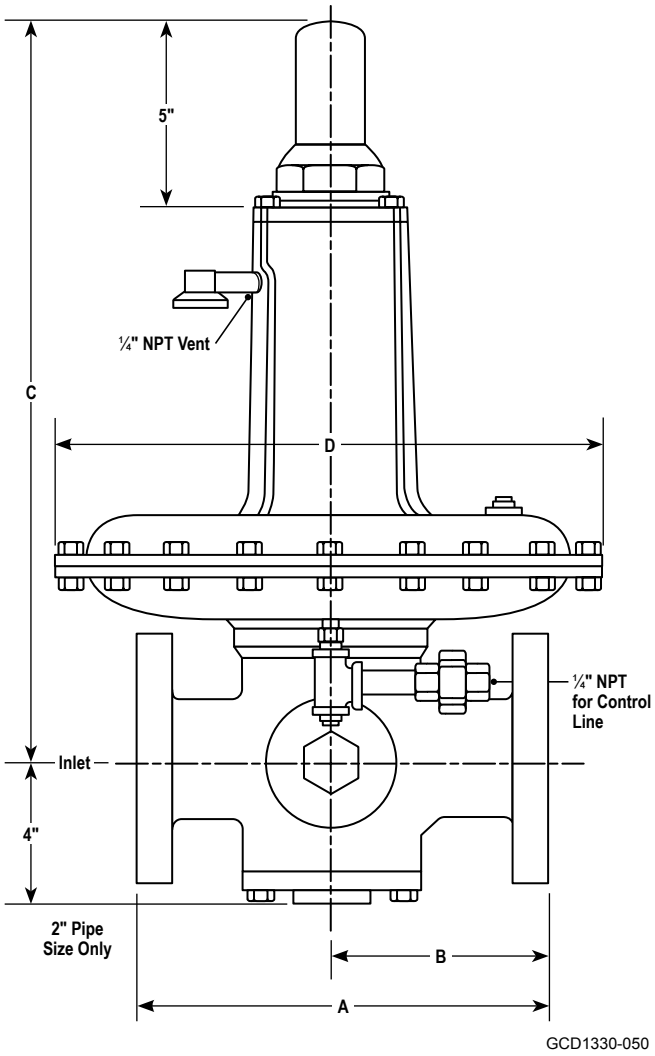


GCD1330-045

Dimensions

Model 461-S

Regulator Body Type	A	B	C	D (12")	D (8½")	Shipping Weight Lbs.	Body Material
Screwed End	6½"	—	19½"	14¼"	11"	75	Cast Iron (ASTM A126-71 class B)
Flanged 125 lbs.	10"	5¼"	19½"	14¼"	11"	80	Cast Iron (ASTM A126-71 class B)
Flanged 250 lbs.	10½"	5½"	19½"	14¼"	11"	85	Ductile Iron (ASTM A395-71 gr 60-40-18)
Flanged 300 lbs.	10½"	5½"	19½"	14¼"	11"	90	Cast Steel (ASTM A216-70a gr WCB)



MODEL 461-S

Model 461-8S

Regulator Body Type	A	B	C	D (12")	Shipping Weight Lbs.	Body Material
Screwed End	6½"	—	—	10 3/16"	75	Cast Iron (ASTM A126-71 class B)
Flanged 125 lbs.	10"	5¼"	18⅜"	10 3/16"	80	Cast Iron (ASTM A126-71 class B)
Flanged 250 lbs.	10½"	5½"	18⅜"	10 3/16"	85	Ductile Iron (ASTM A395-71 gr 60-40-18)
Flanged 300 lbs.	10½"	5½"	18⅜"	10 3/16"	90	Cast Steel (ASTM A216-70a gr WCB)

Model 461-12S

Regulator Body Type	A	B	C	D (12")	Shipping Weight Lbs.	Body Material
Screwed End	6½"	—	—	14"	75	Cast Iron (ASTM A126-71 class B)
Flanged 125 lbs.	10"	5¼"	13¼"	14"	80	Cast Iron (ASTM A126-71 class B)
Flanged 250 lbs.	10½"	5½"	13¼"	14"	85	Ductile Iron (ASTM A395-71 gr 60-40-18)
Flanged 300 lbs.	10½"	5½"	13¼"	14"	90	Cast Steel (ASTM A216-70a gr WCB)

461-S, 461-8S and 461-12S Regulators

Brochure

Authorized Distributor:

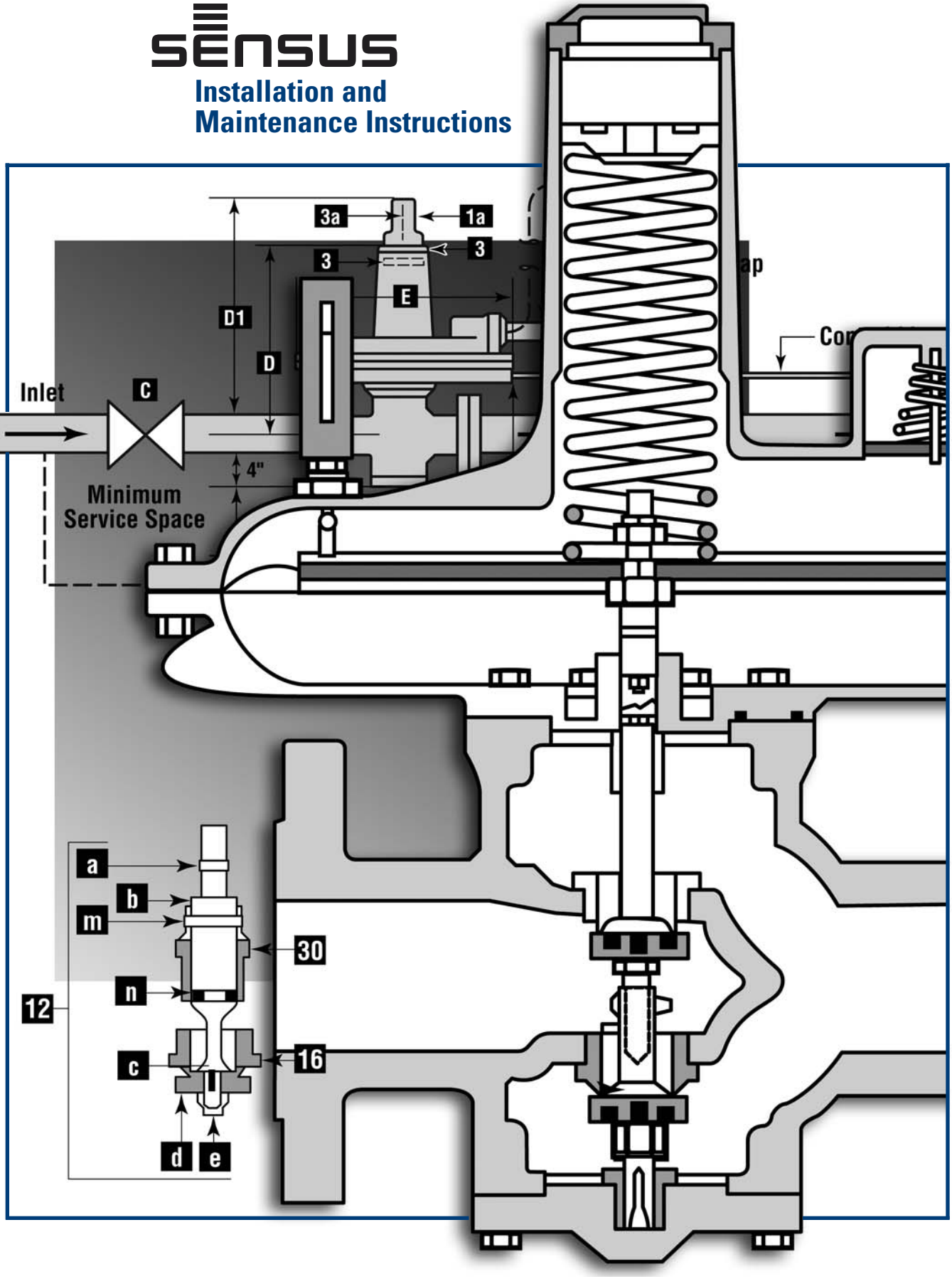
805 Liberty Boulevard
DuBois, PA 15801
1-855-4-SENSUS (1-855-473-6787)

For more information, visit us at www.sensus.com/gas

Models 461-S, 461-8S and 461-12S Regulators
Regulators

SENSUS

Installation and Maintenance Instructions



Installation and Maintenance Instructions
Model 461-S, 461-8S, and 461-12S Regulator

Regulator Models 461-S, 461-8S, and 461-12S are excellent general purpose gas pressure regulators for intermediate and larger loads. Use them for natural gas, air, dry CO_2, propane, butane and other gases.

Maximum Inlet Pressures

Regulator Body Type	Body Materials	Maximum Working Pressure of Body
2" Screwed only	Cast Iron	250 psi
Flanged ANSI 125	Cast Iron	175 psi*
Flanged ANSI 250	Ductile Iron	575 psi*
Flanged ANSI 300	Cast Steel	720 psi*

*Carefully note the following exceptions to the above, based on diaphragm size:

Diaphragm Size ID	Diaphragm Case Material	Maximum Inlet Pressure
12″	Cast Iron	100 psi
8-1/2″	Cast Iron	175 psi
12″	Aluminum	100 psi
8″	Aluminum	175 psi

Valve material selection is limited by inlet pressure and differential:

Valve Material	Maximum Inlet Pressure Rating	Maximum Pressure Differential Rating
Buna-N	575 psi	250 psi
Poly-U Red	720 psi	400 psi
Poly-U Tan	1200 psi	600 psi

Installation and Start-Up

1 Thoroughly purge inlet piping to remove dirt and debris that could damage the regulator or impair its operation. If this cannot be done, a filter or strainer should be installed ahead of the regulator. (see bulletin RDS-1498, Regulator Pressure Ratings).

Make certain that inside of the regulator and piping are free of dirt, foreign matter, and other debris.

2 Install the regulator. Make certain flow through the regulator is in the correct direction. High pressure connects to the inlet side. Be sure that shipping screens or covers, if used, are removed.

On flanges, tighten bolts evenly. On screwed connections, apply pipe dope to male threads only. Where required, the regulator may be inverted.

CAUTION

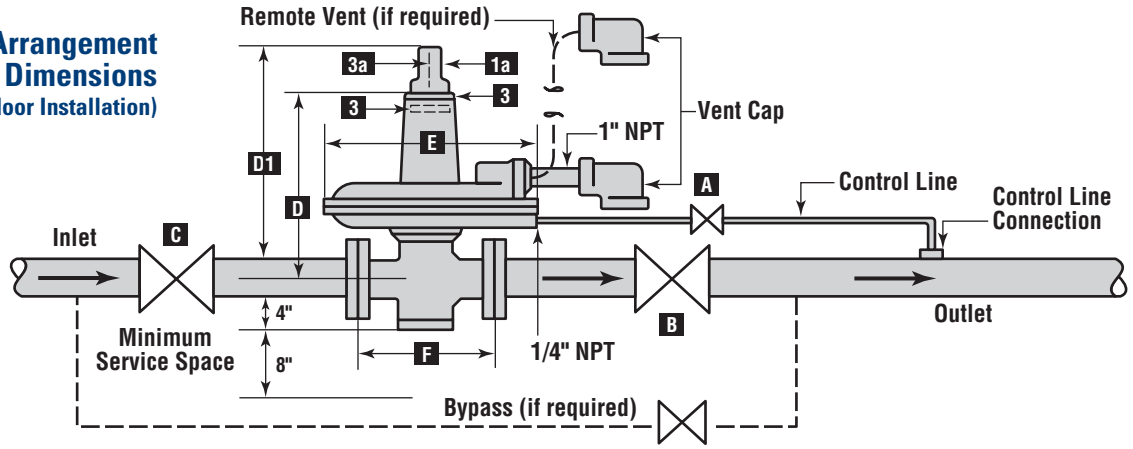
It is the user's responsibility to assure that all regulator vents and/or vent lines exhaust to a non-hazardous location away from any potential sources of ignition. Where vent lines are used, it is the user's responsibility to assure that each regulator is individually vented and that common vent lines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

3 The vent connection is an escape path for flammable gas and it must be located and/or piped so that potential discharge occurs in a safe area away from buildings, open flames, collection areas, arcing devices, etc.

Regulators that are installed indoors, or in a non-vented area must be vented to the outside. Simply run vent piping from the regulator vent connection to a non-hazardous location on the outside away from any potential sources of ignition. The vent piping must be connection size or larger and piped to a safe area.

The outlet of the vent piping must allow for the free and unobstructed passage of air and gas, and must be protected against the potentials listed in instructions.

Typical Arrangement and Dimensions
(Indoor or Outdoor Installation)



Model	D	D1	E
461-12S	13-1/4"	–	14"
461-8S	–	18-3/8"	10-3/16"
461-S (12")	–	19-1/2"	14-1/4"
461-S (8-1/2")	–	19-1/2"	11"

Regulator Body Type	F (Face to Face)
Screwed	6-1/2"
Flanged ANSI 125 FF	10"
Flanged ANSI 250 FF	10-1/2"

4 For outdoor installation, it is recommended that the regulator be installed so that the regulator vent faces downward to avoid the potential of water or other foreign matter entering the vent and interfering with the proper operation of the regulator.

5 Install the control line. It should be sturdy with adequate protection against breakage (regulators go wide open if control line is broken). Pitch it to drain away from the regulator, free of moisture pockets. The control line should be no less than 1/4" steel tubing or pipe for the 461-12S and 461-8S models and 1/2" steel pipe for the 461-S models.

The regulator will work to deliver the pressure(for which it is adjusted) at that point in the piping where the control connection is located.

In general, the control connection should be at least eight pipe diameters downstream from the regulator and should be in as straight a run as possible where turbulence is a minimum. Keep clear of elbows, valves, and other causes of excessive turbulence.

The control connection should be clean and smooth inside the pipe to minimize turbulence. It should be located on the top or side of the pipe, not on the bottom.Where outlet piping increases in size near the regulator, it is generally preferable to locate the connection in the larger size.
The unions for the control lines of the 461-S models contain a small orifice (approximately 1/16" diameter). This orifice should not be removed. Also, make certain it is open and free of foreign material.

6 Check all connections for leaks.

CAUTION

Turn gas on very 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.

7 Put the regulator into operation as follows:

- **a.** Slowly open downstream control line valve **(A)**.
- **b.** Slowly open downstream block valve **(B)**.
- **c.** Very slowly open upstream block valve **(C)**.
- **d.** When start-up and adjustment are completed, make sure valves **(A)**, **(B)**, and **(C)** are fully opened.

See diagram page 2

8 Set adjusting screw for the required outlet pressure. Turn it clock wise to increase the pressure and counterclockwise to decrease it. Only make the adjustment when gas is actually flowing through the regulator.

Remove the seal cap and, if applicable, loosen locknut to make adjustment.

After adjustment is complete, locknut (if applicable) should be tightened firmly and seal cap replaced. The absence of this seal cap can result in unstable operation.

9 To shut down, carefully close valves (C), (B), and (A) in that order.

CAUTION

1 Keep pipe dope and all other foreign substances out of the control line.

2 Never install any type of automatic shut-off device, which closes completely, between the regulator outlet and the downstream control line connection.

3 The 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 protect from vent blockage and minimize the chances of foreign material collecting in the vent side of the regulator diaphragm.

Servicing and Adjustment

General Notes

1 Make sure the regulator is entirely depressured before servicing.

2 A quick visual inspection of the valve can be made by removing inspection plates (33) from the sides of the body. These also provide greatly improved access to the valve when servicing or adjusting. Valve and body parts are interchangeable with other model 461 regulators.

3 Carefully note location and position of disassembled parts to be certain reassembly is correct. Inspect each one carefully and replace those that are worn or damaged or otherwise unsatisfactory.

4 Use lubricants sparingly and with care to avoid exposing tacky surfaces to the gas stream. Such surfaces could cause dirt accumulation on close-clearance parts.

Use moly or silicone type lubricants.
Avoid the use of petroleum base types.
It is best to avoid lubricating the stem or the guide. However, a small amount of silicone spray release agent to lubricate stem O-ring will help assure free movement and a tight seal. An application of silicone base lubricant to the other O-rings and the tetraseals in the regulator will also help assure their tightness.

CAUTION

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

To Service Double Seat Balanced Valve Assembly

1 Remove seal cap **1**, **1a**, or **1b**. Mark or measure position of adjustment **3** or **3a**. Use this to return adjustment to setting during reassembly.
   On 461-12S remove adjustment **3** and spring **9**.
   On 461-8S release adjustment **3a** and remove cover **5**, button **7a**, and spring **9**.
   On 461-S release adjustment **3a** and remove cover **8**, button **7b**, and spring **9**.

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 (1-1/2" hex deep socket). Remove orifice **18** and valve assembly intact through bottom opening.

4 If valve assembly does not require changes, replace without disturbing set screw **12g** (top end of **12b** screws onto **11h**) until it bottoms and should then be **backed off 1/2 turn to 1 full turn**).

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

6 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**).

7 Insert through bottom opening:
   a. upper half valve assembly – screw **12b** onto **11h** until it bottoms, then back off 1/2 to 1 full turn.
   b. orifice **18** – screw firmly into place.
   c. lower half valve assembly – screw onto upper half by 3 or 4 turns (**12h** screws onto **12b**).

8 Make the valve lock-up adjustment. Seat the upper valve against orifice **19** while screwing up the lower half valve assembly (**12h** screws onto **12b**) until the lower valve is seated against **18**. Then, firmly tighten set screw **12g**.

   To seat the upper valve against orifice **19** either reach it through the body side opening or remove diaphragm assembly and pull top end of stem **12b** upwards.

   Tighten **12g** with screwdriver or Allen wrench through body side opening. If necessary, turn the entire valve assembly (carefully – do not disturb adjustment) to face **12g** toward side opening. **12g** must tighten against flat area at top of **12h** to correctly lock the adjustment.

9 Screw entire valve assembly up (top of **12b** screws onto lower end of **11h**) until it bottoms.
Then back off 1/2 to 1 full turn – this is important.

10 Replace bottom inspection plate **14**. Engage pin in **13** with slot in lower end of **12j**, then rotate **14** until holes line up and install cap screws **16**.

11 Replace parts removed under Step 1 above and return adjustment to original setting.

To Service Single Seat Balanced Valve Assembly

1 Remove seal cap **1**, **1a** or **1b**. Mark or measure position of adjustment **3** or **3a**. Use this to return adjustment to this setting during reassembly.
   On 461-12S remove adjustment **3** and spring **9**.
   On 461-8S release adjustment **3a** and remove cover **5**, button **7a**, and spring **9**.
   On 461-S release adjustment **3a** and remove cover **8**, button **7b**, and spring **9**.

2 Remove bottom inspection plate **14**.

3 Remove locknut **12e**, then slip off valve **12d** and retainer **12c**. Orifice **18** can be removed with socket wrench (1-1/2" hex deep socket.) Reassemble in reverse order.

4 If it should be necessary to remove stem **12b** or valve guide **30**, do so by first removing lower diaphragm case **24** (steps 2 through 7 under "To Service Diaphragm" below). Use socket wrench for **30** (1-1/2" hex deep socket).

5 **Note – single seat balanced valve does not require any lock-up adjustment.**

6 **Note :** 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.

7 Replace bottom inspection plate **14**.

8 Replace parts removed under Step 1 above and return adjustment to original setting.

To Change Spring

1 Remove seal cap **1**, **1a** or **1b**.
   On 461-12S remove adjustment **3** and spring **9**.
   On 461-8S release adjustment **3a** and remove cover **5**, button **7a**, and spring **9**.
   On 461-S release adjustment **3a** and remove cover **8** button **7b**, and spring **9**.

2 Insert the new spring. Be sure it nests correctly onto part **11b**.

3 Replace remaining parts removed under Step 1.

To Service Diaphragm

1 Remove seal cap **1**, **1a** or **1b**. Mark or measure position of adjustment **3** or **3a**. Use this to return adjustment to this setting during assembly.
   On 461-12S remove adjustment **3** and spring **9**.
   On 461-8S release adjustment **3a** and remove cover **5**, button **7a**, and spring **9**.
   On 461-S release adjustment **3a** and remove cover **8**, button **7b**, and spring **9**.

