



# Regulator Installation and Maintenance Instructions

## 243 Service Regulators

### Introduction

The 243 is a large capacity general-purpose gas pressure regulator.

Its outstanding performance and versatility make it an excellent choice for use on industrial meter sets, combustion equipment, boilers, burners, unit heaters, furnaces, ovens and other applications.

Use it for natural gas, air, dry CO<sub>2</sub>, propane, butane, L.P.G., nitrogen, and others. Special materials are available for certain corrosive gases.

In addition to the standard models and internal relief models covered in this bulletin, the 243 is also available with low pressure cut-off, with built-in monitor, and as a pilot operated regulator (outlet pressures to 35 psig), a back pressure valve, a relief valve, a vacuum regulator and a vacuum breaker. For information, please contact your Sensus Sales Office or authorized industrial distributor. The 243 is manufactured in conformance with Code B31.8.

Note: The term standard refers to Non-IRV configurations.

### Model Specifications

<b>243-12-1 and 243-12-2</b>	
Maximum Inlet Pressure.....	125 psi
Outlet Pressures.....	3 ½" w.c. to 3 psi
Pipe Sizes.....	1 ¼", 1 ½" and 2"
Diaphragm.....	12" (nominal diameter)
<b>243-8-1 and 243-8-2</b>	
Maximum Inlet Pressure.....	125 psi
Outlet Pressures.....	3 ½" w.c. to 4 ¼" psi
Pipe Sizes.....	1 ¼", 1 ½" and 2"
Diaphragm.....	8" (nominal diameter)
<b>243-8HP</b>	
Maximum Inlet Pressure.....	125 psi
Outlet Pressures.....	3 to 10 psi
Pipe Sizes.....	1 ¼", 1 ½" and 2"
Diaphragm.....	8" (nominal diameter)

### Maximum Inlet Pressures

243-12	ORIFICE SIZE - VALVE	243-8
15 psi	1 ¼" - 30°	•••
25 psi*	1 ¼" - 10°	•••
25 psi	1" - 30°	25 psi
40 psi*	1" - 10°	25 psi
40 psi	¾" - 30°	40 psi
60 psi†	¾" - 10°	40 psi
100 psi	½" - 10°	80 psi
125 psi	¾" - 10°	100 psi
125 psi	¼" - 10°	125 psi
•••	.207" - 10°	125 psi

\* Applies only to 243-12 with external control line.

† 80 psi for 243-12 with external control line

### Temperature Limits

The Model 243 Service Regulators can be used for flowing temperatures from -20°F to 150°F.

### Buried Service

The Model 243 Service Regulators are *not* recommended for buried service.

### Installation and Start Up

(See Illustrations on Page 3.)

1. Make certain that regulator and piping are free of dirt, moisture, foreign matter and other debris.
2. Be sure all shipping screens or covers are removed and regulator is installed with flow in correct direction.
3. Regulator may be installed in any position; right-side-up, upside down, vertical pipe, horizontal pipe, diagonal pipe, etc.

By loosening union bolts (16), the diaphragm case assembly may be rotated to various positions in relation to the body. Make certain (16) are re-tightened to hold diaphragm case assembly in new position and to reseal.

#### 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 the chances for foreign material from collecting in the vent side of the regulator diaphragm.*

4. Make sure there are no leaks and all connections are firm and tight. Tighten flange bolts evenly and firmly. On screwed connections apply pipe dope to male threads only.

5. On regulators arranged for External Control Line, run pipe or tubing from ½" NPT connection in lower case to the control connection in the outlet piping. This control piping should not be less than ½" in size and should be adequately protected against breakage (regulators go wide open if the control line is broken). In general, the control connection should be at least 8 pipe diameters from the regulator and in as straight a run of pipe as possible. The connection itself must be smooth on the inside of the pipe. Pitch the control line away from the regulator and avoid moisture pockets. Keep inside of control line clean. Never install any type of automatic shut-off device, which closes completely, between the regulator outlet and the control line connection.

#### 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 line are used, it is the user's responsibility to assure that each service regulator is individually vented and that common vent lines are not used.*

6. Adjust outlet pressure (set point) by removing cap (1) or (1e) and turning adjustment spring button (3). On 243-8 HP remove cap (1a), loosen locknut and turn adjustment screw (1b). Turn clockwise to increase and counter-clockwise to decrease outlet pressure. Only adjust when gas is flowing through regulator. When adjustment is completed, seal cap (1) or (1e) must be securely screwed into place. The absence of this seal cap can result in unstable operation.

