Model 441-S Regulator Brochure

UTILITY SOLUTIONS GROUP

Introduction

Who We Are

Utility Solutions Group is a manufacturer of natural gas regulators and relief valves based in Columbus, OH. All products are made in the USA and compliant with the requirements of the Build America, Buy America Act. Utility Solutions Group's Quality Management System is certified to ISO 9001 by Smithers Quality Assessments.

441-S Regulator

The Model 441-S is a balanced valve, spring type gas pressure regulator. It is a general-purpose unit that is manufactured in 2", 3", and 4" pipe sizes, and an assortment of inner valve sizes. It is extensively used and has proven itself in many different kinds of distribution and industrial applications.

Simple, basic design has been combined with sturdy construction to make it exceptionally dependable. It also includes unique features which make it easy to adjust and to service.

Large, flexible diaphragms combined with accurately calibrated springs enable this regulator to produce precise pressure control while maintaining a high level of sensitivity and stability. The various diaphragm and spring combinations are given below. The use of a large selection of springs with restricted adjustment ranges is one of the reasons for its outstanding performance.

The Model 441-S is a regulator which responds quickly. It is fast, and this, plus its dependability and accuracy, make it an excellent choice for monitoring as well as other applications where speed is significant.

Model 441-S regulators are designed for top performance on any of a wide variety of gases. It is used most extensively for natural gas. However, it is equally effective on air, liquid propane gas (LPG), propane-air mixtures, nitrogen, dry carbon dioxide (CO_2) and others.

Maximum Inlet Pressures (All Models)

Regulator Body Type	441-S Body Material	Maximum Working Body Pressure	Maximum Inlet Pressure
Threaded	Cast Iron	250 psi	100 psi
Flanged ANSI 125 lb. FF	Cast Iron	175 psi	
Flanged ANSI 250 lb. RF	Ductile Iron	575 psi	
Flanged ANSI 300 lb. RF	Cast Steel	720 psi	

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

(For various soft-seated valve materials)

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

Valve Material	Maximum Pressure Differential	Maximum Inlet Pressure
Buna-N (Black, 50 to 55 duro)	250 psi	575 psi
Polyurethane (Red, 65 to 75 duro)	400 psi	720 psi
Polyurethane (Tan, 85 to 95 duro)	600 psi	1,200 psi

NOTE: The maximum temperature for the above materials are 150°F. Viton, if used, has a maximum temperature rating of 300°F and a maximum pressure differential of 250 psi.

Spring Ranges

Spring Color	Diaphragm Size -Nominal I.D. (O.D. in parenthesis, measurement "G" on Page 6)					
	20" (23 ⅛")	18" (20 ⅝")	16" (18 ⅝")	14" (16 ⅜")	12" (14 ¾")	10" (13 ⅛")
Aluminum	4 ¼" to 6" w.c.	4 ¼" to 4 ¾" w.c.	5 ¼" to 7" w.c.	7" to 10 ½" w.c.	8 ½" to 13" w.c.	-
Green	4 ¾" to 7" w.c.	4 ¾" to 6 ½" w.c.	7" to 10 ½" w.c.	8 ½" to 12" w.c.	10 ½" to 17" w.c.	-
Yellow	5 ¼" to 8 ½" w.c.	6" to 10 ½" w.c.	8 ½" to 15 ½" w.c.	10 ½" to 17" w.c.	12" to 23" w.c.	-
Gray	8 ¼" to 13" w.c.	10 ½" to 17" w.c.	14" w.c. to 1 psi	17" w.c. to 1 ¼ psi	21" w.c. to 1 ½ psi	1 ¼ to 2 psi
Blue	9 ½" to 20" w.c.	16 ½" to 21" w.c.	21" w.c. to 1 ¾ psi	21" w.c. to 2 psi	1 ¼ to 2 ½ psi	1 ½ to 3 ¼ psi
Red	-	-	-	1 ½ to 3 ¾ psi	1 ¾ to 4 psi	2 ½ to 6 psi
			Compatible Diaphragm Sizes for 2" Model 441-S			
		Compatible Diaphragm Sizes for 3" Model 441-S				
	Compatible Diaphragm Sizes for 4" Model 441-S					

NOTE: Springs are colored for identification. When shipped, the regulator is equipped with the lightest spring suitable for the maximum outlet pressure specified on order. If outlet pressure conditions change, replace spring accordingly to table below for best operation. For best performance use the largest diaphragm for the spring and pipe size selected.