2 Remove bolts **22** and then carefully remove upper diaphragm case **21**.

3 Turn diaphragm assembly counterclockwise (this unscrews **11h** from **12b**) and remove.

4 To disassemble diaphragm assembly, remove nut **11a**. When reassembling, note that abrasive side of emery cloth washers face against diaphragm.

5 Screw diaphragm assembly back into place. **11h** screws into **12b** until it bottoms, then **back off 1/2 to 1 full turn – this is important**.

6 **Note: single seat balanced valve does not require any lock-up adjustment**.

7 Carefully reinstall upper diaphragm case **21**. Diaphragm must not be pinched between upper and lower cases **21** and **24**. Make sure travel indicator **45** is working. Tighten bolts **23-22** evenly.

8 Insert spring **9**. Be sure it nests correctly into part **11b**. Replace remaining parts removed under Step 1 above and return adjustment to original setting.

Over-Pressurization Protection

Protection must be provided for the downstream piping system and the regulator's low pressure chambers to assure against the potential of over-pressurization due to a regulator malfunction or a failure of the regulator to lock up. The allowable over-pressurization is the lowest of the maximum pressures permitted by federal codes, state codes, Sensus bulletin RDS-1498, or other applicable standards. The method of providing over-pressure protection could be a relief valve, a monitor regulator, a shut off device or any similar device.

Temperature Limits

The regulator models 461-S, 461-12S, and 461-8S can be used for flowing temperatures from -20°F to 150°F.

Buried Service

The regulator models 461-S, 461-12S, and 461-8S **are not** recommended for buried service.

Condensed Parts List

All Models

Illustration Number	Description	Part Number
1	Seal Cap	143-16-005-00
1a	Seal Cap	121-10-005-52
1b	Seal Cap	090-00-005-02
2*	O-Ring	951357
2a	Tetraseal (or O-Ring) 1-1/2" x 1-5/8"	906534
2b	Tetraseal (or O-Ring) 1-3/4" x 2"	904092
3*	Adjustment Spring Button	143-16-009-00
3a	Spring Adjusting Screw	090-16-007-00
4	Hex Nut, 1/2" – 13	906537
4a	Hex Steel Nut, 5/8" – 11	921407
5	Housing Cover	121-10-005-51
5a	Housing Cover	091-16-080-53
7a	Top Spring Button	121-10-009-51
7b	Thrust Bearing, stainless steel ball, 3/8" dia.	930510
7c	Top Spring Button	091-16-009-00
8	Cap Screws, Hex Hd., 5/16" – 18 x 7/8" lg.	9210029
9	Spring – See Table	

*Minimum Recommended Spare Parts

All Models

Illustration Number	Description	Part Number
12	1" Double Seat Valve Assembly, brass trim, Buna-N	091-16-515-01
	1" Double Seat Valve Assembly, stainless steel trim, Buna-N	091-16-515-03
	1" Double Seat Valve Assembly, brass trim, Red Polyurethane	091-16-515-11
	1" Double Seat Valve Assembly, stainless steel trim, Red Polyurethane	091-16-515-13
	11/16" Double Seat Valve Assembly, brass trim, Buna-N	091-16-515-00
	11/16" Double Seat Valve Assembly, stainless steel trim, Buna-N	091-16-515-02
	11/16" Double Seat Valve Assembly, brass trim, Red Polyurethane	091-16-515-10
	11/16" Double Seat Valve Assembly, stainless steel trim, Red Polyurethane	091-16-515-12
	1" Single Seat Valve Assembly, stainless steel trim, Red Polyurethane	091-16-515-51
	11/16" Single Seat Valve Assembly, stainless steel trim, Red Polyurethane	091-16-515-50
12a*	O-Ring, 3/8" x 1/2"	934007
12b	Male Valve Stem, 5-1/16" lg., brass, for 1" & 11/16" double seat assembly	091-16-116-02
	Male Valve Stem, 5-1/16" lg., stainless, for 1" & 11/16" double seat assembly	091-16-116-00

*Minimum Recommended Spare Parts

Condensed Parts List

All Models

Illustration Number	Description	Part Number
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
12c	Valve Retainer, brass, for 1" double seat assembly (2 used)	091-16-018-03
	Vale Retainer, brass, V Port for 1" double seat (2 used)	091-16-012-04
	Valve Retainer, brass, for 11/16" double seat (2 used)	091-16-018-02
	Valve Retainer, stainless, for 1" single or double seat (1 or 2 used)	091-16-018-01
	Valve Retainer, stainless for 11/16" single or double seat (1 or 2 used)	091-16-018-00
12d*	Molded Valve, Buna-N (Black, 45-55 Duro) for 1" double seat all trim	091-16-315-01
	Molded Valve, Buna-N (Black, 45-55 Duro) for 11/16" double seat all trim	091-16-315-00
	Molded Valve, Polyurethane (Red, 65-75 Duro) for 1" double seat all trim	091-16-315-11
	Molded Valve, Polyurethane (Red, 65-75 Duro) for 11/16" double seat all trim	091-16-315-10
	Molded Valve, Viton (65-75 Duro, stamped V) for 1" double seat all trim	091-16-315-13
	Molded Valve, Viton (65-75 Duro, stamped V) for 11/16" double seat all trim	091-16-315-12
	Molded Valve, Polyurethane (Red 65-75 Duro) for 1" single seat	091-16-315-51
	Molded Valve, Polyurethane (Red 65-75 Duro) for 11/16" single seat	091-16-351-50
	Molded Valve, Viton (65-75 Duro, stamped V) for 1" single seat	091-16-315-58
	Molded Valve, Viton (65-75 Duro, stamped V) for 11/16" single seat	091-16-315-57
12e	Valve Locknut, brass, for double seat assembly	903920
	Valve Locknut, stainless, for double seat assembly	920303
	Valve Locknut, 3/8" – 24 Crown Nylok, for single seat assembly	903936
12f	Valve Stem Locking Ring, stainless, for double seat assembly	091-16-043-01

*Minimum Recommended Spare Parts

Condensed Parts List

All Models

Illustration Number	Description	Part Number
12g	Set Screw, slotted headless cup pt. #12-24 x 1/4" lg.	907694
12h	Female Valve Stem, brass, for double seat assembly	091-16-016-00
	Female Valve Stem, stainless for double seat assembly	091-16-016-03
12j	Valve Guide, brass for double seat assembly	091-16-012-00
	Valve Guide, stainless for double seat assembly	091-16-012-02
12m	Roll Pin, 1/4" x 1-1/2" lg., for single seat assembly	910707
12n*	O-Ring 3/4" x 1" single seat assembly	934015
	O-Ring 9/16" x 3/4", for 11/16" single seat assembly	934011
13	Guide Bushing, brass, with pin	091-16-385-02
	Guide Bushing, stainless,with pin	091-16-385-03
14	Bottom Inspection Plate,Iron	091-16-004-01
	Bottom Inspection Plate, Steel	091-16-004-02
15*	Tetraseal (or O-Ring), 2-3/4" x 3"	904079
16	Cap Screws, Hex Hd., 5/16" - 18 x 1" lg.	910030
17	Body, Screwed, 250 psi, Cast Iron	091-16-001-15
	Body Flanged, ANSI 125, FF, Cast Iron	091-16-001-17
	Body Flanged, ANSI 250, RF, Ductile Iron	091-16-001-18
	Body Flanged, ANSI 300, RF, Cast Steel	091-16-001-06
18	Outlet Orifice, 1" brass	091-16-029-01
	Outlet Orifice 1" stainless	091-16-029-05
	Outlet Orifice, 11/16" brass	091-16-029-00
19	Outlet Orifice, 11/16" stainless	091-16-029-04
	Inlet Orifice, 1" brass	091-16-028-01
	Inlet Orifice, 1" stainless	091-16-028-05
	Inlet Orifice, 11/16" brass	091-16-028-0
	Inlet Orifice, 11/16" stainless	091-16-028-04
20	Control Line Piping Assembly	091-16-361-50
20a	1/4" Sq. Hd. Steel Piping Plug	906055
20b	1/4" Malleable Iron Tee	946150
20c	Nipple and Plug Assembly	091-00-361-50
22	Hex Hd. Steel Bolt, 5/16" - 18 x 1" lg. (461-12S, 461-8S, 461-S 12")	910030
	Hex Hd. Steel Bolt, 5/16" - 18 x 1-1/4" lg. (461-S 8-1/2")	910031
23	Hex Steel Nut, 5/16" - 18	903859
26*	Tetraseal (or O-Ring), 4-3/8" x 4-5/8"	904085
27	Vent Cap, 1/4"	137-02-505-02

*Minimum Recommended Spare Parts

Condensed Parts List

All Models

Illustration Number	Description	Part Number
28	Seal Cap Gasket	091-16-066-00
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
32	Tetraseal (or O-Ring), 1-1/2" x 1-3/4"	904086
33	Ductile Iron Inspection Plate,Side	091-16-072-04
	Steel Inspection Plate, Side	091-16-072-01
45	Travel Indicator Assembly	091-00-365-61

Model 461-12S

All Models

Illustration Number	Description	Part Number
11	Diaphragm Assembly, 3-1/2" w.c. to 2 psi outlet pressure complete	121-16-550-51
11a	Elastic Stop Nut 29-NE-066	903955
11b	Bottom Spring Button	121-10-022-53
11c	Diaphragm Pan	121-16-017-50
11d*	Molded Diaphragm, Buna-N	121-16-150-53-001
11f	Emery Cloth Washer	121-10-178-50
11h	Diaphragm Stud, stainless steel	121-16-058-52

*Minimum Recommended Spare Parts

Maximum Emergency Pressures

For complete Maximum Emergency Pressure information for Model 461 Regulators, refer to bulletin RDS-1498, Regulator Pressure Ratings. If the maximum outlet pressure is exceeded, the regulator must be removed from service and carefully inspected. Damaged or otherwise unsatisfactory parts must be replaced before returning the regulator to service.

Monitoring

The 461-S, 461-8S, or 461-12S make an excellent monitor; a standby regulator installed in series which assumes control if a failure in the operating regulator permits the outlet pressure to exceed the set-point.

The fast rate of response enables it to take over quickly where necessary, and its outstanding performance means that it will provide excellent standby regulation.

It can be located in either the upstream or the downstream position.

When a 461 is used to monitor a regulator with an identical inner valve (another 461, a Model 1100 etc.) the **total maximum capacity** through both can be figured at 70% of the capacity of one of them alone. This applies with the monitor located either upstream or downstream.

Model 461-8S

All Models

Illustration Number	Description	Part Number
11	Diaphragm assembly, 2 psi to 10 psi outlet pressure complete	121-10-550-55
11a	Elastic Stop Nut 29-NE-066	903955
11b	Bottom Spring Button	121-10-022-50
11c	Diaphragm Pan	121-10-017-50
11d*	Diaphragm, Buna-N	121-10-150-50
11e	Upper Plate	121-10-022-52
11f	Emery Cloth Washer	121-10-178-50
11g	Lower Plate	121-10-079-52
11h	Diaphragm Stud, stainless steel	091-16-058-02

Model 461-S

All Models

Illustration Number	Description	Part Number
11	Diaphragm Assembly, 12"	091-16-550-01
	Diaphragm Assembly, 8-1/2"	091-86-550-02
11a	Hex Flexloc Nut 3/8" – 16"	900123
11b	Bottom Spring Button	091-16-009-50
11c	Upper Diaphragm Plate, 12"	091-16-060-00
	Upper Diaphragm Plate, 8-1/2"	091-86-010-00
11d*	Diaphragm,12"	091-16-150-00
	Diaphragm, 8-1/2"	091-86-150-00
11e	Lower Diaphragm Plate, 12"	091-16-060-01
	Lower Diaphragm Plate, 8-1/2"	091-86-010-00
11f	Seal Washer	014-76-179-03
11g	Stat-O-Seal, 3/8"	904985
11h	Diaphragm Stud, stainless steel	091-16-058-02

*Minimum Recommended Spare Parts

Other Gases

The regulator models 461-S, 461-12S, and 461-8S are mainly used on natural gas services; however, these regulators will perform equally well on other gases. When using the regulators on 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 mixture (specific gravity 1.20)	0.71
Nitrogen (specific gravity 0.97)	0.79
Dry CO_2 (specific gravity 1.52)	0.63

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

For use with gases not listed above, please contact your Sensus representative or Sensus Distributor for recommendations.

Models 461-S, 461-8S and 461-12S Regulators

Installation and Maintenance Instructions

SENSUS

Authorized Distributor:

805 Liberty Boulevard
DuBois, PA 15801
800-375-8875
Fax: (814) 375-8460
www.sensus.com/gas

Model 461-12S

Outlet Pressure Range	Spring Color	Spring Part No.
3-1/2" to 6-1/2" w.c.	Red	143-16-021-03
5" to 8-1/2" wc.	Blue	143-16-021-04
6" to 14" wc.	Green	143-16-021-05
12" to 28" wc.	Orange	143-16-021-06
1 psi to 2 psi	Black	143-16-021-07
1-1/2 psi to 3 psi	Cadmium	143-16-021-08

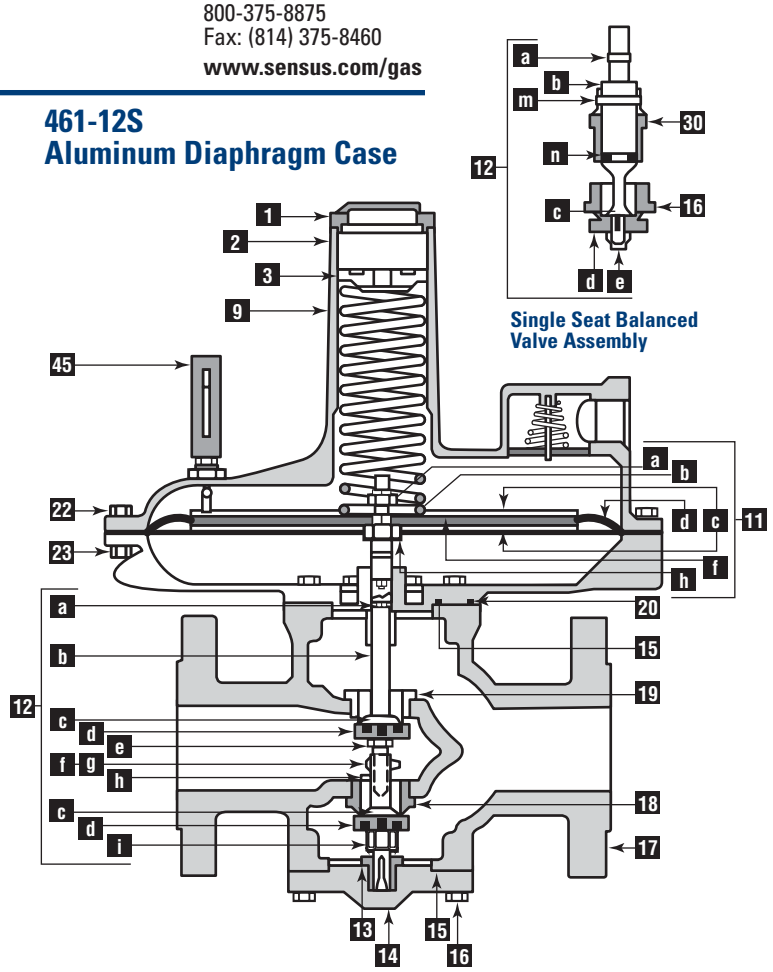
Model 461-S

Diaphragm Size	Outlet Pressure Ratings	Spring Color	Spring Part No.
8-1/2"	3 to 6 psi	Blue	090-70-021-04
	5 to 10 psi	Red	090-70-021-05
12"	2 to 10" w.c.	Aluminum	090-70-021-00
	4 to 16" w.c.	Green	090-70-021-01
	7 to 29" w.c.	Yellow	090-70-021-02
	1.5 to 1.75 psi.	Gray	090-70-021-03
	1 to 3.5 psi.	Blue	090-70-021-04

Model 461-8S

Outlet Pressure Range	Spring Color	Spring Part No.
1 psi to 2 psi	Orange	143-16-021-06
2 psi to 4-1/4 psi	Black	143-16-021-07
3 psi to 6-1/2 psi	Cadmium	143-16-021-08
6 psi to 10 psi	Cadmium (outer) White (inner)	143-16-021-08 143-16-021-13

461-12S Aluminum Diaphragm Case



Capacities at Other Pressures

Capacity for pressure reductions not listed in the table can be calculated with the following formula:

1 $Q = K\sqrt{P_0 (P - P_0)}$

2 $Q = \frac{KP_1}{2}$

Q = maximum capacity of the regulator (in SCFH of 0.6 specific gravity natural gas)

K = the **"K" factor;** the regulator constant (from Sensus bulletin R-1330, page 6)

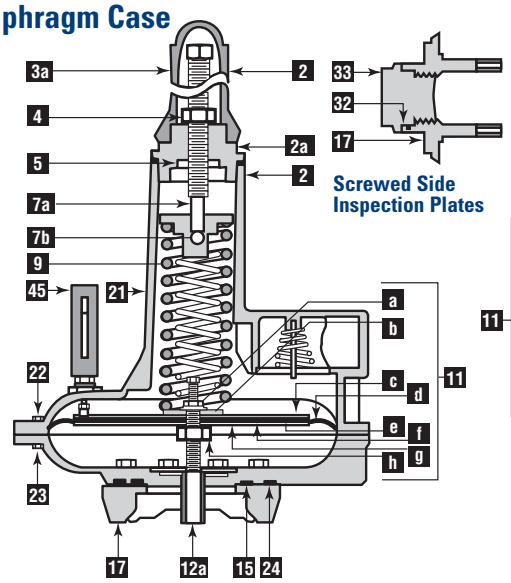
P_1 = **absolute** inlet pressure (psia)

P_2 = **absolute** outlet pressure (psia)

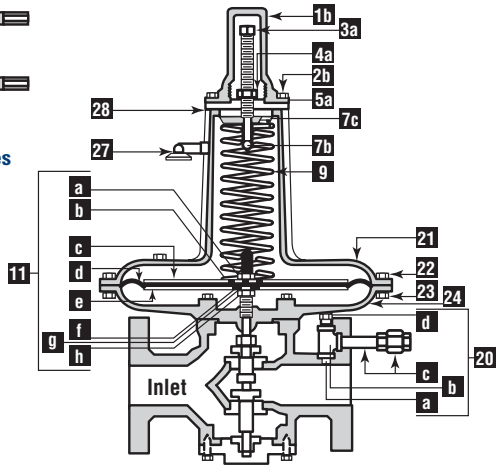
Use formula 1 when $\frac{P_1}{P_0}$ is less than 1.894

Use formula 2 when $\frac{P_1}{P_0}$ is greater than 1.894

461-8S Aluminum Diaphragm Case



461-S Cast Iron Diaphragm Case



R-1331 R9

Model 461-57S

sensus

Maximum Inlet Pressure– All Models

Regulator Body Type	461 Body Material	Maximum Working Pressure of Body	Maximum Inlet Pressure
Screwed End	CAST IRON (ASTM A126-71 Class B)	250 psi	250 psi
Flanged ANSI 125 lb. FF	CAST IRON (ASTM A126-71 Class B)	175 psi	175 psi
Flanged ANSI 250 lb. RF	DUCTILE IRON (ASTM A395-71 GR 60-40-18)	575 psi	575 psi
Flanged ANSI 300 lb. RF	CAST STEEL (ASTM A2 16-70A GR WCB)	720 psi	720 psi
Flanged ANSI 600 lb. RF	CAST STEEL (ASTM A216-70A GR WCB)	1200 psi	1000 psi

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

Valve Material	Maximum Pressure Differential	Maximum Inlet Pressure
Buna-N (black, 50 to 55 duro)	250 psi	575 psig
Polyurethane (red, 65 to 75 duro)	400 psi	720 psig
Polyurethane (tan, 85 to 95 duro)	600 psi	1200 psig

*The differential and inlet pressure given are only to be used as general guidelines. In all cases, pressures must always remain within the ranges specified in Sensus literature. for any given regulator, do not exceed the specified maximum pressures.

The maximum temperature for the above materials is 150º F.

