

Installation, Operation & Maintenance Instructions for Series 2001PR “Top Gun” Regulator



Note: This document is to be used in conjunction with WellMark Catalog Document, Section No. 5.2, “Series 2001PR Top Gun High Pressure Regulator”, pages 3 through 5.

WARNING!

Over-pressure of this regulator or installation of the regulator in applications which may see pressure levels beyond those for which the regulator is designed may result in leakage and/or catastrophic failure. This failure could result in leaking gas, damage to surrounding equipment, personal injury or death. To prevent such damage/injury the regulator should be installed in a safe location and should be chosen based upon the user’s specific application.

It is highly recommended that suitable pressure-relieving devices, as recommended by appropriate codes or standards, be installed in your system to assure that maximum rated pressures are not exceeded.

Installation

The Series 2001PR Top Gun Regulator should be chosen based upon the maximum inlet pressures, pressure drops and outlet pressures as described in Table 1 and 2. Flow capacities are listed in Table 3. The operating temperature range is -20°F to 150°F. When choosing and installing a regulator one must ensure that the conditions do not exceed these parameters. Furthermore, large differentials in pressure across the regulator may result in the formation of ice in the orifice area. The resulting decrease in orifice area may affect the regulators ability to flow in sufficient volume for downstream demand. Therefore, large pressure drop applications may require the use of more than one regulator.

Make sure that line pressure has been eliminated prior to the installation of any regulator. Prior to installation the line should be inspected to ensure that there is no debris that might damage the regulator. Install regulator with properly sized threaded connections and utilizing thread sealant.

The regulator should be installed with the flow arrow on the side of the body in the correct orientation to flow - i.e. higher pressure upstream, lower regulated pressure downstream. **As is true with most regulators, the Series 2001PR regulator has an outlet pressure rating that is less than the inlet pressure rating. Over-pressure protection must be provided to avoid over-pressure condition if the actual inlet pressure can exceed the outlet pressure rating. Refer to Table 1 and 2 for maximum inlet pressures, pressure drops and outlet pressure ranges.**

The regulator may be installed in any orientation as long as the flow is in proper agreement with the flow arrow on the side of the body. However, the regulator should be positioned such that the screened Breather (24) will not collect debris or moisture.

Vent Line Option

The Series 2001PR Top Gun Regulator includes a vent or Breather (24) in the Spring Housing (3). If there is concern about build-up of gas in a confined location, the Breather may be removed to allow installation of a remote vent line. With the Breather removed, a vent line may be installed into the 1/4” NPT port. This vent line should be as large a diameter as possible and should utilize minimal bends and elbows. Furthermore, the vent line opening should be protected from weather or debris and should be checked regularly for blockage.

Table 1: Maximum Pressures and Pressure Drops

Port Diameter	1/8”	1/4”	3/8”	1/2”
Max. Allowable Inlet Pressure, psig ¹	1500	1500	1000	750
Max. Allowable Pressure Drop, psid	1500	1000	500	250

¹ The sum of the outlet pressure setting and the maximum allowable pressure drop determines the maximum allowable inlet pressure for a given installation. For example, with a 3/8” seat ring orifice (maximum pressure drop of 500 psi) and a 275 psig outlet pressure setting, the maximum inlet pressure is 775 psig (500 psi + 275 psi + 775 psi).

Table 2: Outlet Pressure Ranges

Outlet Pressure Range psig	27-50	46-95	90-150	150-200	200-275	275-500
Max. Outlet Pressure over Pressure setting ¹ , psig	200					200 ²
Max. Emergency Outlet (Casing) Pressure, psig	550					

¹ Internal parts of the regulator may be damaged if the outlet pressure exceeds the pressure setting beyond the amounts shown.

² This applies to outlet pressure settings below 350 psig only. For pressure settings above 350 psig, outlet pressure is limited to 550 psig, the maximum emergency outlet (casing) pressure.

Startup Operation

WARNING!

Release downstream pressure to prevent a potential over-pressure of the diaphragm. Failure to do so may result in property damage and/or personal injury. Always employ upstream and downstream pressure gauges to monitor startup pressures.

With the regulator isolated with shutoff valves on both the upstream and downstream sides, slowly open upstream valve followed by slowly opening the downstream valve. Check all connections for leaks and make necessary output adjustments by manipulating the Adjusting Screw (1) per the adjustment procedures below.

