

KENCO ENGINEERING COMPANY

P.O. BOX 470426, TULSA, OK 74147-0426

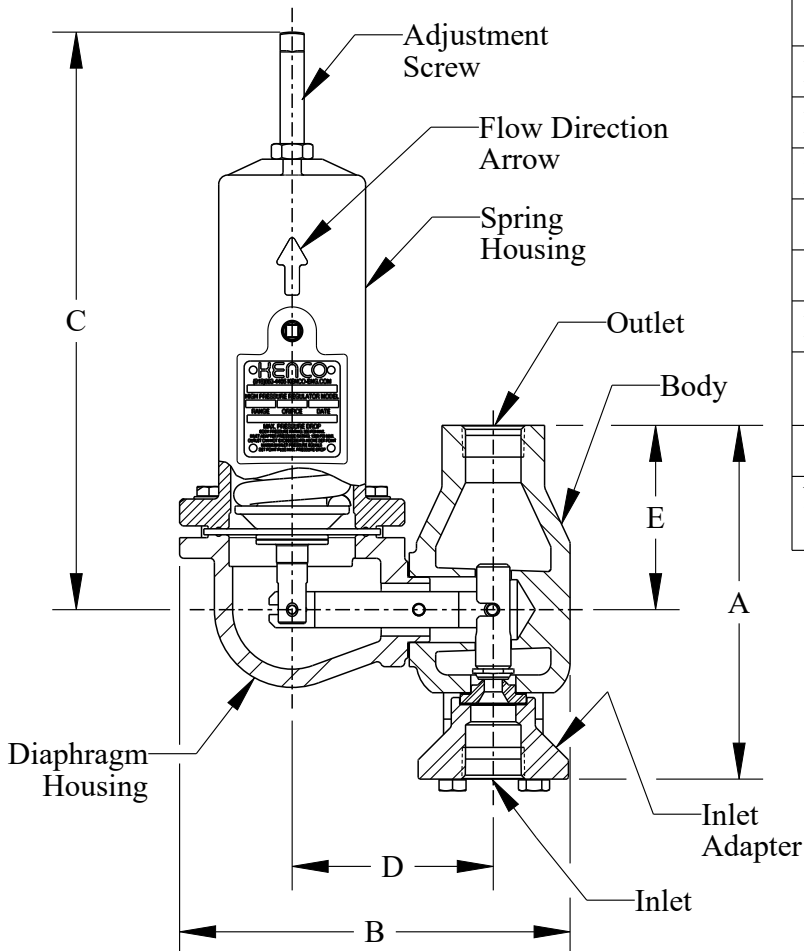
PHONE: (918) 663-4406; www.kenco-eng.com; E-MAIL: info@kenco-eng.com

MODEL KPRH HIGH PRESSURE REGULATOR INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS

Principle of Operation:

The model KPRH is a direct-acting pressure reducing regulator for use with natural gas, air and a variety of other gases. The outlet pressure is controlled by a diaphragm and adjustable spring that opens or closes the valve as the downstream flow demand changes. A decrease in flow demand will cause the downstream pressure to increase and consequently, the diaphragm will compress the spring. The positive movement of the diaphragm will move the seal closer to the orifice, thus restricting the flow and causing the downstream pressure to decrease. An increase in flow demand will cause the downstream pressure to decrease and the spring force will push the diaphragm and move the seal further away from the orifice. Moving the seal further from the orifice will result in an increase in flow and pressure. With the correct spring and orifice combination, the opposing actions of the spring and diaphragm will maintain a constant pressure while meeting the flow demand.