Viton valve material has a maximum temperature rating of 300ºF and maximum pressure differential of 250 psi.

Spring Ranges

Outlet Pressure Range	Spring Color	Spring Part Number
3 to 6 psi	Yellow	091-00-021-05
5 to 9 psi	Gray	091-00-021-04
7½ to 15 psi	Blue	091-00-021-03
12½ 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 White*	091-00-021-01 091-00-021-08*

*Inner Spring

Pipe Size

Model 461-57S
Only 2" Available

Temperature Limits

The 461-57S "Roll-Out" Diaphragm Regulators may be used for flowing gas temperatures from -20ºF to 150ºF.

Buried Service

The 461-57S "Roll-Out" Diaphragm Regulator is ***not*** recommended for buried service.

Caution: It is the user's responsibility to assure that all regulator vents and/or vent lines exhaust to a non-hazardous location away from **any potential** sources of ignition. **Refer to Sensus Bulletin RM-1331 for more detailed information.**

The "Roll-Out" Diaphragm

SENSUS
The Measure of the Future

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.)

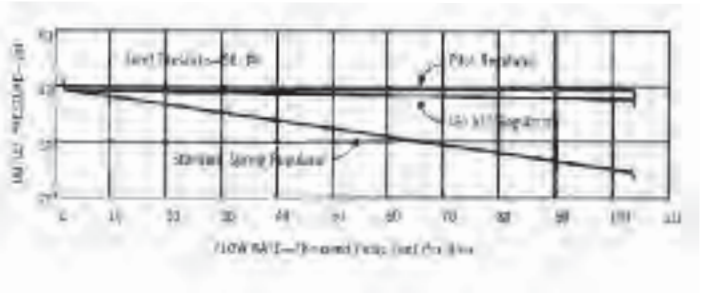
The action of the "Roll-Out" diaphragm differs from that of the conventional diaphragm in the manner in which the change in effective area occurs. Where the effective area of a conventional diaphragm would increase as the regulator opens, the "Roll-Out" area decreases. Conversely, where the area of the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

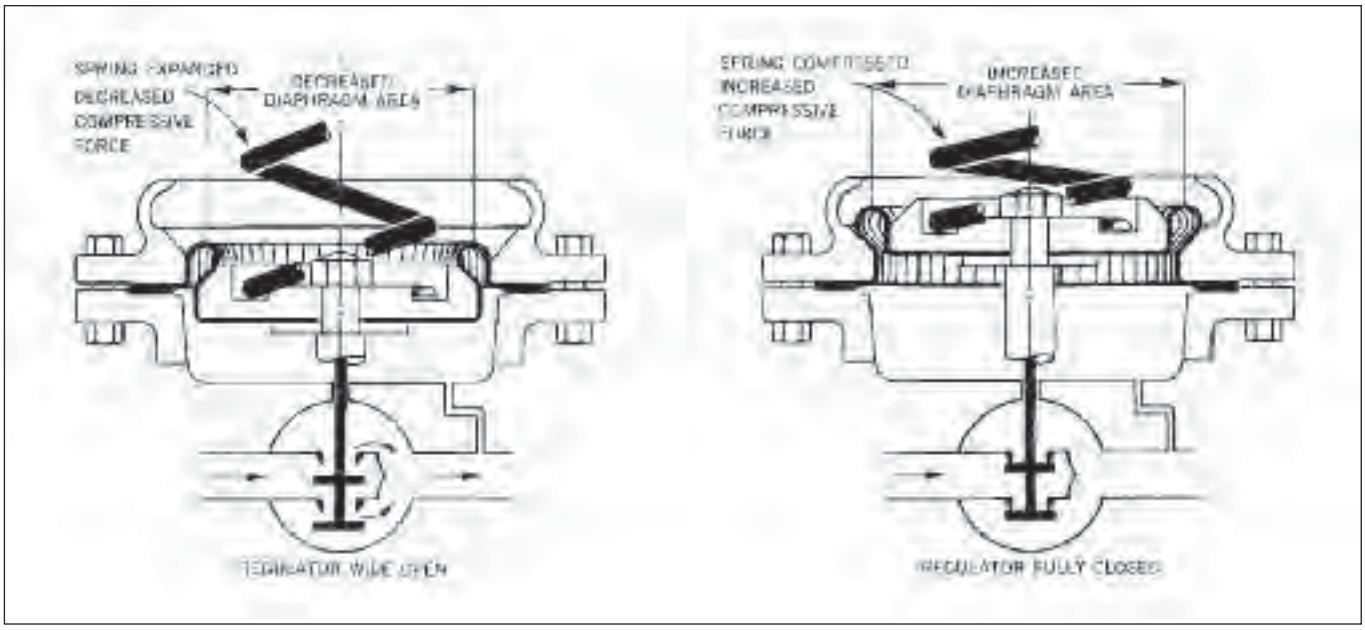
Spring type regulators are operated by the inter-action between spring and diaphragm. The compressive force of the spring works to open the regulator and is balanced by the opposing force of outlet pressure on the diaphragm which provides the closing force.

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. 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 461-57S 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.





Other Features

Simple Design–dependable regulation–trouble free operation–fast response–no pilot –no pilot freezing–no pilot maintenance.

Standard Face to Face Dimensions

Standardized "461" Bodies & Inner Valve Assemblies–easy maintenance–parts are interchangeable with other 461 models (see page 6.)

Simplified Valve Adjustment–easy to adjust for tight lock-up–accurate.

Molded Soft Seats–Buna -N or Polyurethane–positive tight shut-off–reduces potential of 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 Type Body Seals–eliminate 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 1½" hex deep socket wrench.

461-57S
"Roll-Out" Diaphragm Regulators

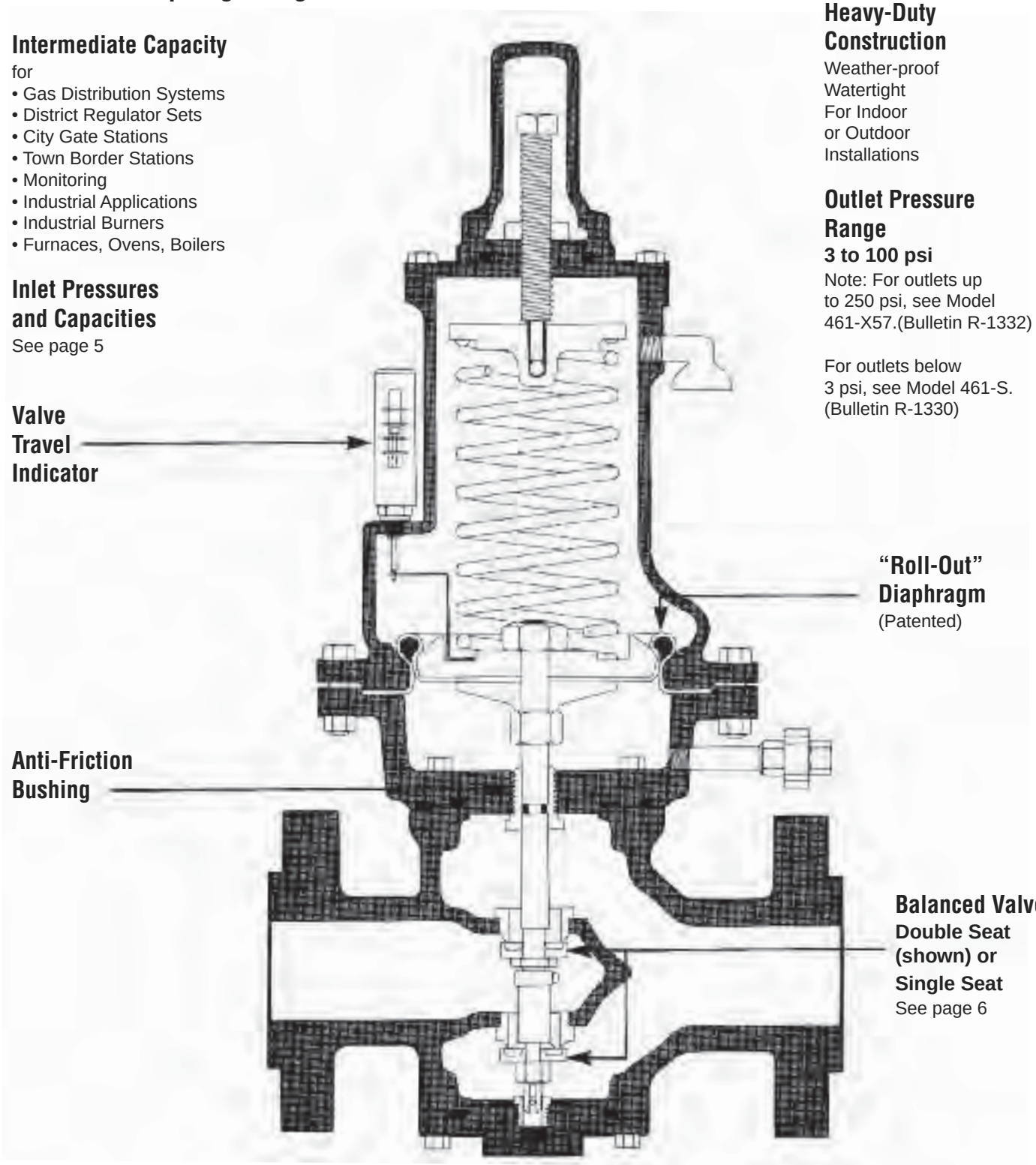
Intermediate Capacity
for
- Gas Distribution Systems
- District Regulator Sets
- City Gate Stations
- Town Border Stations
- Monitoring
- Industrial Applications
- Industrial Burners
- Furnaces, Ovens, Boilers

Inlet Pressures and Capacities
See page 5

Heavy-Duty Construction
Weather-proof
Watertight
For Indoor
or Outdoor
Installations

Outlet Pressure Range
3 to 100 psi
Note: For outlets up to 250 psi, see Model 461-X57.(Bulletin R-1332)

For outlets below 3 psi, see Model 461-S. (Bulletin R-1330)



Capacity in 1000 SCFH of Natural Gas (0.6 Specific Gravity–14.65 psia–60ºF)

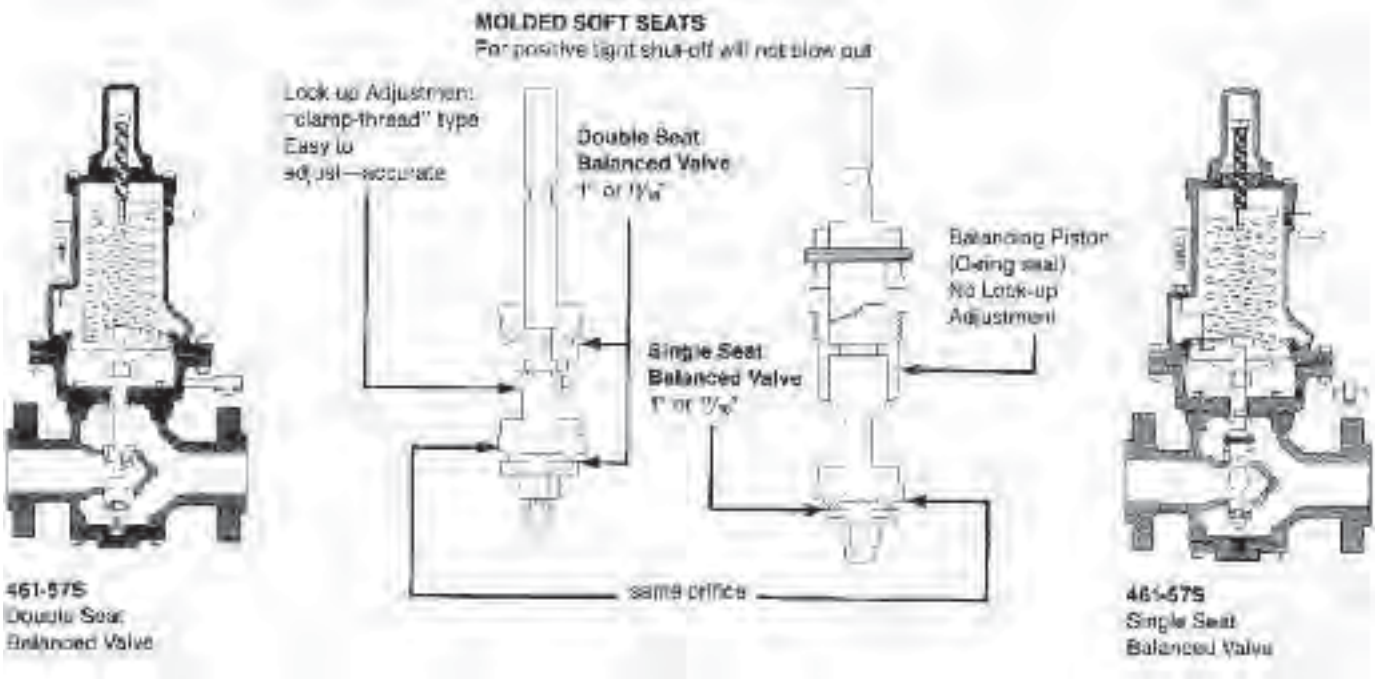
Inlet Pressure psi	Outlet Pressure psi	Double Seat Balanced		Single Seat Balanced	
		1" Valve	11/16" Valve	1" Valve	11/16" Valve
4	3	8.4	4.2	5.4	2.7
5	3	11.8	5.9	7.6	3.8
	4	8.6	4.3	5.6	2.8
6	3	14.4	7.2	9.3	4.6
	4	12.2	6.1	7.9	3.9
	5	8.8	4.4	5.7	2.8
8	3	18.6	9.6	12.1	6.0
	4	17.2	8.6	11.1	5.6
	5	15.2	7.6	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 & 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 & 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 & 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 & 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
50	40	46.6	23.3	30.3	15.1
	45	34.4	17.2	22.3	11.1
60	25 & 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 & 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 & 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& 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 & less	164	82.0	106	53.3
	80	162	81.3	105	52.8
	100	151	75.7	98.4	49.2
175	85 & less	189	94.8	123	61.6
	100	185	92.7	120	60.2
200	100 & 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
1000		1014	507	659	329
"K" FACTORS		2000	1000	1300	650

Note: The above performance data is based on normal testing at 70ºF flowing temperature. Changes in performance can occur at extreme low flowing temperatures.

Fully Interchangeable Valve Assemblies

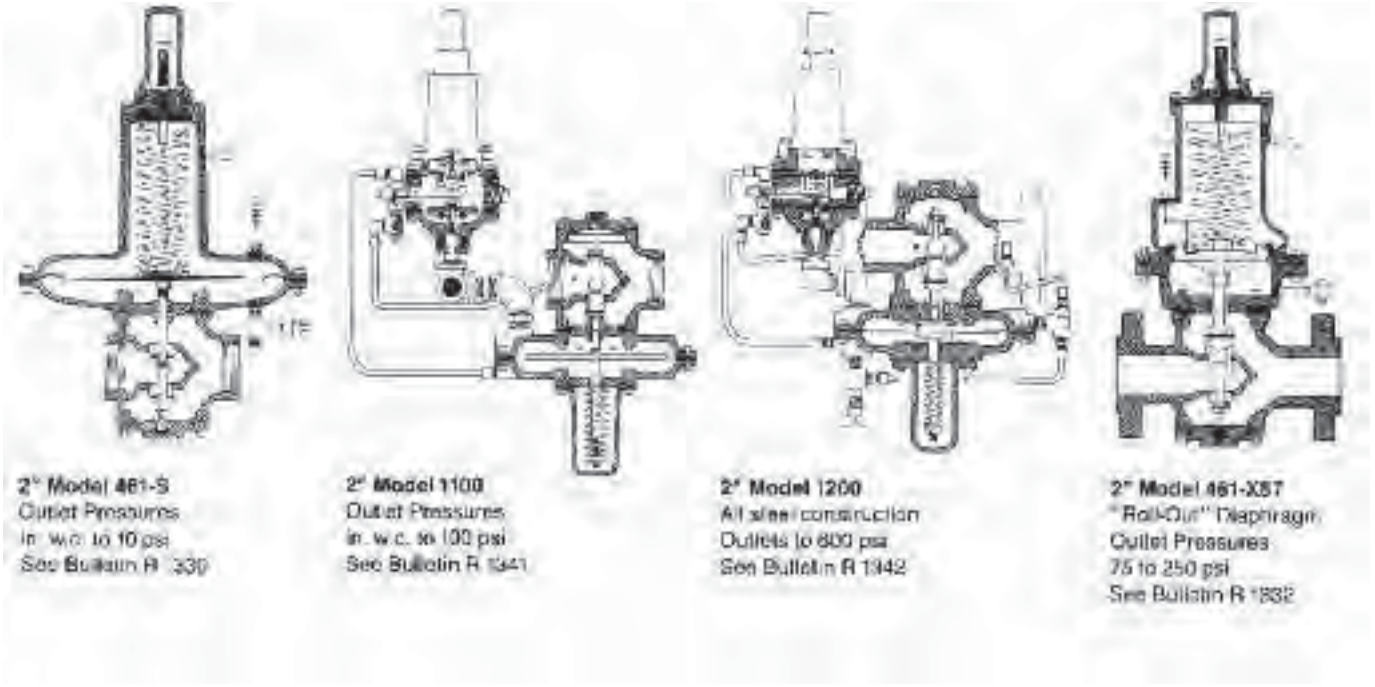
Valve assemblies can be interchanged with the regulator in place in the line.

Use the 11/16" Single Seat initially for small loads. Then in the future, as loads grow, change only the Valve Assembly, up to 1" Double Seat for maximum capacity.



The 461 Family of Regulators

Other Models Which Use Type 461 Balanced Valves



Maximum Emergency Pressures

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

Cast Iron Body, Screwed End . . . . . 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. . . . . 1100 psi

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

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

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

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.

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

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

Safely contained means no leakage as well as no bursting.

Before using any of the above data, make sure this entire section is clearly understood.

Overpressurization Protection

Protect the downstream piping system and the regulator's low pressure chambers against overpressurization due to possible regulator malfunction or failure to achieve positive lockup. The allowable outlet pressure is the lowest of the maximum pressures permitted by federal codes, state codes, Bulletin RDS-1498 or other applicable standards. The method of protection can be a relief valve, monitor regulator, shut-off device or similar mechanism.

Capacities at Other Pressures

Capacity for pressure reductions not listed in the table can be calculated with the following formulae:

1. $Q = K\sqrt{Po(P_1-P_0)}$ . . . . . (for $\frac{P_1}{P_0}$ less than 1.894)

2. $Q = \frac{KP_1}{2}$ . . . . . (for $\frac{P_1}{P_0}$ greater than 1.894)

Q = maximum capacity of the regulator (in SCFH of 0.6 specific gravity natural gas).
K = the **"K" factor**, the regulator constant (from the table)
P_1 = **absolute** inlet pressure (psia).
P_0 = **absolute** outlet pressure (psia).

Use formula 1 when $\frac{P_1}{P_0}$ is less than 1.894.

Use formula 2. when $\frac{P_1}{P_0}$ is greater than 1.894.

Other Gases

Model 461-57S Regulators are mainly used on natural gas. However they perform equally as well on LP gas, nitrogen, dry CO_2, air and others.

OTHER GASES	CORRECTION FACTOR
Air (Specific Gravity 1.0)	0.77
Propane (Specific Gravity 1.53)	0.63
1350 BTU Propane-Air Mix (1.20)	0.71
Nitrogen (Specific Gravity 0.97)	0.79
Dry Carbon Dioxide (Specific Gravity 1.52)	0.63
For other noncorrosive gases: CORRECTION FACTOR =	$\sqrt{\frac{0.6}{\text{Specific Gravity of the Gas}}}$

For use with other gases not listed above, please contact your Sensus representative or Industrial Distributor for recommendations.

