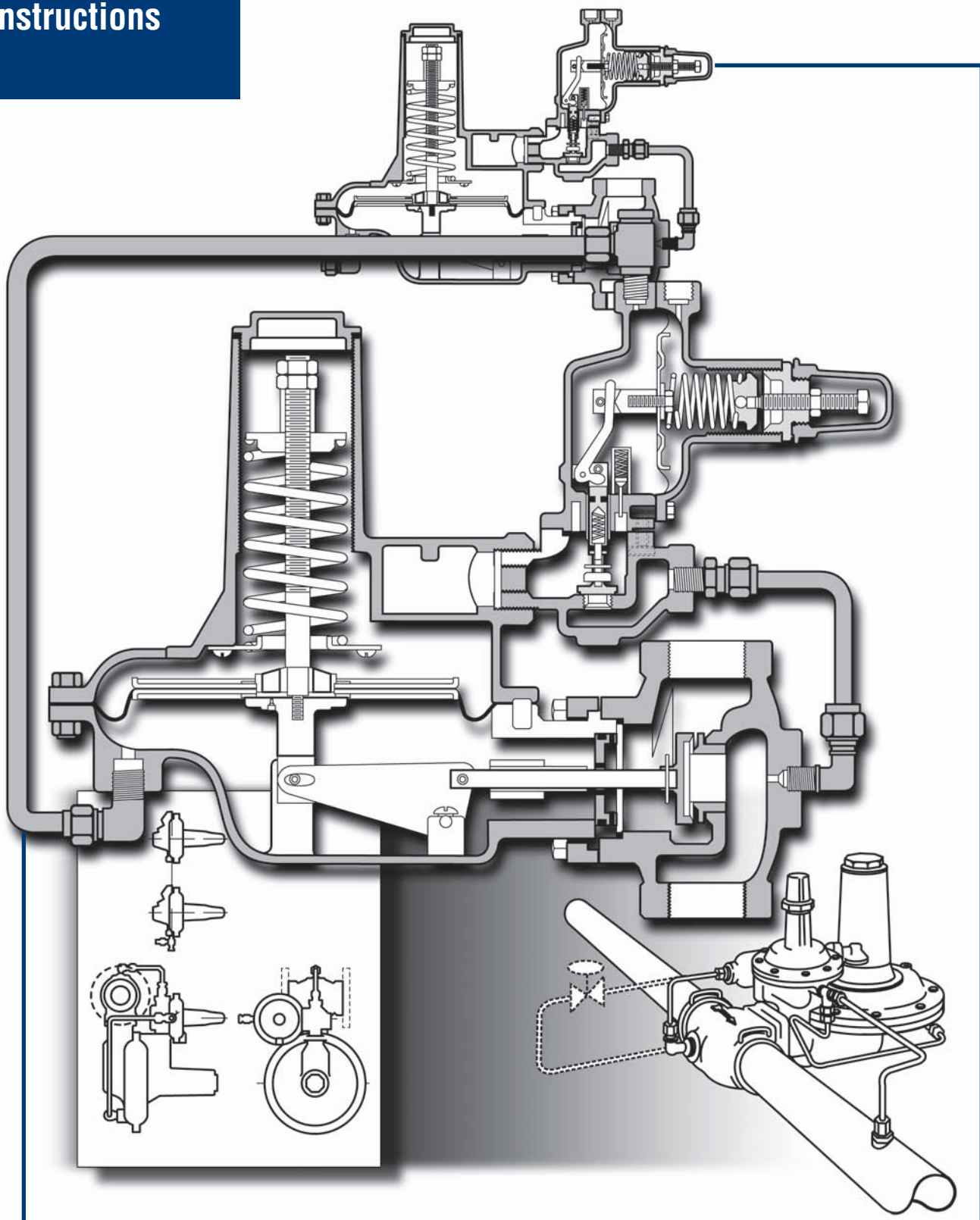


# Model 243-RPC Regulator

## Installation and Maintenance Instructions

THE GAS INDUSTRY



# Installation and Maintenance Instructions

## Model 243-RPC Regulator

The 243-RPC is a genuine Pilot Operated Regulator (Relay Principle of Operation) at an economical price.

The relay principle means exceptionally precise pressure control. Accuracy is largely unaffected by changes in the inlet pressure.

Although particularly applicable to pressure factor measurement and fixed factoring, the 243-RPC makes an excellent choice elsewhere. Use it on commercial or industrial applications where pilot operation is specified, as on gas burners of various kinds and gas engines. Use it also on smaller distribution loads such as district regulator stations. And while most applications involve natural gas, the 243-RPC performs equally well on other noncorrosive gases such as LPG, dry CO<sub>2</sub>, air, nitrogen and others.

For additional information, including capacities, see Sensus Metering Systems Bulletin R-1343.

