



# Model 243 Regulator

## Installation & Maintenance Manual



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## Regulator 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, unit heaters, furnaces, ovens, and other applications.

Use it for natural gas, air dry carbon dioxide (CO<sub>2</sub>), liquid propane gas (LPG), butane, nitrogen (N<sub>2</sub>), and others. Special materials are available for certain corrosive gases.

In addition to the standard models and internal relief valve (IRV) models covered in this bulletin, the 243 is also available with low-pressure cut off (LPCO), with built-in monitor, and as a pilot operated regulator (RPC) (outlet pressures up to 35 psi), back-pressure valve, relief valve, vacuum regulator and vacuum breaker. For information, please contact your Utility Solutions Group Representative or Authorized Distributor. The 243 is manufactured in conformance with Code B31.8.

**NOTE:** The term "standard" refers to non-IRV configurations.

## Model Specifications

### 243-12 and 243-12-2

Maximum Inlet Pressure .....	125 psi
Outlet Pressures .....	3 1/2" w.c. to 3 psi
Pipe Sizes .....	1 1/4", 1 1/2", and 2"
Diaphragm .....	12" (nominal diameter)

### 243-8-1 and 243-8-2

Maximum Inlet Pressure .....	125 psi
Outlet Pressures .....	3 1/2" w.c. to 4 1/4 psi
Pipe Sizes .....	1 1/4", 1 1/2", and 2"
Diaphragm .....	8" (nominal diameter)

### 243-8HP

Maximum Inlet Pressure .....	125 psi
Outlet Pressures .....	3 to 10 psi
Pipe Sizes .....	1 1/4", 1 1/2", and 2"
Diaphragm .....	8" (nominal diameter)

## Maximum Inlet Pressure

243-12	Orifice Size	Valve Angle	243-8
15 psi	1 1/4"	30°	–
25 psi*	1 1/4"	10°	–
25 psi	1"	30°	25 psi
40 psi*	1"	10°	25 psi
40 psi	3/4"	30°	40 psi
60 psi †	3/4"	10°	40 psi
100 psi	1/2"	10°	80 psi
125 psi	3/8"	10°	100 psi
125 psi	1/4"	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.

## Installation and Start-Up

(See illustration on Page 5)

1. Ensure the regulator and piping are free of dirt, moisture, foreign matter and other debris. Check nameplate data to ensure the regulator conforms with what was ordered.
2. Ensure all shipping screens or covers are removed and the regulator is installed with flow in the correct direction.

**NOTE:** The regulator may be installed in any position; right side up, upside down, vertical pipe, horizontal pipe, diagonal pipe, etc.

3. By loosening union bolts (16), the diaphragm case assembly may be rotated to various positions in relation to the body. Make certain union bolts (16) are 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 material, bees, insects, etc to minimize the chances for foreign material 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. Apply pipe dope threaded connections, male threads only.
5. On regulators that are arranged for an external control line, run pipe or tubing from a 1/2-inch national pipe thread (NPT) connection in the lower case to the control connection in the outlet piping. This control piping should not be less than 1/2-inch in size and should be adequately protected against breakage (regulators open fully if the control line is broken).

**NOTE:** The control connection should be at least 8 pipe diameters from the regulator and in as straight a run of pipe as possible. To avoid excessive turbulence, 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 the inside of the control line clean. Never install any type of automatic shutoff device, which closes completely, between the regulator outlet and the control line connection.



### 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.**

6. Adjust outlet pressure (set-point) by removing cap (1) or (1e) and turning adjustment spring button (3).

On the 243-8HP, remove cap (1a), loosen lock nut and turn adjustment screw (1b). Turn clockwise to increase and counter-clockwise to decrease outlet pressure. Only adjust when gas is flowing through the regulator. When adjustment is completed, seal cap (1) or (1e) must be securely threaded into place. The absence of this seal cap can result in unstable operation.

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

**NOTE:** Internal relief valves must be sized appropriately. For information, contact your Utility Solutions Group Representative.

8. Install vent piping ensuring regulator is vented to a safe location that is free of debris and obstructions.



## CAUTION

**Regulators installed indoors must be vented outside. Run vent pipe from the regulator vent connection to a safe place outside.**

**NOTE:** Vent piping should be as short and direct as possible. Vent piping for regulators with an IRV (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 the regulator.



