

KIMRAY INC.®

INSTALLATION OPERATION & MAINTENANCE GUIDE



PRESSURE REGULATOR

PILOT OPERATED

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Model: *Pilot Operated*
Installation, Operation & Maintenance Guide

A Before you start

CAUTION:

The instructions provided herein should be completely reviewed and understood before operating or repairing this equipment. All **CAUTION** and **WARNING** notes must be strictly observed to prevent personal injury or equipment damage.

A1 Scope

Do not install, operate, or maintain a pressure regulator without being fully trained and qualified with the Kimray installation, operation and maintenance manual.

To avoid personal injury or property damage, it is important to carefully read, understand, and follow all the contents of this manual, including all safety cautions and warnings.

If you have any questions about this manual, contact your Kimray applications support group before proceeding.

A2 Introduction

This repair manual contains information for the BP, BPNV, LBP, pressure regulators.

A3 Description

The Kimray back pressure regulator combines a pressure pilot with a control valve. Except where liquid or very low gas pressure is involved, upstream gas is used to operate the valve. In the pilot, a spring is compressed with an adjusting screw. This places a force against a thick diaphragm which is in contact with the controlled pressure on the side opposite of the spring. As the two forces work against each other, they continually reposition a small three-way valve (the pilot plug and seats) which controls diaphragm pressure in the valve. Proper function can best be accomplished when the gas flowing through the pilot is clean and free of liquid. The valve shuts off with a resilient seat on the plug closing against a metal seat in the valve body.

The Kimray back pressure regulator maintains a constant upstream pressure. It limits upstream pressure by adjusting open to relieve excess pressure or conserves upstream pressure by adjusting closed to limit the flow to downstream.

CAUTION:

When ordered, the pressure regulator configuration and construction materials were selected to meet specific pressure, temperature, pressure drop and fluid conditions. Since some body / trim material combinations are limited in their pressure drop and temperature ranges, do not subject the pressure regulator to any other conditions without first contacting the Kimray Inc, sales office or a sales / applications representative.

WARNING:

DO NOT exceed the maximum pressure specified on the nameplate. Under no circumstances should the regulator supply pressure ever exceed the maximum psig.

A4 Maintenance

Maintenance should be performed on a regular basis. Initial intervals of 12 months is recommended. The maintenance interval may increase or decrease depending on changing application environments. The valve can be repaired without being removed from the piping.

Related Publications

The following publications are applicable for the regulator

Number	Type	Title
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See catalog section A for product pages.

Abbreviations / Acronyms

The abbreviations that follow are used in this manual.

Term	Definition
BP	Back Pressure
BPNV	Back Pressure Non Vent
LBP	Liquid Back Pressure

Commonly Replaced Parts

- Trim Set
- Diaphragm
- O-ring

Occasional Replacement Parts

- Body
- Spring

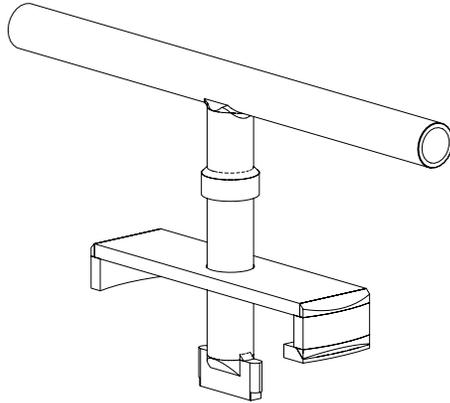
A5 Changes and Updates

NOTE:

To prevent galling or seizing at assembly level for straight threads Kimray recommends using a nickel impregnated paste. For other threads use a nickel impregnated PTFE thread sealant tape.