### Outlet Pressure Range

Outlet Pressure Range	Pilot Spring	
	Spring Color	Spring Part Number
3-1/2" to 6-1/2" w.c.	Red	143-08-021-00
5" to 8-1/2" w.c.	Blue	143-08-021-01
6" to 14" w.c.	Green	143-08-021-02
12" to 28" w.c.	Orange	143-08-021-03
1 psi to 2 psi	Black	143-08-021-06
1 psi to 5 psi	White	138-18-021-01
3 psi to 15 psi	Gray	138-18-021-04
10 psi to 35 psi	Brown	138-18-021-03
3-1/2" to 5 psi	Aluminum	138-18-021-05

### Maximum Inlet Pressures

Pipe Sizes	Orifice Sizes	Maximum Inlet Pressure
1-1/2" and 2" NPT Screwed	1/4", 3/8", 1/2"	150 psi
	3/4"	125 psi
2" ANSI 125 FF Flanged	1"	60 psi
	1-1/4"	30 psi
1-1/4" NPT Screwed	1/4", 3/8", 1/2"	150 psi
	3/4"	125 psi

### Installation and Start-Up

#### General Notes

- A. The instructions that follow are based on installation practices and performance standards currently recommended in the industry.
- B. If any of these instructions are not understood or user desires to deviate from them, or if there are any questions on them or on the specific application of this regulator, phone the Sensus Metering Systems Technical Services Department.
- C. Keep this bulletin for future reference.

#### Preliminary Instructions

- A. Make sure the 243-RPC to be installed agrees with what was specified and is required for the installation.
- B. Make sure the installation complies with applicable standards and codes.
- C. Temperature range is -20°F to +150°F. Do not use in applications that are not within these limits.
- D. Although the 243-RPC is used mainly for natural gas, it performs equally well on other noncorrosive gases (air, LPG, nitrogen, dry CO<sub>2</sub>, etc). Do not use on corrosive gases.

#### Installation

- A. Thoroughly purge the inlet piping to remove dirt and debris that could damage the regulator or impair its operation. If the installation is in a location where continual dirt problems are encountered, a filter or strainer should be installed ahead of the regulator.

**NOTE:** Inlet and outlet shut-off valves are recommended.

A bypass is also recommended where it will help in repair or replacement.

- B. Remove shipping covers or screens from the inlet, outlet, and control line connections. Make sure the the regulator is free of foreign matter and debris.
- C. Install the regulator. Make sure the inlet and outlet are piped correctly and the body flow arrow is in the correct direction. High pressure connects to the inlet side. Apply pipe joint compound to male pipe threads only. On flanged connections, make sure the inlet and outlet flanges are properly aligned before installing the regulator. Tighten the flanges evenly and firmly.

**NOTE:** Diaphragm horizontal is the preferred mounting position as shown on the typical installation drawings. Inverting the regulator will change the set-point slightly and readjustment may be required. Readjust per Section "Set-Point Adjustment".

- D. The vent fitting should be positioned to prevent the entry of water or other foreign matter which could interfere with the proper operation of the regulator. This is particularly important on outdoor installations.

### CAUTION

**Regulators installed indoors should be vented to a safe place outside. The vent line should be as short as possible with minimum bends or elbows. Avoid moisture pockets. The vent line outlet must be protected against entry of water or other foreign matter but must allow unobstructed venting. Locate the outlet in a safe place to avoid hazard if any gas is discharged. 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.**

# Installation and Maintenance Instructions

## Model 243-RPC Regulator

- E.** Models 243-RPC and 243-RPC-A require a control line (note the instruction tag affixed to the control line connection at the pilot).  
Run the control line at least five pipe diameters downstream of the regulator. The control connection in the outlet piping should be clean and smooth on the inside. It should be located in straight pipe clear of valves and fittings to avoid excess turbulence. Keep the control line clean on the inside and protect it from corrosion. Slope it away from the regulator to avoid moisture pockets. The control line must be strong (1/4" or larger steel tubing or pipe is preferred) and protected against breakage. Regulators open wide if the control line breaks.  
Model 243-RPC-B has internal control and therefore does not require a control line.

- F.** A load limiting regulator should be used where outlet pressure is below 1 psi and inlet pressure exceeds 40 psi. Install as shown on the typical installation drawings and adjust for a set-point 3 to 5 psi above the 243-RPC set-point.
- G.** Make sure the regulator is correctly connected and pipe joints are tight.

### Start-Up

- A.** Note the regulator set-point (set-point is the outlet pressure the regulator is adjusted to deliver). Regulator is factory adjusted to the set-point specified on the order.
- B.** The inlet and outlet block valves should both be closed. The bypass, if used, should also be closed.
- C.** Slowly and carefully open the inlet block valve just enough to allow inlet pressure to build up slowly in the regulator until fully pressurized.

