Model 441-57S 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.

441-57S Regulator

The 441-57S medium pressure regulator is a spring-operated model that incorporate a "roll-out" diaphragm, similar to the performance found in pilot-operated regulators.

The action of the roll-out diaphragm reduces "droop," which is the fall off in outlet pressure as a spring regulator opens to increase flow. This makes the regulators' exceptional performance possible. By offering near-pilot-operated regulator performance without a pilot, the 57S-series offers simplicity, dependability, and exceptionally fast response.

The 441-57S is perfect for most large-capacity applications:

- Gas distribution systems
- District regulator sets
- City gate stations
- Town border stations
- Monitoring
- A wide variety of industrial applications.

Spring Ranges

Outlet Pressure Min. to Max.	Spring Color	Nominal Diaphragm Size (I.D.)
3 to 6 psi	Yellow	5" All Ranges
5 to 9 psi	Gray	
7.5 to 15 psi	Blue	
12.5 to 30 psi	Red	
25 to 55 psi	Brown	
50 to 75 psi	Black	
70 to 100 psi	Brown and White*	

* White colored spring is nested inside brown.

Body Construction and Pressure Ratings

Regulator Body Type	Body Material	Maximum Working Body Pressure
2" Threaded	Cast Iron (ASTM A126-71 Class B)	250 psi
Flanged ANSI 125 lb. FF	Cast Iron (ASTM A126-71 Class B)	175 psi
Flanged ANSI 250 lb. RF	Ductile Iron (ASTM A395-71 gr 60-40-18)	575 psi
Flanged ANSI 300 lb. RF	Cast Steel (ASTM A2 16-70A GR WCB)	720 psi
Flanged ANSI 600 lb. RF*	Cast Steel (ASTM A2 16-70A GR WCB)	1,200 psi

* 2" and 3" pipe size only.

Maximum Inlet Pressures by Valve Size

Valve Size	Maximum Inlet Pressure
4 ¼"	150 psi
3"	300 psi
2 ⅛"	500 psi
1 ¾"	1,000 psi
1 ½"	1,000 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.

Model 441-57S Regulator Brochure

Roll-Out Diaphragm

The heart of the Model 441-57S is the "Roll-Out" diaphragm. The 441-57S is a spring regulator with performance which approximates that of a pilot operated regulator. The "Roll-out" Diaphragm makes this exceptional performance possible because its action reduces "droop" to a minimum ("droop" being fall off in outlet pressure as a spring regulator opens to increase flow.)

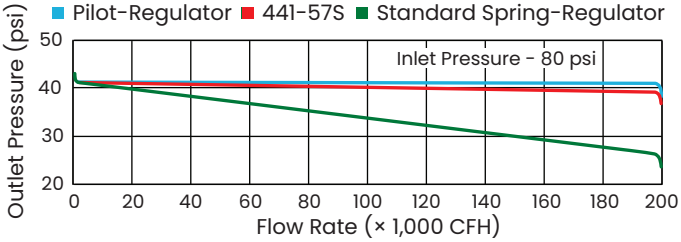
The action of the "Roll-Out" diaphragm differs from that of the conventional diaphragm in the manner in which the change in effective area occurs. Where the effective area of a conventional diaphragm would increase as the regulator opens, the "Roll-Out" area decreases. Conversely, where the area of the conventional diaphragm decreases during closing, the "Roll-Out" area increases. The following explanation and the illustrations below show how this affects regular performance.

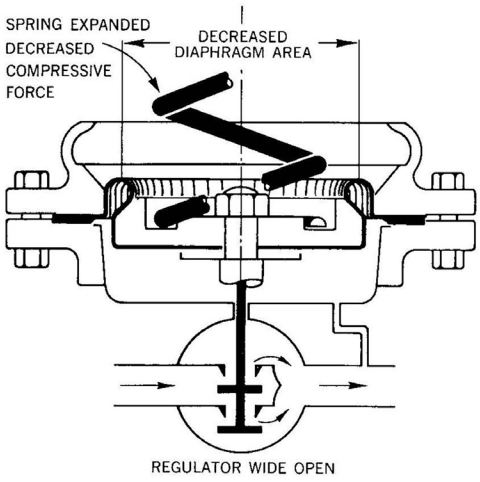
Spring type regulators are operated by the inter-action between spring and diaphragm. The compressive force of the spring works to open the regulator and is balanced by the opposing force of outlet pressure on the diaphragm which provides the closing force.