## Installation and Start Up (Continued)

7. On regulators with Internal Relief Valve, there is no adjustment for the internal relief. It is fixed, with relief beginning at approximately 9" w.c. to 20" w.c., above regulator set point, depending on relief spring (11k) used.

Internal Relief Valves must be carefully sized. For information, contact your Sensus Representative.

6. Regulators installed indoors must be vented outside. Run vent pipe from regulator vent connection to safe place outside. Vent piping should be as short and direct as possible.

Vent piping for regulators with internal relief valve (Models 243-12-2 or 243-8-2) must be large enough to vent all relief valve discharge to atmosphere without excessive back pressure and resulting excessive pressure in regulator.

Vent pipe outlet must be protected against nest building animals, bees, insects, etc., and positioned to protect against flooding, drain water, ice formation, etc. but must allow free and unobstructed passage of air or gas.

### 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.

## Servicing

1. Make sure the regulator is entirely depressured before disassembling.

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

3. For access to valve (21) and orifice (24) loosen union bolts (16) and remove diaphragm case assembly from body.

To remove valve (21), first remove hair pin cotter (20b).

Orifice (24) unscrews from body. Use 1-5/8" hex socket "thinwall" type. When replacing orifice use moderate amount of pipe dope on orifice threads.

4. Before reassembling and tightening union bolts (16), make certain Tetraseal (17) is in position.

5. To replace diaphragm; remove spring (4), remove flange bolts (8) and nuts (9), and disassemble diaphragm assembly. Remove old diaphragm (11a) from diaphragm pan (11b). Remove old adhesive from the diaphragm pan using a solvent such as methyl ethyl ketone (MEK).

To reassemble, apply a thin, even layer of a rubber based adhesive such as 3M Industrial Adhesive #EC-847 to the cleaned, prepared side of the diaphragm pan.

Attach the diaphragm to the adhesive side of the diaphragm pan, being careful to align the center hole of the diaphragm with the corresponding center hole in the diaphragm pan. Make certain all parts are reassembled in their correct order and bolts (8) are tightened to a torque of 150 in-lbs. Bolts must be tight enough to prevent leakage but not too tight that the diaphragm material is crushed or damaged. Diaphragm must not be twisted or pinched.

6. Upon completion of servicing, make certain that 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.

## Condensed Parts List

The following are the parts generally required in maintenance and servicing. For a listing of all parts refer to Parts List RP-1306

ILL. No.	Description	Part Number
1	Cover Cap (IRV)	143-16-005-00
1e	Cover Cap (STD)	143-16-005-08
1d	Tetraseal 1 1/2 x 1 3/8"	906534
2	O-Ring #2-140	951357
2a	O-Ring #2-142	951376
3	Adjustment Spring Button	143-16-009-00
4	Spring (See Table, 1st page)	
5	243-12 Cover Assembly IRV (includes vent valve and spring)	143-16-503-03
	243-12 Cover Assembly STD (includes vent valve and spring)	143-16-503-19
	243-8 Cover Assembly (includes vent valve and spring)	143-82-503-04
8	Flange Bolt, 3/8" x 1" Hex Hd	910030
9	Flange Nut, 3/8" - 18 Hex S.F.	921002
10	243-12 Lower Case	143-16-002-00
	243-12 Lower Case (tapped for external control line)	143-16-002-01
	243-08 Lower Case	143-82-002-00
	243-08 Lower Case (tapped for external control line)	143-82-002-01
11a	243-12 Diaphragm	143-16-150-00
	243-8 Diaphragm	143-82-150-00
	243-8 HP Diaphragm	121-10-150-50
11b	243-12 Diaphragm Pan	143-16-017-00
	243-8 Diaphragm Pan	143-82-017-00
	243-8 HP Diaphragm Pan	121-10-017-50
11d	Seal Washer	143-16-115-00
11e	Emery Cloth Washer (faces against top side of 243-8 HP diaphragm)	143-82-178-00
11f	Spring guide	143-16-018-00
	Spring guide (243-8 HP)	121-10-022-53
11k	Internal Relief Valve Spring, for 243-8-2 only.	143-82-021-03
	(relief begins at approx. 9" w.c. above regulator set point)	
11k	Internal Relief Valve Spring (relief begins at approx. 9" w.c. for 243-12-2, and approx. 20" w.c. for 243-8-2 above regulator set point)	143-16-021-02
11s	243-8 HP Diaphragm Plate	121-10-022-52
13	243-12 Coupling-Lever-Stem Assembly	143-16-530-00
	243-8 Coupling-Lever-Stem Assembly	143-82-530-00
	243-8 (HP) Coupling-Lever-Stem Assembly	143-82-530-02
16	Union Bolts, 3/8" x 1 1/4" Hex	910056
17	Tetraseal (or O-Ring) 2 1/4 x 2 1/2"	904075
18	243-8 Throat Block with O-Ring Seal	143-16-508-00
	243-12 Throat Block with O-Ring Seal	143-16-508-04
20b	Hair Pin Cotter	143-62-118-00
21	Valve Assembly - 10°- Buna N	143-16-511-09
	Valve Assembly - 10°- Viton	143-16-511-11
	Valve Assembly - 30°- Buna N	143-16-511-10
	Valve Assembly - 30°- Viton	143-16-511-12
24	1 1/4" Orifice, Brass	143-16-023-03
	1" Orifice, Brass	143-16-023-02
	3/4" Orifice, Brass	143-16-023-01
	1/2" Orifice, Brass	143-16-023-00
	3/8" Orifice, Brass	143-16-023-04
	1/4" Orifice, Brass	143-16-023-10
	.207" Orifice, Brass	143-16-023-11
25	Travel Stop Stem	143-16-060-02
26	Warning Tag-Travel Stop	143-16-136-05
27	Warning Tag-Body Interchangeability	143-16-136-06
28	Clamping Plate	143-16-102-01