### CAUTION

**With a pressure gauge, carefully watch the outlet pressure of the regulator. While inlet pressure builds up, outlet pressure must not exceed set-point by more than 1 psi. If regulator outlet pressure begins to exceed set-point by more than 1 psi, close the inlet block valve.**

This indicates regulator is not closing properly. Check and make necessary correction before proceeding with start-up. If regulator outlet pressure exceeds set-point by more than 5 psi, refer to "Maximum Emergency Pressures" for limitations and instructions.

- D.** Check installation for leaks.
- E.** Slowly open the outlet block valve to allow a small flow (approximately 250 SCFH). Safely dispose of this gas.
- F.** With gas flowing, check for correct inlet and outlet pressures (it may be necessary to further open the inlet block valve to maintain full inlet pressure). If a change in the outlet pressure is needed, readjust per section "Set-Point Adjustment".

**NOTE:** For the regulator to be fully operable, inlet pressure must be at least 1-1/2 psi greater than the outlet pressure.

- G.** Check for tight shut-off (lock-up). To do this, reduce flow to zero by slowly closing outlet block valve. Outlet pressure should not exceed set-point by more than 1-1/2" w.c. (for set-points below 1 psi), 1/4 psi (for set-points of 1 to 5 psi), and 1 psi (for set-points over 5 psi).
- H.** Fully open inlet and outlet block valves. Do this slowly and carefully. Watch pressure gauges.
- I.** Carefully start-up by making sure there are no leaks.

### Set-Point Adjustment

- A.** The 243-RPC is factory adjusted as specified on the order. To change the set-point:
1. Remove pilot seal cap **60** and loosen lock-nut **62**.

### CAUTION

**Do not remove main cover cap 1. It is sealed and pressurized and does not contribute to set-point adjustment.**

2. Turn set-point adjustment **61** clockwise to increase or counterclockwise to decrease the outlet pressure.

### CAUTION

**There should be gas flow through the regulator during adjustment, preferably small (approximately 250 SCFH).**

**Do not adjust set-point when there is no flow.**

3. When the desired set-point is achieved, retighten lock-nut **62** and install seal cap **60**. Make sure tetraseal **63** is not damaged.

### Pilot Spring Change

- A.** The outlet pressure range of the 243-RPC is determined by the pilot spring (see table of Outlet Pressure Ranges). To change the spring:
1. Take regulator out of service per following section "Shut-down".  
**Note:** Do not change main spring **4**. It does not contribute to set-point adjustment.
  2. Remove pilot seal cap **60**, loosen lock-nut **62**, and turn set-point adjustment **61** counterclockwise until spring compression is released.
  3. Remove top cap **64**, ferrule **66**, and spring **68**. Be careful not to lose ball **67**.
  4. Install new spring. During reassembly, make sure the spring is nested correctly at both ends.
  5. Adjust to the desired set-point per previous section "Set-Point Adjustment".

### Shutdown

- A.** To take the regulator out of service, fully close the inlet shut-off valve. If the regulator feeds into piping that remains pressurized, also fully close the outlet shut-off valve. Close valves slowly and carefully.
- B.** Make sure the regulator is entirely depressurized before servicing or removal from the line. Safely dispose of any gas released to atmosphere.

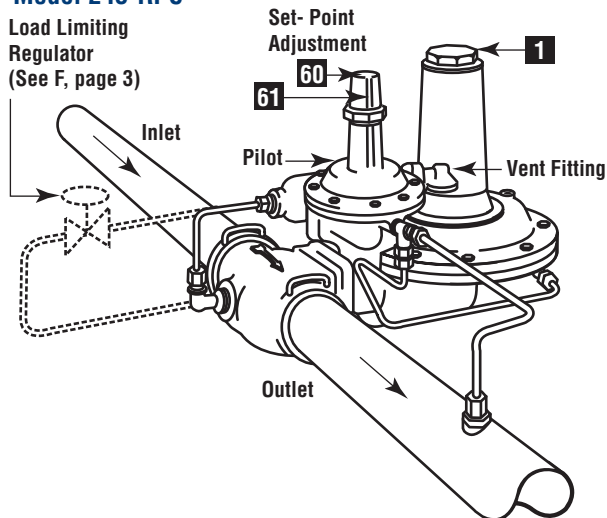
# Installation and Maintenance Instructions