Materials of Construction

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)
Lower Diaphragm Plate . . . . . Cast Iron
Upper Diaphragm Plate . . . . . Die Cast Aluminum
Diaphragm . . . . . Buna-N with Dacron Reinforcement
Diaphragm Stud . . . . . Stainless Steel
Removable Outlet 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 Molded Valve . . . . . Steel for Soft Seat Stainless Steel for Nylon Seat
Valve Retainer . . . . . Brass or Stainless Steel
Bodies . . . . . see table on Page 3

Metrification

Use the following for Metric conversions:

Std. metres^3/hr. x 35.31= std. ft.^{3}/hr. (SCFH) std. ft.^{3}/hr. (SCFH) x 0.0283 = std. metres^3/hr.
kilograms/centimeter^2 (kgcm^2) x 14.22 = psig psig x 0.0703=kilograms/centimeter^2(kg/cm^2)
kilopascals (kPa) x 0.145 = psig psig x 6.90 - kilopascals (kPa)
bars x 14.50 = psig psig x 0.069 = bars
millimeters water (mm H_2O) x .394 = in. w.c. in w.c. x 25.4 = millimeters water (mm H_2O)
millimeters mercury (mm Hg) x 0.535 = in. w.c. in w.c. x 1.868 = millimeters mercury (mm Hg)

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 an 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” means that it will provide excellent regulation if an emergency calls it into operation.

Two monitor set arrangements are shown in the sketches 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.

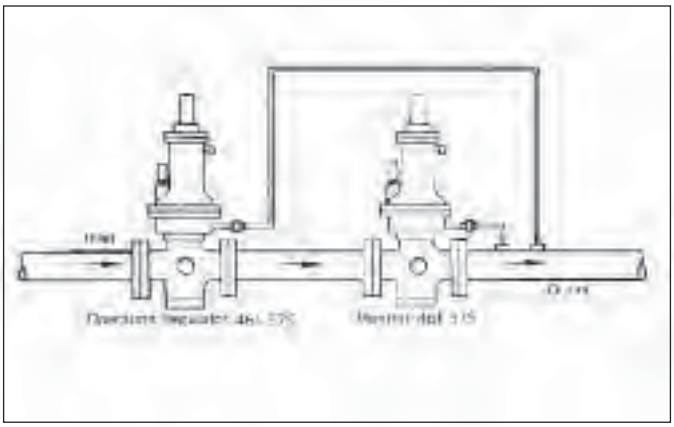
The 461-57S is also used for monitoring other types of regulators. This is shown in the second sketch. It is excellent for monitoring pilot operated regulators.

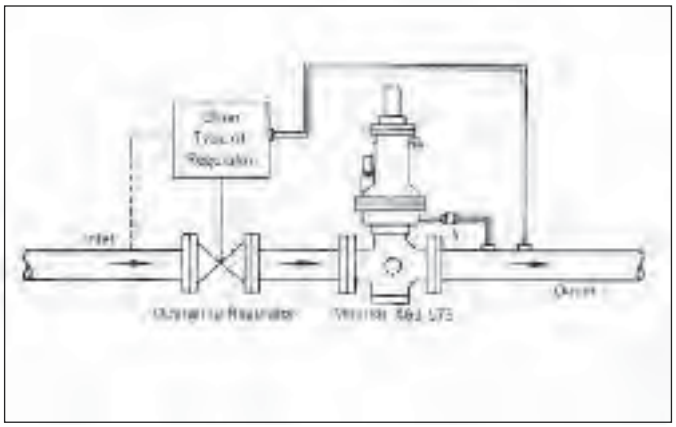
Both sketches show the monitor in the downstream position. When installed this way, the 461-57S is usually set for an outlet pressure 2 to 4 psi higher than the operating regulator and thus is wide open during normal operation.

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. In general, however, the sketch on page 9 “Typical Installation” 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.



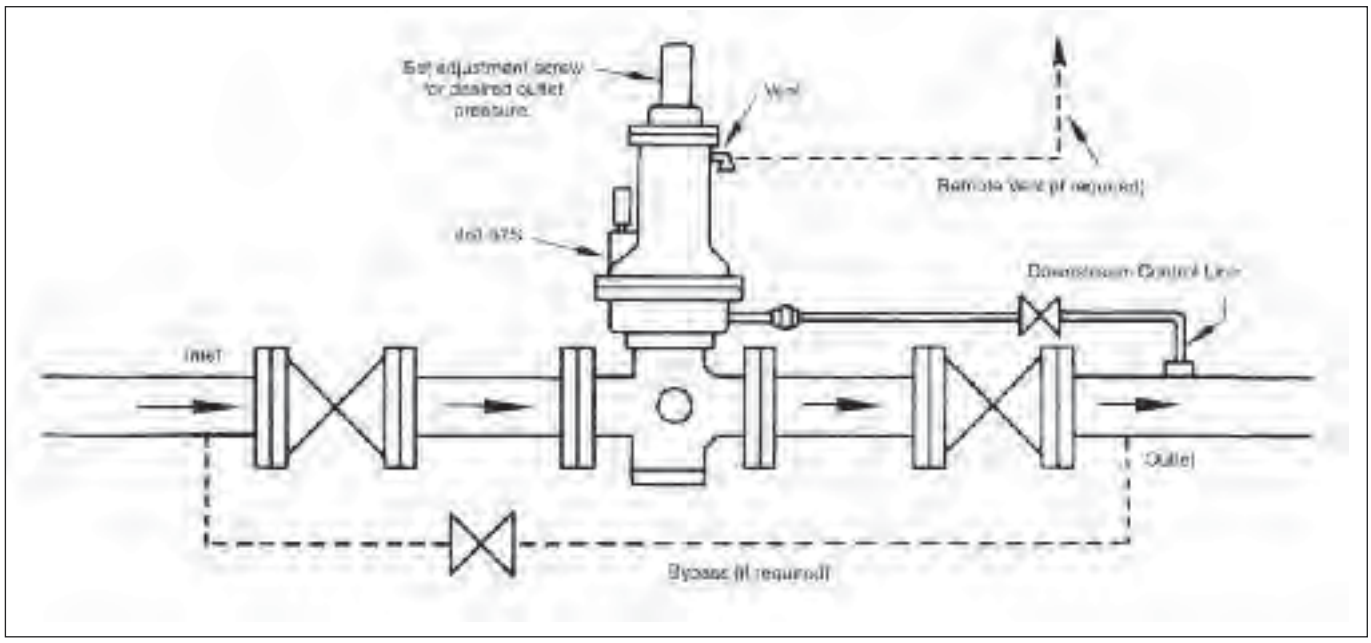


Periodic Inspection: Regulators are pressure control devices with numerous moving parts subject to wear that is dependent upon particular operating conditions. To assure continuous satisfactory operation, a periodic inspection schedule must be adhered to with the frequency of inspection determined by the severity of service and applicable laws and regulations. **See bulletin RM-1331 for field service instructions.**

The simple and compact design of the Model 461-57S makes it an easy regulator to install. The sketch below shows a typical arrangement.

The regulator will work to deliver the pressure, for which it is adjusted, at that point in the downstream system where the **downstream control line connection** is made.

As a general rule, it should be at least 8 pipe diameters downstream from the regulators and should be located in as straight a run of pipe as possible. Where outlet piping increases in size near the regulator, it is preferable to connect into the larger diameter portion. The connection itself must be smooth and clean, free of rough edges, wilding icicles, etc.

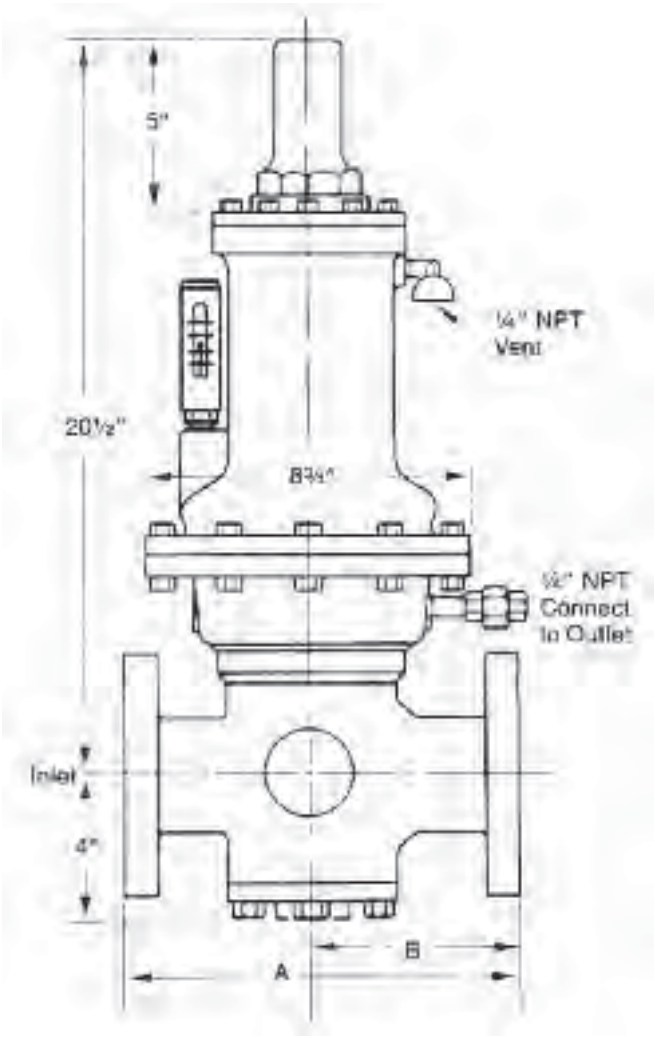


How to Order

Specify:
1. 2" Model 461-57S.
2. Piping connections and body material (see table on Page 2)
3. Outlet pressure and/or spring (see table on Page 3)
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 (see Page 6)–if not specified, double seat will be furnished.

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 he outlet pressure during start-up to prevent an outlet pressure overload. **Refer to RM-1331 for more detailed start-up procedures.**

Dimensions



Regulator Body Type	A	B	Shipping Weight Lbs.
Screwed	6½	3¾	70
Flanged ANSI 125 lb.	10	5¼	80
Flanged ANSI 250 lb.	10½	5½	85
Flanged ANSI 300 lb.	10½	5⅝	88
Flanged ANSI 600 lb.	11¼	6	90

Other Sensus Gas Pressure Regulators

SENSUS
The Measure of the Future

Sensus produces a broad product line of Gas Pressure Regulators which are widely used throughout the natural gas industry. These regulators are also suitable for non-corrosive industrial gas applications such as propane, butane, air, nitrogen, dry CO_2, etc. For additional detailed information on a particular model, please request the indicated bulletin from Sensus customer service, or visit our web product catalog at www.sensus.com/gas

Multi-Purpose Service Regulators

Models 496, 61R2, 143-80
Bulletin: TD-1301, TD-1307, TD-1308
½",¾", 1", and 1¼" pipe size
Inlet pressures . . . . . .to 125 psi
Outlet pressures . . . . . .3½" w.c. to 6 psi
Capacity to 2250 CFH
Available with straight through body.
Also available: internal relief valve and low pressure cut-off.

Industrial Service Regulators

Models 243-8, 234-12, 243-8HP
Bulletin: R-1306
1¼", 1½", and 2" pipe size
Inlet pressures . . . . . .to 125 psi
Outlet pressures . . . . . .3½" w.c. to 10 psi
Capacity to 25,000 CFH
Also available: internal relief valve, low pressure cut-off external control line, back pressure regulator, relief valve, vacuum regulator and vacuum breaker.

Industrial Field Regulators

For intermediate to high pressure applications. Ideal on pipeline taps servicing plants and buildings. Appropriate for double stage reduction ahead of service regulators, and for high pressure burners and compressed air systems.

Model 046
Bulletin: R-1312
¾", 1", and 1¼" pipe size
Inlet pressures . . . . . .to 1000 psi
Outlet pressures . . . . . .3 to 200 psi
Capacity to 40,000 SCFH
Monitor and pressure loaded version, and internal relief valve also available.

Model 141A
Bulletin: R-1311
2" pipe size
Inlet pressures . . . . . .to 1500 psi
Outlet pressures . . . . . .5 to 400 psi
Capacity to 55,000 SCFH

Pilot Loaded Regulators

For intermediate and high-pressure applications requiring precise pressure reduction with minimal droop. Ideal for standard and high capacity flows on burners, driers, dehydrators and compressor line. Appropriate for fixed factor billing.

Models 243-RPC
Bulletin: R-1343
1¼", 1½" and 2" pipe size
Inlet pressures . . . . . .to 150 psi
Outlet pressures . . . . . .3½" w.c. to 35 psi
Capacity to 76,000 SCFH

Model 1100
Bulletin: R-1341
2" pipe size (screwed or flanged)
Inlet pressures . . . . . to 400 psi
Outlet pressures . . . . . .3½" w.c. to 100 psi
Capacity to 414,000 SCFH

Model 1200
Bulletin: R-1342
2" pipe size (flanged)
Inlet pressures . . . . . to 1200 psi
Outlet pressures. . . . . 20 to 600 psi
Capacity to 789,000 SCFH

Sensus also produces Industrial and Combustion Regulators; High Pressure, High Capacity Regulators; and Safety Relief Valves. Detailed information available upon request.

SENSUS
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Model 461-57S Regulator

Installation and Maintenance Instructions

Introduction

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 unique action reduces “droop” to a minimum (“droop” being fall-off in outlet pressure as a spring regulator opens to increase flow).

Installation and Start-Up

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

1. Thoroughly purge inlet piping to remove dirt and debris which could damage the regulator or impair its operation. If this cannot be done, a filter or strainer should be installed ahead of the regulator (see Sensus Bulletin RDS-1498, Regulator Pressure Ratings). Make certain that regulator is free of any dirt or foreign matter that might have collected.
2. Place regulator in the line with high pressure connected to the inlet side (be sure that shipping screens or covers, if used, are removed from the inlet and outlet).

   On flanges, tighten bolts evenly.

   Where required, the regulator may be inverted. It may also be installed in a vertical line. However, if installed in a vertical line, there could be excessive wear in anti-friction bushing.
3. From the ¼" union **20** extend pipe or tubing to the control connection into the outlet piping. (See Figure 1 on page 2.) This 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

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.

   The regulator will work to deliver the pressure, for which it is adjusted, at that point in the outlet piping where the control connection is located.

   In general the control connection should be at least eight pipe diameters from the regulator and should be in as straight a run of pipe as possible.

   The control connection should be clean and smooth, free of rough edges, welding “icicles”, etc.

   Where outlet piping increases in size near the regulator, it’s generally preferable to locate the control connection in the larger size. The ¼" union **20** contains a small orifice, approximately 1/16" diameter. This orifice should not be removed. Also, make certain this orifice is open and free of foreign material.

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 from collecting in the vent side of the regulator diaphragm.

4. Check all connections for leaks.
5. Put the regulator into operation as follows: (See Figure 1)
   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**.
   d. Set the adjusting screw **2** for the required outlet pressure. Turn it clockwise to increase the pressure and counter-clockwise to decrease it. Only make this adjustment when gas is actually flowing through the regulator.

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.

   e. After adjustment is complete, the lock nut **3** should be tightened firmly and the seal cap **1** replaced.
6. To shut down, carefully close valves **C**, **B**, and **A** in that order.

Spring Ranges

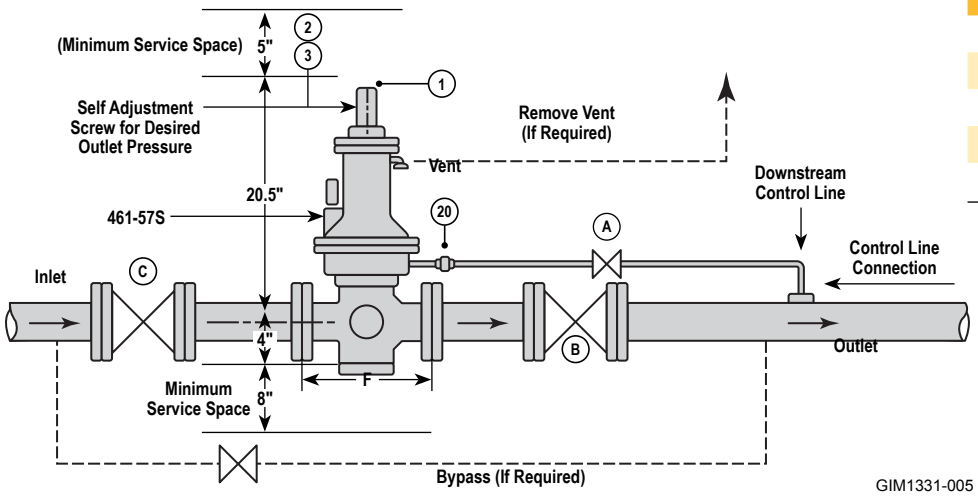
Outlet Pressure Range	Color of Spring	Nominal Diaphragm Size (I.D.)
3 to 6 psi	Yellow	5" all ranges
5 to 9 psi	Gray	
7½ to 15 psi	Blue	
12½ to 30 psi	Red	
25 to 55 psi	Brown	
50 to 75 psi	Black	
70 to 100 psi	Brown plus White*	

*White colored spring is nested within brown.

Maximum Inlet Pressures for all Regular Body Types			
Regulator Body type	**461 Body Materials**	**Maximum Working Pressure of Body**	**Maximum Inlet Pressure**
Screwed End	Cast Iron (ASTM A126-71 Class B)	250 psi	250 psi
Flanged ANSI 125 lb. FF	Cast Iron (ASTM A126-71 Class B)	175 psi	175 psi
Flanged ANSI 250 lb. RF	Ductile Iron (ASTM A395-71 gr 60-4-18)	575 psi	575 psi
Flanged ANSI 300 lb. RF	Cast Steel (ASTM A216-70a gr WCB)	720 psi	720 psi
Flanged ANSI 600 lb. RF	Cast Steel (ASTM A216-70a gr WCB)	1200 psi	1000 psi

*This document replaces RM-1331-R10

Figure 1. Typical Arrangement and Dimensions (indoor and outdoor installation)



Regulator Body Type	(Face to Face, in.)
Screwed	6½
Flanged ANSI 125	10
Flanged ANSI 250	10½
Flanged ANSI 300	10½
Flanged ANSI 600	11¼

Servicing and Adjustment

General Notes (see Illustrations on pages 5 and 6)

1. Make sure the regulator is entirely depressurized before servicing.
2. A quick visual inspection of the valve can be made by removing inspection plates **33** from the sides of the body. These also provide greatly improved access to the valve when servicing or adjusting.
3. The diaphragm **11d**, the springs **9**, and all other parts from the diaphragm up (except the **11h** stud) are interchangeable with the Model 441-57S Regulator. Valve and body parts are interchangeable with other 461 Regulators (461-S, 461-X57, 1100, 1200).
4. Use lubricants sparingly and with care to avoid exposing tacky surfaces to the gas stream. Such surfaces could cause dirt accumulation on close clearance parts.

   Use moly or silicone type lubricants. Avoid the use of petroleum base types.

   Lubricate the stem **12b**, guide **12j** and stem O-rings **12a** and **12n** with dry silicon lubricant to help assure free movement and a tight seal.

   An application of lubricant to other O-rings and the tetraseals in the regulator will also help ensure their tightness.
5. 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.

To Service Double-Seat Balanced Valve Assembly

1. Remove seal cap **1**, back off adjusting screw **2**, remove housing cover **6**, and remove spring **9**.
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 (1½" hex, deep socket). Remove orifice **18** and valve assembly intact through bottom opening.
4. If valve assembly and orifice do not warrant replacement, screw orifice **18** firmly into place. Replace without disturbing set screw **12g**. Top end of **12b** screws into **11h** until it bottoms and should then be **backed off one-half to one full turn**.
5. If new parts are needed, disassemble valve assembly by loosening set screw **12g** and unscrewing **12h** from **12b**, and then unscrewing nut **12e** and part **12j**.
6. 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**).
7. Insert through bottom opening:
   a. Upper half valve assembly – screw **12b** onto **11h** until it bottoms then **back off one-half to one full turn**.
   b. Orifice **18** – screw firmly into place.
   c. Lower half valve assembly – screw onto upper half by three or four turns (**12h** screws onto **12b**).
8. Make the valve lock-up adjustment. Seat the upper valve against orifice **19** while screwing up the lower half valve assembly (**12h** screws onto **12b** until the lower valve is seated against **18**). Then, firmly tighten set screw **12g**.
   a. To seat the upper valve against orifice **19**, either reach it through the body side opening or remove diaphragm assembly and pull top end of stem **12b** upwards.
   b. Tighten **12g** with screwdriver through body side opening. If necessary, carefully turn the entire valve assembly. (Do not disturb adjustment to face **12g** toward side opening.)
   c. **12g** must tighten against flat area at top of **12h** to correctly lock the adjustment.
9. Screw entire valve assembly up (top of **12b** screws onto lower end of **11h** until it bottoms), then **back off one-half to one full turn – this is important**.
10. Complete assembly as per steps 6 thru 10 under “To Assemble 461-57S”.

