

# Model 243-RPC Regulator

## 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 Bulletin DS-G-REG-1343.

### Outlet Pressure Range

OUTLET PRESSURE RANGE	PILOT SPRING	
	SPRING COLOR	SPRING PART NUMBER
3½" to 6½" w.c.	Red	143-08-021-00
5" to 8½" 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
3½" to 5 psi	Aluminum	138-18-021-05

### Maximum Inlet Pressures

PIPE SIZES	ORIFICE SIZES	MAXIMUM INLET PRESSURE
1½" and 2" NPT Screwed	¼", ⅜", ½"	150 psi
	¾"	125 psi
2" ANSI 125 FF Flanged	1"	60 psi
	1¼"	30 psi
1¼" NPT Screwed	¼", ⅜", ½"	150 psi
	¾"	125 psi

### Installation and Start-Up

#### General Notes

- The instructions that follow are based on installation practices and performance standards currently recommended in the industry.
- If any of these instructions are not understood or the 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 Technical Services Department.
- Keep this bulletin for future reference.

### Preliminary Instructions

- Make sure the 243-RPC to be installed matches what was specific and is required for the installation.
- Make sure the installation complies with applicable standards and codes.
- Temperature range is -20°F to 150°F. Do not use in applications that are not within these limits.
- 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

- 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 shutoff valves are recommended. A bypass is also recommended where it will help in repair or replacement.

- Remove shipping covers or screens from the inlet, outlet and control line connections. Make sure the regulator is free of foreign matter and debris.
- 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 setpoint slightly and readjustment may be required. Readjust per section "Setpoint Adjustment."

- The vent fitting should be positioned to prevent the entry of water or other foreign matter that 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.

- E. Models 243-RPC and 243-RPC-A require a control line (note the instruction tag affixed to the control 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 an 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 setpoint 3 to 5 psi above the 243-RPC setpoint.
- G. Make sure the regulator is connected correctly and pipe joints are tight.

### Start-Up

- A. Note the regulator setpoint (setpoint is the outlet pressure that the regulator is adjusted to deliver). The regulator is factory adjusted to the setpoint specified on the order.
- B. Both the inlet and outlet block valves should 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 pressured.



**CAUTION**

**With a pressure gauge, carefully watch the outlet pressure of the regulator. While inlet pressure builds up, outlet pressure must not exceed setpoint by more than 1 psi. If regulator outlet pressure begins to exceed setpoint by more than 1 psi, close the inlet block valve. This indicates that the regulator is not closing properly. Check and make necessary corrections before proceeding with the start-up. If the regulator outlet pressure exceeds the setpoint 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 "Setpoint 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 shutoff (lock-up). To do this, reduce flow to zero by slowly closing outlet block valve. Outlet pressure should not exceed setpoint by more than 1 1/2" w.c. (for setpoints below 1 psi), 1/4 psi (for setpoints of 1 to 5 psi), and 1 psi for setpoints 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.

### Setpoint Adjustment

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



**CAUTION**

**Do not remove main cover cap 1. It is sealed and pressured and does not contribute to setpoint adjustment.**

2. Turn setpoint 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 setpoint when there is no flow.**

3. When the desired setpoint 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 spring:
  1. Take regulator out of service per following section "Shutdown."