Adjustment

The range of adjustment for a particular regulator is indicated on the nameplate. Different ranges can be achieved by substituting a different Spring (5).

IMPORTANT: If a new spring is installed the nameplate must be remarked to indicate the new pressure range.

Refer to Tables 1 & 2 prior to adjustment for pressure and flow information, assuring that the chosen spring will facilitate the desired pressure regulation and that the maximum pressure output does not exceed the downstream system pressure limits.

Loosen the Jam Nut (2).

To INCREASE pressure:

Turn Adjustment Screw clockwise.

To DECREASE pressure:

Turn Adjustment Screw counter clockwise.

Once the desired pressure is achieved, hold Adjustment Screw while securing the Jam Nut.

Shutdown

WARNING!

Downstream pressure must be released to prevent an over-pressurization of the diaphragm. Failure to do so may result in property damage and/or personal injury.

Close the upstream block valve followed by closing the downstream block valve. Open the nearest vent valve between the regulator and the downstream block valve.

Operation

When the outlet pressure is lower than the set pressure, force generated by the Spring (5) upon the Spring Guide (7) and Diaphragm (11) causes the Lever Assembly (14) to hold the valve in an open condition. As the outlet pressure exceeds the set pressure, the Diaphragm, acting upon the Lower Spring Guide compresses the spring allowing the Lever Assembly to close the valve until the outlet pressure equalizes with the set pressure.

Maintenance

Routine maintenance should be expected due to normal wear and tear, damage from external sources or debris. The regulator components - especially the moving and sealing parts - should be inspected periodically and replaced as necessary. Frequency of inspection/replacement depends upon severity of conditions, but may also be required by local/state/federal law or industry standards.

Large pressure drops or large amounts of particulate in the flow will result in accelerated wear on the **Valve Disk Assembly** (21) and **Orifice** (20).

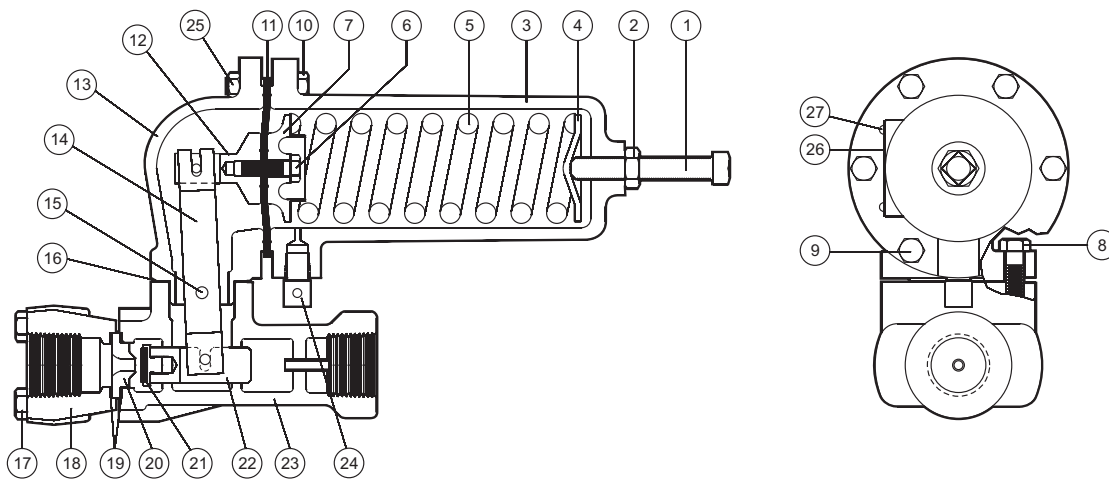
Replacing the Orifice, Lever Assembly and Disk Assembly