For pressures below 4" w.c. install the Model 441-S upside down.

Construction Features

Simple Design- Dependable regulation, trouble free operation, and fast response.

Standard Face to Face Dimensions

Standardized 441 Bodies and Inner Valve Assemblies- Easy maintenance, parts are interchangeable with other 441 models.

Simplified Valve Adjustment- Accurate, easy to adjust for tight lock-up.

Molded Soft Seats- Positive tight shut-off, will not blow out.

Sensitive Diaphragms- Large areas give accurate regulation.

O-Ring Stem Seal- With removable anti-friction bushing.

Bushing Guided Inner Valve- Accurate stem alignment and valve seating.

Side Inspection Plates- Both sides of body-quickly removable.

O-Ring Body Seals- Eliminates gaskets on upper and lower body openings, and side inspection plates.

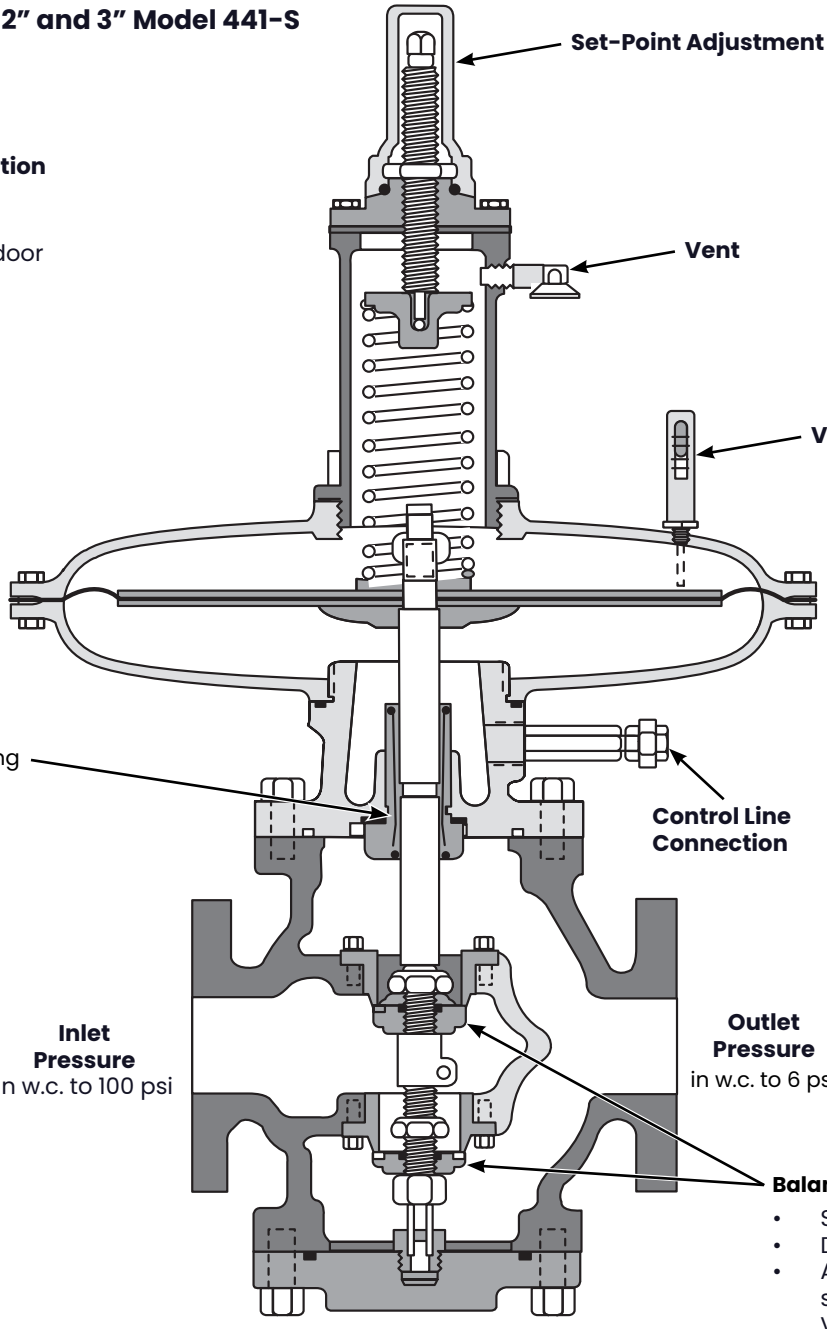
Self-Aligning Spring Adjustment- Color-coded springs.