SPECIAL TOOLS AND EQUIPMENT

Kimray Seat Wrenches and Stem Guides



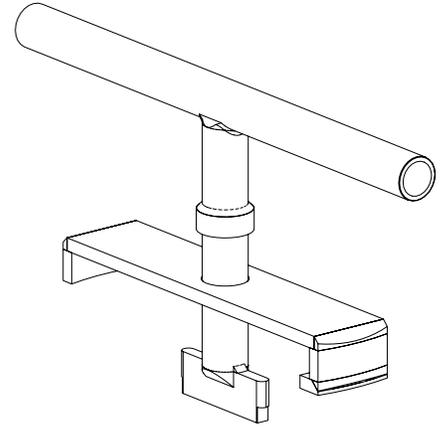
2 in.
#272SW



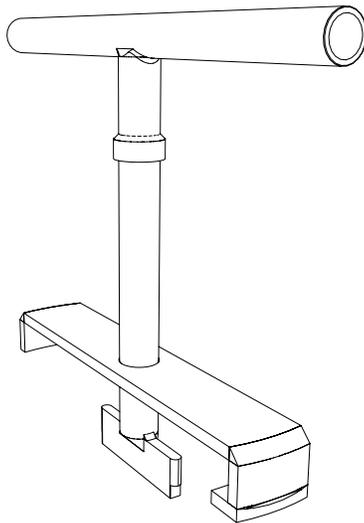
1 in.
#1851



2 in.
#1852



3 in.
#273SW



4 in.
#274SW



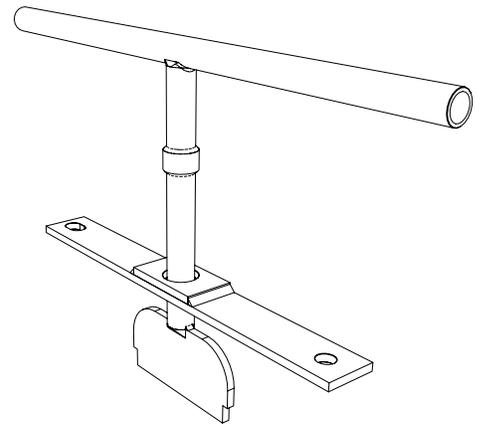
3 in.
#1853



4 in.
#1854



6 in.
#1855



6 in.
#275SW

Power Tube Brush			
Diameter	Wire Size	Length	Stem Diameter
1/4 in.	0.004 in.	3 1/2 in.	1/8 in.
3/4 in.	0.006 in.	3 1/2 in.	1/4 in.
1 1/4 in.	0.008 in.	3 1/2 in.	1/4 in.

NOTE: **Standard Non-Kimray Tube Brushes**



Tip:
Kimray recommends using the above special tools and equipment for disassembly, assembly and new part replacements.