Ordering Information						
Model	Process Connections	Outlet Pressure Range (Spring Color)	Orifice Size	Orifice Seal Material	Diaphragm Material	
KPRH	1 (1" NPT) 2 (2" NPT)	050 (27-50 PSI, Red) 095 (46-95 PSI, White) 150 (90-150 PSI, Gray) 200 (150-200 PSI, Green) 275 (200-275 PSI, Blue) 500 (275-500 PSI, Yellow)	125 (1/8") 188 (3/16") 250 (1/4") 375 (3/8") 500 (1/2")	B (Nitrile) N (Nylon) T (PTFE) V (Fluorocarbon)	N (Neoprene) V (Fluorocarbon)	



Materials	
Body	ASTM A216 WCC Carbon Steel
Diaphragm Housing	ASTM A216 WCC Carbon Steel
Inlet Adapter	ASTM A105 Carbon Steel
Spring Housing	356 Cast Aluminum
Orifice & Seal Holder	316 Stainless Steel
Diaphragm	Neoprene, Fluorocarbon
Orifice Seal	Nitrile, Nylon, PTFE, Fluorocarbon
Gaskets	Flexible Graphite
Note: The wetted pressure containing components comply with NACE MR0175.	

Dimensions		
Dimension	1" NPT KPRH	2" NPT KPRH
A	7.37	7.88
B	8.14	8.69
C	12.03	12.03
D	4.19	4.19
E	3.84	4.08

Product Specifications

Maximum Inlet Pressure	See Below
Maximum Outlet Pressure	Determined By Spring Note: Actual set point cannot exceed the pressure range of the selected spring.
Body and Diaphragm Housing Rating	550 PSI
Maximum Body Overpressure	200 PSI Above Set Point Note: This applies to set points of 350 PSI or less. The body pressure must never exceed its rating of 550 PSI.
Temperature Range:	-20 to 180° Fahrenheit (0° to 180° for Fluorocarbon Seal and Diaphragm)

Maximum Inlet Pressures and Pressure Drops

Orifice Size	1/8"	3/16"	1/4"	3/8"	1/2"
Maximum Inlet Pressure*	1500 PSI	1500 PSI	1500 PSI	1000 PSI	750 PSI
Maximum Pressure Drop (Nitrile Seal)	600 PSI	600 PSI	600 PSI	500 PSI	250 PSI
Maximum Pressure Drop (Nylon / PTFE Seal)	1500 PSI	1500 PSI	1000 PSI	500 PSI	250 PSI
Maximum Pressure Drop (Fluorocarbon Seal)	200 PSI	200 PSI	200 PSI	200 PSI	200 PSI

*Note: The inlet pressure can never exceed the sum of the set point and maximum pressure drop. For example, a KPRH with 3/8" orifice, nitrile orifice seal, and 90 PSI set point has a maximum inlet pressure of 590 PSI.

Orifice Selection Instructions:

Select the correct orifice size by comparing the wide open flow capacity at the application conditions to the flow rate needed for the application. First, calculate the flow rate, Q, through each orifice size using the Universal Gas Sizing Equation (Equation 1), the wide open flow coefficients, and the application conditions. Then select the smallest orifice size that will meet the required flow needs.

Variables	
Q	Flow Rate, SCFH
T	Gas Temperature @ Regulator Inlet, °Rankine
G	Gas Specific Gravity
P1	Pressure @ Regulator Inlet, PSIA
ΔP	Pressure Drop Across Regulator, PSIA
Cg	Gas Sizing Coefficient
Cv	Liquid Sizing Coefficient
C1	Flow Coefficient
Equation 1 (Angle is in Degrees)	$Q = \sqrt{\frac{520}{GT}} C_g P_1 \sin \left[\left(\frac{3417}{C_1} \right) \sqrt{\frac{\Delta P}{P_1}} \right]$
Equation 2	$Q = \sqrt{\frac{520}{GT}} C_g P_1$
Reference	Fisher Controls International Inc. (1977). <i>Control Valve Handbook</i> (2nd ed.).

Wide Open Flow Coefficients

Orifice	Cg	Cv	C1
1/8"	12	0.5	24.0
3/16"	56	1.82	30.8
1/4"	76	2.56	29.7
3/8"	169	5.95	28.4
1/2"	277	8.7	31.8

Note: All flow coefficients were determined using lab tested data.