- 1) Disconnect piping from **Inlet Adapter** (18), removing Adapter and four **Cap Screws** (17).
- 2) Remove **Orifice** (20) and **Inlet Body Gasket** (19).
- 3) Remove vent piping if it is installed.
- 4) Remove two **Cap Screws** (8), which secure the **Diaphragm Adapter** (13) to the **Body** (23). Remove the **Diaphragm Adapter** and **Spring Case** (3) as a unit.
- 5) If the **Lever Assembly** is to be replaced, drive out the **Pin** (15) and slide the **Lever Assembly** out of the **Diaphragm Adapter**. When replacing the Lever Assembly, make sure that the slot engages the **Connector Head Assembly** (12). Replace the pin.
- 6) Remove the **Valve Carrier** (22) from the **Body**.
- 7) Use a 3/4-inch socket to remove and re-install the **Valve Disk** and holder.
- 8) Discard old **Inlet Body Gaskets** and replace with new. Re-install the **Valve Carrier** into the **Body**.
- 9) Re-install the **Diaphragm Adapter/Spring Housing** unit, making sure that the Lever Assembly properly engages the Valve Carrier. Finally, tighten the two **Cap Screws** that secure the **Diaphragm Adapter/Spring Housing** unit to the **Body**. **IMPORTANT: Spring Case** (3) must be oriented such that it points away from the **Inlet Adapter** (18).
- 10) Re-install the **Inlet Adapter** to the **Body**, installing and tightening the four **Cap Screws**.

Replacing the Diaphragm

- 1) Remove spring tension by loosening the **Jam Nut** (2) and turning the **Adjusting Screw** (1) counter-clockwise until all spring compression is relieved.
- 2) Disconnect vent line if installed.
- 3) Unscrew two **Cap Screws** (9) and four **Cap Screws** (10) with **Hex Nuts** (25).
- 4) Remove the **Spring Housing** (3).
- 5) Remove from the Lever Assembly, as a unit, the **Diaphragm** (11), **Connector Head Assembly** (12), **Lower Spring Guide** (7) and **Cap Screw** (6).

- 6) Unscrew the **Cap Screw** (6) from the **Connector Head** (12) and disassemble the **Diaphragm** (11).
- 7) Install a new **Diaphragm**, making sure that it is properly centered. Re-assemble **Connector Head Assembly** and **Lower Spring Guide**, securely tightened with the **Cap Screw**.
- 8) Engage Connector Head in Lever Assembly.
- 9) Re-install the **Spring Housing** with **Cap Screws** and **Nuts** finger-tight only. Assure proper **Diaphragm** slack by slightly compressing the **Spring** with the **Adjusting Screw** (tighten by turning clockwise). Finally, complete the tightening of all **Cap Screws** and **Nuts**.



Parts List

Item	Description	Qty.	Part No.
1	Adj. Screw, 27-50 Outlet Pressure	1	11014
	Adj. Screw, 46-95 Outlet Pressure	1	11013
	Adj. Screw, 90-500 Outlet Pressure	1	11097
2	Jam Nut	1	10098
3	Spring Housing	1	40440
4	Upper Spring Guide, up to 275 psi	1	11001
	Upper Spring Guide, above 275 psi	1	11032
5	Spring, 27-50 Outlet Pressure	1	11027
	Spring, 46-95 Outlet Pressure	1	11028
	Spring, 90-150 Outlet Pressure	1	11002
	Spring, 150-200 Outlet Pressure	1	11029
	Spring, 200-275 Outlet Pressure	1	11030
	Spring, 275-500 Outlet Pressure	1	11031
6	Cap Screw	1	11012
7	Lower Spring Guide, up to 275 psi	1	40445
	Lower Spring Guide, above 275 psi	1	40446
8	Cap Screw	2	10090
9	Cap Screw	2	11011
10	Cap Screw	4	11010
11*	Diaphragm, Neoprene	1	11004
	Diaphragm, Viton®	1	11033
12	Connector Head Assembly, Brass	1	21052
	Connector Head Assembly, 316 SS	1	21053
13	Diaphragm Adapter	1	40443
14	Lever Assembly	1	21023
15	Pin	1	11000
16	Gasket	1	11008