**NOTE:** Do not change main spring **4**. It does not contribute to setpoint adjustment.

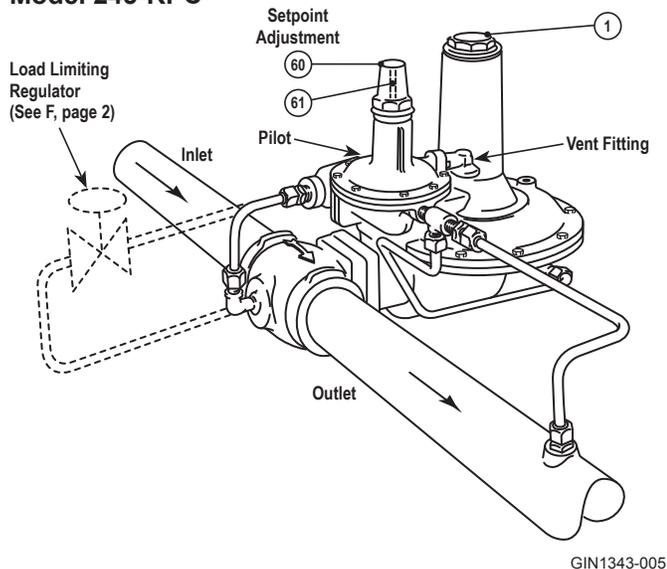
  2. Remove pilot seal cap **60**, loosen lock-nut **62**, and turn setpoint adjustment **61** counterclockwise until spring compression is released.
  3. Remove top cap **64**, ferrule **66** and spring **68**. Be careful not to lose ball **67**.
  4. Install new spring. During reassembly, make sure the spring is nested correctly at both ends.
  5. Adjust to the desired setpoint per previous section "Setpoint Adjustment."

### Shutdown

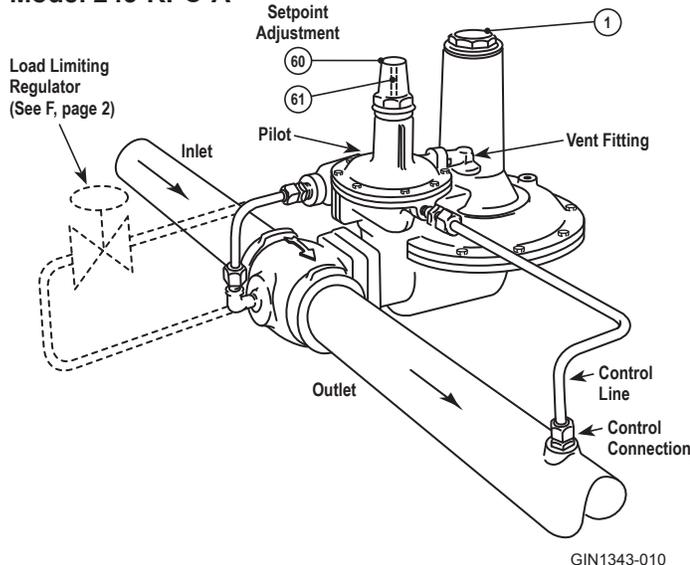
- A. To take the regulator out of service, fully close the inlet shutoff valve. If the regulator feeds into piping that remains pressured, also fully close the outlet shutoff valve. Close valves slowly and carefully.
- B. Make sure the regulator is entirely depressured before servicing or removal from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

## Typical Installations

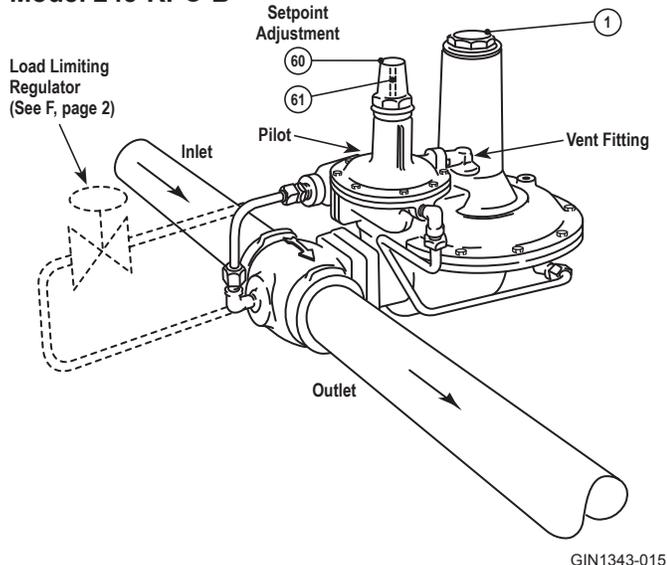
### Model 243-RPC



### Model 243-RPC-A



### Model 243-RPC-B



## 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 $\frac{5}{8}$ " 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  $\frac{1}{16}$ " 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 $\frac{1}{4}$ ". 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 5.