Important Note:

$$\left[\left(\frac{3417}{C_1} \right) \sqrt{\frac{\Delta P}{P_1}} \right] \geq 90^\circ$$

Shows when critical flow will occur. In all critical flow conditions, use Equation 2.

Overpressure Protection:

The model KPRH pressure regulator must always be used with overpressure protection. Use Equation 1 to size for the appropriate relief valve.

Installation and Startup Instructions:

1. Ensure all pressure has been relieved from the piping where the regulator will be installed.
2. Inspect both the regulator and piping for any damage or debris. Notify the factory of any regulator damage.
3. Pressure gauges and isolation valves should be installed at the inlet and outlet of the regulator.
4. A bleed valve should be installed at the outlet of the regulator to allow for safe depressurization.
5. Install the regulator with the flow direction arrow pointing in the direction of flow. Kenco Engineering recommends using PTFE based thread sealant paste on all threaded connections.
6. Ensure that the proper overpressure protection is in place prior to startup.
7. Prior to startup, the regulator must be fully isolated from all process pressure.
8. Slowly introduce the regulator to upstream pressure. At the factory, the KPRH is set at the lower end of the outlet range or 90 PSIG for the 150-200 through 275-500 PSI springs. The actual outlet pressure upon startup may vary since inlet pressures are application specific.
9. Turn the adjustment screw clockwise to reach the desired set point.
10. Slowly open the downstream isolation valve and watch the downstream pressure gauge to ensure the regulator is not over pressurized.
11. If opening the downstream isolation valve results in an increased flow demand and drop in set point, adjust the regulator set point accordingly.
12. If a decrease in set point is desired, turn the adjustment screw counterclockwise. If there is a closed system downstream of the regulator, gas must be bled off in order for the lower set point to register on the pressure gauge.
13. Once the desired set point has been reached, tighten the adjustment screw jam nut.
14. Do not exceed the set point of the selected spring and do not exceed the maximum pressure drop.

Shutdown Instructions:

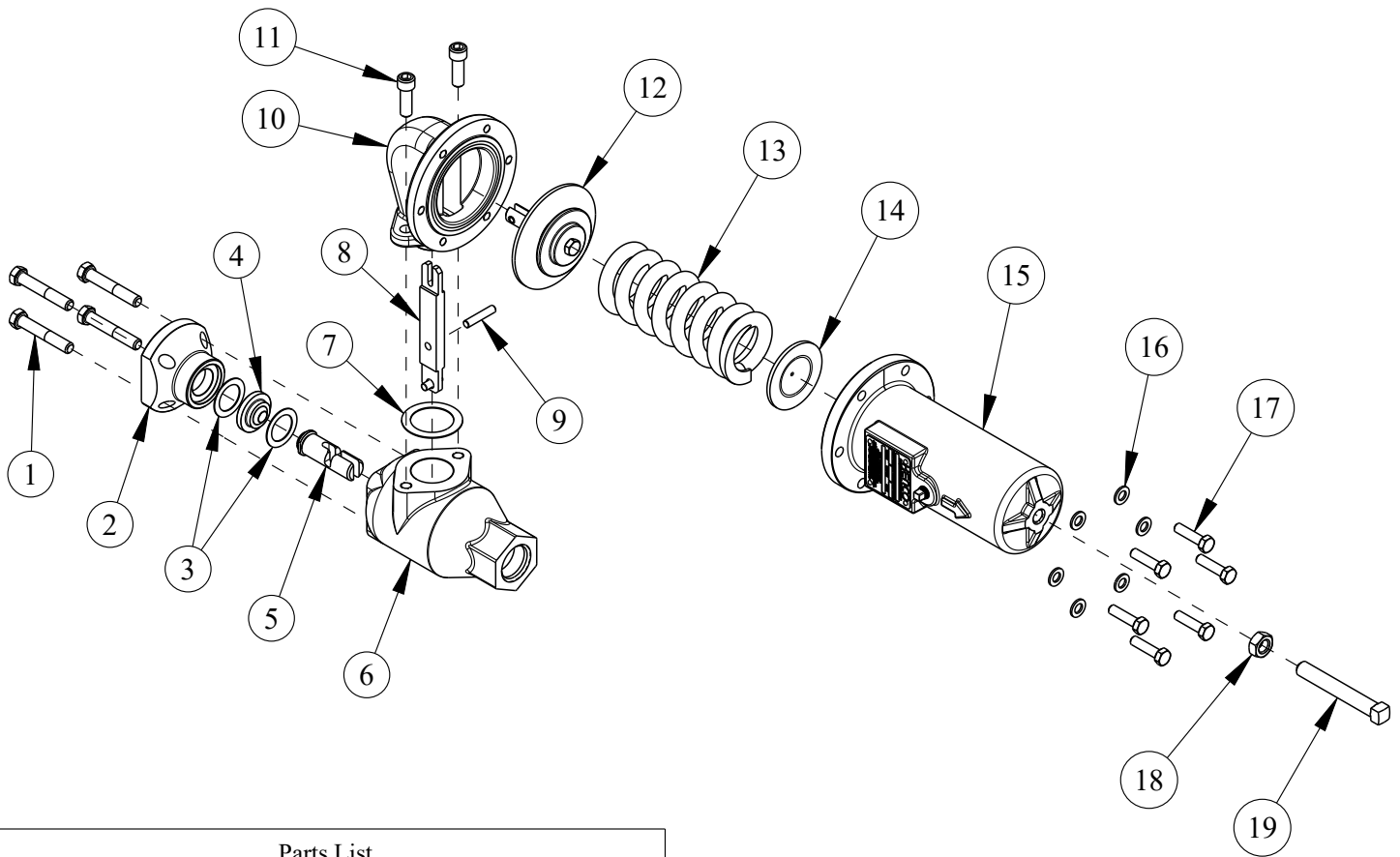
1. Close the inlet and outlet isolation valves.
2. Bleed off all pressure downstream of the regulator. The gas upstream of the regulator will pass through the orifice and bleed off as well.
3. Verify that there is no pressure upstream or downstream of the regulator.

General Maintenance Notes:

1. The KPRH must be properly shut down and isolated from all pressure before any maintenance can be performed.
2. Kenco Engineering recommends replacing the orifice gaskets (3), valve stem assembly (5), diaphragm housing gasket (7), and diaphragm assembly (12) any time maintenance is performed on the regulator.
3. Upon reassembly, the flow direction arrow on the spring housing (15) must be pointing away from the inlet adapter (2) and in the direction of gas flow.

Maintenance Instructions:

1. Perform the proper shutdown procedure per the instructions in this manual.
2. Loosen the adjustment screw (19) until there is no compression on the spring (13).
3. Remove the 5/16" screws (17), washers (16), spring housing (15), spring compression plate (14), spring (13) and diaphragm assembly (12). Discard the used diaphragm assembly.
4. Install the new diaphragm assembly (12) and ensure that the diaphragm assembly pin is in the lever (8) slot and the diaphragm assembly is centered on the face of the diaphragm housing (10).
5. Reinstall the spring housing (15) and other associated parts, but leave the screws (17) finger tight. If desired, replace the spring (13) at this time.
6. Use the adjustment screw (19) to push the diaphragm assembly (12) down into the diaphragm housing (10) to remove any slack in the diaphragm. Both the spring housing (15) and diaphragm housing (10) have a raised face that captures the diaphragm. The outside edge of the diaphragm must either slightly protrude or be flush with the outer edge of the raised faces.
7. Tighten the 5/16" screws (17) to 12 foot-pounds in a criss-cross pattern to complete the diaphragm assembly (12) replacement.
8. Remove the piping from the inlet adapter (2) and remove the hex. head screws (1), inlet adapter (2) orifice gaskets (3) and orifice (4).
9. Remove the 3/8" cap screws (11), diaphragm housing (10), and valve stem assembly (5). The spring housing (15), diaphragm assembly (12) and associated parts will remain assembled to the diaphragm housing.
10. Put a new valve stem assembly (5) into the valve body (6) and replace the diaphragm housing gasket (7). Clean off the gasket surfaces as needed and assemble the diaphragm housing (10) to the valve body (6). Ensure that the lever (8) pin is keyed into the valve stem (5) during assembly. Lubricate and tighten the screws (11) to 16 foot-pounds.
11. Replace the orifice gaskets (3) and orifice (4) if needed. Then install the inlet adapter (2). Clean off the gasket surfaces as needed and lubricate and tighten the hex. head screws (1) in a criss-cross pattern to 16 foot-pounds (1" NPT Regulator) or 21 foot-pounds (2" NPT Regulator).
12. Attach the process piping and then follow the startup procedure in this manual. Since the adjustment screw was backed out and all compression removed from the spring, the set point upon startup will be very low. Adjust the set point according to the startup procedure.