Flanged Removable Seats (Orifices)- Easily changed without special tools.

V-Port Orifice Restrictors- Allows regulator to maintain outlet pressure performance at lower flow rates.

NOTE: Increases turn down to 40:1.

2" and 3" Model 441-S



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

O-Ring Stem Seal
- With removable anti-friction bushing

Balanced Valve
- Soft Seats
- Double-Seat
- Available reduced size valves and V-Port Valves

Capacity Table

Measurements in 1,000 SCFH of Natural Gas (0.6 Specific Gravity - 14.65 psi - 60°F)

Inlet Pressure (psi)	Outlet Pressure (psi)	2" Model		3" Model			4" Model		
		1 ¾" Valve	1 ½" Reduced valve	2 ⅛" Valve	1 ¾" Reduced valve	1 ½" Reduced valve	3" Valve	2 ⅛" Reduced valve	1 ¾" Reduced valve
7" w.c.	4" w.c.	6.8	5.3	11.1	8.2	5.3	22.1	11.1	6.7
14" w.c.	4" w.c.	12.3	9.7	20.1	15.0	9.7	40.2	20.1	12.3
	7" w.c.	10.3	8.1	16.8	12.6	8.1	33.7	16.8	10.3
1	4" w.c.	19.0	14.9	31.0	23.2	14.9	62.1	31.0	18.9
	7" w.c.	17.9	14.1	29.3	21.8	14.1	58.5	29.3	17.8
	14" w.c.	14.8	11.6	24.2	18.1	11.6	48.4	24.2	14.8
2	4" w.c.	28.3	22.2	46.1	34.4	22.2	92.2	46.1	28.1
	7" w.c.	27.2	21.3	44.4	33.1	21.3	88.7	44.4	27.1
	14" w.c.	25.6	20.0	41.7	31.1	20.0	83.3	41.7	25.4
	1 psi	21.2	16.6	34.6	25.8	16.6	69.1	34.6	21.1
3	4" w.c.	34.8	27.3	56.8	42.4	27.3	113	56.8	34.6
	0.25	34.3	26.9	55.9	41.7	26.9	111	55.9	34.1
	14" w.c.	33.2	26.0	54.1	40.4	26.0	108	54.1	33.0
	1	29.9	23.4	48.8	36.4	23.4	97.5	48.8	29.8
	2	21.8	17.0	35.5	26.5	17.0	70.9	35.5	21.6
4	4" w.c.	40.8	32.0	66.6	49.7	32.0	133	66.6	40.6
	7" w.c.	40.3	31.6	65.7	49.0	31 .6	131	65.7	40.1
	14" w.c.	39.2	30.7	63.9	47.7	30.7	127	63.9	39.0
	1	37.0	29.0	60.3	45.0	29.0	120	60.3	36.8
	2	31.0	24.3	50.6	37.8	24.3	101	50.6	30.9
	3	22.9	17.9	37.3	27.8	17.9	74.5	37.3	22.7
5	4" w.c.	45.7	35.8	74.6	55.7	35.8	149	74.6	45.5
	7" w.c.	45.2	35.4	73.7	55.0	35.4	147	73.7	44.9
	14" w.c.	44.7	35.0	72.8	54.3	35.0	145	72.8	44.4
	1	42.5	33.3	69.2	51 .7	33.3	138	69.2	42.2
	2	38.1	29.9	62.1	46.4	29.9	124	62.1	37.9
	3	32.1	25.2	52.4	39.1	25.2	104	52.4	31 .9
	4	23.4	18.3	38.1	28.5	18.3	76.2	38.1	23.3
6	4" to 7" w.c.	49.6	38.8	80.8	60.3	38.8	161	80.8	49.3
	14" w.c.	49.0	38.4	79.9	59.6	38.4	159	79.9	48.7
	1	47.9	37.5	78.1	58.3	37.5	156	78.1	47.7
	2	44.1	34.5	71.9	53.7	34.5	143	71 .9	43.9
	3	39.2	30.7	63.9	47.7	30.7	127	63.9	39.0
	4	33.2	26.0	54.1	40.4	26.0	108	54.1	33.0
	5	23.9	18.7	39.0	29.1	18.7	78.0	39.0	23.8