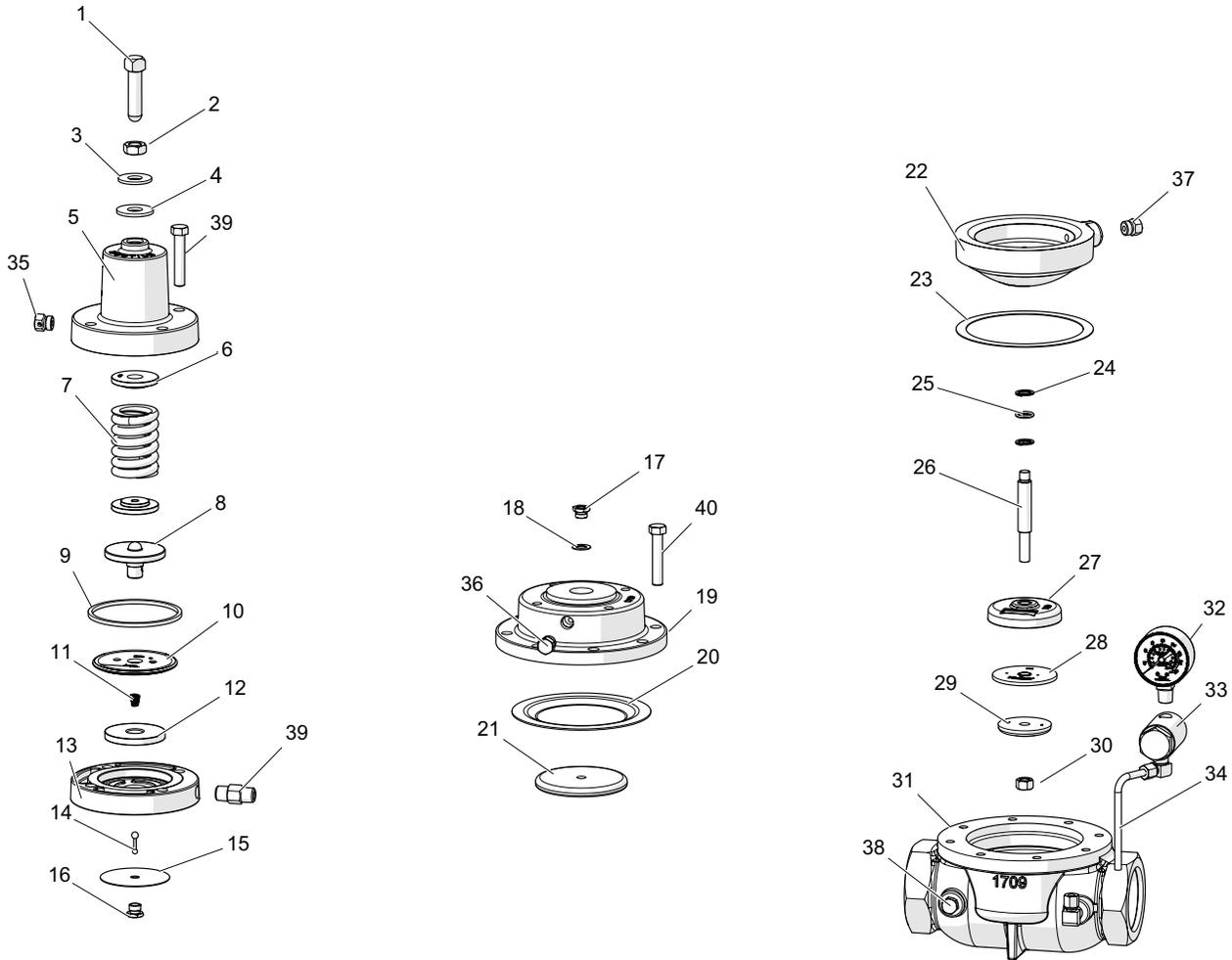
PRESSURE REGULATOR



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ORIENTATION



A7

* Recommended spare parts and stocked as repair kits
See catalog section A for additional information

Item	Description	Qty
1	Adjusting Screw	1
2	Nut	1
3	Washer	1
4	Packing Seal	1
5	Bonnet	1
6	Spring Plates	2
7	Spring	1
8	Plate	1
9	Diaphragm Ring *	1
10	Diaphragm *	1
11	Spring *	1
12	Nut	1
13	Housing	1
14	Plug *	1
15	Diaphragm *	1

Item	Description	Qty
16	Seat *	1
17	Seat *	1
18	Gasket *	1
19	Housing	1
20	Diaphragm *	1
21	Plate	1
22	Housing	1
23	Gasket *	1
24	Back Up's *	2
25	O-Ring *	1
26	Stem	1
27	Disk	1
28	Seat *	1
29	Ratio Plug	1
30	Lock Nut *	1

Item	Description	Qty
31	Body	1
32	Gauge	1
33	Filter	1
34	Tubing	1
35	Breather Plug	1
36	Breather Plug	1
37	Breather Plug	1
38	Plug	1
39	Screws	4
40	Screws	8

Kimray reserves the right to modify or improve the designs or specifications of such products at anytime without notice.

1 Installation

Before installing the pressure regulator, inspect it for shipment damage and for foreign material that may have collected during shipment. Inspect the openings in the valve and clean the pipe lines to remove scale, chips and debris.

1. Install the regulator with the arrow on the body pointing in the direction of flow. The arrow indicates that the direction of flow and will not necessarily prevent flow in the opposite direction.
2. Install the regulator using good piping practice. For flanged bodies use a suitable gasket between the body and the pipeline flanges. For threaded (NPT) bodies, use TFE tape or pipe thread sealant on external pipe threads.

NOTE:

Never stand directly over or in front of a regulator when the system is pressurized. The regulator could suddenly open, blowing debris onto the face and eyes. Check all vents periodically to be certain they are clear.

If a vent should become blocked the regulator could lose control.

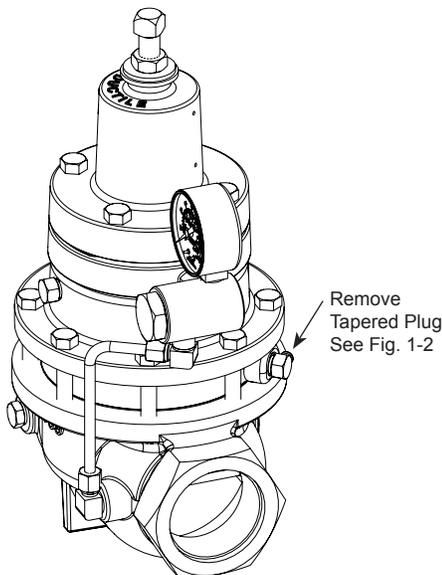


Fig. 1-1

Back Pressure Regulator:

Remove the tapered plug after the regulator is installed. The plug only prevents the oil from leaking out of the regulator during shipment and installation.