Item	Description	Qty.	Part No.
17	Cap Screw, 1"	4	11009
	Cap Screw, 2"	4	11050
18	Inlet Adapter, 1" Steel	1	40442
	Inlet Adapter, 2" Steel	1	40589
19	Inlet Body Gasket, Copper	2	11005
	Inlet Body Gasket, Composition (for NACE)	2	11015
20	Orifice, Brass 1/8"	1	21042
	Orifice, Brass 3/16"	1	21112
	Orifice, Brass 1/4"	1	21028
	Orifice, Brass 3/8"	1	21040
	Orifice, Brass 1/2"	1	21041
	Orifice, Stainless Steel 1/8"	1	21043
	Orifice, Stainless Steel 3/16"	1	21093
	Orifice, Stainless Steel 1/4"	1	21044
	Orifice, Stainless Steel 3/8"	1	21045
	Orifice, Stainless Steel 1/2"	1	21046
21	Valve Disk Assembly, Brass/TFE	1	21026
	Valve Disk Assembly, 316SS/TFE	1	21047
22	Valve Carrier, Brass	1	31005
	Valve Carrier, 316SS	1	31011
23	Body, 1" Steel (WCB)	1	40444
	Body, 2" Ductile Iron	1	40588
24	Breather	1	05011-1640
25	Hex Nut	4	05000-1726
26	Name Plate	1	21039
27	Drive Screw	4	10075
28	Plug, 1/8" NPT (2" only)	1	06000-0494

Table 3: High Pressure Regulator Flow Capacities (scfh of 0.6 Specific Gravity Gas; based on 20% Drop)

Outlet Pressure Range psig	Inlet Pressure psig	Outlet Pressure psig	Seat Ring Orifice Diameter (Inches)				
			1/8	3/16	1/4	3/8	1/2
27-50	60	50	900	2000	3100	5200	8100
	75		1300	28500	3800	7200	10,000
	100		1700	3500	5700	10,500	13,000
	150		2600	5700	8700	13,000	17,000
	200		3500	7800	11,000	16,000	19,000
	300		5300	10,500	14,000	20,000	23,000
	400		6900	13,000	17,000	23,000	—
	550		9600	16,000	20,000	26,000	—
	600		9800	17,000	21,000	—	—
	1050		17,000	23,000	27,000	—	—
1500	19,000	25,000	—	—	—		
46-95	60	50	800	1500	2400	4300	6400
	75		1200	2100	3100	5500	8000
	100		1500	3100	4200	7500	10,000
	150		2400	4500	6700	11,000	14,000
	200		3400	6600	9400	14,000	17,000
	300		5200	8900	11,000	16,000	20,000
	400		6800	11,000	15,000	20,000	—
	550		9500	13,000	17,000	23,000	—
	600		9800	14,000	19,000	—	—
	1050		14,000	19,000	22,000	—	—
1500	18,000	24,000	—	—	—		
46-95	100	75	1700	3200	5000	8000	13,000
	125		2200	4300	6700	10,000	15,000
	200		3500	7300	10,000	16,000	22,000
	250		4400	9400	13,000	19,000	24,000
	325		5700	11,000	16,000	23,000	27,000
	400		7100	14,000	19,000	27,000	—
	575		9700	18,000	23,000	30,000	—
	600		9900	19,000	25,000	—	—
	1075		18,000	27,000	32,000	—	—
	1500		23,000	32,000	—	—	—
90-150	125	100	2000	3600	5500	9200	13,000
	150		2500	4600	6800	11,000	16,000
	200		3600	6600	9400	13,000	22,000
	250		4400	8500	11,000	18,000	26,000
	300		5300	9800	14,000	21,000	30,000
	350		6100	10,000	16,000	25,000	32,000
	400		7000	13,000	18,000	27,000	—
	600		9500	18,000	23,000	35,000	—
	1100		19,500	28,000	35,000	—	—
	1500		25,000	35,000	—	—	—
90-150	150	125	2400	4600	6700	11,000	17,000
	200		3500	6800	10,000	15,000	23,000
	250		4300	8900	12,000	19,000	29,000
	300		5200	10,000	15,000	25,000	34,000
	375		6600	13,000	18,500	28,000	39,000
	400		7300	14,500	19,000	29,000	—
	500		7900	15,000	25,000	36,000	—
	625		10,000	22,000	29,000	41,000	—
	1125		18,000	33,000	42,000	—	—
	1500		26,000	43,000	—	—	—
90-150	200	150	2400	6800	10,000	16,000	26,000
	250		4400	8800	13,000	20,000	32,000
	300		5300	10,000	15,000	24,000	35,000
	400		7100	14,000	22,000	34,000	42,000
	450		7700	17,000	24,000	36,000	—
	650		9000	24,000	33,000	49,000	—
	800		13,000	29,000	38,000	—	—
	1150		20,000	38,000	49,000	—	—
	1500		26,000	47,000	—	—	—
	150-200		200	150	3400	6200	9300
250		4300	8800		12,000	20,000	27,000
300		5300	10,000		15,000	24,000	30,000
400		7100	14,000		21,000	32,000	38,000
450		7600	15,000		24,000	36,000	—
650		9000	21,000		33,000	48,000	—
800		13,000	27,000		37,000	—	—
1150		19,500	34,000		49,000	—	—
1500		26,000	44,000		—	—	—