Size each regulator on the basis of the minimum expected inlet pressure ranges and maximum expected outlet pressure. Outlet pressure ranges and diaphragm sizes are shown in the table "Spring Ranges" on Page 1.

NOTE: The performance data on this page is based on normal testing at 70°F flowing temperature. Changes in performamce can occur at extreme low-flowing temperatures.

Capacity Table (Continued)

Measurements in 1,000 SCFH of Natural Gas (0.6 Specific Gravity - 14.65 psi - 60°F)

Inlet Pressure (psi)	Outlet Pressure (psi)	2" Model		3" Model			4" Model		
		1 ¾" Valve	1 ½" Reduced valve	2 ⅛" Valve	1 ¾" Reduced valve	1 ½" Reduced valve	3" Valve	2 ⅛" Reduced valve	1 ¾" Reduced valve
8	4" to 7" w.c.	57.7	45.2	94.1	70.2	4.5.2	188	94.1	57.4
	14" w.c.	57.2	44.8	93.2	69.6	44.8	186	93.2	56.9
	1 psi	56.6	44.4	92.3	68.9	44.4	184	92.3	56.3
	2 psi	53.9	42.2	87.9	65.6	42.2	175	87.9	53.6
	3 psi	50.6	39.7	82.5	61.6	39.7	165	82.5	50.4
	4 psi	46.8	36.7	76.3	57.0	36.7	152	76.3	46.6
	5 psi	41.4	32.4	67.4	50.3	32.4	134	67.4	41.2
	6 psi	34.8	27.3	56.8	42.4	27.3	113	56.8	34.6
10	7" w.c.	64.8	50.8	105	78.9	50.8	211	105	64.5
	14" w.c.	64.3	50.3	104	78.2	50.3	209	104	63.9
	1	63.7	49.9	103	77.5	49.9	207	103	63.4
	2	62.6	49.1	102	76.2	49.1	204	102	62.3
	3	60.5	47.4	98.5	73.6	47.4	197	98.5	60.1
	4	57.2	44.8	93.2	69.6	44.8	186	93.2	56.9
	6	49.0	38.4	79.9	59.6	38.4	159	79.9	48.7
12	7" w.c.	71.4	55.9	11.6	86.8	55.9	232	116	71.0
	14" w.c.	70.8	55.5	115	86.2	55.5	230	115	70.4
	1	70.3	55.0	114	85.5	55.0	228	114	69.9
	2	69.7	54.6	113	84.8	54.6	227	113	69.3
	3	68.6	53.8	111	83.5	53.8	223	111	68.3
	4	66.5	52.1	108	80.8	52.1	216	108	66.1
	6	60.5	47.4	98.5	73.6	47.4	197	98.5	60.1
15	1 or less	80.1	62.7	130	97.4	62.7	260	130	79.6
	2	79.5	62.3	129	96.8	62.3	259	129	79.1
	3	79.0	61.9	128	96.1	61.9	257	128	78.6
	4	77.9	61.0	127	94.8	61.0	253	127	77.5
	6	74.1	58.0	120	90.1	58.0	241	120	73.7
20	4 or less	93.7	73.4	152	114	734	305	152	93.2
	6	92.6	72.6	151	112	72.6	301	151	92.1
25	6 or less	108	84.5	175	131	84.5	351	175	107
30		121	94.8	197	147	94.8	393	197	120
40		148	116	241	180	116	482	241	147
50		175	137	286	213	137	571	286	174
60		202	158	330	246	158	660	330	201
80		257	201	419	313	201	837	419	255
100		311	244	508	379	244	1,014	508	310
"K" Factors Standard Valves		5,450	4,270	8,880	6,630	4,270	17,740	8,880	5,420
"K" Factors V-Port Valves		5,260	4,160	8,440	6,390	4,160	13,850	8,440	5,260
For V-Port Valves, multiply table values by the following:		0.965	0.974	0.950	0.964	0.974	0.781	0.950	0.970