## Model 243-RPC Regulator

### Typical Installations

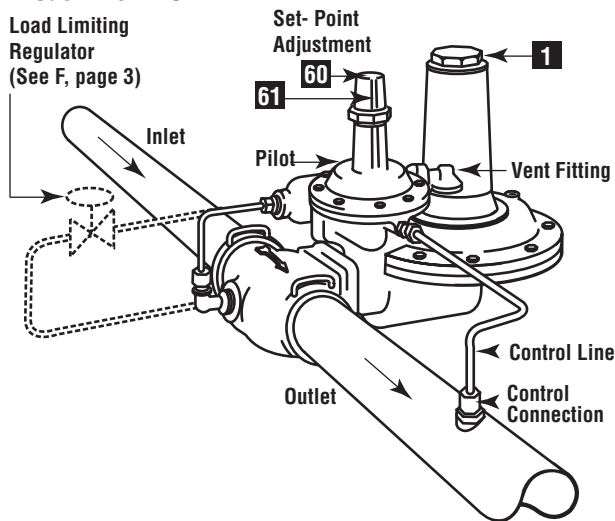
#### Model 243-RPC

Load Limiting Regulator  
(See F, page 3)



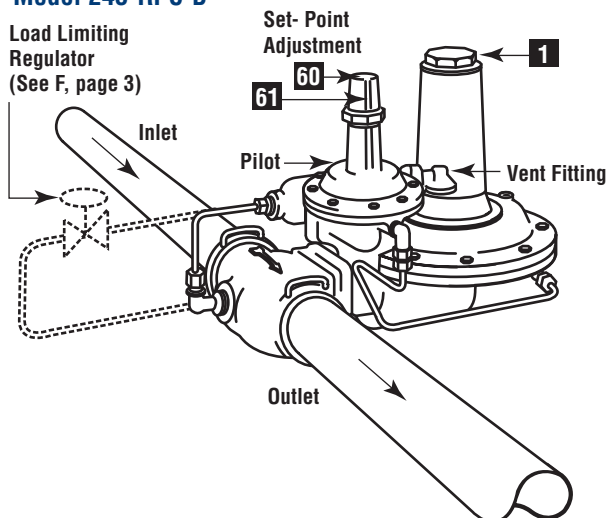
#### Model 243-RPC-A

Load Limiting Regulator  
(See F, page 3)



#### Model 243-RPC-B

Load Limiting Regulator  
(See F, page 3)



### Servicing

#### General Instructions

1. Make sure the regulator is entirely depressured before disassembling.
2. During disassembly, carefully note location and position of all parts to be certain reassembly is correct. Inspect each part and replace those that are worn or damaged or otherwise unsatisfactory.
3. When servicing is completed, make sure regulator installation is entirely free of leaks.

#### 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 Main Valve Assembly And Orifice

4. For access to valve **21** and orifice **24**, disconnect pilot tubing **46** and on Models 243-RPC and 243-RPC-A disconnect control line. Then carefully loosen and remove four union bolts **16** and remove entire main diaphragm case assembly from body **25**.
5. Remove hair pin cotter **20** to remove valve **21**.
6. Use 1-5/8" hex socket "thin-wall" type to unscrew orifice **24** from body. When replacing orifice **24** use moderate amount of pipe joint compound to orifice threads to assure pressure tightness.
7. To replace o-ring **19**, remove throat block **18** by first loosening the two small Allen set-screws that lock it into place (use 1/16" Allen wrench). When reinstalling **18**, lubricate o-rings **19** and **18a** with moderate amount of Parker O-Lube or equal and make sure it is pushed fully inwards into position and the two small Allen set-screws are firmly tightened. Note instruction **19** under section "Throat Block".
8. Before tightening union bolts **16**, make certain tetraseal **17** is correctly positioned.

#### To Service Main Diaphragm

9. To replace main diaphragm **11a**, remove cap **1**, nuts **50**, spacer **51**, spring ferrule **52**, spring **4**, and rim bolts **8**, and disconnect the pilot tubing connections and remove top case **5**. Unscrew threaded stem **53** and disassemble diaphragm assembly. Note step 12.
10. Coupling-lever-stem assembly **13** can be removed by first removing valve **21** per steps 4 and 5 above.
11. Make certain reassembled parts are in their correct order and rim bolts **8** are tightened evenly and firmly. They must be tight enough to prevent leakage yet not so tight that the diaphragm is crushed or damaged. The diaphragm must lay flat in the rim joint and must not be twisted or pinched. Care must also be taken while inserting rim bolts **8** to avoid damaging the diaphragm. To prevent tearing diaphragm material, tighten bolts by rotating nuts onto bolts. Do not rotate bolts.
12. When loosening and tightening threaded stem **53**, be careful to avoid distorting coupling-lever-stem assembly **13**.
13. When reinserting spring **4**, tighten lock nuts **50** to a dimension "A" of 1-1/4". Do this only when main diaphragm case assembly is in place and union bolts **16** are tight. Note step 8.