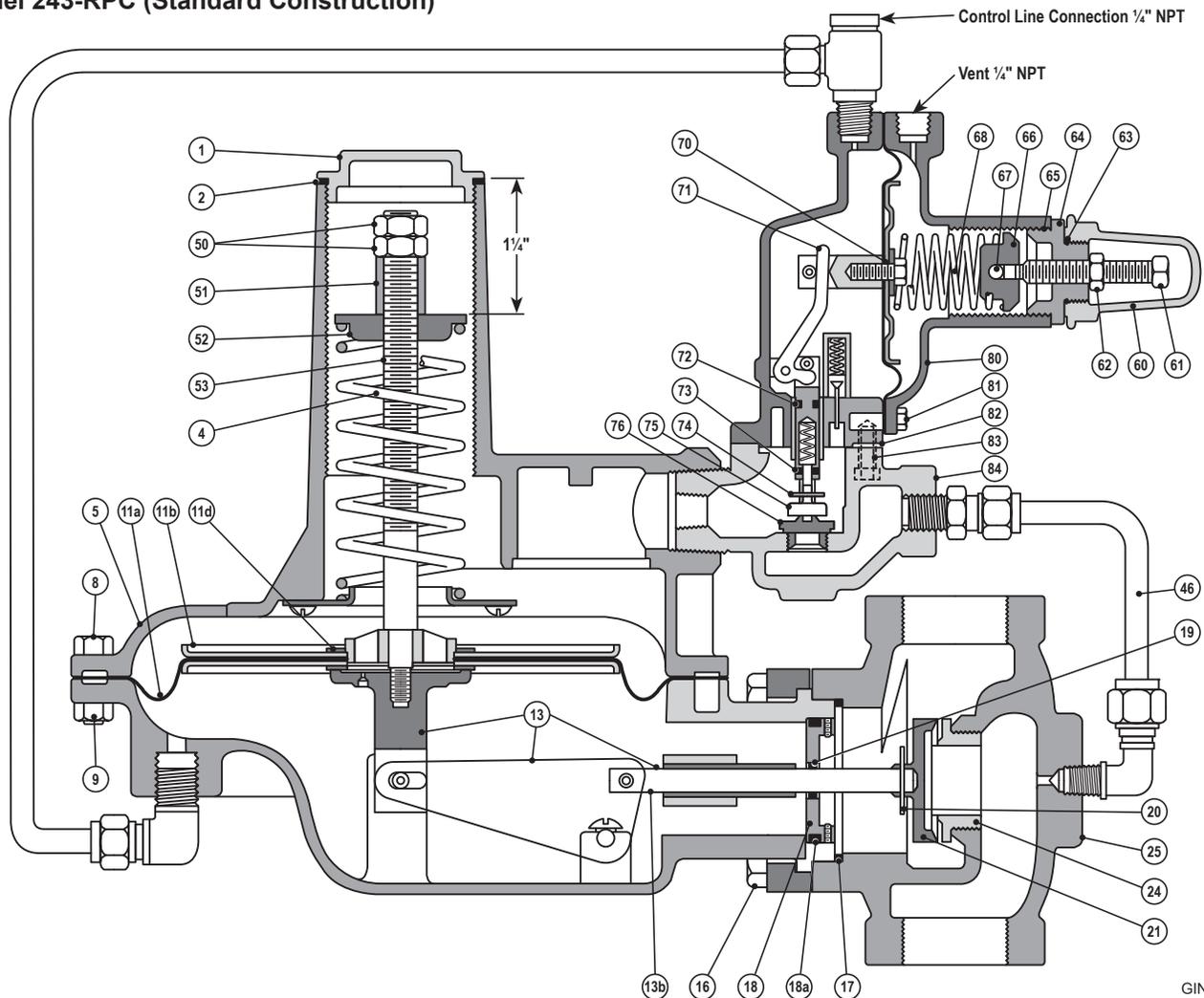
### Condensed Parts List

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
18	Throat Block (243-RPC only)	143-16-008-00
18	Throat Block 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
21	Valve-10°-Buna N	143-16-511-09
21	Valve-30°-Buna N (do not use in Model 243-RPC)	143-16-511-10