Size each regulator on the basis of the minimum expected inlet pressure ranges and maximum expected outlet pressure. Outlet pressure ranges and diaphragm sizes are shown in the table "Spring Ranges" on Page 1.

NOTE: The performance data on this page is based on normal testing at 70°F flowing temperature. Changes in performamce can occur at extreme low-flowing temperatures.

Overpressurization Protection

Methods of overpressuirzation protection include relief valves, monitor regulators, shutoff devices, or similar mechanisms. These protect the downstream piping system and the regulator's low-pressure chambers against overpressurization due to possible regulator malfunction or failure to achieve complete lockup. The allowable outlet pressure is the lowest of the maximum pressures permitted by federal codes, state codes, and other applicable standards.

CAUTION

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

Maximum Emergency Pressures

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

The maximum inlet pressure the Model 441-S Regulator may be subjected to under abnormal conditions without causing damage to the regulator is:

Maximum Inlet Pressure ..... 125 psi

The maximum outlet pressures the Model 441-S Regulator may be subjected to under abnormal conditions without causing damage to the regulator is are:

10" Diaphragm ..... Set-point + 4 psi
12" Diaphragm ..... Set-point + 3 psi
14" Diaphragm ..... Set-point + 2 psi
16" Diaphragm ..... Set-point + 1 psi
18" Diaphragm ..... Set-point + 1 psi
20" Diaphragm ..... Set-point + 1 psi

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

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

10" Diaphragm ..... 15 psi
12" Diaphragm ..... 10 psi
14" Diaphragm ..... 10 psi
16" Diaphragm ..... 5 psi
18" Diaphragm ..... 5 psi
20" Diaphragm ..... 5 psi

NOTE: Safely contained means no leakage as well as no bursting.

CAUTION

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.

Monitoring

The 441-S makes an excellent monitor; a standby regulator which provides over-pressure protection by assuming control if a failure in the operating regulator causes outlet pressure to exceed the set-point.

For service of this kind the 441-S does not require any changes or modifications. It is merely installed in series with the operating regulator and set for a somewhat higher outlet pressure.

It is fully connected into the system but remains open so it will not cause any obstruction or interfere with normal operation. At the same time, it is fully operable and ready to take control if an emergency event occurs.

The fast response of the 441-S means that it will take control quickly. Where necessary, its outstanding performance will provide excellent standby regulation.

The downstream control lines for both the operating regulator and monitor are connected into the system, downstream from both. However, for maximum protection, these control lines should be entirely separate from each other including their connections into the system.

The 441-S can be used to monitor another 441-S or other types of regulators. Because of its simplicity and dependability, it is often used for monitoring pilot operated regulators.

Where a 441-S is used to monitor a regulator of the same pipe size and having an identical inner valve, (another 441-S, a 441-VPC, etc.) the total maximum capacity through both can be figured at 70% of the capacity of one of them alone. This applies with the monitor located in either the upstream or downstream position.