To Service Single Seat Balanced Valve Assembly

1. Remove seal cap **1**, back off adjusting screw **2**, remove housing cover **6**, and remove spring **9**.
2. Remove bottom inspection plate **14**.
3. Remove lock nut **12e**, then slip off valve **12d** and retainer **12c**. Orifice **18** can be removed with socket wrench (1½" hex, deep socket). Reassemble in reverse order.
4. If it should be necessary to remove stem **12b** or valve guide **30**, do so by first removing lower diaphragm case **21** (steps 2 thru 4 under "To Take 461-57S Apart"). Use socket wrench (1½" hex, deep socket) for **30**.

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

   Note: 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.
5. Reassemble as per applicable steps under "To Assemble 461-57S".

To Change Spring

1. Remove seal cap **1**, back off adjusting screw **2**, remove housing cover **6**, and remove spring **9**.
2. Insert the new spring. Be sure it nests correctly into part **11c** and that travel indicator bracket **36k** is in place. Inspect the diaphragm before inserting the spring to be sure the roll-out is uniform and in place. (Use a flashlight, if necessary.)
3. Complete as per steps 8, 9, and 10 under "To Assemble 461-57S".

To Service Diaphragm

1. Remove seal cap **1**, back off adjusting screw **2**, remove housing cover **6**, and remove spring **9**.
2. Remove bolts **23** and then carefully remove upper diaphragm case **10**.
3. Turn diaphragm assembly counterclockwise until **11h** unscrews from **12b**, then remove assembly and inspect diaphragm.
4. If a new diaphragm **11d** is required, remove nut **11a** and disassemble.
5. When reassembling, **be sure fabric side and gasket of diaphragm is toward the vent side of the regulator and the rubber side of diaphragm toward the pressure side. The gasket is always placed on the spring side of diaphragm.**
6. To minimize rolling friction and prevent sticking, coat the fabric side of the diaphragm with Molycote, or equivalent graphite based lubricant, before installation. Screw diaphragm assembly back into place. (**11h** screws into **12b** until it bottoms), then **back off one-half to one full turn – this is important**.
7. Form roll into roll-out diaphragm **11d**, then carefully reinstall upper diaphragm case **10**. Diaphragm must not be pinched between upper and lower cases, **10** and **21**. Also, roll-out loop must be uniformly full and even. It should be in place as shown of the cross-section drawing. Tighten bolts **23** and nuts **22** evenly.
8. Replace spring, etc., per steps 7 thru 10 under "To Assemble 461-57S".

To Take 461-57S Apart

1. Remove seal cap **1**, loosen nut **3**, back off adjusting screw **2**, remove cover cap screws **16**, remove housing cover **6**, remove gasket **28**, and remove spring **9**.
2. Remove bolts **23** and nuts **22** and upper diaphragm case **10**.
3. Unscrew diaphragm assembly **11** from stem **12b**.
4. Remove lower case to body cap screws **16** and remove lower diaphragm case **21**.
5. Remove valve assembly and orifice **18** per previous sections on servicing valve assembly.
6. Remove inlet orifice **19** (or guide **30**) through top opening using 1½" socket wrench.

To Assemble 461-57S

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. **11h** screws into **12b** until it bottoms, then **back off one-half to one full turn – this is important**.
5. Install upper diaphragm case per step 7 under "To Service Diaphragm".
6. Replace bottom inspection plate **14** (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. Insert the spring. Be sure it nests correctly into part **11c** and that travel indicator bracket is in place. Inspect the diaphragm before inserting the spring to be sure the roll-out is uniform and in place. (Use a flashlight, if necessary.)
8. Insert top spring button **7a** and ball bearing **7b**. Be sure it is nested correctly on the spring.
9. Install housing cover gasket **28** and housing cover **6**. Be sure the lower end of adjusting screw **2** goes into the hole in button **7a**. Install housing cover screws **16**.
10. Set adjusting screw **2** for desired outlet pressure, firmly tighten nut **3** and replace seal **4** and cap **1**.

CAUTION

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

Maximum Emergency Pressures

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

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

Cast Iron Body, Screwed End	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	1100 psi

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

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

Set-point is defined as the outlet pressure a regulator is adjusted to deliver. 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. The maximum pressure than can be safely contained by the diaphragm case is:

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

Safely contained means no leakage as well as no bursting.

Other Gases

Model 461-57S Regulators are mainly used with natural gas. However, they perform equally well with LP gas, nitrogen, dry CO_2, air and others.

Other Gases	Correction Factor
Air (Specific Gravity 1.0)	0.77
Propane (Specific Gravity 1.53)	0.63
1350 BTU Propane-Air Mix (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: $\text{CORRECTION FACTOR} = \sqrt{\frac{0.60}{\text{Specific gravity of the gas}}}$

For use with gases not listed above, please contact your Sensus representative or Industrial Distributor for recommendations.

Buried Service

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

Temperature Limits

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

Over-pressurization Protection

Protect the downstream piping system and the regulator's low pressure chambers against over-pressurization 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, Sensus Bulletin RDS-1498, or other applicable standards. The method of protection can be a relief valve, monitor regulator, shutoff device, or similar mechanism.

Condensed Parts List

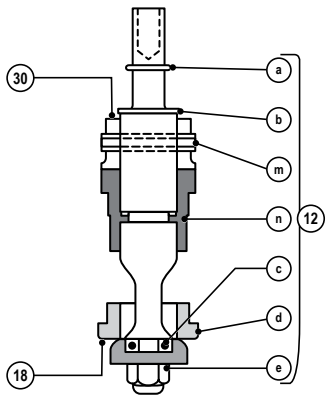
NOTE: Items in bold face type denote minimum recommended spare parts.

Illustration Number	Description	Part Number
3	Hex Steel Nut ⅝" – 11	921407
4	**Tetraseal (or O-Ring) 1¾" x 2"**	**904092**
7b	Thrust Bearing-Stainless ball ⅜" Dia.	930510
8	Anti-Friction Bushing Assy.	091-16-373-00
9	Spring – Yellow 3 to 6 psi Spring – Gray 5 to 9 psi Spring – Blue 7½ to 15 psi Spring – Red 12½ to 30 psi Spring – Brown 25 to 55 psi Spring – Black 50 to 75 psi Spring – Brown plus White 70 to 100 psi Brown outer spring White inner spring	091-00-021-05 091-00-021-04 091-00-021-03 091-00-021-02 091-00-021-01 091-00-021-00 091-00-021-01 091-00-021-08
11a	Hex, Steel Nut ⅝" – 18	905993
11c	Diaphragm Plate – upper	091-00-010-00
11d	**Diaphragm – 5" Roll-Out**	**091-00-350-00**
11e	Diaphragm Plate – lower	091-00-022-00
11f	**O-Ring, ⅝" x ¾"**	**902922**
11g	Split Lockwasher ⅝"	932531
11h	Diaphragm Stem	091-00-058-00
12	1" Double-Seat Valve Assembly brass trim, Buna-N 1" Double-Seat Valve Assembly stainless trim, Buna-N 1" Double-Seat Valve Assembly brass trim, Red Polyurethane 1" Double-Seat Valve Assembly stainless trim, Tan Polyurethane, V-port 1" Double-Seat Valve Assembly brass trim, Tan Polyurethane, V-port 1 1/16" Double-Seat Valve Assembly brass trim, Buna-N 1 1/16" Double-Seat Valve Assembly stainless trim, Buna-N 1 1/16" Double-Seat Valve Assembly brass trim, Red Polyurethane 1 1/16" Double-Seat Valve Assembly stainless trim, Red Polyurethane 1" Single-Seat Valve Assembly stainless trim, Red Polyurethane 1 1/16" Single-Seat Valve Assembly stainless trim, Red Polyurethane	091-16-515-01 091-16-515-03 091-16-515-11 091-16-515-13 091-16-515-65 091-16-515-00 091-16-515-02 091-16-515-10 091-16-515-12 091-16-515-51 091-16-515-50
12a	**O-Ring, ⅜" x ½"**	**934007**
12b	Male Valve Stem, 5 1/16" Lg. brass for 1" & 1 1/16" Double-Seat assembly Male Valve Stem, 5 1/16" Lg. stainless for 1" & 1 1/16" Double-Seat assembly Valve Stem – stainless for 1" Single-Seat assembly	091-16-116-02 091-16-116-00 091-00-016-07
12c	Valve Stem – stainless for 1 1/16" Single-Seat assembly Valve Retainer – brass for 1" Double-Seat (2 used) Valve Retainer – brass for 1 1/16" Double-Seat (2 used) Valve Retainer – stainless for 1" Single- or Double-Seat (1 or 2 used) Valve Retainer – Stainless for 1 1/16" Single- or Double-Seat (1 or 2 used)	091-00-016-06 091-16-018-03 091-16-018-02 091-16-018-01 091-16-018-00

Condensed Parts List (Continued)

NOTE: Items in bold face type denote minimum recommended spare parts.

Illustration Number	Description	Part Number
12d	**Molded Valve Buna-N (Black, 45-55 Duro), for 1" Double-Seat all trim**	**091-16-315-01**
	Molded Valve, Buna-N (Black, 45-55 Duro), for 11/16" Double-Seat all trim	091-16-315-00
	Molded Valve, Polyurethane (Red, 65-75 Duro), for 1" Double-Seat all trim	091-16-315-11
	Molded Valve, Polyurethane (Red, 65-75 Duro), for 11/16" Double-Seat all trim	091-16-315-10
	Molded Valve, Polyurethane (Tan, 85-95 Duro), for 1" Double-Seat all trim	091-16-315-15
	Molded Valve, Polyurethane (Tan, 85-95 Duro), for 11/16" Double-Seat all trim	091-16-315-14
	Molded Valve, Viton (65-75 Duro, stamped V), for 1" Double-Seat all trim	091-16-315-13
	Molded Valve, Viton (65-75 Duro, stamped V), for 11/16" Double-Seat all trim	091-16-315-12
	Molded Valve, Polyurethane (Red, 65-75 Duro), for 1" Single-Seat	091-16-315-51
	Molded Valve, Polyurethane (Red, 65-75 Duro), for 11/16" Single-Seat	091-16-315-50
	Molded Valve, Polyurethane (Tan, 85-95 Duro), for 1" Single-Seat	091-16-315-60
	Molded Valve, Polyurethane (Tan, 85-95 Duro), for 11/16" Single-Seat	091-16-315-59
	Molded Valve, Viton (65-75 Duro, stamped V), for 1" Single-Seat	091-16-315-58
	Molded Valve, Viton, (65-75 Duro, stamped V), for 11/16" Single-Seat	091-16-315-57
	Stainless Valve – Nylon disc, for 1" Double-Seat	091-16-315-04
	Stainless Valve – Nylon disc, for 11/16" Double-Seat	091-16-315-03
	Stainless Valve – Nylon disc, for 1" Single-Seat	091-16-315-52
	Stainless Valve – Nylon disc, for 11/16" Single-Seat	091-16-315-02



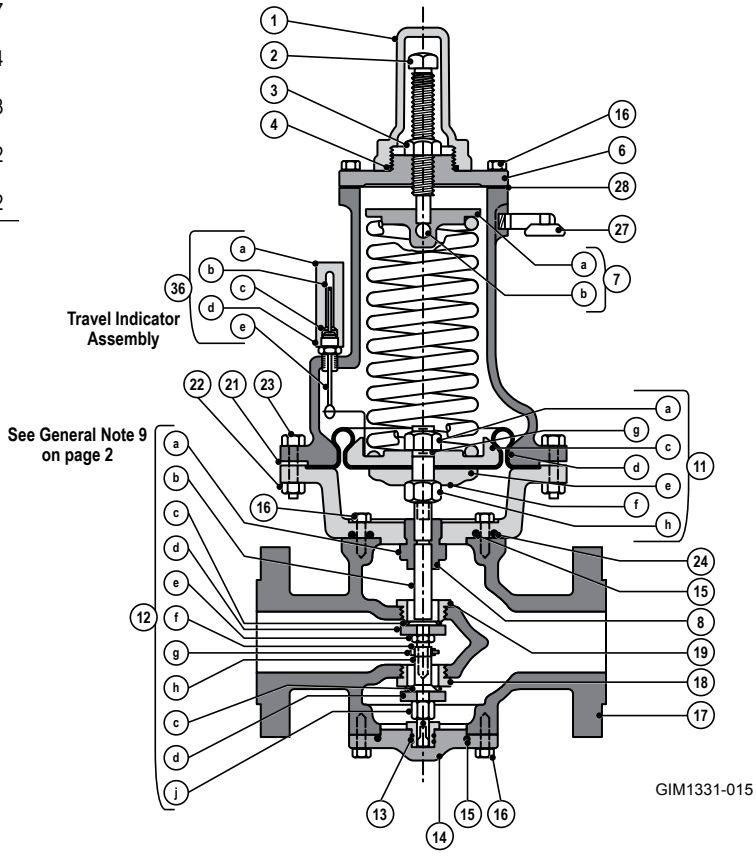
GIM1331-010

SINGLE SEAT BALANCE VALVE ASSEMBLY

Condensed Parts List (Continued)

NOTE: Items in bold face type denote minimum recommended spare parts.

Illustration Number	Description	Part Number
12e	Valve lock nut – brass for Double-Seat assembly	091-16-102-00
	Valve lock nut – stainless for Double-Seat assembly	091-16-102-01
	Valve lock nut – 3/8" – 24 Crown Nylok, for Single-Seat assembly	903936
12f	Valve Stem Locking Ring – stainless for Double-Seat assembly	091-16-043-01
12g	Set Screw – slotted headless or Hex. Soc. cup pt.	907694
12h	Female Valve Stem – brass for Double-Seat assembly	091-16-016-00
	Female Valve Stem – stainless for Double-Seat assembly	091-16-016-03
12j	Valve Guide – brass for Double-Seat assembly	091-16-012-00
	Valve Guide – stainless for Double-Seat assembly	091-16-012-02
12m	Roll Pin – 1/4" x 1 1/2" Lg. for Single-Seat assembly	901707



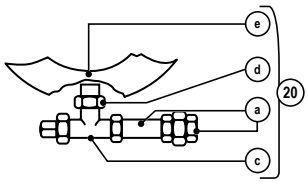
GIM1331-015

DOUBLE SEAT BALANCE VALVE ASSEMBLY

Condensed Parts List (Continued)

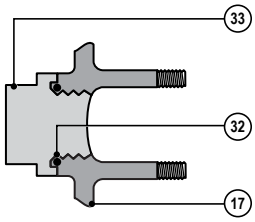
NOTE: Items in bold face type denote minimum recommended spare parts.

Illustration Number	Description	Part Number
12n	**O-Ring – ¾" x 1", for Single-Seat assembly** **O-Ring – 9/16" x ¾", for 11/16" Single-Seat assembly**	**934015** **934011**
13	Guide Bushing – brass, with pin Guide Bushing – stainless, with pin	091-16-385-02 091-16-385-03
15	**Tetraseal (or O-Ring), 2¾" x 3"**	**904079**
16	Hex. Cap Screw – 120,000# Tensile, 5/16" – 18 x 1" (24 used)	910030
18	**Outlet Orifice – 1" brass** Outlet Orifice – 1" stainless Outlet Orifice – 11/16" brass Outlet Orifice – 11/16" stainless	**091-16-029-01** 091-16-029-05 091-16-029-00 091-16-029-04
19	**Inlet Orifice – 1" brass** Inlet Orifice – 1" stainless Inlet Orifice – 11/16" brass Inlet Orifice – 11/16" stainless	**091-16-028-01** 091-16-028-05 091-16-028-00 091-16-028-04
20a	Nipple, Orifice Plug and Union Assembly	091-00-361-00
20c	Tee (14T)	946150
20e	Pipe Plug (1/4)	906055
22	Hex. Steel Bolt – ⅜" – 16 x 1¾" Lg. (8 used)	920853
23	Hex. Steel Bolt – ⅜" – 16 x 1¾" Lg. (8 used)	910058
24	**Tetraseal (or O-Ring), 4⅜" x 4⅝"**	**904085**
27	Vent Cap – ¼"	137-02-505-02
28	**Housing Cover Gasket**	**091-00-066-30**
30	Valve Stem Guide – stainless, 11/16" Single-Seat assembly Valve Stem Guide – stainless, 1" Single-Seat assembly	091-16-012-52 091-16-012-53
32	**Tetraseal (or O-Ring), 1½" x 1¾"**	**904086**
36	Travel Indicator Assembly (¼" scale) Travel Indicator Assembly (⅝" scale) Travel Indicator Assembly (1" scale) Travel Indicator Assembly (1¼" scale)	091-00-365-73 091-00-365-75 091-00-365-77 091-00-365-79
36a	Window (opens down ¼") Window (opens down ⅝") Window (opens down 1") Window (opens down 1¼")	091-00-174-76 091-00-174-80 091-00-174-82 091-00-174-84
36b	Tube Cap	950188
36c	O-Ring	950071
36d	Half Union (Imp.48F.¼NPT)	903984



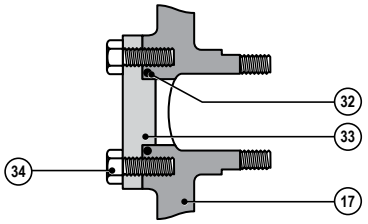
GIM1331-020

OUTLET CONTROL PIPING



GIM1331-025

SCREWED SIDE INSPECTION PLATES



GIM1331-030

TWO BOLT SIDE INSPECTION PLATES

Maximum Emergency Pressure

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

The maximum emergency pressure the inlet side of the Model 461-57S Regulator may be subjected to under abnormal conditions without causing damage to the regulator is:

Cast Iron Body..... Maximum Inlet Pressure + 25 psi

Ductile Iron Body.. Maximum Inlet Pressure + 60 psi

Cast Steel Body.. Maximum Inlet Pressure + 100 psi

If 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.

The maximum pressure which the diaphragm may be subjected to under abnormal conditions without causing internal damage is the set-point + 25 psi. If the pressure on the diaphragm exceeds set-point by more than + 25 psi, 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. 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 175 psi. Safely contained means no leakage as well as no bursting.

Before using any of the above data, make sure this entire section is clearly understood.

Other Gases

The Model 461-57S Regulator is mainly used with natural gas services; however, this regulator will perform equally as well with other gases. When using the Model 461-57S Regulator 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 Sensus representative or Industrial Distributor for recommendations.

Monitoring

The Model 461-57S Regulator makes an excellent monitor. It can act as a standby regulator installed in series which assumes control if a failure in the operating regulator permits the outlet pressure to exceed the set-point. It can be located in either the upstream or the downstream position.

When a Model 461-57S Regulator is used to monitor a regulator with an identical inner valve (another 461-57S Regulator), the **total maximum capacity** through both regulators can be figured at 70% of the capacity of one regulator alone. This applies with the monitor located either upstream or downstream.

Authorized Distributor:

805 Liberty Boulevard
DuBois, PA 15801
1-800-375-8875

For more information, visit us at www.sensus.com/gas

SENSUS

R-1332 R7

Model 461-X57

High Pressure Regulators with Roll-Out Diaphragm

SENSUS

Model 461-X57 High Pressure Regulators with "Roll-Out Diaphragm"

The "Roll-Out Diaphragm"

The 461-X57 is something unique in a high pressure regulator. It features the same "Roll-Out" diaphragm principle that has achieved such remarkable success in the widely used 441-57S and 461-57S Regulators.

The 461-X57 offers pilot performance with spring regulator simplicity. The "Roll-Out" diaphragm makes this outstanding performance possible by minimizing that old gremlin, "droop."

"Droop" means rough regulation . . . wide fluctuation in pressure control as flow varies. It is the result of spring effect plus diaphragm effect.

The "Roll-Out" diaphragm changes this by eliminating diaphragm effect and neutralizing spring effect, thus, "droop" is reduced to insignificance. The result — smooth, constant pressure regulation. It comes amazingly close to the control performance of the pilot operated regulator.