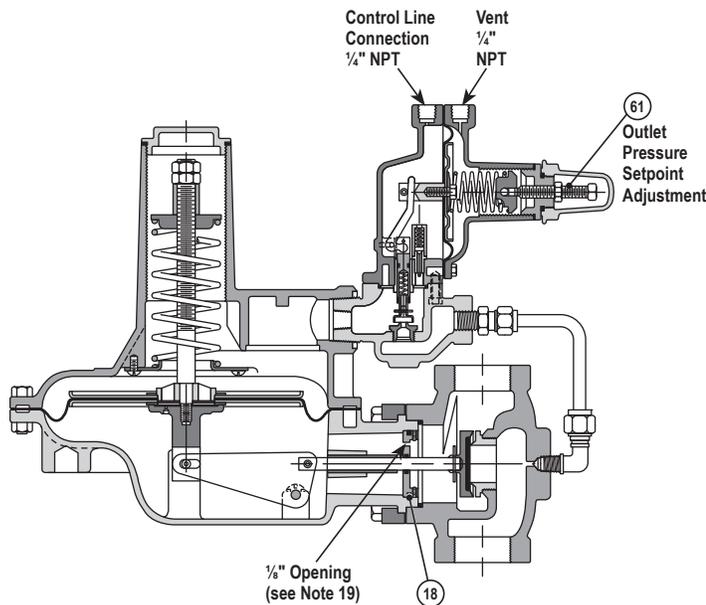
Illustration Number	Description	Part Number
24	1/4" Orifice, Brass	143-16-023-03
24	1" Orifice, Brass	143-16-023-02
24	3/4" Orifice, Brass	143-16-023-01
24	1/2" Orifice, Brass	143-16-023-00
24	3/8" Orifice, Brass	143-16-023-04
24	1/4" Orifice, Brass	143-16-023-10
63	Tetraseal	906515
65	Tetraseal	904076
68	Pilot Spring (See table, page 1)	
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)



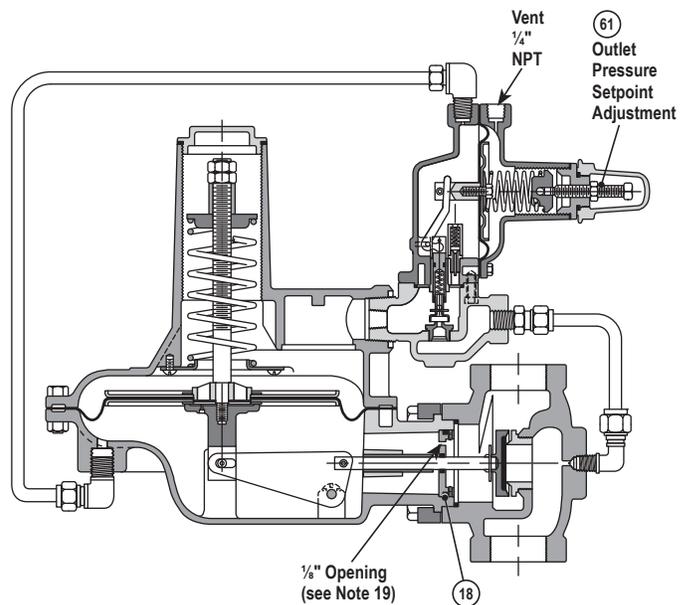
GIN1343-020

### Model 243-RPC-A – 1/8" Throat Opening



GIN1343-025

### Model 243-RPC-B – 1/8" Throat Opening and no control line



GIN1343-030

#### 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 to the body 25, as shown above. Also, for 1/2" and smaller orifices, use the 10° valve; 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 that 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 setpoint plus 5 psi (setpoint is defined as the outlet pressure that 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 overpressurization due to a regulator malfunction or a failure of the regulator to lock up. The allowable overpressurization 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 overpressure protection could be a relief valve, a monitor regulator, a shutoff device or any similar device.