**NOTE:** Instructions to **SERVICE PILOT** are on Page 6.

# Installation and Maintenance Instructions

## Model 243-RPC Regulator

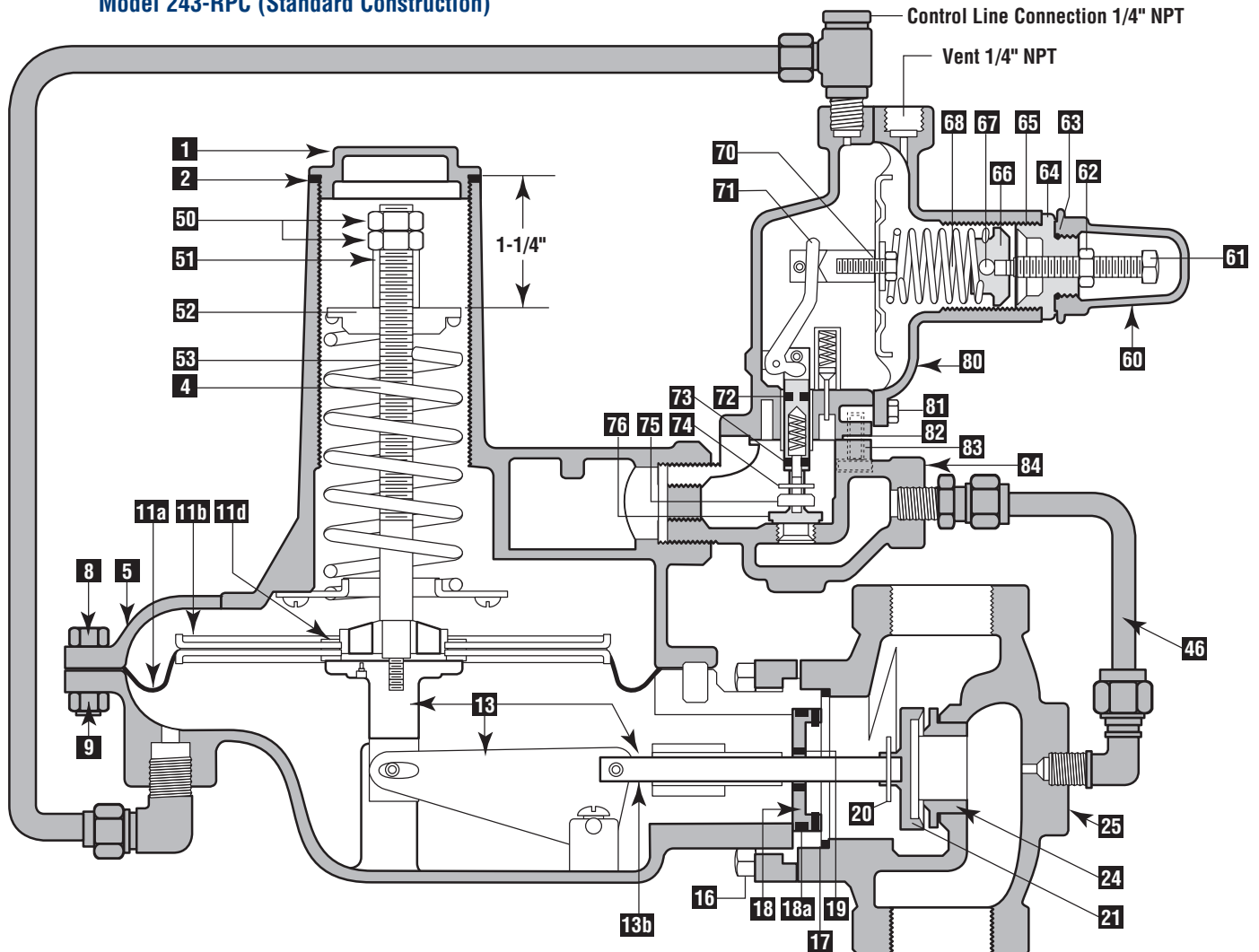
### Condensed Parts List

The following are the parts generally required in maintenance and servicing.

Illustration Number	Description	Part Number
2	Tetraseal	951357
4	Spring (green)	143-16-021-05
11a	Main Diaphragm	143-82-150-00
11b	Diaphragm Pan	143-82-017-00
11d	Seal Washer (cement seal washer to pan)	143-16-115-00
13	Coupling-Lever-Stem Assembly	143-82-530-03
17	Tetraseal	904075
	Throat Block (243-RPC only)	143-16-008-00
18	Throat Block with 1/8" opening (243-RPC-A & 243-RPC-B only)	143-16-008-01
18a	O-Ring	905809
19	O-Ring	934007
20	Hair Pin Cotter	143-62-118-00
	Valve -10° - Buna N	143-16-511-09
21	Valve -30° - Buna N (do not use in Model 243-RPC)	143-16-511-10