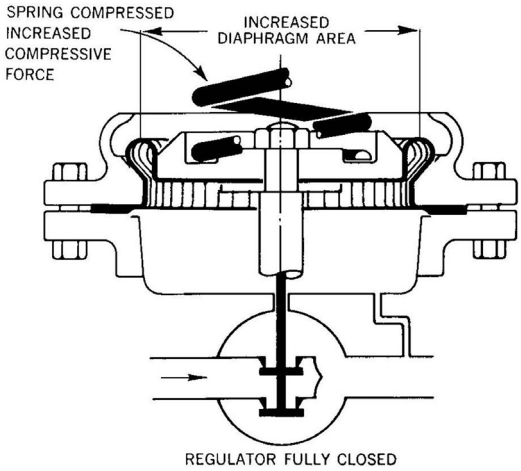
As the regulator opens, the compressive force of the spring decreases. However, as this spring force decreases, there must be a corresponding decrease in the opposing force from the diaphragm. For this opposing diaphragm force to decrease, either the effective area or the outlet pressure must decrease. Here is the essential difference; with a conventional diaphragm the outlet pressure must decrease, where as with the "Roll-Out" diaphragm it is the effective area that decreases, permitting the outlet pressure to remain constant.

The operation actually is quite simple, yet the action of the "Roll-Out" diaphragm is so effective that "droop" is practically eliminated.

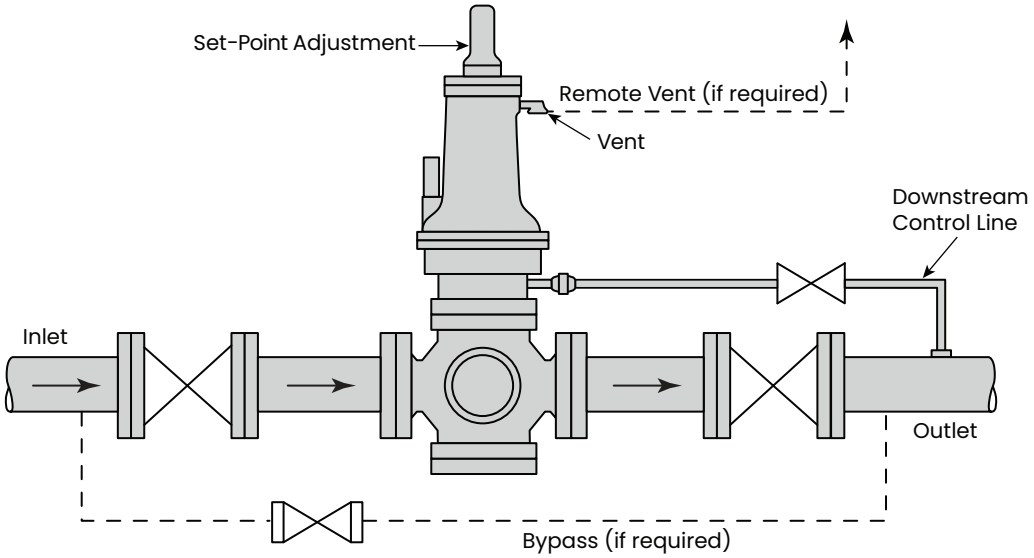
The Model 441-57S provides constant pressure regulation not previously possible in a "pounds to pounds" spring regulator. It approaches pilot performance, and, in addition, offers the further advantages of simplicity, dependability, freedom from freeze-up, and exceptionally fast response.







Typical Installation



Monitoring

The Model 441-57S is also excellent for use as a monitor: a stand-by regulator mounted in series which assumes control if a failure in the operating regulator permits the outlet pressure to rise above its set point.

The 441-57S has a fast rate of response and, therefore, will take control quickly in case of emergency. It requires no changes or modifications when used for monitoring. Its simple design and rugged construction make it an exceptionally dependable regulator, and its control accuracy and freedom from "droop" mean that it will provide excellent regulation if an emergency calls it into operation.

Two monitor set arrangements are shown in the illustrations below. The first shows a set in which the operating regulator and the monitor are both Model 441-57S. This makes an unusually neat and compact installation.