Other Gases

The Model 441-S regulators are mainly used with natural gas. However, they perform equally as well with liquid propane gas (LPG), nitrogen, dry carbon dioxide (CO_2), air and others. When using with other gases, the regulator capacities must be adjusted using the following correction factors:

Type of Gas	Correction Factor
Air (Specific Gravity 1.0)	0.77
Propane (Specific Gravity 1.53)	0.63
1350 BTU Propane-Air Mix (Specific Gravity 1.20)	0.71
Nitrogen (Specific Gravity 0.97)	0.79
Dry Carbon Dioxide (Specific Gravity 1.52)	0.63

For other non-corrosive gases, use the following formula:

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

For use with gases not listed above, please contact your Utility Solutions Group representative or Authorized Distributor.

Temperature Limits

The Model 441-S Regulator can be used for flowing temperatures from -20°F to 150°F.

Buried Service

The Model 441-S Regulator is not recommended for buried service.

Relief Valves and Back Pressure Valves

Use Model 441-SR for applications which require a higher degree of accuracy and sensitivity than is possible with standard poppet type reliefs. Essentially, it is a regulator arranged to provide inlet pressure control.

The 461-SR is the same as the 441-S except that inner valve is reversed, the body is turned around, and the control line is arranged for connection to the inlet sign (upstream).

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

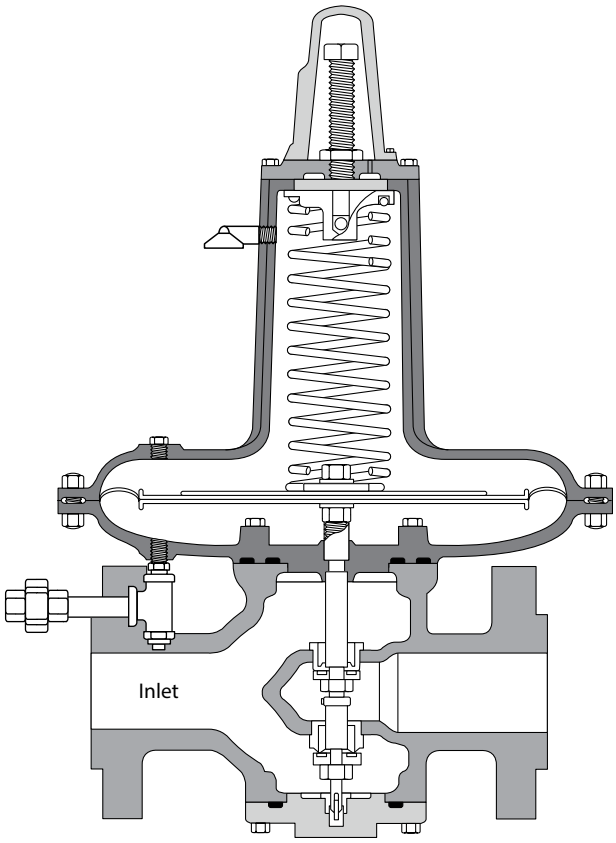
As a back pressure valve, it prevents gas from exiting a system until the system pressure reaches the set-point. At set-point it begins to open and then regulates the discharge to hold the system at set-point.