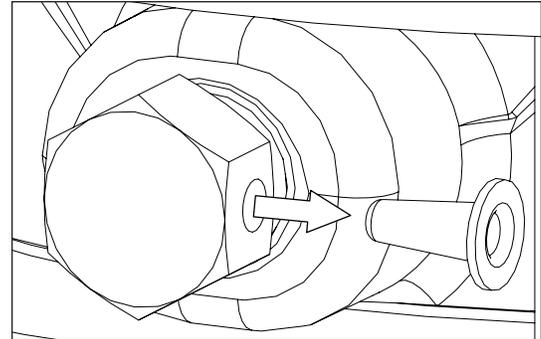


Fig. 1-2

WARNING:

Regulators rated to 175 psig (12 bar), if hazardous or flammable gas is being conveyed and the regulator is in an enclosed area, personal injury or property damage could result from accumulated gas being released through the vent. To avoid potential risk, provide adequate ventilation or pipe away the vented gas.

This does not apply to non venting **NV** models. No gas is vented with **NV**.

Verify all pressure connections are tight before pressurizing the system.

2 Start-up and Test

With the installation completed and appropriate relief and check valves installed and set, slowly open the upstream and downstream shutoff valves. Turn the adjusting screw out and then back in until you feel it begin to meet resistance as it engages the spring.

Back Pressure Regulator.....Open

As you turn the adjusting screw clockwise, the set point pressure will increase.

WARNING:

Before any service, be certain that the valve is fully isolated and that all pressure upstream and downstream has been relieved. Use bypass valves or fully shut off the process. Be sure that any operating or instrument gas lines has been disconnected. Never assume that a check valve is fully blocking the downstream line. Never tighten any fitting or the main connections to the regulator while there is pressure on the line. A leaking valve indicates that service is required. Failure to take the valve out of service immediately may create a hazardous condition.

PRESSURE REGULATOR

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DISASSEMBLY

3 Adjusting Screw, Tubing, Gauge

Use an adjustable wrench to remove the adjusting screw on top of the regulator. See Fig. 3-1

Remove tubing. See Fig. 3-2

Use pliers as a Back Up on filter then remove the gauge with a wrench. This avoids breaking the nipple in housing. See Fig. 3-3