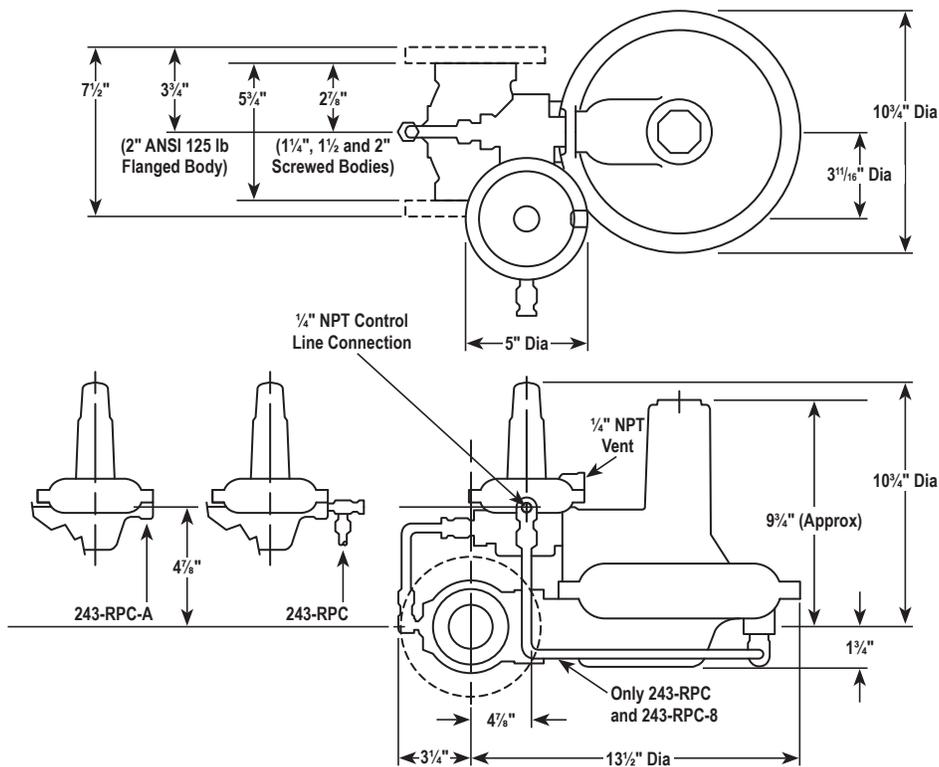
#### Temperature Limits

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.

## Dimensions



GIN1343-035

## Materials of Construction

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

## Other Gases

243-RPC Regulators are most widely used on natural gas. However, they perform equally well on LP gas, nitrogen, dry CO<sub>2</sub>, air and others.

For capacities, multiply the table values in Bulletin IN-G-REG-1343 by 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 noncorrosive gases use the following formula:

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

Special material may be available for certain corrosive gases. Please contact your Sensus representative or industrial distributor for recommendations.