Outlet Pressure Range psig	Inlet Pressure psig	Outlet Pressure psig	Seat Ring Orifice Diameter (Inches)					
			1/8	3/16	1/4	3/8	1/2	
150-200	250	200	4200	8300	12,000	20,000	30,000	
	300		5200	10,000	16,000	25,000	35,000	
	450		7800	16,000	26,000	43,000	50,000	
	600		9500	22,000	34,000	55,000	—	
	700		11,000	25,000	40,000	61,000	—	
	800		13,000	30,000	43,000	—	—	
	1000		16,000	37,000	50,000	—	—	
	1200		20,000	41,000	59,000	—	—	
	1500		26,000	53,000	—	—	—	
	200-275		250	200	4200	8200	11,000	20,000
300	5200	10,000	14,500		25,000	35,000		
450	7700	16,000	24,000		40,000	50,000		
600	9500	22,000	31,000		51,000	—		
700	11,000	25,000	35,000		55,000	—		
800	13,000	29,000	42,000		—	—		
1000	16,000	36,000	50,000		—	—		
1200	19,000	41,000	55,000		—	—		
1500	26,000	51,000	—		—	—		
200-275	300	250	4900		9000	15,000	28,000	42,000
400	7000		14,000	23,000	40,000	56,000		
500	8500		18,000	29,000	51,000	65,000		
600	9500		22,000	34,000	59,000	—		
750	12,500		28,000	44,000	69,000	—		
1000	16,000		39,000	58,000	—	—		
1250	21,000		49,000	69,000	—	—		
1500	26,000		59,000	—	—	—		
200-275	300		275	4700	9000	15,000	28,000	39,000
400	6900			14,000	25,000	40,000	54,000	
525	8600	18,000		35,000	68,000	94,000		
775	11,000	28,000		51,000	95,000	—		
1000	16,000	39,000		67,000	—	—		
1275	21,000	50,000		87,000	—	—		
1500	26,000	60,000		—	—	—		
275-500	300	275		4500	7500	10,000	20,000	31,000
400	6600			12,000	16,000	31,000	43,000	
525	8600			16,000	21,000	39,000	56,000	
775	11,000		24,000	32,000	55,000	—		
1000	17,000		32,000	43,000	—	—		
1275	21,000		40,000	53,000	—	—		
1500	26,000		46,000	—	—	—		
275-500	400		300	6600	11,000	16,000	31,000	42,000
550	9700			18,000	23,000	44,000	63,000	
600	9900			19,000	26,000	48,000	—	
700	11,000	23,000		30,000	54,000	—		
800	13,000	26,000		35,000	61,000	—		
900	15,000	29,000		39,000	—	—		
1300	22,000	43,000		58,000	—	—		
1500	26,000	49,000		—	—	—		
275-500	500	400		8300	16,000	24,000	44,000	62,000
650	10,000			24,000	33,000	61,000	86,000	
800	13,000		30,000	41,000	76,000	—		
900	15,000		34,000	49,000	85,000	—		
1000	17,000		38,000	54,000	—	—		
1200	20,000		46,000	63,000	—	—		
1400	24,000		55,000	76,000	—	—		
1500	26,000		60,000	—	—	—		
250-500	550		500	8700	16,000	26,000	50,000	77,000
750	12,000			28,000	40,000	78,000	100,000	
900	15,000	34,000		52,000	92,000	—		
1000	17,000	39,000		60,000	100,000	—		
1500	26,000	59,000		72,000	—	—		

Table 4: Wide-Open Flow Coefficients

Orifice Size	C _g	C _v	C _i
1/8 inch	13.9	0.49	28.4
3/16 inch	31.3	1.11	28.2
1/4 inch	55.1	2.03	27.2
3/8 inch	122.5	4.61	26.6
1/2 inch	216.0	8.18	26.4