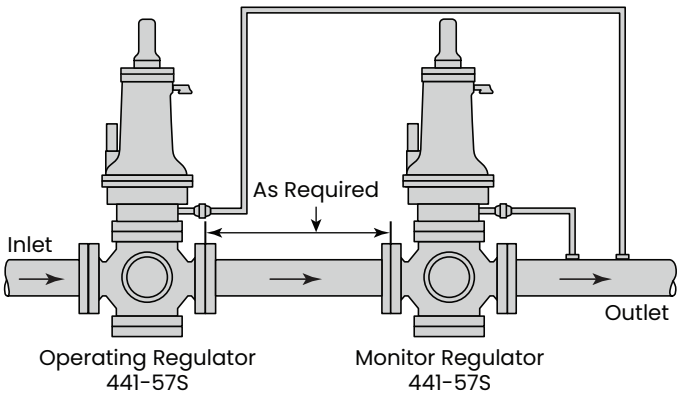
The 441-57S is also used for monitoring other types of regulators. This is shown in the second Illustration. It is excellent for monitoring pilot operated regulators.

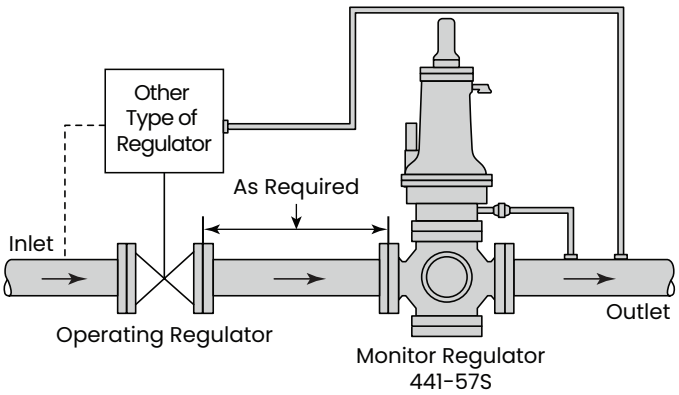
Both illustrations show the monitor in the downstream position. When installed this way, the 441-57S is usually set for an outlet pressure 2 to 4 psi higher than the operating regulator and thus is wide open during normal operation.

The monitor can also be located upstream, and with this arrangement the 441-57S is usually set for an outlet somewhat higher than the above.

Shutoff and bypass valving varies with individual practices and requirements. The "Typical Installation" illustration above can be used as a guide for the arrangement of these valves.

When identical 441-57S Regulators are used for both the operating regulator and the monitor, the total maximum capacity through both may be figured as 70 percent of the capacity of one of them alone. This applies with the monitor located either downstream or upstream.





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, high erosion resistance, and 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.

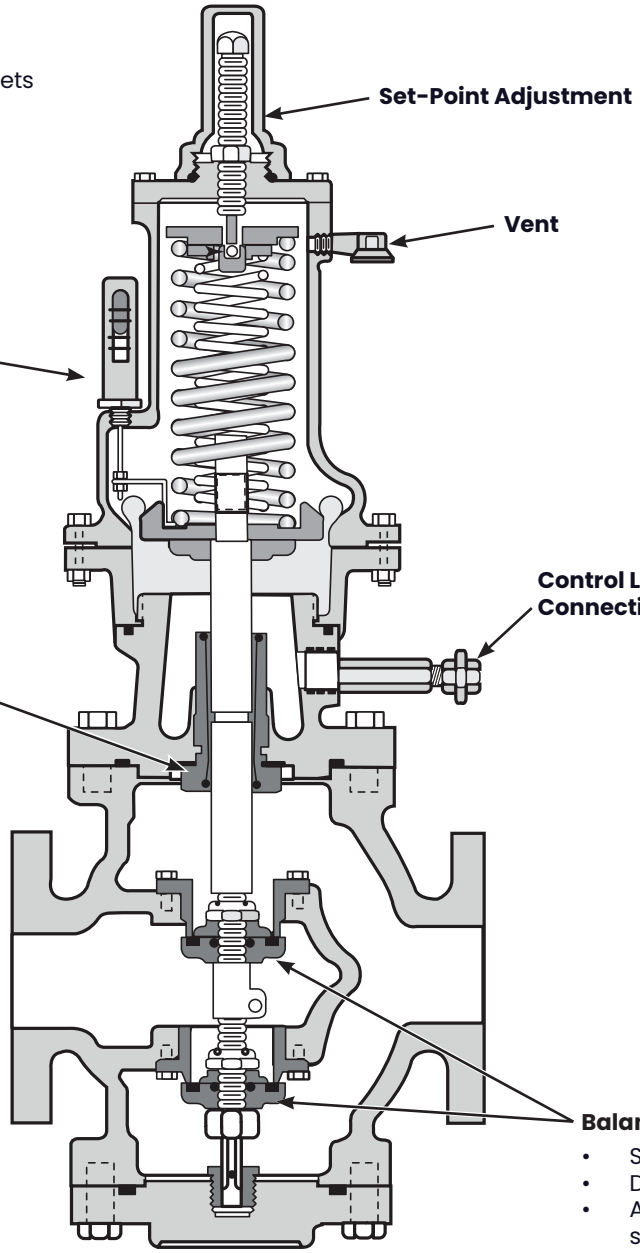
V-Port Orifice Restrictors- Allows regulator to maintain outlet pressure performance at lower flow rates.