## Monitoring

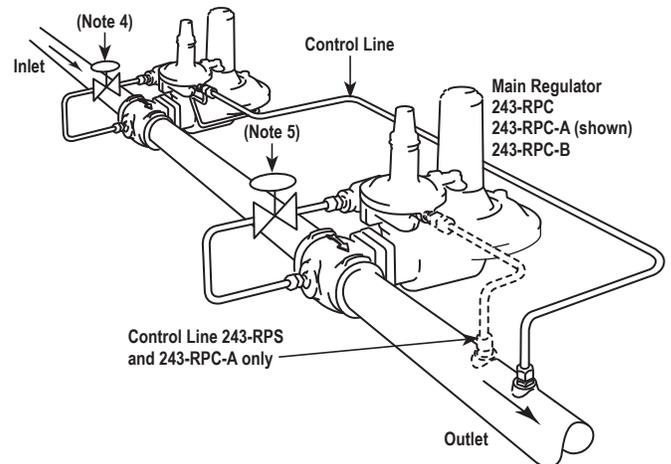
Monitoring is used to guard against a regulator failure causing excessive pressure downstream. A monitor set consists of two regulator in series, one of which is a standby. The main regulator controls normally. The standby monitor is adjusted for a somewhat higher setpoint pressure so it is normally 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 setpoint.

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

Note the following:

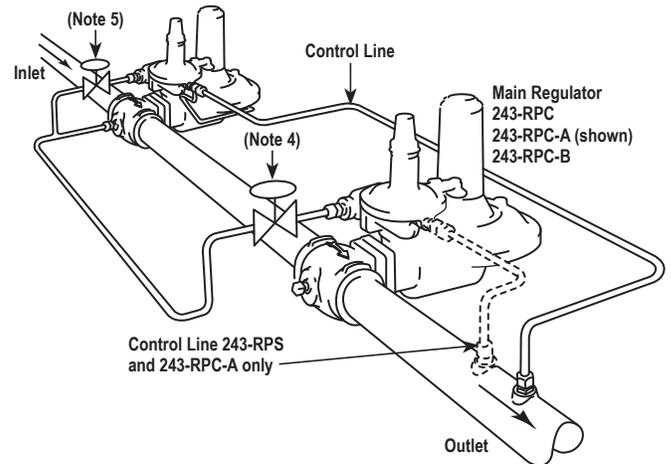
1. Either regulator can be used as the monitor (main regulator upstream and monitor downstream, or monitor upstream and main regulator downstream). Both arrangements have their advantages and which is used depends on individual requirements and preferences.
2. The upstream regulator (whether the main 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 setpoint 3 to 4 psig higher than the monitor setpoint.
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 setpoint 3 to 4 psig higher than the main regulator setpoint.
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.

### Monitor 243-RPC



GIN1343-040

### Monitor 243-RPC



GIN1343-045

## Metrication

Use the following for metric conversions:

$$\text{std. meters}^3/\text{hr.} \times 35.31 = \text{std. ft.}^3/\text{hr. (SCFH)}$$

$$\text{std. ft.}^3/\text{hr. (SCFH)} \times 0.0283 = \text{std. meters}^3/\text{hr.}$$

$$\text{kilograms/centimeter}^2(\text{kg/cm}^2) \times 14.22 = \text{psig}$$

$$\text{psig} \times 0.0703 = \text{kilograms/centimeter}^2(\text{kg/cm}^2)$$

$$\text{kilopascals (kPa)} \times 0.145 = \text{psig}$$

$$\text{psig} \times 6.90 = \text{kilopascals (kPa)}$$

$$\text{bars} \times 14.50 = \text{psig}$$

$$\text{psig} \times 0.69 = \text{bars}$$

$$\text{millimeters water (mm H}_2\text{O)} \times .0394 = \text{in. w.c.}$$

$$\text{in. w.c.} \times 25.4 = \text{millimeters water (mm H}_2\text{O)}$$

$$\text{millimeters mercury (mm Hg)} \times 0.535 = \text{in. w.c.}$$

$$\text{in. w.c.} \times 1.868 = \text{millimeters mercury (mm Hg)}$$

# Model 243-RPC Regulator

Installation and Maintenance Instructions



## Authorized Distributor:

All products purchased and services performed are subject to Sensus' terms of sale, available at either <http://na.sensus.com/TC/TermsConditions.pdf> or 1-800-METER-IT. Sensus reserves the right to modify these terms and conditions in its own discretion without notice to the customer.

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