Illustration Number	Description	Part Number
	1-1/4" Orifice, Brass	143-16-023-03
	1" Orifice, Brass	143-16-023-02
	3/4" Orifice, Brass	143-16-023-01
24	1/2" Orifice, Brass	143-16-023-00
	3/8" Orifice, Brass	143-16-023-04
	1/4" Orifice, Brass	143-16-023-10
63	Tetraseal	906515
65	Tetraseal	904076
68	Pilot Spring (See Table, page 2)	
70	Pilot Diaphragm Assembly	138-18-550-00
72	O-Ring	934005
73	Pilot Stem Assembly	138-18-316-00
74	Hair Pin Cotter	906494
75	Pilot Valve (Poly-U Tan)	138-18-311-03
76	Pilot Orifice (stainless steel)	143-08-023-12
82	Tetraseal	904076

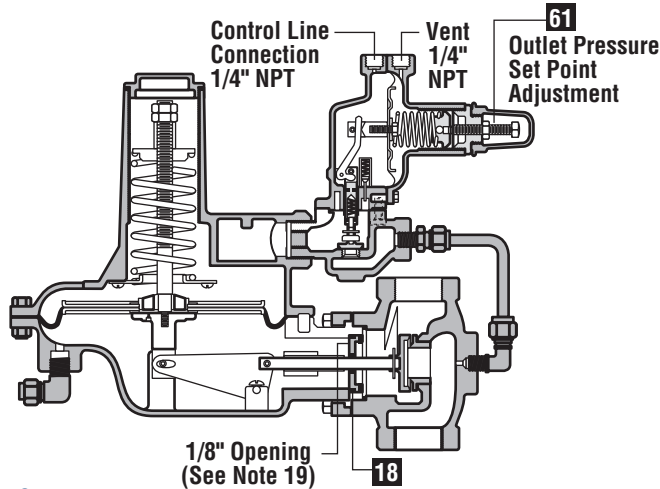
### Model 243-RPC (Standard Construction)



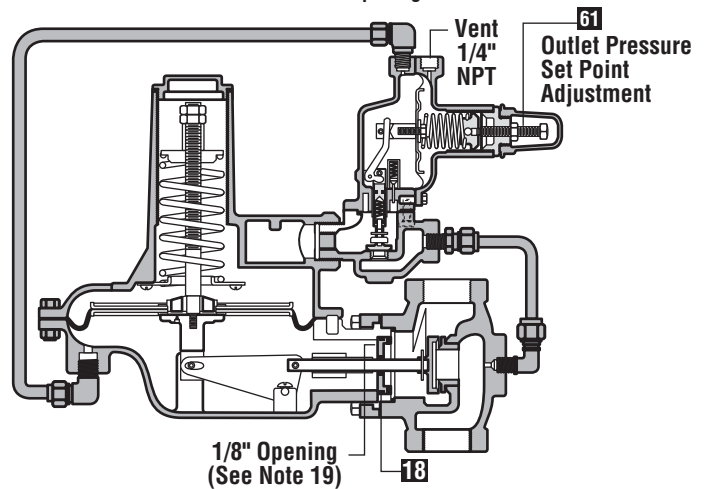
# Installation and Maintenance Instructions

## Model 243-RPC Regulator

**Model 243-RPC-A** — 1/8" Throat Opening



**Model 243-RPC-B** — 1/8" Throat Opening and no control line



**To Service Pilot**

14. For access to pilot valve 75, stem assembly 73, and orifice 76, disconnect tubing connections to pilot diaphragm case, remove four bolts 83 and separate entire pilot diaphragm case assembly from body 84 to expose valve 75 and orifice 76.
15. Remove hair pin cotter 74 to remove valve 75.
16. Use a 3/4" hex socket "thin-wall" type to unscrew orifice 76. When replacing orifice, use a small amount of pipe joint compound on threads to assure pressure tightness.
17. To remove stem assembly 73 and o-ring 72, remove pilot top case 80 and the diaphragm assembly per step 18. Remove lever 71 to remove stem assembly 73.
18. To replace pilot diaphragm assembly 70, remove seal cap 60, loosen lock nut 62, and turn adjustment 61 counterclockwise until spring compression is released. Remove top cap 64 and remove ferrule 66 and spring 68. Be careful not to lose ball 67. Remove screws 81 and top case 80 and remove diaphragm assembly by sliding it off the end of lever 71.

**Throat Block**

19. On Models 243-RPC-A and 243-RPC-B, throat block 18 must be positioned so that the 1/8" opening is aligned in the furthest downstream location in relation to the body 25, as shown above. Also, for 1/2" and smaller orifices, use the 10° valve; and for 3/4" and larger orifices, use the 30° valve. Model 243-RPC does not have the 1/8" opening.