Large Capacity

- High-Pressure Regulator Sets
- Gas Distribution Systems
- Town Border Stations
- Transmission Systems
- Monitoring
- High-Pressure Industrial Applications

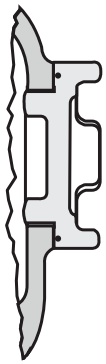
Heavy Duty Construction

- Weather-proof
- Watertight
- For Indoor or Outdoor Installations



Side Inspection Plates

- Located on both sides of the body
- Quickly removable
- Provide easy inspection and servicing of th inner valve



Capacities 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			6" 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	4 ¼" Valve	3" Reduced Valve	2 ⅛" Reduced Valve
4	3	22.9	17.9	37.3	27.8	17.9	74.5	37.3	22.7	138	77.7	37.3
5	3	32.1	25.2	52.4	39.1	25.2	104	52.4	31.9	194	109	52.4
	4	23.4	18.3	38.1	28.5	18.3	76.2	38.1	23.3	142	79.5	38.1
6	3	39.2	30.7	63.9	47.7	30.7	127	63.9	39.0	237	133	63.9
	4	33.2	26.0	54.1	40.4	26.0	108	54.1	33.0	201	112	54.1
	5	23.9	18.7	39.0	29.1	18.7	78.0	39.0	23.8	145	81.4	39.0
8	3	50.6	39.7	82.5	61.6	39.7	165	82.5	50.4	307	172	82.5
	4	46.8	36.7	76.3	57.0	36.7	152	76.3	46.6	283	159	76.3
	5	41.4	32.4	67.4	50.3	32.4	134	67.4	41.2	250	140	67.4
	6	34.8	27.3	56.8	42.4	27.3	113	56.8	34.6	211	118	56.8
10	3	60.5	47.4	98.5	73.6	47.4	197	98.5	60.1	366	205	98.5
	4	57.2	44.8	93.2	69.6	44.8	186	93.5	56.9	346	194	93.2
	5	53.9	42.2	87.9	65.6	42.2	175	87.9	53.6	326	183	87.9
	6	49.0	38.4	79.9	59.6	38.4	159	79.9	48.7	297	166	79.9
	8	36.5	28.6	59.5	44.4	28.6	118	59.5	36.3	221	124	59.5
12	3	68.6	53.8	111	83.5	53.8	223	111	68.3	415	233	111
	4	66.5	52.1	108	80.8	52.1	216	108	66.1	402	225	108
	5	63.7	49.9	103	77.5	49.9	207	103	63.4	386	216	103
	6	60.5	47.4	98.5	73.6	47.4	197	98.5	60.1	366	205	98.5
	8	51.7	40.5	84.3	62.9	40.5	168	84.3	51.5	313	175	84.3
	10	38.1	29.9	62.1	46.4	29.9	124	62.1	37.9	231	129	62.1
15	3	79.0	61.9	128	96.1	61.9	257	128	78.6	478	268	128
	4	77.9	61.0	127	94.8	61.0	253	127	77.5	472	264	127
	5	76.3	59.7	124	92.8	59.7	248	124	75.8	462	259	124
	6	74.1	58.0	120	90.1	58.0	241	120	73.7	448	251	120
	8	68.1	53.3	111	82.8	53.3	221	111	67.7	412	231	111
	10	60.5	47.4	98.5	73.6	47.4	197	98.5	60.1	366	205	98.5
	12	48.5	38.0	79.0	59.0	38.0	157	79.0	48.2	293	164	79.0
20	3	94.2	73.8	153	115	73.8	307	153	93.7	571	320	153
	4	93.7	73.4	152	114	73.4	305	152	93.2	567	318	152
	6	92.6	72.6	150	112	72.6	301	150	92.1	561	314	150
	8	89.3	70.0	145	108	70.0	291	145	88.8	541	303	145
	10	85.5	67.0	139	104	67.0	278	139	85.1	518	290	139
	12	79.5	62.3	129	96.8	62.3	259	129	79.1	481	270	129
	15	65.9	51.6	107	80.2	51.6	214	107	65.5	399	223	107
25	6 or less	108	84.5	175	131	84.5	351	175	107	653	366	175
	8	106	83.7	174	130	83.7	347	174	106	646	362	174
	10	104	81.9	170	127	81.9	340	170	104	633	355	170
	12	101	79.4	165	123	79.4	330	165	100	613	344	165
	15	93.7	73.4	152	114	73.4	305	152	93.2	567	318	152
	20	71.4	55.9	116	86.8	55.9	232	116	71.0	432	242	116
30	9 or less	121	94.8	197	147	94.8	393	197	120	732	410	197
	12	119	93.5	194	145	93.5	388	194	118	722	405	194
	15	114	89.6	186	139	89.6	372	186	113	693	388	186
	20	101	79.4	165	123	79.4	330	165	100	613	344	165
	25	76.3	59.7	124	92.8	59.7	248	124	75.8	462	259	124