Denotes recommended spare parts

## Model 243 Regulator Illustrations

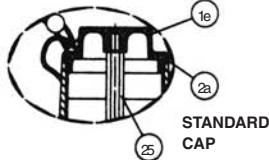
### 243-12-2

I.R.V. Regulator  
- as shown -

### 243-12-1

Same as I.R.V. Regulator except no Internal Relief Valve and Standard Cover Cap as shown in inset.

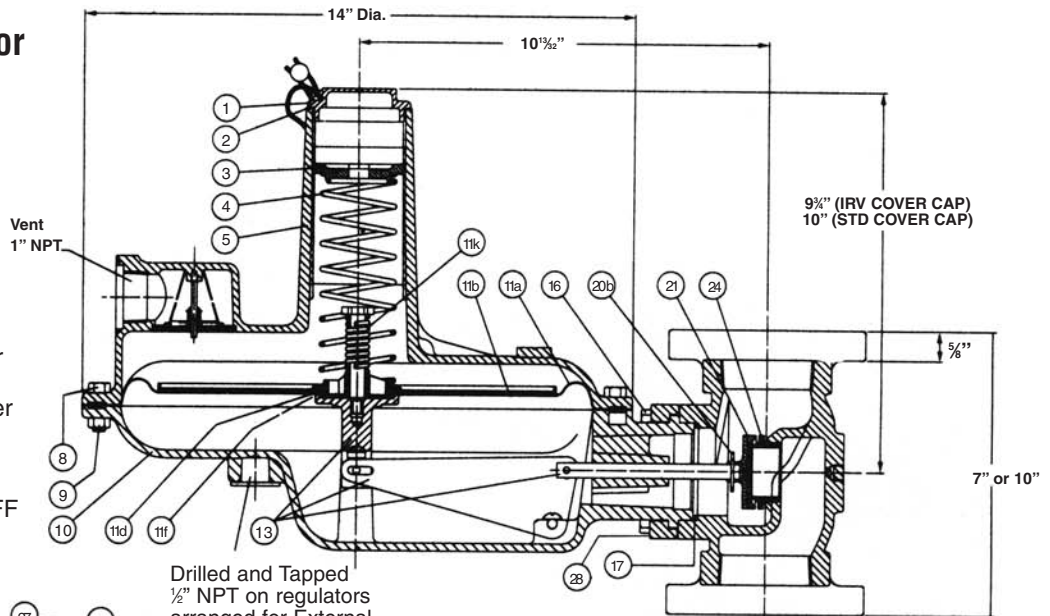
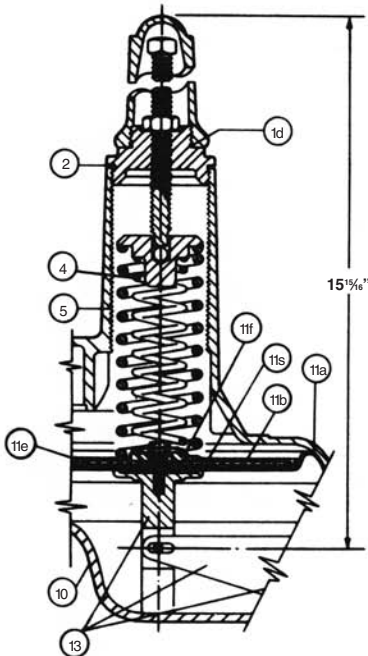
PIPE SIZES  
2" Flanged ANSI 125 lb FF  
1 1/2" and 2" Screwed