## Warning

**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 material, bees, insects, etc. To minimize the chances for foreign material from collecting in the vent side of the regulator diaphragm.**



## 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.**

## Temperature Limits

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

## Buried Service

The Model 243 Regulator is not recommended for buried (underground) service.

## Servicing

1. Ensure the regulator is entirely depressurized before disassembling.
2. Make note of the location and position of all disassembled parts to ensure correct reassembly. Inspect each part and replace those that are worn, damaged, or otherwise unsatisfactory.
3. For access to valve (21) and orifice (24) loosen union bolts (16) and remove the diaphragm case assembly from the body. To remove valve (21), first remove hair pin cotter (20b). Orifice (24) unscrews from the body.

**NOTE:** Use 1 ½-inch hex socket "thin wall" type. When replacing the orifice, use a moderate amount of pipe dope on orifice threads.

4. Before reassembling and tighten union bolts (16), ensuring 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).

**NOTE:** Remove old adhesive from the diaphragm pan using a solvent such as methyl ethyl ketone (MEK). Before reassembly, 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.

6. 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.
7. Ensure all parts are reassembled in their correct order and bolts (8) are tightened to 150 in-lbs of torque.

**NOTE:** Bolts must be tight enough to prevent leakage but not too tight that the diaphragm material is crushed or damaged. The diaphragm must not be twisted or pinched.

8. Upon completion of servicing, ensure the regulator is entirely free of leaks.



## CAUTION

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

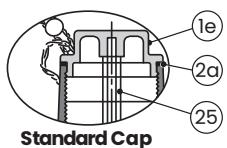
## Model 243 Regulator Dimensions and Features

### 243-12-2

IRV Regulator (as shown)

### 243-12-1

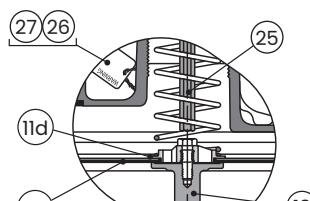
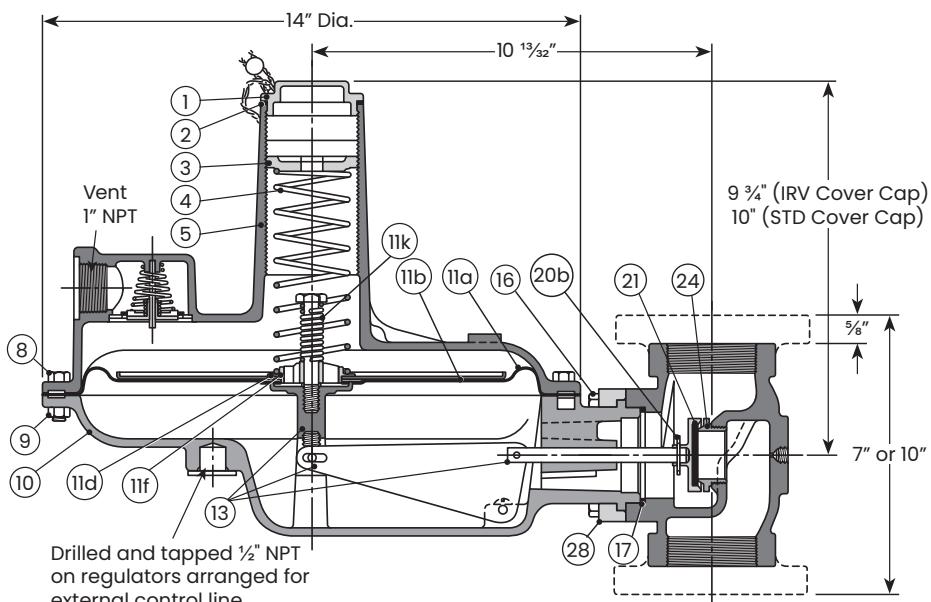
Same as IRV regulator except no internal relief valve and standard cover cap (illustration below)



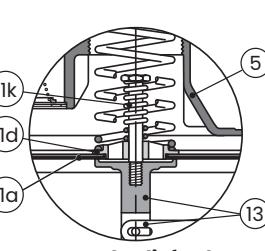
### Pipe Sizes

2-inch flanged ANSI 125 lb FF

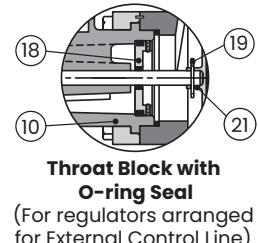
1 1/2-inch and 2-inch NPT



Standard Diaphragm Assembly



Internal Relief Valve



Throat Block with O-ring Seal  
(For regulators arranged for External Control Line)