Size each regulator on the basis of the minimum expected inlet pressure and the maximum outlet pressure.

For best performance of the Model 441-57S, use full table capacity values. For smaller capacities, refer to Model 461-57S.

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

Capacities Table

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

Inlet Pressure (psi)	Outlet Pressure (psi)	2" Model		3" Model			4" Model			6" 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	4 ¼" Valve	3" Reduced Valve	2 ⅛" Reduced Valve
40	14 or less	148	116	241	180	116	482	241	147	897	503	241
	20	143	112	233	174	112	466	233	142	868	486	233
	25	132	103	215	161	103	431	215	131	802	449	215
	30	115	90.0	187	139	90.0	374	187	114	696	390	187
	35	85.5	67.0	139	104	67.0	278	139	85.1	518	290	139
50	20 or less	175	137	286	213	137	571	286	174	1,062	595	286
	25	171	134	278	208	134	557	278	170	1,036	581	278
	30	162	127	264	197	127	528	264	161	983	551	264
	40	127	99	206	154	99	413	206	126	769	431	206
60	25 or less	202	158	330	246	158	660	330	201	1,227	688	330
	30	199	156	325	242	156	649	325	198	1,207	677	325
	40	179	140	293	218	140	585	293	178	1,089	610	293
	50	138	108	225	168	108	450	225	137	838	470	225
80	35 or less	256	201	418	312	201	835	418	255	1,554	871	418
	40	254	199	413	309	199	826	413	252	1,537	862	413
	50	239	187	389	291	187	778	389	238	1,448	812	389
	60	210	164	342	256	164	684	342	209	1,273	714	342
	70	158	123	257	192	123	514	257	157	957	536	257
100	45 or less	311	244	508	379	244	1,014	508	310	1,887	1,058	508
	50	309	242	504	376	242	1,007	504	307	1,837	1,050	504
	60	297	233	484	362	233	968	484	296	1,801	1,010	484
	70	274	214	446	333	214	892	446	272	1,660	930	446
	80	236	185	385	287	185	770	385	235	1,432	803	385
125	60 or less	379	297	618	461	297	1,234	618	377	2,296	1,287	618
	70	371	291	605	452	291	1,209	605	369	2,250	1,261	605
	80	355	278	579	432	278	1,156	579	353	2,151	1,206	579
	100	291	228	475	354	228	949	475	290	1,765	989	475
150	73 or less	446	350	728	543	350	1,454	728	444	2,706	1,517	728
	80	443	347	722	539	347	1,442	722	440	2,683	1,504	722
	100	412	323	672	502	323	1,343	672	410	2,478	1,400	672
175	85 or less	515	404	840	627	404	1,678	840	512	-	1,750	840
	100	505	395	823	614	395	1,644	823	502	-	1,715	823
200	100 or less	584	457	952	710	457	1,901	952	579	-	1,983	952
250		720	564	1,174	876	564	2,345	1,174	716	-	2,445	1,174
300		856	671	1,396	1,042	671	2,788	1,396	852	-	2,908	1,396
400		1,129	884	1,840	1,373	884	-	1,840	1,132	-	-	1,840
500		1,401	1,098	2,284	1,705	1,098	-	2,284	1,394	-	-	2,284
600		1,674	1,311	-	2,036	1,311	-	-	1,655	-	-	-
1,000		2,764	2,165	-	3,362	2,165	-	-	3,343	-	-	-
"K" Factors Standard Valves		5,450	4,270	8,880	6,630	4,270	17,740	8,880	5,420	33,000	18,500	8,880
"K" Factors V-Port Valves		5,260	4,160	8,440	6,390	4,160	13,850	8,440	5,260	25,500	14,430	8,440
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	0.773	0.780	0.950