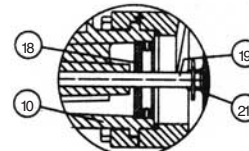
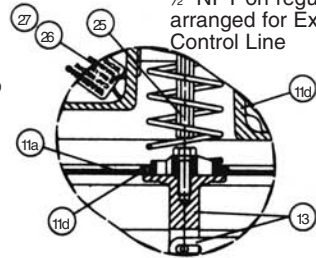
### 243-8 HP

Remainder of regulator  
same as 243-8-1

PIPE SIZES  
2" Flanged ANSI 125 lb FF  
1 1/4", 1 1/2" and 2" screwed



Drilled and Tapped  
1/2" NPT on regulators  
arranged for External  
Control Line



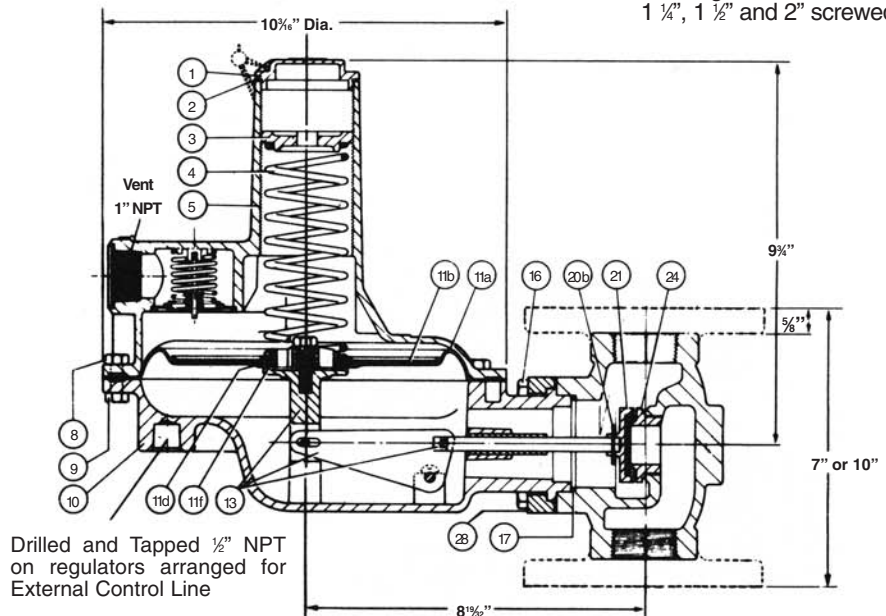
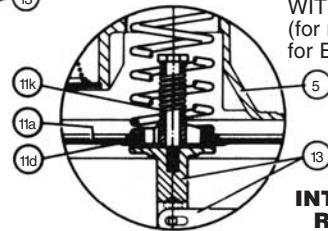
### 243-8-1

Standard Regulator  
- as shown -

### 243-8-2

Same as Standard  
Regulator except  
Internal Relief Valve as  
shown in inset.

PIPE SIZES  
2" Flanged ANSI 125 lb FF  
1 1/4", 1 1/2" and 2" screwed



Drilled and Tapped 1/2" NPT  
on regulators arranged for  
External Control Line

## Maximum Emergency Pressures

The maximum pressure the regulator inlet may be subjected to under abnormal conditions without causing damage to the regulator is the maximum inlet pressure (from the table below) plus 50 psi.