### 243-8 HP

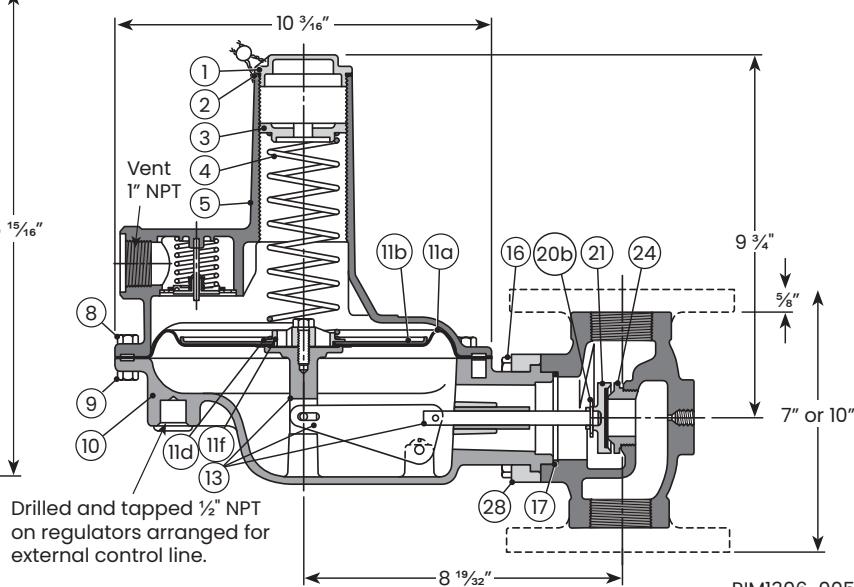
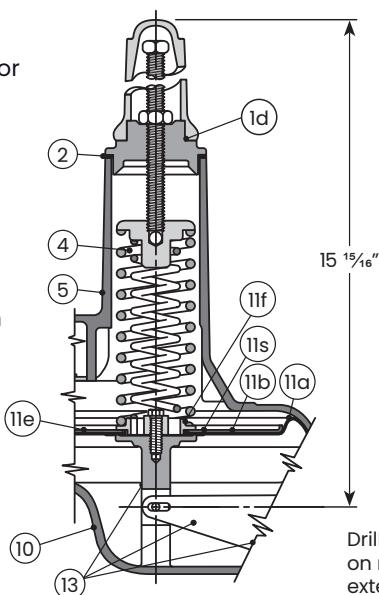
Remainder of regulator same as 243-8-1.

### 243-8-1

Standard regulator (as shown below)

### 243-8-2

Same as Standard Regulator except with Internal Relief Valve



RIM1306-005

### Pipe Sizes

2-inch flanged ANSI 125 lb FF

1 1/4-inch, 1 1/2-inch, and 2-inch NPT

## Model 243 Condensed Parts List

The Following are parts generally required in maintaining and servicing Model 243 Regulators. For a complete parts list, refer to parts list PL-G-REG-1306.

Illustration Number	Descriptions	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 5/8"	906534
2	O-Ring #2-140	951357
2a	O-Ring #2-142	951376
3	Adjustment Spring Button	143-16-009-00
4	Spring, Color-Coded (See "Spring Ranges" Table)	-
	243-12 Cover Assembly IRV (Includes Vent, Valve, and Spring)	143-16-503-03
5	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, 5/16" x 1" Hex Hd.	910030
9	Flange Nut, 5/16" - 18 Hex S.F.	921002
	243-12 Lower Case	143-16-002-00
10	243-12 Lower Case (Tapped for External Control Line)	143-16-002-01
	243-8 Lower Case	143-82-002-00
	243-8 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
	243-8HP Diaphragm	121-10-150-50
	243-12 Diaphragm Pan	143-16-017-00
11b	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	Emory Cloth Washer (For 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, (243-8-2 Only)**	143-82-021-03
11k	Internal Relief Valve Spring, (243-12-2 and 243-8-2)**	143-16-021-02
11s	243-8 HP Diaphragm Plate	121-10-022-52
	243-12 Coupling-Lever-Stem Assembly	143-16-530-00
13*	243-8 Coupling-Lever-Stem Assembly	143-82-530-02
	243-8 HP Coupling-Lever-Stem Assembly	143-82-530-02
16	Union Bolts, 3/16" x 1 1/4" Hex	910056
17*	Tetraseal (or O-ring) 2 1/4" x 2 1/2"	904075

Illustration Number	Descriptions	Part Number
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 Cotter Pin	143-62-118-00
	Valve-Assembly - 10°, Buna-N	143-16-511-09
21*	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
	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
	5/8" 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.