Size each regulator on the basis of the minimum expected inlet pressure and the maximum outlet pressure.

For best performance of the Model 441-57S, use full table capacity values. For smaller capacities, refer to Model 461-57S.

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

Overpressurization Protection

Methods of overpressurization 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, Utility Solutions Group Bulletin RDS-1498, and other applicable standards.

CAUTION

Turn gas on 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.

Maximum Emergency Pressures

Before using any of the below data, ensure this entire section is clearly understood.

The following are the maximum inlet pressures which the regulator body may be subjected to under abnormal conditions without causing internal damage are:

Cast Iron Body ..... Maximum Inlet Pressure + 25 psi
Ductile Iron Body ..... Maximum Inlet Pressure + 60 psi
Cast Steel Body ..... Maximum Inlet Pressure + 100 psi

The maximum outlet pressure which the diaphragm may be subjected to under abnormal conditions without causing internal damage is:

Maximum Outlet Pressure ..... set-point + 25 psi.

NOTE: The "set-point" is the outlet pressure the regulator is adjusted to deliver.

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

Maximum Pressure ..... 175 psi

NOTE: Safely contained means no leakage and no bursting.

CAUTION

If any pressure exceeds the above values the regulator must be removed from service and inspected. Damaged or otherwise unsatisfactory parts must be repaired or replaced before returning the regulator to service.

Relief Valves and Back Pressure Valves

Where inlet pressure control is required, as with a back pressure valve or relief valve, use the Model 441-57SR.

The 441-57SR is the same as the 441-57S except that the inner valve is reversed, the body is turned around, and the control line is arranged for connection to the inlet side (upstream)

The adjustment is 3 to 90 psi.

Use the table on Pages 5 and 6 for capacities.

Capacities at Other Pressures

Capacity for pressure reductions not listed on Page 4 can be calculated with the following formula:

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

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

Q = Maximum capacity of regulator, in SCFH of 0.6 specific gravity natural gas

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

P_i = absolute inlet pressure (psi)

P_o = absolute outlet pressure (psi)

Other Gases

The Model 441-57S regulator is 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.