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

243-12-1.....	set-point+3 psi
243-12-2, 243-8-1 and 243-8-2.....	set-point+5 psi
243-8HP.....	set-point+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 case is:

243-12-1 and 243-12-2.....	15 psi
243-8-1 and 243-8-2.....	45 psi
243-8HP.....	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.

**Note: The use of an internal or external relief valve is recommended for installations subjected to no flow for extended periods of time such as pilotless ignition systems. A travel stop stem is located in the 243-12-1 and 243-12-4 to provide over pressurization protection to internal components during overpressurization.**

## Spring Ranges

SPRING COLOR	OUTLET PRESSURE RANGE		PART NUMBER
	243-12	243-8	
Red	3 1/2" to 6 1/2" w.c.	***	143-16-021-03
Red-Black	***	3 1/2" to 6 1/2" w.c.	143-82-021-00
Blue	5" to 8 1/2" w.c.	***	143-16-021-04
Blue-Black	***	5" to 8 1/2" w.c.	143-82-021-01
Green-Black	***	6" to 14" w.c.	143-82-021-02
Green	6" to 14" w.c.	12" to 28" w.c.	143-16-021-05
Orange-Black	10" to 18" w.c.	***	143-16-021-11
Orange	12" to 28" w.c.	1 to 2 psi	143-16-021-06
Black	1 to 2 psi	2 to 4 1/4 psi	143-16-021-07
Cadmium	1 1/2 to 3 psi	3 to 5 psi*	143-16-021-08
Cadmium	1 1/2 to 3 psi	3 to 6 1/2 psi*	143-16-021-08
Cadmium	***	***	143-16-021-08
White †	*** } *** }	6 to 10 psi*	143-16-021-13

† White is nested inside Cadmium

\*243-8 HP only  
\*243-8-2 (IRV) only

## Monitoring

The Model 243 Regulators make excellent monitors. They can act as standby regulators 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 243 Regulator is used to monitor a regulator with an identical inner valve (another 243 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 up or downstream.

## Full Open Capacity

Use the following formulae for the full open capacity for 243 regulators.

$$1. Q = K\sqrt{P_o(P_1 - P_o)} \dots \dots \dots (\text{for } \frac{P_1}{P_o} \text{ less than } 1.894)$$

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

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<sub>1</sub> = absolute inlet pressure (psia)

P<sub>o</sub> = absolute outlet pressure (psia)

Orifice Size-in.	.207"	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"
K	90	132	292	520	1100	1800	2480

## Other Gases

243 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 capacities, multiply the table values on pages 8 thru 19 in Bulletin R-1306 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: CORRECTION FACTOR	$\sqrt{\frac{0.6}{\text{Specific Gravity of the Gas}}}$

While used primarily for natural gas services, Model 243 regulators perform equally well on LPG vapor, air, dry CO<sub>2</sub> nitrogen and other inert gas applications. Please contact your Sensus representative for special construction which may be available for certain corrosive gases.