Installation

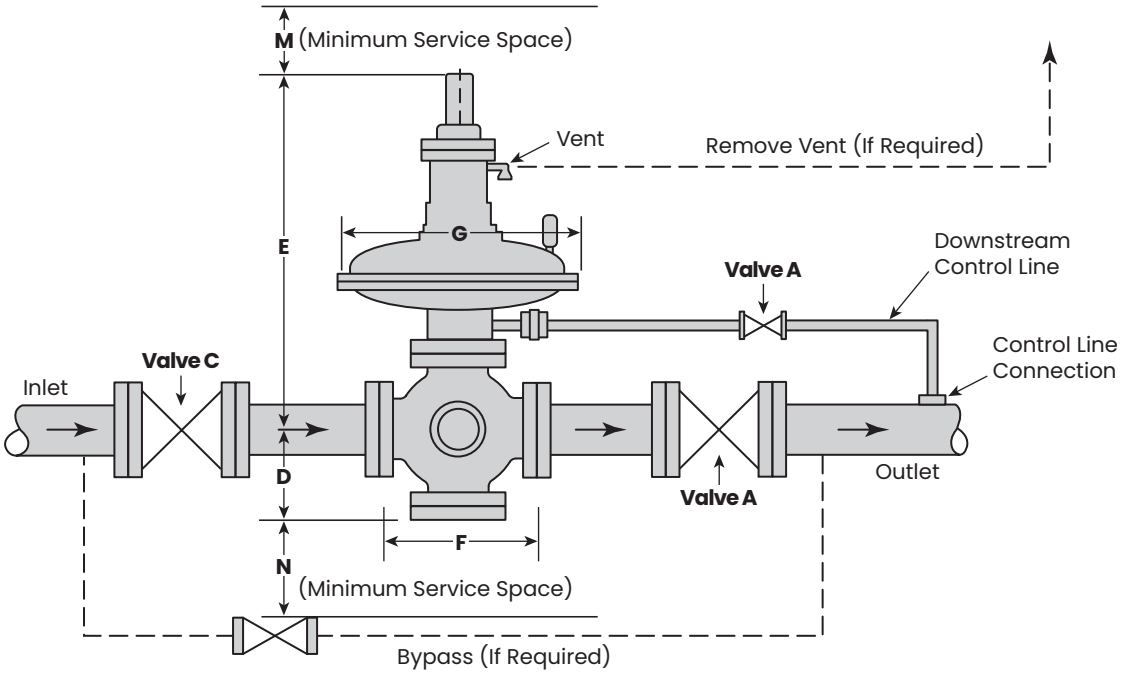
1. Install in line as shown with pressure connected to side marked Inlet.
2. For gas, pipe outlet to safe discharge point.
3. Connect inlet line to ½" union.
4. By turning adjustment screw, set valve to open at desired pressure. Turning clockwise increases opening pressure.

Model 441-SR offers these advantages:

- Accurate setting and control at low relieving pressure because of large, sensitive diaphragm.
- Tight shutoff without leakage due to soft-seat valve construction.
- Large relieving capacity due to large size double valves.



Typical Arrangement and Dimensions



Pipe Size of 441-S	D	E	G	M	N
2″	6″	24″	(See Spring Ranges Table on Page 1)	5″	7″
3″	6″	24″		5″	7″
4″	9 ½″	26″		5″	8″

Regulator Body Type	F (Face to Face)		
	2″ Pipe	3″ Pipe	4″ Pipe
Threaded	10″	-	-
Flanged ANSI 125 lb. FF	10″	11 ¾″	13 ⅞″
Flanged ANSI 250 lb. RF	10 ½″	12 ½″	14 ½″
Flanged ANSI 300 lb. RF	10 ½″	12 ½″	14 ½″

Additional Information

For additional information on a particular model, please request more information from your Utility Solutions Group Representative or Authorized Distributor.

Construction Materials

Diaphragm Housing and Spring Case	Cast Iron (ASTM A126-71 Class B)
Diaphragm Plates	Steel
Diaphragm	Buna-N with Nylon Reinforcement
Diaphragm Connecting Stem and Anti-Friction Bushing	Stainless Steel
Valve Stems	Brass or Stainless Steel
Removable Seats (Orifice)	Cast Iron or Stainless Steel
Soft Seat Valve Material	Buna-N. molded in holder
Holder for Molded Valve	Steel
Valve Retainer	Cast Iron or Stainless Steel
Bodies and Side Inspection Plates	(See Table on Page 2)

How to Order Model 441-S Regulator

Specify:

1. Pipe size and model.
2. Piping connections and body material (see table on Page 5)
3. Diaphragm size
4. Outlet Pressures and Spring (see tables Page 1).
5. Inlet Pressure (minimum and maximum inlet pressures, if available).
6. Capacity required (SCFH).
7. Type of Gas (natural gas, propane, etc.).
8. Trim (standard or stainless steel).
9. If a reduced valve is required.

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