Figure 1 shows how the "Roll-Out" diaphragm works. Figure 2 shows how close performance comes to that of a pilot operated regulator. And the cutaway picture on Page 4 shows how simple it is.

Speed of response is fast. Installation, adjustment and servicing are surprisingly easy. The hazard of shutoff from pilot freeze-up is eliminated. And, to top it off, the ingenious ball-check diaphragm sentry (Figure 3, this page) adds yet another feature to a list that makes the 461-X57 truly a remarkable high pressure regulator.

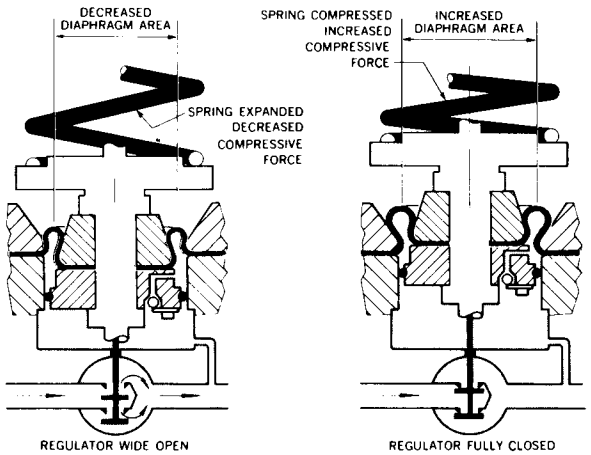


Figure 1

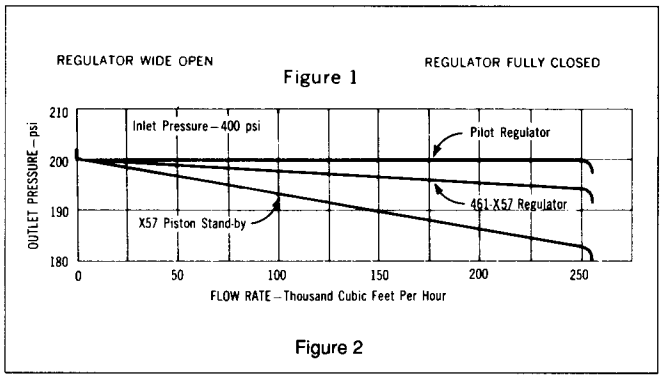


Figure 1

Figure 2

Ball-Check Diaphragm Sentry

The ball-check diaphragm sentry is a safety device for keeping the regulator in operation in case of diaphragm failure.

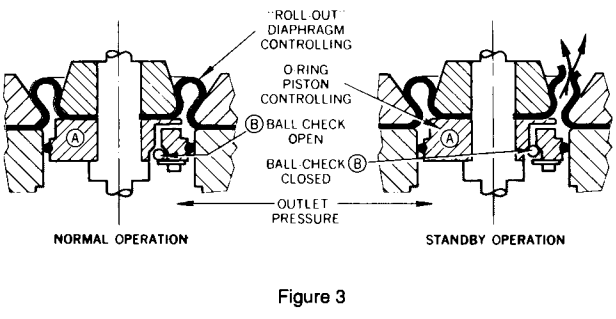


Figure 3

Referring to Figure 3, this is how it works:

1. O-ring piston Ⓐ holds the Roll-Out diaphragm in correct alignment during normal operation.
2. Ball-check Ⓑ 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 Ⓑ.
   With Ⓑ closed, outlet pressure is trapped beneath O-ring piston Ⓐ, which then becomes a substitute for the diaphragm. With Ⓐ as a substitute for the diaphragm, the regulator continues to operate.
4. The closing of Ⓑ also prevents the diaphragm break from allowing gas to escape through the vent.
5. Regulation with the O-ring piston will show increased deviation from set-point. This deviation is the warning that a failure has occured.

Maximum Inlet Pressure

Regulator Body Type	461 Body Materials	Maximum Working Pressure of Body	Maximum Inlet Pressure
Flanged ANSI 250 RF	Ductile Iron (ASTM A395-71 gr 60-40-18)	575 psi	575 psi
Flanged ANSI 300 RF	Cast Steel (ASTM A216-70a gr WCB)	720 psi	720 psi
Flanged ANSI 600 RF	Cast Steel (ASTM A216-70a gr WCB)	1200 psi	1000 psi

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

Valve Material	Maximum Pressure Differential	Maximum Inlet Pressure
Buna-N (black, 50 to 550 duro)	250 psi	575 psi
Polyurethane (red, 65 to 75 duro)	400 psi	720 psi
Polyurethane (tan, 85 to 95 duro)	600 psi	1000 psi

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

The maximum temperature for the above materials is 150°F.

Viton valve material has a maximum temperature rating of 300°F and a maximum pressure differential of 250 psi.

Spring Ranges

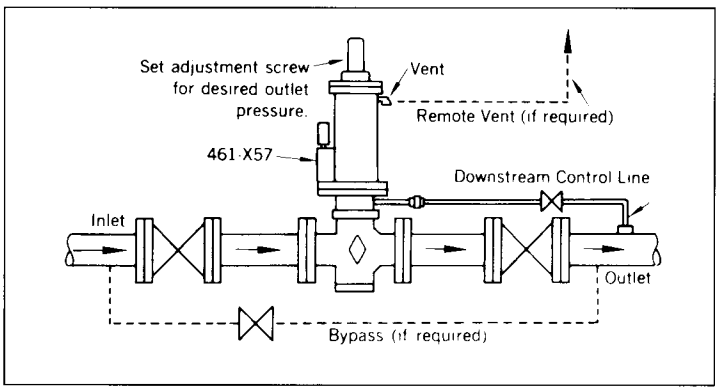
Outlet Pressure Ranges	Spring Color	Spring Part Number
75 to 100 psi	Red	091-00-021-02
100 to 175 psi	Brown	091-00-021-01
150 to 250 psi	Black	091-00-021-00

Typical Installation

Caution: It is the user's responsibility to assure that a service regulator vents and/or vent lines exhaust to a non-hazardous location away from **any potential** sources of ignition. **Refer to Equimeter Bulletin RM-1332 for more detailed information.**

The simple and compact design of the Model 461-X57 makes it an easy regulator to install. The sketch below shows a typical arrangement.

The regulator will work to deliver the pressure, for which it is adjusted, at that point in the downstream system where the downstream control line connection is made. As a general rule, it should be at least 8 pipe diameters downstream from the regulator and should be located in as straight a run of pipe as possible. Where outlet piping increases in size near the regulator, it is preferable to connect into the larger diameter portion. The connection itself must be smooth and clean, free of rough edges, welding icicles, etc.



Pipe Sizes

Inlet x Outlet NPT
2″ Model Available Only

Temperature Limits

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

Buried Service

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

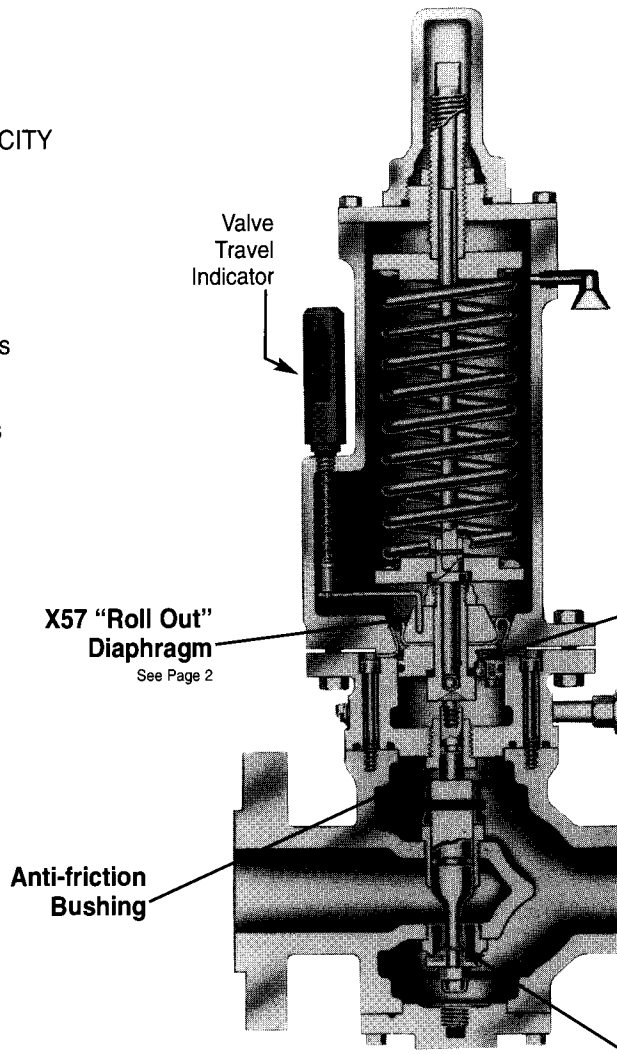
Caution: Turn gas on slowly. If an outlet stop valve is used, it should be opened first. Do not overload the diaphragm with a sudden surge of inlet pressure. Monitor the outlet pressure during start-up to prevent an outlet pressure overload. **See Bulletin RM-1332 for more detailed start-up procedures.**

Construction and Design Features

461-X57 High-Pressure Regulators

INTERMEDIATE CAPACITY
For

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



Other Features

Simple Design – dependable regulation – trouble free operation – fast response – no pilot – no pilot freezing – no pilot maintenance.

Standard Face to Face Dimensions

Standardized "461" Bodies & Inner Valve Assemblies – easy maintenance – parts are interchangeable with other 461 models.

Simplified Valve Adjustment – easy to adjust for tight lock-up – accurate.

Molded Polyurethane Soft Seats – positive tight shut-off – high erosion resistance – 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 openings and side inspection plates.

Self-Aligning Spring Assembly – color coded springs.

Model 461-X57
Capacity Table

SENSUS

Capacity 461-X57 in 1000 scfh of natural gas (0.6) specific gravity - 14.65 psia - 60°F.)

Inlet Pressure psi	Outlet Pressure psi	Double Seat Balanced		Single Seat Balanced	
		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 & 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 & 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 & 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 & 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	93.6	121.0	60.8
	200	146.0	73.2	95.1	47.5

Inlet Pressure psi	Outlet Pressure psi	Double Seat Balanced		Single Seat Balanced	
		1" Valve	11/16" Valve	1" Valve	11/16" Valve
250	125 & 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 & 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 & 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 & 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 & 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	205 & 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 & Less	464.0	232.0	301.0	151.0
	250	460.0	230.0	299.0	149.0
500	250 & Less	514.0	257.0	334.0	167.0
550	250 & Less	564.0	282.0	366.0	183.0
600	250 & Less	614.0	307.0	399.0	199.0
700	250 & Less	714.0	357.0	464.0	232.0
800	250 & Less	814.0	407.0	529.0	264.0
1000	250 & Less	1014.0	507.0	659.0	329.0
"K" Factors		**2000**	**1000**	**1300**	**650**

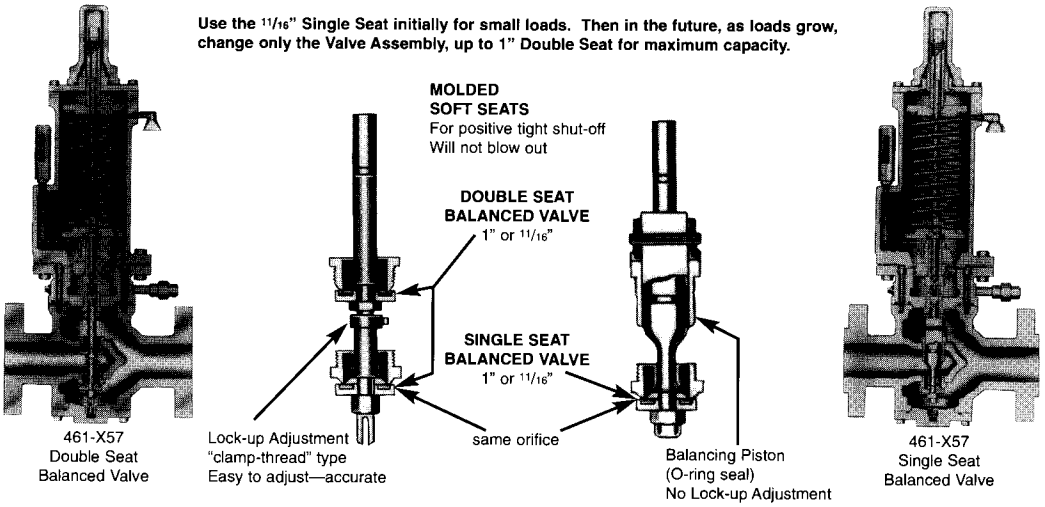
1. Size each regulator on the basis of the minimum expected inlet pressure and the maximum required outlet pressure
2. For best performance of the Model 461-X57, use full table capacity values.
3. For lower capacities see Models 040/141 (Bulletins R-1310 & R-1311).

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

Fully Interchangeable Valve Assemblies

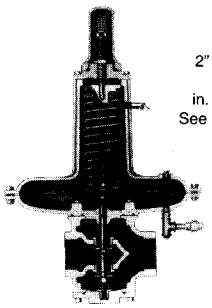
Valve assemblies can be interchanged with the regulator in place in the line.

Use the 11/16" Single Seat initially for small loads. Then in the future, as loads grow, change only the Valve Assembly, up to 1" Double Seat for maximum capacity.

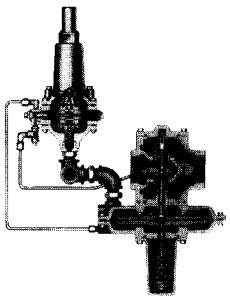


The 461 Family of Regulators

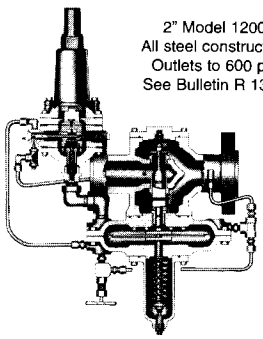
Other models which use Type 461 balanced valves



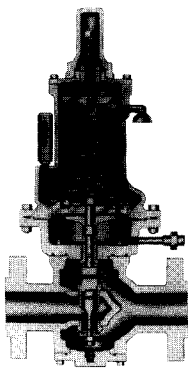
2" Model 461-S
Outlets
in. w.c. to 10 psi
See Bulletin R 1330



2" Model 1100
Outlets
in. w.c. to 100 psi
See Bulletin R 1341



2" Model 1200
All steel construction
Outlets to 600 psi
See Bulletin R 1342



2" Model 461-57S
"Roll-Out Diaphragm
Outlet Pressures
3 to 100 psi
See Bulletin R 1331

Maximum Emergency Pressures

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

Ductile Iron,
Flanged ANSI 250...630 psi
Cast Steel,
Flanged ANSI 300...800 psi
Cast Steel,
Flanged ANSI 600..1100 psi

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

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

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

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.

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

All 461-X57.....350psi

Safely contained means no leakage as well as no bursting.

Before using any of the above data, make sure this entire section is clearly understood.

Overpressurization Protection

Protect the downstream piping system and the regulator's low pressure chambers against overpressurization due to the 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, Equimeter Bulletin RDS-1498, or other applicable standards. The method of protection can be a relief valve, monitor regulator, shutoff device, or similar mechanism.

Capacities at Other Pressures

Capacity for pressure reductions not listed in the table can be calculated with the following formulae:

1. $Q = K\sqrt{P_o\,(P_I - P_o)}$

2. $Q = \frac{K\,P_I}{2}$

Q = maximum capacity of the regulator (in SCFH of 0.6 specific gravity natural gas).

K = the **"K" factor,** the regulator constant (from bottom of table, page 5).

P_I = absolute inlet pressure (psia).

P_o = absolute outlet pressure (psia).

Use formula 1. when $\frac{P_I}{P_o}$ is less than 1.894.

Use formula 2. when $\frac{P_I}{P_o}$ is greater than 1.894.

Periodic Inspection: Regulators are pressure control devices with numerous moving parts subject to wear that is dependent upon particular operating conditions. To assure continuous satisfactory operation, a periodic inspection schedule must be adhered to with the frequency of inspection determined by the severity of service and applicable laws and regulations. **See bulletin RM-1332 for field service instructions.**

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 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 sketches 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 illstallation.

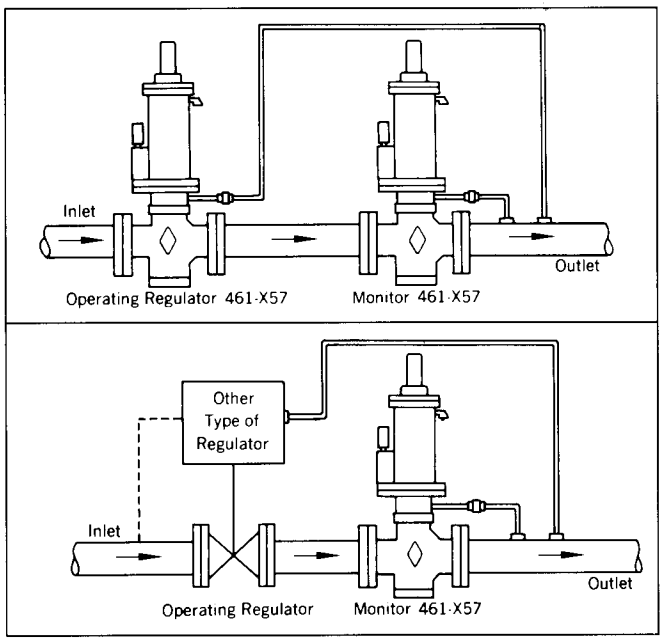
The 461-X57 is also used for monitoring other types of regulators. This is shown in the second sketch. It is excellent for monitoring pilot operated regulators.

Both sketches 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. In general, however, the sketch "Typical Installation" on page 3 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.

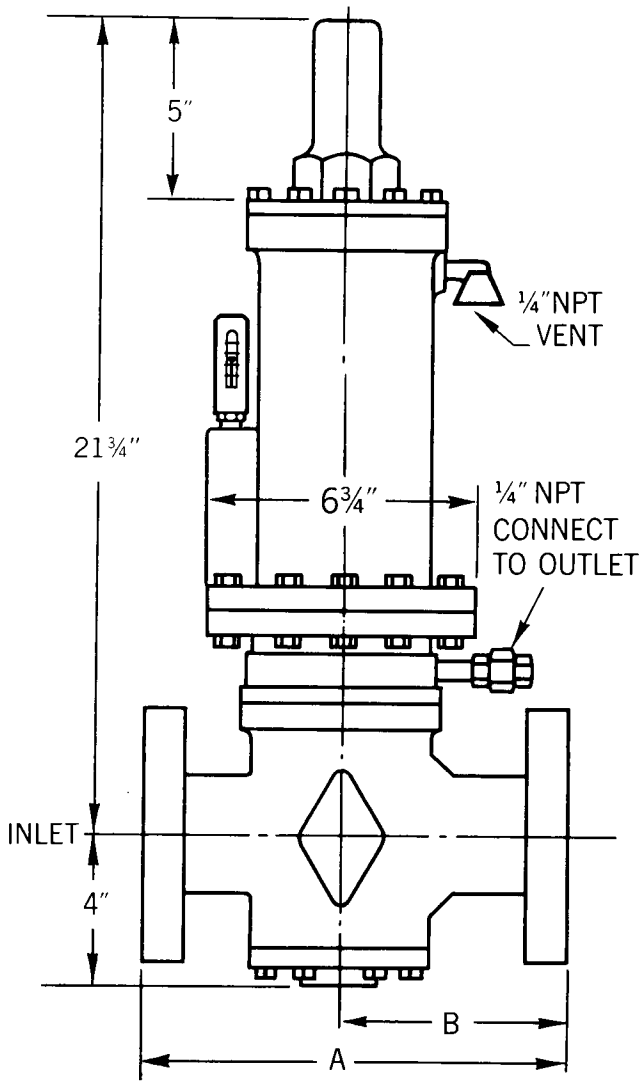


Metrication

Use the following for metric conversions:

std. metres^3/hr. x 35.31 = std. ft.^{3}/hr (SCFH) std. ft.^{3}/hr (SCFH) x 0.0283 = std. metres^3/hr.
kilograms/centimeter^2(kg/cm^2) x 14.22 = psig psig x 0.0703 = kilograms/centimeter^2(kg/cm^2)
kilopascals (kPa) x 0.145 = psig psig x 6.90 = kilopascals (kPa)
bars x 14.50 = psig psig x 0.69 = bars
millimeters water (mm H_20) x .0394 = in. w.c. in. w.c. x 25.4 = millimeters water (mm H_20)
millimeters mercury (mm Hg) x 0.535 = in w.c. in. w.c. x 1.868 = millimeters mercury (mm Hg)

Regulator Body Type	A	B	Shipping Weight Lbs.
Flanged ANSI 250 RF	10 1/2	5 1/2	85
Flanged ANSI 300 RF	10 1/2	5 5/8	88
Flanged ANSI 600 RF	11 1/4	6	90



Caution: It is the user's responsibility to assure that a service regulator vents and/or vent lines exhaust to a non-hazardous location away from **any potential** sources of ignition. **Refer to Equimeter Bulletin RM-1332 for more detailed information.**

Materials of Construction

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 & 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	see table on Page 3

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Other Gases

Model 461-X57 Regulators are mainly used on natural gas. However, they perform well on LP gas, nitrogen, dry CO_2, air, and others.