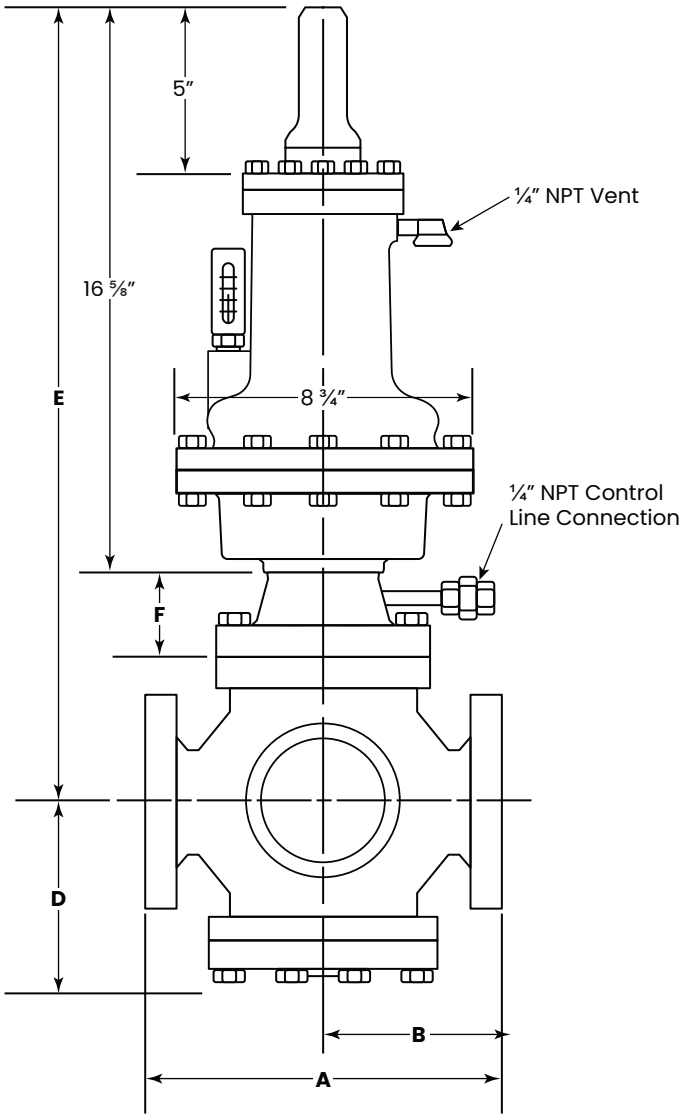
Temperature Limits

The Model 441-57S Regulator can be used for flowing temperatures from -20°F to 150°F.

Buried Service

The Model 441-57S Regulator is not recommended for buried service.

Dimensions



Construction Materials

Diaphragm Housing, Spring Cage	Cast Iron (ASTM A126-71 Class B)
Housing Cover (Spring Cage Cap)	Ductile Iron (ASTM A395-71 gr 60-40-18)
Upper Diaphragm Plate	Die Cast Aluminum
Lower Diaphragm Plate	Cast Iron
Diaphragm	Buna-N with Dacron Reinforcement
Diaphragm Connecting Stem and Anti-Friction Bushing	Stainless Steel
Removable Seats (Orifices)	Cast Iron or Stainless Steel
Valve Stems	Brass or Stainless Steel
Soft Seat Valve Material	Molded Polyurethane
Holder for Valve Material	Steel
Valve Retainer	Cast Iron or Stainless Steel
Side Inspection Plates	Ductile Iron
Bodies	See "Body Construction and Pressure Ratings" table.

Regular Body Type		Pipe Size				
		Threaded	FLanged ANSI			
		2″	2″	3″	4″	6″
125 lb. Cast Iron	A	10″	10″	11 3⁄4″	13 7⁄8″	17 3⁄4″
	B	5 5⁄16″	5 5⁄16″	6 1⁄8″	7 5⁄8″	9 7⁄16″
250 lb. Ductile Iron or 300 lb. Steel	A	-	10 1⁄2″	12 1⁄2″	14 1⁄2″	18 5⁄8″
	B	-	5 9⁄16″	6 1⁄2″	7 15⁄16″	9 7⁄8″
600 lb. Steel	A	-	11 1⁄4″	13 1⁄4″	15 1⁄2″	20″
	B	-	5 15⁄16″	6 7⁄8″	8 7⁄16″	10 9⁄16″
	D	6″	6″	6″	9 1⁄2″	12″
	E	24″	24″	24″	25″	28 1⁄2″
	F	2 11⁄16″	2 11⁄16″	2 11⁄16″	2 3⁄8″	4 3⁄16″
Shipping Weight (lbs.)		115	125 to 140	140 to 180	240 to 300	445 to 520

How to Order

Specify:

1. Pipe size and Model 441-57S.
2. Piping connections and body material (Page 2)
3. Trim (standard or stainless steel)
4. Inlet pressure (maximum and minimum, if available)
5. Outlet pressure set-point
6. Capacity required (SCFH)
7. Type of gas (natural gas, propane, etc.)
8. Spring part number

UTILITY SOLUTIONS GROUP

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