Parts List		
Item	Quantity	Description
1	4	Screw, Hex. Head (Steel) 3/8-16 x 2-1/4 (1" NPT Regulator) 1/2-13 x 2-3/4 (2" NPT Regulator)
2	1	Adapter, Inlet (Steel)
3	2	Gasket, Orifice (Flexible Graphite)
4	1	Orifice (316 Stainless Steel)
5	1	Assembly, Valve Stem (316 S.S. / Seal Matl.)
6	1	Body (Steel)
7	1	Gasket, Diaphragm Housing (Flexible Graphite)
8	1	Assembly, Lever (Steel / 18-8 Stainless Steel)
9	1	Pin (18-8 Stainless Steel)
10	1	Housing, Diaphragm (Steel)
11	2	Screw, Socket Head 3/8-16 x 1-1/8 (Steel)
12	1	Assembly, Diaphragm (Steel / Aluminum / Diaphragm Matl.)
13	1	Spring (Steel)
14	1	Plate, Spring Compression (Steel)
15	1	Housing, Spring (Aluminum)
16	6	Washer, Flat 5/16 (Steel)
17	6	Screw, Hex. Head 5/16-18 x 1-1/4 (Steel)
18	1	Nut, Hex. Jam 1/2-13 (Steel)
19	1	Screw, Adjustment (Steel)

Repair Kit Part Numbers	
Part Number	Contents
KPRH-B-N-RK	Gaskets (3, 7), Nitrile Seal (5) & Neoprene Diaphragm (12)
KPRH-N-N-RK	Gaskets (3, 7), Nylon Seal (5) & Neoprene Diaphragm (12)
KPRH-T-N-RK	Gaskets (3, 7), PTFE Seal (5) & Neoprene Diaphragm (12)
KPRH-V-V-RK	Gaskets (3, 7), FKM Seal (5) & FKM Diaphragm (12)
KPRH-N-V-RK	Gaskets (3, 7), Nylon Seal (5) & FKM Diaphragm (12)
KPRH-T-V-RK	Gaskets (3, 7), PTFE Seal (5) & FKM Diaphragm (12)
KPRH-ORIFICE-125-RK	1/8" Orifice (4), Gaskets (3, 7)
KPRH-ORIFICE-188-RK	3/16" Orifice (4), Gaskets (3, 7)
KPRH-ORIFICE-250-RK	1/4" Orifice (4), Gaskets (3, 7)
KPRH-ORIFICE-375-RK	3/8" Orifice (4), Gaskets (3, 7)
KPRH-ORIFICE-500-RK	1/2" Orifice (4), Gaskets (3, 7)
KPRH-SPRING-050-RK	27-50 PSI Spring (13)
KPRH-SPRING-095-RK	46-95 PSI Spring (13)
KPRH-SPRING-150-RK	90-150 PSI Spring (13)
KPRH-SPRING-200-RK	150-200 PSI Spring (13)
KPRH-SPRING-275-RK	200-275 PSI Spring (13)
KPRH-SPRING-500-RK	275-500 PSI Spring (13)