The capacity data on page 4 applies to natural gas. To find the capacity of the Model 461-X57 when used with other gases, multiply the SCFH values from page 5 by a correction factor from the following table:

OTHER GASES	CORRECTION FACTOR
Air (Specific Gravity 1.0)	**0.77**
Propane (Specific Gravity 1.53)	**0.63**
1350 BTU. Propane-Air Mix (1.20)	**0.71**
Nitrogen (Specific Gravity 0.97)	**0.79**
Dry Carbon Dioxide (Specific Gravity 1.52)	**0.63**

$$\text{For Other Gases CORRECTION FACTOR} = \sqrt{\frac{0.6}{\text{Specific Gravity of the Gas}}}$$

How to Order

Specify:

1. 2″ Model 461-X57
2. Piping connections & body material (see table on page 3)
3. Outlet pressure and/or spring (see table on page 3)
4. Inlet pressure, psi (minimum & maximum, if available)
5. Capacity required (scfh)
6. Type of gas (natural gas, propane, etc.)
7. Double seat or single seat and 1″ or $^{11}/_{16}$″ valve (see page 6)

Installation and Maintenance see RM-1332

Other Equimeter Gas Pressure Regulators

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Equimeter produces a broad product line of Gas Pressure Regulators which are widely used throughout the natural gas industry. These regulators are also suitable for non-corrosive industrial gas applications such as propane, butane, air, nitrogen, dry CO_2, etc. For additional detailed information on a particular model. please request the indicated bulletin from the local Equimeter sales office.

Multi-Purpose Service Regulators

Model Accurol 2000
Bulletin: R-2000 3/4", 1" pipe size
Inlet pressures ..... to 125 psi
Outletl pressures .....5" w.c. to 2 psi
Capacity to 2000 CFH
Available with 90° body.
Also available with internal relief valve.

Model 143-80
Bulletin: R-1301
3/4", 1", 1 1/4" pipe size
Inlet pressures ..... to 125 psi
Outlet pressures .....3 1/2" w.c. to 6 psi
Capacity to 2000 CFH
Available with straight-through body.
Also available: internal relief valve and low pressure cut-off.

Model 143-6
Bulletin: R-1303
3/4", 1", 11/4" pipe size
Inlet pressures ..... to 125 psi
Outlet pressures .....3 1/2" w.c. to 6 psi
Capacity to 2000 CFH
Available with 90° angle or straight-through body.
Also available: internal relief valve and low pressure cut-off.

Industrial Service Regulators

Models 243-8,243-12, 243-8HP
Bulletin: R-1306
1 1/4",1 1/2" and 2" pipe size
Inlet pressures .....to 125 psi
Outlet pressures .....3 1/2" w.c. to 10 psi
Capacity to 25,000 CFH
Also available: internal relief valve, low pressure cut-off external control line, back pressure regulator, relief valve, vacuum regulator and vacuum breaker.

Industrial Field Regulators

For intermediate to high pressure applications. Ideal on pipeline taps servicing plants and buildings. Appropriate for double stage reduction ahead of service regulators, and for high pressure burners and compressed air systems.

041, 042
Bulletin: R-1310
3/4",1" and 1 1/4" pipe size
Inlet pressures ..... to 1000 psi
Outlet pressures ..... 3 to 200 psi
Capacity to 40,000 SCFH

141 A
Bulletin: R-1311
2" pipe size
Inlet pressures ..... to 1500 psi
Outlet pressures ..... 5 to 400 psi
Capacity to 55,000 SCFH

Pilot Loaded Regulators

For intermediate and high-pressure applications requiring precise pressure reduction with minimal droop. Ideal for standard and high capacity flows on burners, driers, dehydrators and compressor line. Appropriate for fixed factor billing.

243-RPC
Bulletin: R-1343
1 1/4",1 1/2"and 2" pipe size
Inlet pressures.....to 150 psi
Outlet pressures
.....31/2" w.c. to 35 psi
Capacity to 76,000 SCFH

11 00
Bulletin: R-1341
Pipe size: 2"
(screwed or flanged)
Inlet pressures.....to 400 psi
Outlet pressures
.....3" w.c. to 100 psi
Capacity to 414,000 SCFH

1200
Bulletin: R-1342
Pipe size: 2" (flanged)
Inlet pressures
.....to 1200 psi
Outlet pressures
.....20 to 600 psi
Capacity to 789,000 SCFH

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Parts List
MODEL 461-X57
Regulators

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ILL. NO.	DESCRIPTION	PART NUMBER
1	Seal Cap	090-00-005-02
2	Spring Adjusting Screw	091-00-007-50
3	Hex. Steel Jam Nut, 7/8"-14	922233
[4]	Tetraseal (or O-Ring), 1¾" x 2"	904092
6	Housing cover-ductile	091-16-380-01
7	Top Spring Button	091-00-009-50
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
10	Upper Diaphragm Case	091-00-003-50
11	Diaphragm Assembly	
	11a Elastic Stop Nut ¾"-16 (#52NTE-126)	903958
	11c Diaphragm Plate–Upper	091-00-010-50
	[11d] Diaphragm–2½" Roll-Out	091-00-350-50
	11e Diaphragm Plate–Lever	091-00-022-50
	11f O-Ring, ¾" x 7/8"	906611
	11h Diaphragm Stud–Stainless	091-00-058-50
	11j Thrust Bearing Stainless Steel Ball 3/8" Dia.	930510
	11k O-Ring, 2⅛" x 2½"	934033
12	1" Single Seat Valve Assembly–stainless trim, Red Polyurethane	091-16-515-51
	1" Single Seat Valve Assembly–stainless trim, Nylon	091-16-515-61
	1 1/16" Single Seat Valve Assembly–stainless trim, Red Polyurethane	091-16-515-50
	1 1/16" Single Seat Valve Assembly–stainless trim, Nylon	091-16-515-60
	1"Double Seat Valve Assembly–stainless trim, Buna-N	091-16-515-03
	1" Double Seat Valve Assembly–stainless trim, Red Polyurethane	091-16-515-13
	1" Double Seat Valve Assembly–stainless trim, Nylon	091-16-515-21
	1 1/16" Double Seat Valve Assembly–stainless trim, Buna-N	091-16-515-02
	1 1/16" Double Seat Valve Assembly–stainless trim, Red Polyurethane	091-16-515-12
	1 1/16" Double Seat Valve Assembly–stainless trim, Nylon	091-16-515-20
	[12a] O-Ring, 3/8" x ½"	934007
	12b Valve Stem–stainless, for 1" single seat assembly	091-00-016-07
	Valve Stem–stainless, for 1 1/16" single seat assembly	091-00-016-06
	Male Valve Stem, 5 1/16" Lg. –stainless, for 1" & 1 1/16" double seat assembly	091-16-116-00
	12c Valve Retainer–stainless, for 1" single or double seat (1 or 2 used)	091-16-018-01
	Valve Retainer–stainless, for 1 1/16" single or double seat (1 or 2 used)	091-16-018-00
	[12d] Molded Valve, Polyurethane (red, 65-75 Duro), for 1" double seat all trim	091-16-315-11
	Molded Valve, Polyurethane (red 65-75 Duro), for 1 1/16" double seat all trim	091-16-315-10
	Molded Valve Polyurethane (tan 85-95 Duro), for 1" double seat all trim	091-16-315-15
	Molded Valve Polyurethane (tan 85-95 Duro), for 1 1/16" double seat all trim	091-16-315-14
	Molded Valve, Viton (65-75 Duro, stamped V), for 1" double seat all trim	091-16-315-13
	Molded Valve, Viton (65-75 Duro, stamped V), for 1 1/16" double seat all trim	091-16-315-12
	Molded Valve, Polyurethane (red 65-75 Duro), for 1" single seat	091-16-315-51
	Molded Valve, Polyurethane (red 65-75 Duro), for 1 1/16" single seat	091-16-315-50
	Molded Valve, Polyurethane (tan, 85-95 Duro), for 1" single seat	091-16-315-60
	Molded Valve, Polyurethane (tan, 85-95 Duro), for 1 1/16" single seat	091-16-315-59
	Molded Valve, Viton (65-75 Duro, stamped V), for 1" single seat	091-16-315-58
	Molded Valve, Viton (65-75 Duro, stamped V), for 1 1/16" single seat	091-16-315-57
	Stainless Valve–Nylon disc, for 1" single seat (1 used)	091-16-315-52
	Stainless Valve–Nylon disc, for 1 1/16" single seat (1 used)	091-16-315-02
	Stainless Valve–Nylon disc, for 1" double seat (2 used)	091-16-315-04
	Stainless Valve–Nylon disc, for 1 1/16" double seat (2 used)	091-16-315-03
	12e Valve Locknut–3/8-24 Crown Nylok, for single seat assembly	903936
	Valve Locknut–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 x ¼" Lg.	907694
	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 Rollpin–¼" x 1½" Lg.–for single seat assembly	901707
	[12n] O-Ring, 9/16" x ¾", for 1 1/16" single seat assembly	934011
	O-Ring ¾" x 1" for 1" single seat assembly	934015
13	Guide Bushing–stainless, with pin	091-16-385-03
14	Bottom Inspection Plate–steel	091-16-004-02
[15]	Tetraseal (or O-Ring), 2¾" x 3"	904079
16	Hex Cap Screw–120,000# Tensile, 5/16"-18 x 1" Lg. (16 used)	910030
17	Following body uses screwed ductile iron side inspection plate	

[ ] Minimum recommended spare parts.

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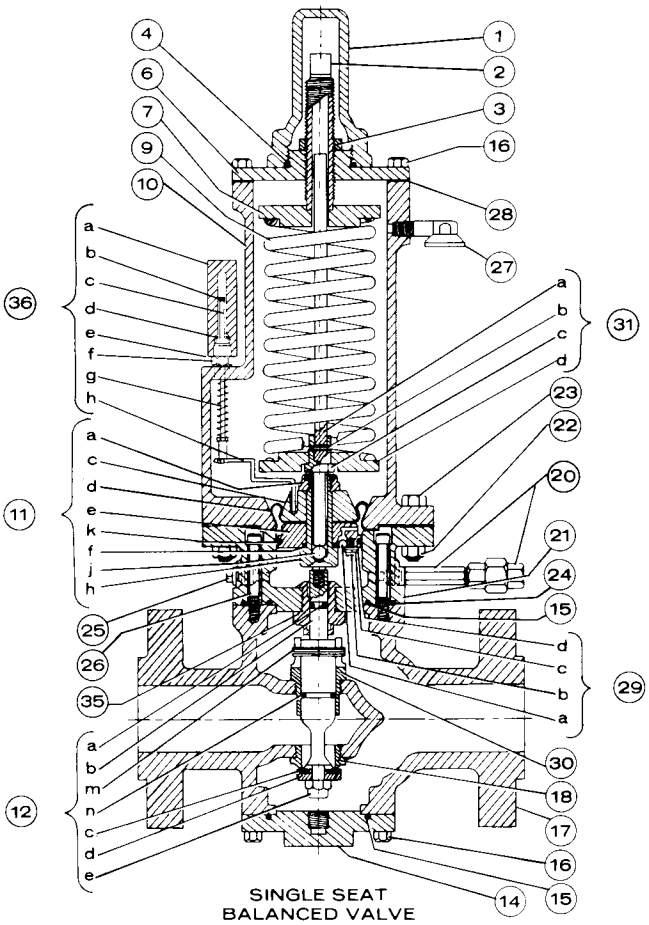
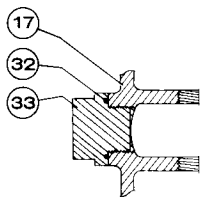
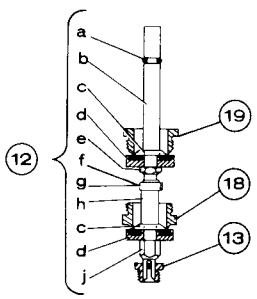


SINGLE SEAT
BALANCED VALVE
ASSEMBLY



SCREWED
SIDE INSPECTION PLATES



DOUBLE SEAT
BALANCED VALVE
ASSEMBLY

ILL. NO.	DESCRIPTION	PART NUMBER
	Body, Flanged ANSI 250 lb. RF, ductile iron	091-16-001-18
	Following bodies use screwed steel side inspection plate	
	Body, Flanged ANSI 300 lb. RF, cast steel	091-16-001-06
	Body, Flanged ANSI 600 lb. RF, cast steel	091-16-001-01
18	Outlet Orifice–1″ stainless	091-16-029-05
	Outlet Orifice–$1\frac{1}{16}$″ stainless	091-16-029-04
19	Inlet Orifice–1″ stainless	091-16-028-05
	Inlet Orifice–$1\frac{1}{16}$″ stainless	091-16-028-04
20	Nipple, Orifice Plug and Union Assembly	091-00-361-01
21	Lower Diaphragm Case	091-00-002-51
22	Hex Steel Nut $\frac{3}{8}$″-16, 120,000# Tensile	920853
23	Hex Steel Bolt $\frac{3}{8}$″-16 x $1\frac{3}{4}$″ Lg. (8) 120,000# Tensile	910058
24	Tetraseal (or O-Ring), $4\frac{3}{8}$″ x $4\frac{5}{8}$″	904085
25	¼″ Sq. Hd. Steel Pipe Plug	906053
26	Soc. Hd. Cap Screw 120,000# Tensile $\frac{5}{16}$″-18 x $2\frac{1}{4}$″ Lg. (8 used)	939110
27	Vent Cap–¼″	137-02-505-02
28	Housing Cover Gasket	091-00-066-30
29	29a Stainless Stl. Ball ¼″ Dia.	930506
	29b Soc Hd. Cap Screw #10-24 x $\frac{3}{8}$″ Lg.	939900
	29c #10 Steel Lockwasher	904012
	29d Washer (Ball Retaining)	09016-178-0100
30	Valve Stem Guide--stainless, $1\frac{1}{16}$″ single seat assembly	091-16-012-52
	Valve Stem Guide–stainless, 1″ single seat assembly	091-16-012-53
31	Spring Thrust Assembly	091-00-358-00
	31a Spring Thrust Rod (Upper)	091-00-062-50
	31b Type 2 Groov Pin $\frac{1}{8}$″ x $\frac{9}{16}$″ Lg.	904118
	31c Spring Thrust Rod (Lower)	091-00-158-50
	31d Lower Spring Button	091-00-009-51
32	Tetraseal (or O-Ring), $1\frac{1}{2}$″ x $1\frac{3}{4}$″	904086
33	Screwed Ductile Side Inspection Plate	091-16-072-04
	Screwed Steel Side Inspection Plate	091-16-072-01
35	Guide Bushing–Assembly (S.S.)	091-16-373-00
36	Travel Indicator Assembly	091-00-365-81000
	36a Indicator Rod Assembly	091-00-365-07095
	36b Tube Cap	950188
	36c Window	09100-174-76000
	36d O-Ring	950071
	36e L'washer	950078
	36f Hyd Conn ¼″ x ¼″	903984
	36g Spring	09100-021-50000
	36h Bracket	09100-170-5100
46	X-57 Diaphragm Assembly complete–all parts above body to convert a 461 type regulator to 461-X57	091-00-502-00
47	Nameplate (not shown)	091-16-086-00
48	Nameplate (not shown)	090-00-086-04
49	Rd. Hd. Type "U" Drive Screw–#4 x $\frac{3}{16}$″ Lg. (not shown)	903004
50	Socket Wrench (not shown)–$1\frac{1}{2}$″ hex. deep–for parts 18, 19, 30	091-16-328-00

☐ Minimum recommended spare parts.

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Authorized Distributor

Model 461-X57 Regulator

Installation and Maintenance Instructions

Installation and Start-Up

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

1. Thoroughly purge inlet piping to remove dirt and debris which could damage the regulator or impair its operation. If this cannot be done, a filter or strainer should be installed ahead of the regulator. Make certain regulator is free of any dirt or foreign matter that might have collected.
2. Place regulator in the line with high pressure connected to the inlet side (be sure that shipping screens or covers, if used, are removed from the inlet and outlet).

   On flanges, tighten bolts evenly.
3. From the ¼" union **20** extend pipe or tubing to the control connection into the outlet piping. This control piping should not be less than ¼" in size and should be adequately protected against breakage (regulators go wide open if the control line is broken).

   The regulator will work to deliver the pressure, for which it is adjusted, at that point in the outlet piping where the control connection is located.

   In general, the control connection should be at least 8 pipe diameters from the regulator and should be in as straight a run of pipe as possible.

   The control connection should be clean and smooth, free of rough edges, welding “icicles,” etc.

   Where outlet piping increases in size near the regulator, it is generally preferable to locate the control connection in the larger size.
4. Also, make certain this orifice is open and free of foreign material.
5. Check all connections for leaks. Put the regulator into operation as follows:
   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**.
   d. Set the adjusting screw **2** for the required outlet pressure. Turn it clockwise to increase the pressure and counter-clockwise 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.
6. To shut down, carefully close valves **C**, **B** and **A** in that order.

CAUTION

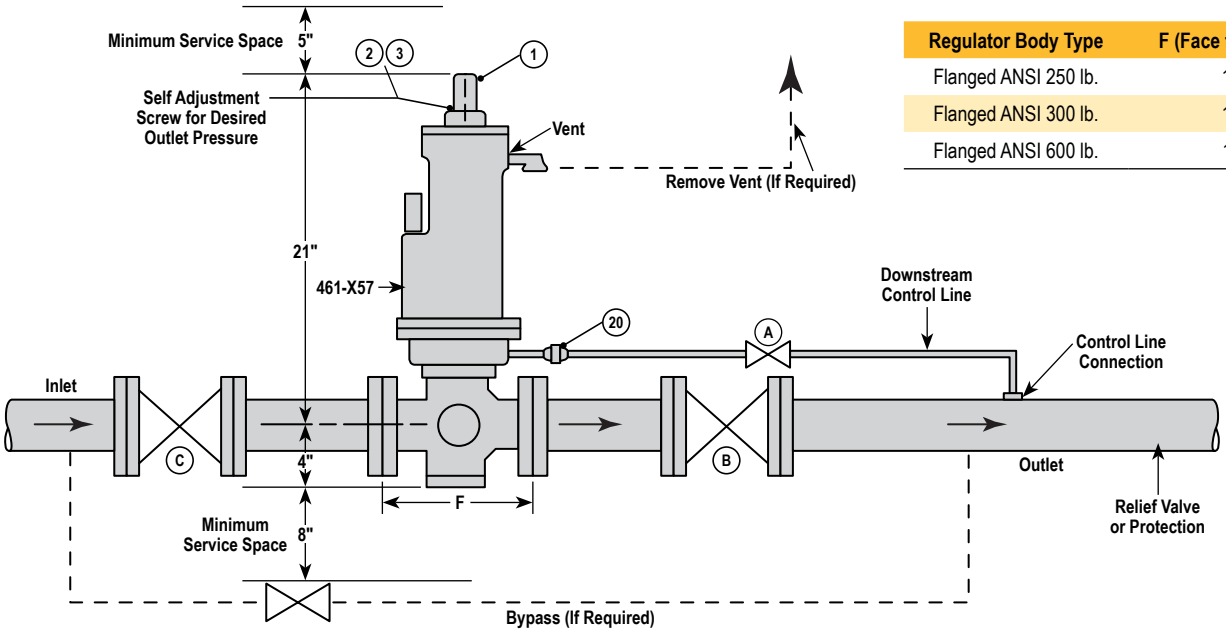
• It is the user’s responsibility to ensure all regulator vents and/or vent lines exhaust to a non-hazardous location away from any potential sources of ignition. Where vent lines are used, it is the user’s responsibility to ensure that each regulator is individually vented and that common vent lines are not used.