**Maximum Emergency Pressures**

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

1/4", 3/8", 1/2" and 3/4" orifices	175 psi
1" orifice	110 psi
1-1/4" orifice	80 psi

The maximum pressure the control line connection on the Model 243-RPC and 243-RPC-A may be subjected to without causing damage to the internal parts of the regulator is set-point plus 5 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 cases is 45 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 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 Metering Systems 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 243-RPC Regulator can be used for flowing temperature from -20° F to 150° F.

**Buried Service**

The 243-RPC Regulator **is not** recommended for buried service.

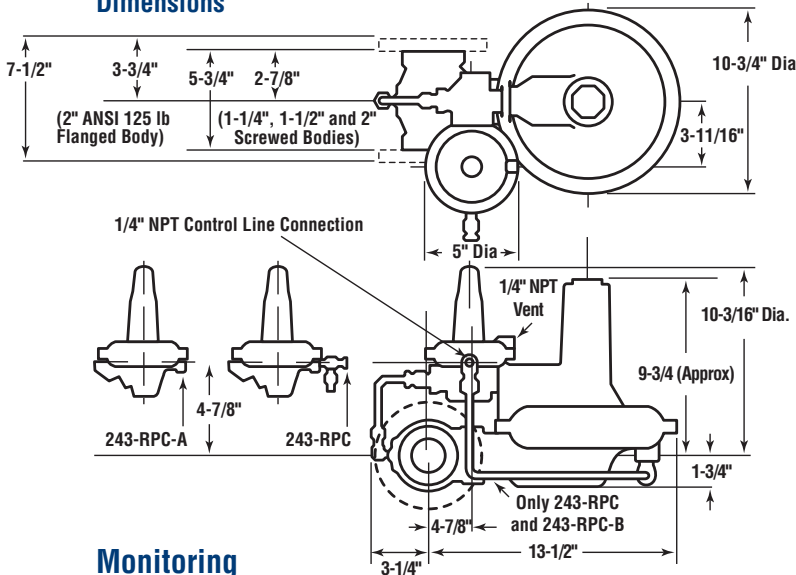
**Materials of Construction**

<b>Bodies</b>	Cast Iron (ASTM A 126 Class B)
<b>Diaphragm Cases</b>	Die Cast Aluminum Alloy
<b>Diaphragms</b>	Buna-A with nylon Fabric Insert
<b>Diaphragm Pans</b>	Plated Steel
<b>Main Diaphragm Coupling</b>	Zinc Die Casting
<b>Orifice</b>	Brass
<b>Valve</b>	Buna-N Soft Seat in Aluminum Holder
<b>Stem</b>	Brass
<b>Levers</b>	Plated Stamped Steel
<b>O-Rings and Tetraseals</b>	Buna-N
<b>Main Spring Seal Cup</b>	Zinc Die Casting
<b>Pilot Adjustment Screw</b>	Steel
<b>Pilot Seal Cap</b>	Cast Iron
<b>Pilot Trim</b>	Stainless Steel
<b>Pilot Diaphragm Coupling</b>	Plated Steel
<b>Pilot Load Relief</b>	Plated Steel
<b>Pilot Tubing</b>	Steel
<b>Tubing Fittings</b>	Brass

# Installation and Maintenance Instructions

## Model 243-RPC Regulator

### Dimensions

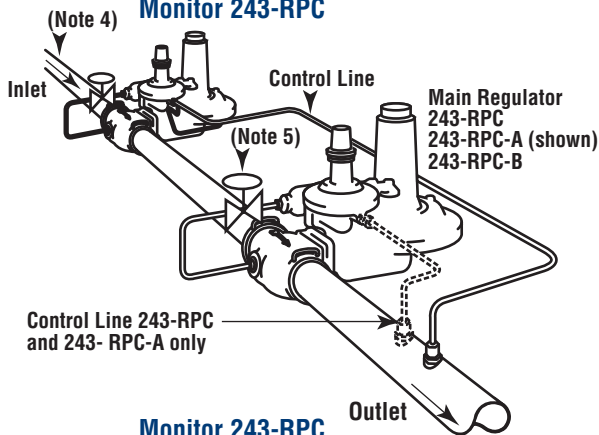


### Monitoring

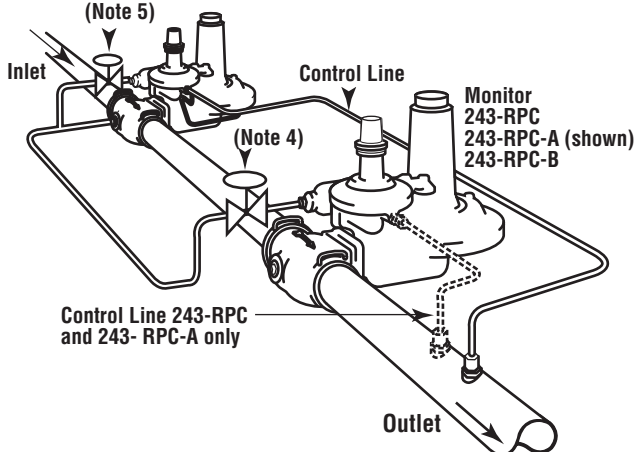
Monitoring is used to guard against a regulator failure causing excessive pressure downstream.