**Note: The term standard refers to Non-IRV configurations.**



**CONDENSED CAPACITY TABLE IN SCFH OF NATURAL GAS (0.6 Specific Gravity-14.65 psia-60°F.)**

	INLET PRESSURE psi	ORIFICE SIZE and VALVE ANGLE	OUTLET PRESSURE SET POINT and SPRING					
			6" w.c. RED SPRING (1" w.c. droop)	7" w.c. BLUE SPRING (1" w.c. droop)	11" w.c. GREEN SPRING (2" w.c. droop)	18" w.c. ORANGE SPRING (3" w.c. droop)	1 psi BLACK SPRING (0.2 psi droop)	2 psi CADMIUM SPRING (0.6 psi droop)
<b>2" 243-12</b>	2	1 1/4"-30°	6,400	6,000	5,600	4,200	3,350	••••
	5	1 1/4"-30°	11,000	11,000	10,500	8,000	6,600	8,200
	15	1 1/4"-30°	14,000	14,000	14,000	13,500	13,000	15,500
	25	1"-30°	15,000	15,000	15,000	16,500	15,000	18,000
	40	3/4"-30°	20,000	20,000	20,000	20,000	20,000	20,000
	60	3/4"-10°	15,000	15,000	15,500	15,000	15,500	16,500
	100	1/2"-10°	13,000	13,000	14,000	14,000	14,000	16,000
125	3/8"-10°	12,000	12,000	12,000	12,000	12,000	12,000	
<b>1 1/2" 243-12</b>	2	1 1/4"-30°	4,000	3,800	4,000	3,000	2,800	••••
	5	1 1/4"-30°	6,100	5,700	6,000	5,600	5,500	6,000
	15	1 1/4"-30°	9,300	9,300	10,000	10,000	10,000	13,000
	25	1"-30°	11,000	11,000	11,500	11,500	11,000	14,500
	60	3/4"-10°	12,000	10,500	12,500	12,500	12,500	15,000
	100	1/2"-10°	12,000	12,000	12,500	13,000	13,000	16,000
	125	3/8"-10°	11,000	11,000	11,000	11,000	11,000	12,000
<b>1 1/2" and 2" 243-12 with External Control Line</b>	5	1"-10°	8,200	6,500	7,200	5,500	5,400	6,800
	5	1 1/4"-10°*	10,500	7,800	8,500	6,500	7,000	8,600
	10	1"-10°	12,000	10,000	11,000	8,000	8,500	10,500
	10	1 1/4"-10°*	15,000	13,000	13,500	11,000	10,500	13,000
	25	1"-10°	20,000	17,000	17,000	15,000	14,500	20,000
	25	1 1/4"-10°*	22,000	20,000	20,000	18,000	18,000	25,000
	40	1"-10°	24,000	21,000	24,000	21,000	20,000	25,000
	80	3/4"-10°	30,000	21,000	27,000	22,000	22,000	25,000
	100	1/2"-10°	19,000	19,000	19,000	19,000	19,000	19,000
	125	3/8"-10°	15,000	15,000	15,000	15,000	15,000	15,000

2" size only.

	INLET PRESSURE psi	ORIFICE SIZE AND VALVE ANGLE	OUTLET PRESSURE SET POINT and SPRING						
			6" w.c. RED-BLACK SPRING (1" w.c. droop)	7" w.c. BLUE-BLACK SPRING (1" w.c. droop)	18" w.c. GREEN SPRING (3" w.c. droop)	1 psi ORANGE SPRING (0.2 psi droop)	3 psi BLACK SPRING (0.6 psi droop)	5 psi* CADMIUM SPRING (1 psi droop)	10 psi* CADMIUM and WHITE SPRING (2 psi droop)
<b>1 1/2" 243-8</b>	2	1"-30°	3,200	2,700	2,100	2,100	••••	••••	••••
	10	1"-30°	7,400	7,000	6,600	6,500	7,100	6,000	••••
	25	1"-30°	12,500	12,500	11,500	11,000	12,500	12,000	12,000
	40	3/4"-10°	10,500	10,500	11,000	11,000	13,000	12,000	15,000
	80	1/2"-10°	11,500	11,500	12,000	11,500	13,500	11,000	17,000
	100	3/8"-10°	11,000	11,000	11,000	11,000	12,000	11,000	15,000
	125	1/4"-10°	8,000	8,000	8,000	8,000	8,000	8,000	9,000
<b>1 1/4" 243-8</b>	2	3/4"-10°	2,250	1,700	1,900	1,850	••••	••••	••••
	10	3/4"-10°	3,100	2,900	2,950	2,700	3,600	3,300	••••
	25	3/4"-10°	4,200	4,200	4,400	4,150	5,000	4,400	9,000
	40	3/4"-10°	4,200	4,800	5,300	5,300	6,300	5,800	12,000
	80	1/2"-10°	5,600	5,600	4,850	4,650	5,500	4,500	13,000
	100	3/8"-10°	6,000	6,000	6,000	6,000	6,550	6,000	13,000
125	1/4"-10°	6,000	6,000	8,000	8,000	8,000	8,000	8,800	
<b>2" 243-8</b>	5	1"-30°			5,500	4,000	4,400	••••	••••
	10	1"-30°			9,400	7,000	7,600	6,000	••••
	25	1"-30°			14,500	14,500	15,000	13,000	15,500
	40	3/4"-30°			20,000	17,500	17,500	12,000	22,000
	80	1/2"-10°			14,000	13,500	15,000	11,500	18,500
	100	3/8"-10°			12,000	11,000	12,000	11,000	16,000
125	1/4"-10°			8,000	8,000	8,000	8,000	9,000	

Refer to Bulletin R-1306 for detailed capacity tables and curves.

\*243-8HP only.

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Representatives in all principal cities.  
Distributors throughout the world.



805 Liberty Boulevard  
DuBois, PA 15801



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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 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.