• 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 minimize the chances for foreign material collecting in the vent side of the regulator diaphragm.

• 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.

• Regulators are pressure control devices with numerous moving parts subject to wear that is dependent upon particular operating conditions. Adhere to a periodic inspection schedule with the frequency of inspection determined by the severity of service and applicable laws and regulations.

Typical Arrangement And Dimensions (Indoor or Outdoor Installation)



Regulator Body Type	F (Face to Face, in.)
Flanged ANSI 250 lb.	10½
Flanged ANSI 300 lb.	10½
Flanged ANSI 600 lb.	11¼

GIM1332-005

*This document replaces RM-1332-R3

Servicing and Adjustment

General Notes

1. Make sure the regulator is entirely depressured before servicing.
2. A quick visual inspection of the valve can be made by removing inspection plates **33** from the sides of the body. These also provide greatly improved access to the valve when servicing or adjusting.
3. The diaphragm **11d**, the spring **9**, and all other parts from the lower diaphragm plate **11e** and above are interchangeable with the Model 441-X57 Regulator.

   Valve and Body parts are interchangeable with other 461 Regulators (461-S, 461-57S, 1100, 1200).
4. Use lubricants sparingly and with care to avoid exposing tacky surfaces to the gas stream. Such surfaces could cause dirt accumulation on close clearance parts.

   Use moly or silicone type lubricants. Avoid the use of petroleum base types.

   It is best to avoid lubricating the stem **12b** or the guide **12j**. However, a small amount of lubricant on stem O-rings **12a** and **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 also help assure their tightness.
5. 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.

To service Double-Seat Balanced Valve Assembly

1. Remove seat 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 (1½" hex deep socket 50). Remove **18** and valve assembly intact through bottom opening.
4. If valve assembly is all right replace without disturbing set screw **12g** (top end of **12b** screws onto **11h** until it bottoms and should then be **backed off one-half to one full turn**).
5. If new parts are needed, disassemble valve assembly by loosening set screw **12g** and unscrewing **12h** from **12b**, and then unscrewing nut **12e** and part **12j**.
6. 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**).
7. 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 screw onto upper half by 3 or 4 turns (**12h** screws onto **12b**).
8. Make the valve lock-up adjustment. Seat the upper valve against orifice **19** while screwing up the lower half valve assembly (**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.
9. Screw entire valve assembly up (top of **12b** screws onto lower end of **11h**) until it bottoms. Then **back off one-half to one full turn – this is important**.
10. Complete assembly as per steps 6 thru 10 under “To Assemble 461-X57.”

To Service 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**. Orifice **18** can be removed with socket wrench (1½" hex deep socket 50). Reassemble in reverse order.
4. If it should be necessary to remove stem **12b** or valve guide **30**, do so by first removing lower diaphragm case **21** (steps 2 through 4 under “To Take 461-X57 Apart”. Use socket wrench for **30** (1½" hex deep socket 50).

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

   NOTE: 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.
5. Reassemble as per applicable steps under “To Assemble 461-X87.”

To Change Spring

1. Remove seal cap **1**, back off adjusting screw **2**, and remove 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 make sure spring is correctly nested into **7** and **31d**.
3. Look down through top opening of diaphragm case **10** and make visual inspection of diaphragm **11d**. The visible roll of the diaphragm should be uniformly in place. (Use a flashlight if necessary.)
4. Make sure 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. Complete as per steps 9 and 10 under “To Assemble 461-X57”.

To Service 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** then carefully remove upper diaphragm case **10**.
3. Turn diaphragm assembly counterclockwise until **11h** unscrews from **12b**, then 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 later inserting of bracket **36h** into hole in **11c**.
5. When reassembling, be sure fabric side of diaphragm is toward the vent side of the regulator and the rubber side of the diaphragm is toward the pressure side. The gasket is always placed on the spring side of the diaphragm.
6. Screw diaphragm assembly back into place. 11h screws into 12b until it bottoms, **then back off one-half to one full turn – this is important**.

   Make sure 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**.
7. Fold roll into roll-out diaphragm **11d** and then carefully reinstall upper diaphragm case **10**. Diaphragm must not be pinched between upper and lower cases, **10** and **21**. Also, roll-out loop must be uniformly full and even, it should be in place as shown on the cross section drawing. Tighten bolts **23-22** evenly.
8. Insert end of **36h** into hole in **11c**.
9. Replace spring and complete assembly per steps 7 though 10 under “To Assemble 461-X57”.

To Disassemble 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 upper diaphragm case **10**.
3. Unscrew diaphragm assembly **11** from stem **12b**.
4. Remove cap screws **26** and remove 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 1½" socket wrench 50.

To Assemble 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. **11h** screws into **12b** until it bottoms, then **back off one-half to one full turn – this is important.**
5. Install upper diaphragm case per Steps 7 and 8 under “To Service Diaphragm”.
6. Replace bottom inspection plate **14** (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** making sure 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**. Be sure 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**.

Condensed Parts List

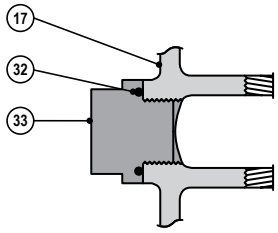
NOTE: Items in bold face type denote minimum recommended spare parts.

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), 1¾" x 2”**	**904092**
9	Spring-Black 150 to 250 psi Spring-Brown 100 to 175 psi Spring-Red 75 to 100 psi	091-00-021-00 091-00-021-01 091-00-021-02
11	Diaphragm Assembly	
11a	Elastic Stop Nut ¾" – 16 (#52NTF-126A)	903958
11c	Diaphragm Plate Upper	091-00-010-50
11d	**Diaphragm 2½" Roll-Out**	**091-00-350-50**
11e	Diaphragm Plate Lower	091-00-022-50
11f	O-Ring, ¾" x 1⅞"	906611
11h	Diaphragm Stud LRS	091-00-058-50
11j	Thrust Bearing Stainless Steel Ball ⅜" Dia.	930510
11k	O-Ring, 2⅛" x 2½"	934033
12	1" Single-Seat Valve Assembly, stainless trim, Red Polyurethane 11/16" Single-Seat Valve Assembly, stainless trim, Red Polyurethane 1" Double-Seat Valve Assembly, stainless trim, Red Polyurethane 11/16" Single-Seat Valve Assembly, stainless trim, Red Polyurethane	091-16-515-51 091-16-515-50 091-16-515-13 091-16-515-12
12a	**O-Ring, ⅜" x ½"**	**934007**
12b	Valve Stem stainless for 1" Single-Seat assembly Valve Stem stainless for, 11/16" Single-Seat assembly Male Valve Stem, 5 1/16" Lg. stainless, for 1" & 11/16" Double-Seat assembly	091-00-016-07 091-00-016-06 091-16-116-00
12c	Valve Retainer stainless for, 1" Single- or Double-Seat (1 or 2 used) Valve Retainer stainless for, 11/16" Single- or Double-Seat (1 or 2 used)	091-16-018-01 091-16-018-00

Condensed Parts List (Continued)

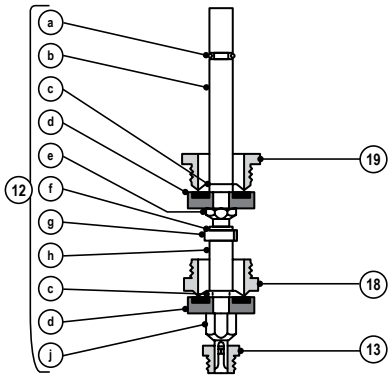
NOTE: Items in bold face type denote minimum recommended spare parts.

Illustration Number	Description	Part Number
12d	Molded Valve Polyurethane (red, 65-75 Duro), for 1" Double-Seat all trim	091-16-315-11
	Molded Valve Polyurethane (red, 65-75 Duro), for 11/16" Double-Seat all trim	091-16-315-10
	Molded Valve Polyurethane (tan, 85-95 Duro), for 1" Double-Seat all trim	091-16-315-15
	Molded Valve Polyurethane (tan, 85-95 Duro), for 11/16" Double-Seat all trim	091-16-315-14



GIM1332-010

SCREWED SIDE INSPECTION PLATES



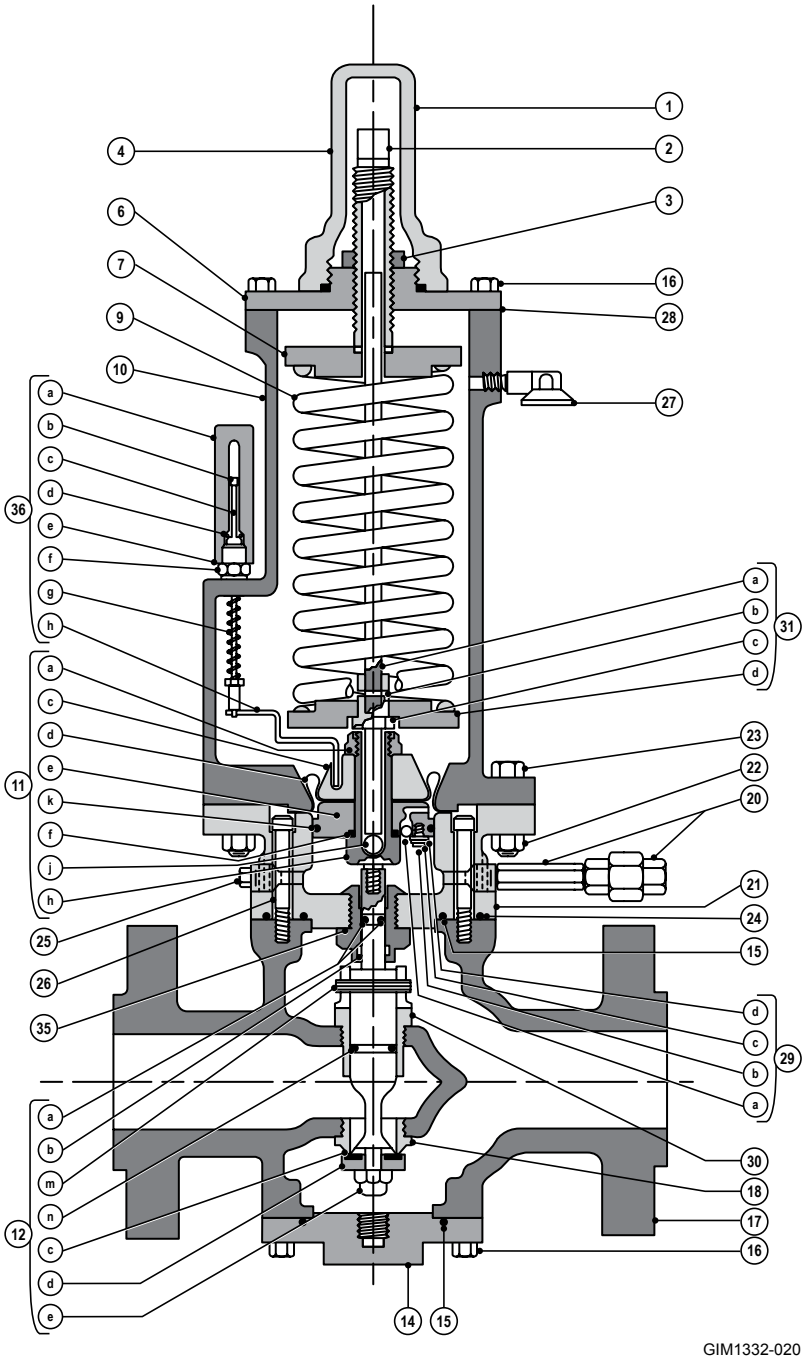
GIM1332-015

DOUBLE SEAT BALANCED VALVE ASSEMBLY

Condensed Parts List (Continued)

NOTE: Items in bold face type denote minimum recommended spare parts.

Illustration Number	Description	Part Number
12d (Cont.)	Molded Valve, Viton (65-75 Duro, stamped V), for 1" Double-Seat all trim	091-16-315-13
	Molded Valve, Viton (65-75 Duro, stamped V), for 11/16" Double-Seat all trim	091-16-315-12
	Molded Valve, Polyurethane (red, 65-75 Duro), for 1" Single-Seat	091-16-315-51
	Molded Valve, Polyurethane (red, 65-75 Duro), for 11/16" Single-Seat	091-16-315-50



GIM1332-020

SINGLE SEAT BALANCED VALVE ASSEMBLY

Condensed Parts List (Continued)

NOTE: Items in bold face type denote minimum recommended spare parts.

Illustration Number	Description	Part Number
12d (Cont.)	**Molded Valve, Polyurethane (tan, 85-95 Duro), for 1" Single-Seat**	**091-16-315-60**
	Molded Valve, Polyurethane (tan, 85-95 Duro), for 11/16" Single-Seat	**091-16-315-59**
	Molded Valve, Viton (65-75 Duro, stamped V), for 1" Single-Seat	**091-16-315-58**
	Molded Valve, Viton (65-75 Duro, stamped V), for 11/16" Single-Seat	**091-16-315-57**
	Stainless Valve Nylon disc, for 1" Single-Seat (1 used)	**091-16-315-52**
	Stainless Valve Nylon disc, for 11/16" Single-Seat (1 used)	**091-16-315-02**
	Stainless Valve Nylon disc, for 1" Double-Seat (2 used)	**091-16-315-04**
	Stainless Valve Nylon disc, for 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 x 1/4" Lg.	907694
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" x 1 1/2" Lg. for Single-Seat assembly	901707
12n	**O-Ring, 9/16" x 3/4", for 1" Single-Seat assembly**	**934011**
	O-Ring, 3/4" x 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" x 3"**	**904079**
16	Hex Cap screw 120,000# Tensile 5/16" – 18 x 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# Tensile	920853
23	**Hex Steel Bolt 3/8" – 16 x 1 3/4" 19 – (8)**	**910058**
24	Tetraseal (or O-Ring), 4 3/8" x 4 5/8"	904085
26	Soc. Hd. Cap Screw 120,000# Tensile 5/16" – 18 x 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 x 3/8" Lg.	939900
29c	#10 Steel Lockwasher	904012

Condensed Parts List (Continued)

NOTE: Items in bold face type denote minimum recommended spare parts.

Illustration Number	Description	Part Number
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 thru 31)	091-00-358-00
31a	Spring Thrust Rod (upper)	091-00-062-50
31b	Type 2 Groove Pin 1/8" x 9/16" Lg.	904118
31c	Spring Thrust Rod (lower)	091-00-158-50
32	**Tetraseal (or O-Ring), 1 1/2" x 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**

Maximum Emergency Pressures

NOTE: Before using any of the data below, make sure this entire section is clearly understood.

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

Ductile Iron. Flanged ANSI 250	630 psi
Cast Steel, Flanged ANSI 300	800 psi
Cast Steel, Flanged ANSI 600	1100 psi

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

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

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

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.

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

All 461-X57 ..... 350 psi

Safely contained means no leakage as well as no bursting.

Over-pressurization Protection

Protect the downstream piping system and the regulator's low pressure chambers against over-pressurization due to the 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, Sensus Bulletin RDS-1498, or other applicable standards. The method of protection can be a relief valve, monitor regulator, shut-off device, or similar mechanism.

Capacities at Other Pressures

Capacity for pressure reductions not listed in the table found in bulletin R-1332 can be calculated with the following formulae:

1. $Q = K\sqrt{P_0(P_1 - P_0)}$

2. $Q = \frac{K P_1}{2}$

Q = maximum capacity of the regulator (in SCFH of 0.6 specific gravity natural gas).

K = the **"K" factor**, the regulator constant (from bottom of table, page 5 of bulletin R-1332)

P_1 = absolute inlet pressure (psia).

P_0 = absolute outlet pressure (psia).

Use formula 1, when $\frac{P_1}{P_0}$ is less than 1.894.

Use formula 2, when $\frac{P_1}{P_0}$ is greater than 1.894.

Maximum Inlet Pressures

Regulator Body Type	461 Body Materials	Max. Working Pressure Of Body	Max. Inlet Pressure
Flanged ANSI 250 RF	Ductile Iron (ASTM A395 gr 60-40-18)	575 psi	575 psi
Flanged ANSI 300 RF	Cast Steel (ASTM A216 gr WCB)	720 psi	720 psi
Flanged ANSI 600 RF	Cast Steel (ASTM A216 gr WCB)	1200 psi	1000 psi

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.

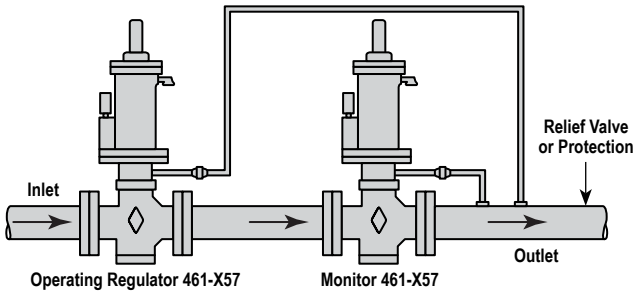
The 461-X57 is also used for monitoring other types of regulators. This is shown in the second diagram. It is excellent for monitoring pilot operated regulators.

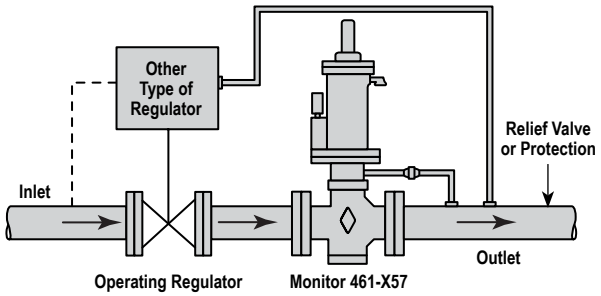
Both diagrams show the monitor in the downstream position. When installed this way, the 461-X57 is usually set for an outlet pressure 4 to 6 psi higher than the operating regulator and thus is wide open during normal operation.

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

Shutoff and bypass valving vanes with individual practices and requirements. In general, however, the cover diagram "Typical Arrangement and Dimensions" can be used as a guide for the arrangement or 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.





GIM1332-025

Metrication

Use the Following for Metric Conversions:

std. meters³/hr. x 35.31 = std. ft.³/hr. (SCFH) std. ft.³/hr. (SCFH) x 0.0283 = std. meters³/hr.
kilograms/centimeter²(kg/cm²) x 14.22 = psig psig x 0.0703 = kilograms/centimeters²(kg/cm²)
kilopascals (kPa) x 0.145 = psig psig x 6.90 = kilopascals (kPa)
bars x 14.50 = psig psig x 0.69 = bars
millimeters water (mm H_2O) x .0394 = in. w.c. in. w.c. x 25.4 = millimeters water (mm H_2O)
millimeters mercury (mm Hg) x 0.535 = in w.c. in. w.c. x 1.868 = millimeters mercury (mm Hg)

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.

Spring Ranges

Outlet Pressure Min. Max.	Color of Spring	Nominal Diaphragm Size (I.D.)
75 to 100 psi	Red	2½" all ranges
100 to 175 psi	Brown	
150 to 250 psi	Black	

Other Gases

Model 461-X57 Regulators are mainly used with natural gas. However, they perform equally well with LP gas, nitrogen, dry CO_2, air and others.

Other Gases	Correction Factor
Air (Specific Gravity 1.0)	0.77
Propane (Specific Gravity 1.53)	0.63
1350 BTU Propane-Air Mix (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:

$$\text{CORRECTION FACTOR} = \sqrt{\frac{0.60}{\text{Specific gravity of the gas}}}$$

For use with gases not listed above, please contact your Sensus representative or Industrial Distributor for recommendations.

Authorized Distributor:

805 Liberty Boulevard
DuBois, PA 15801
1-800-375-8875

For more information, visit us at www.sensus.com/gas