\*\* Internal Relief Valve Spring provides relief at approximately 9" w.c.

## Spring Ranges

Spring Color	Outlet Pressure Range		Spring 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	—	6 to 10 psi*	143-16-021-08
White †	—	6 to 10 psi*	143-16-021-13

\* Model 243-8 HP only

§ Model 243-8-2 (IRV) only

† White is nested inside Cadmium

See sales brochure USG-SB-004 for 243-8-6 and 243-12-6 spring ranges.

## Maximum Emergency Pressure

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

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

243-12-1	set-point + 3 psi
243-12-2, 243-8-1, and 243-8-2	set-point + 5 psi
243-8 HP	set-point + 5 psi

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

The maximum pressures that can be safely contained by the diaphragm case are:

243-12-1 and 243-12-2	15 psi
243-8-1 and 243-8-2	15 psi
243-8 HP	25 psi



### CAUTION

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

**NOTE:** "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 pilot-less ignition systems. A travel stop stem is located in the 243-12-1 to provide over-pressurization protection to internal components during

## Monitoring

Model 243 Regulators make excellent monitors. They can act as standby regulators installed in series and assume 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 Model 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 upstream or downstream.

## Full Open Capacity

Use the following formula for the full open capacity of 243 regulators:

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

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

Q = Full open capacity in SCFH of 0.6 specific gravity natural gas

K = the "K" factor, the regulator constant (see table below)

P<sub>i</sub> = absolute inlet pressure (psi)

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

Orifice Size	0.207"	1/4"	5/8"	1/2"	3/4"	1"	1 1/4"
K	90	132	292	520	1,100	1,800	2,480

## Other Gases

243 regulators are mainly used on natural gas. However, they perform equally as well on liquid propane gas (LPG), nitrogen gas (N<sub>2</sub>), dry carbon dioxide (CO<sub>2</sub>), air and others.

For capacities, multiply the table values on Pages 6 through 22 of sales brochure USG-SB-003 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 non-corrosive gases, use the following formula:

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

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

**NOTE:** The term "standard" refers to non-IRV configurations.

## Condensed Capacity Table

Measurements in SCFH of Natural Gas (0.6 Specific Gravity - 14.65 psi - 60°F)

Model	Inlet Pressure psi	Orifice Size and Valve Angle	Outlet Pressure Set-Point					
			6" w.c.	7" w.c.	11" w.c.	18" w.c.	1 psi	2 psi
			Spring Color					
2" 243-12	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	5/8" - 10°	12,000	12,000	12,000	12,000	12,000	12,000
1 1/2" 243-12	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	5/8" - 10°	11,000	11,000	11,000	11,000	11,000	12,000
	5	1" - 10°	8,200	6,500	7,200	5,500	5,400	6,800
1 1/2" and 2" 243-12 with External Control Line	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	5/8" - 10°	15,000	15,000	15,000	15,000	15,000	15,000

\* 2" size only

**NOTE:** Refer to sales brochure USG-SB-003 for detailed capacity tables and curves.

## Condensed Capacity Table

Measurements in SCFH of Natural Gas (0.6 Specific Gravity - 14.65 psi - 60°F)

Model	Inlet Pressure psi	Orifice Size and Valve Angle	Outlet Pressure Set-Point						
			6" w.c.	7" w.c.	11" w.c.	18" w.c.	1 psi	5 psi*	10 psi*
			Spring Color						
			Red (1" w.c. droop)	Blue (1" w.c. droop)	Green (2" w.c. droop)	Orange (3" w.c. droop)	Black (0.2 psi droop)	Cadmium (1 psi droop)	Cadmium White (0.6 psi droop)
1 1/4" 243-8	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
1 1/2" 243-8	125	1/4"-10°	6,000	6,000	8,000	8,000	8,000	8,000	8,800
	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
2" 243-8	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
	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	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

\* 243-8 HP only

**NOTE:** Refer to sales brochure USG-SB-003 for detailed capacity tables and curves.



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