A monitor set consists of two regulators in series, one of which is a standby. The main regulator controls normally. The standby monitor is adjusted for a somewhat higher set-point pressure so it is normally open and allows the gas to flow freely. If a failure in the main regulator causes the outlet pressure to rise, the monitor takes over and controls outlet pressure to its somewhat higher set-point.

#### Monitor 243-RPC



#### Monitor 243-RPC



243-RPC Regulators can be used for monitoring as illustrated.

Note the following:

1. Either regulator can be used as the monitor (main regulator upstream and monitor downstream, or monitor upstream and main regulator downstream). Both arrangements have their advantages and which is used depends on individual requirements and preferences.
2. The upstream regulator (whether the main regulator or monitor) must have a blocked throat with stem seal and an external control line. Hence, only use the standard 243-RPC in the upstream position.
3. The downstream regulator (whether the main regulator or monitor) can be the same as 2 above or have internal control. Hence, a standard 243-RPC, 243-RPC-A, or 243-RPC-B can be used.
4. For the monitor (whether upstream or downstream), a load limiting regulator should be used on the inlet supply to the pilot as illustrated. Adjust it for a set-point 3 to 4 psig higher than the monitor set-point.
5. For the main regulator, a load limiting regulator is necessary only for outlet pressures below 1 psig where inlet exceeds 40 psig. Adjust it for a set-point 3 to 4 psig higher than the main regulator set-point.
6. The capacity of the regulators in a monitor set should be calculated by taking 70% of the capacity of the smaller regulator in the monitor set or 70% of either unit if they are the same size.

### Other Gases

243-RPC Regulators are mainly used on natural gas. However, they perform equally well on LP gas, nitrogen, dry CO<sub>2</sub>, air and others. For capabilities, multiply the table values in Bulletin R-1343 by the following correction factors:

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:

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

Special material may be available for certain corrosive gases. Please contact your Sensus Metering Systems Representative or Industrial Distributor for recommendations.

## Metrication

Use the following for metric conversions:

std. meters<sup>3</sup>/hr. x 35.31 = std. ft.<sup>3</sup>/hr. (SCFH)  
std. ft.<sup>3</sup>/hr. (SCFH) x 0.0283 = std. meters<sup>3</sup>/hr.

---

kilograms/centimeter<sup>2</sup> (kg/cm<sup>2</sup>) x 14.22 = psig  
psig x 0.0703 = kilograms/centimeter<sup>2</sup> (kg/cm<sup>2</sup>)

---

kilopascals (kPa x 0.145 = psig  
psig x 6.90 = kilopascals (kPa)

---

bars x 14.50 = psig  
psig x .069 = bars

---

millimeters water (mm H<sub>2</sub>O) x .0394 = in. w.c.  
in. w.c. x 25.4 = millimeters water (mm H<sub>2</sub>O)

---

millimeters mercury (mm Hg) x 0.535 = in. w.c.  
in. w.c. x 1.868 = millimeters mercury (mm Hg)

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## Authorized Distributor:

### Limited Warranty

Seller warrants the Goods to be free from defects in materials manufactured by Seller and in Seller's workmanship for a period of **(one(1) year)** after tender of delivery (the "Warranty Period"). **THIS LIMITED WARRANTY**

**(A) IS IN LIEU OF, AND SELLER DISCLAIMS AND EXCLUDES, ALL OTHER WARRANTIES, STATUTORY, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR OF CONFORMITY TO MODELS OR SAMPLES;**

**(B)** does not apply to any Goods which have been (I) repaired, altered or improperly installed; (II) subjected to improper use or storage; (III) used or incorporated with other materials or equipment, after Buyer or anyone using the Goods has, or reasonably should have, knowledge of any defect or nonconformance of the Goods; or (IV) manufactured, fabricated or assembled by anyone other than the Seller;

**(C)** shall not be effective unless Buyer notifies Seller in writing of any purported defect or nonconformance within **(thirty (30) days)** after Buyer discovers or should have reasonably discovered such purported defect or nonconformance; and

**(D)** shall only extend to Buyer and not to any subsequent buyers or users of the Goods. Buyer shall provide Seller access to the Goods as to which Buyer claims a purported defect or nonconformance; upon request by Seller, Buyer shall, at its own risk and expense, promptly return the Goods in question to Seller's Plant.