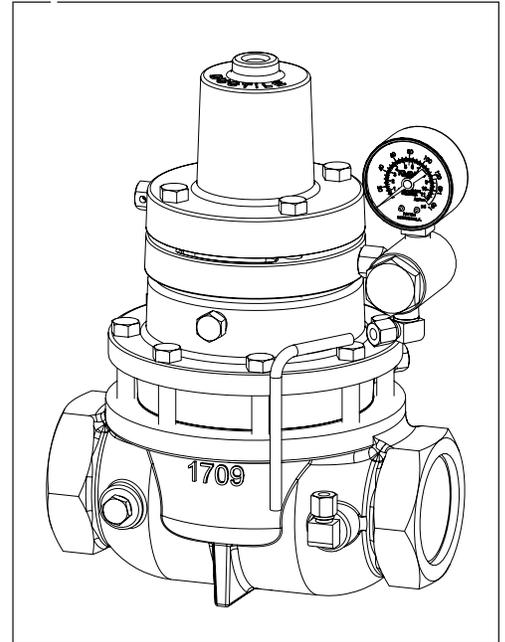


Fig. 3-2

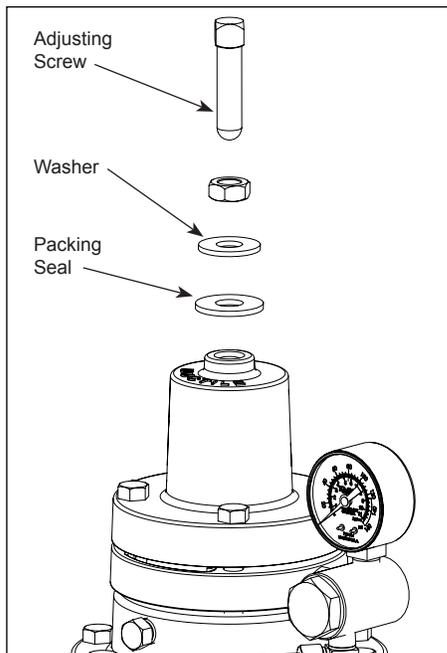


Fig. 3-1

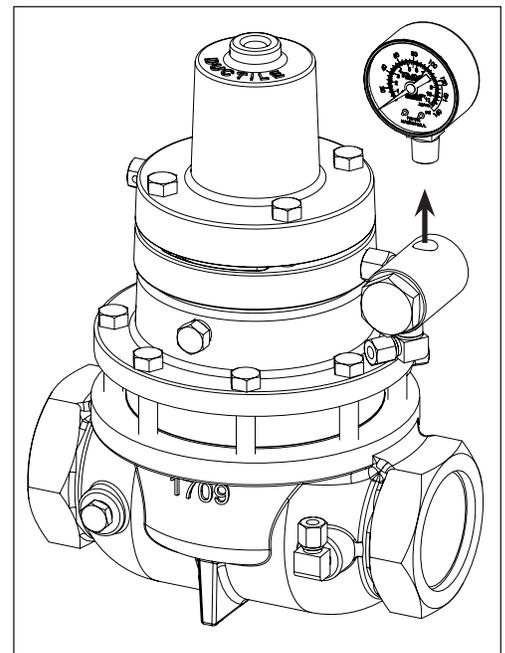


Fig. 3-3

Model: *Pilot Operated*

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DISASSEMBLY

4 Bonnet, Spring

Loosen the top screws to remove the Bonnet.

Pry bonnet loose with a flat head screwdriver.
See Fig. 4-1

Remove the spring and (2) plates. See Fig. 4-2

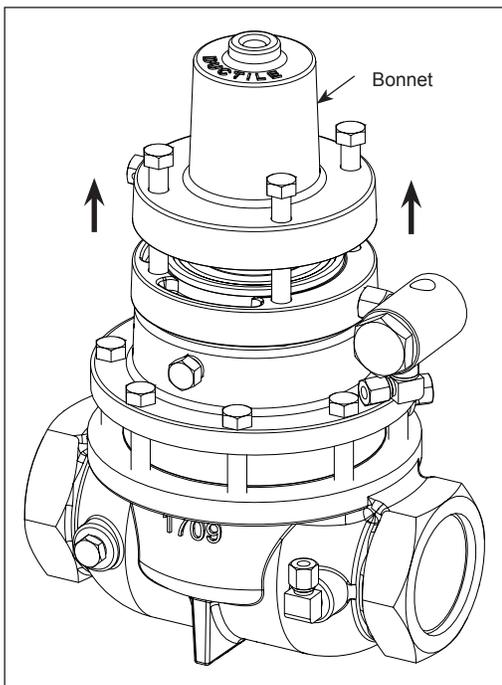


Fig. 4-1

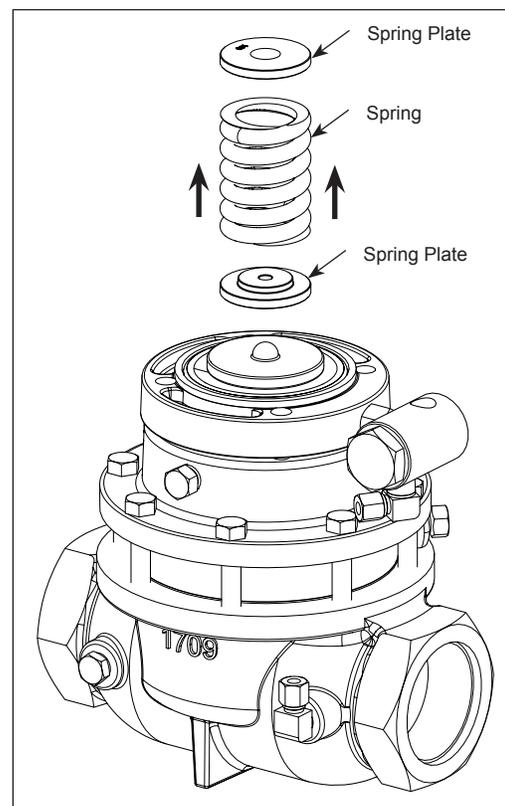


Fig. 4-2

* Recommended spare parts and stocked as repair kits

DISASSEMBLY

5 Diaphragm Housing Assembly

Pry up the Housing with a screwdriver. See Fig. 5-1

Flip the Housing over and remove the Pilot Seat with a 9/16 in. socket or wrench. See Fig. 5-2

Remove the Diaphragm.

Remove the Pilot Plug.

Flip the Housing over and remove the sense Diaphragm Assembly. See Fig. 5-3

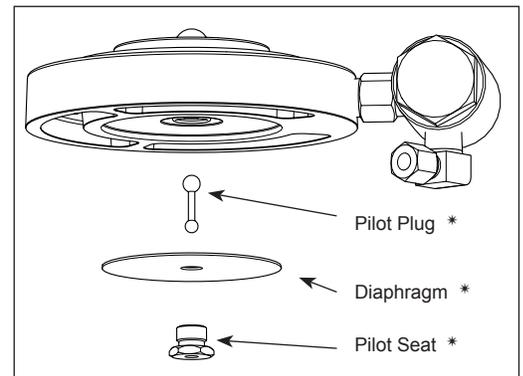


Fig. 5-2

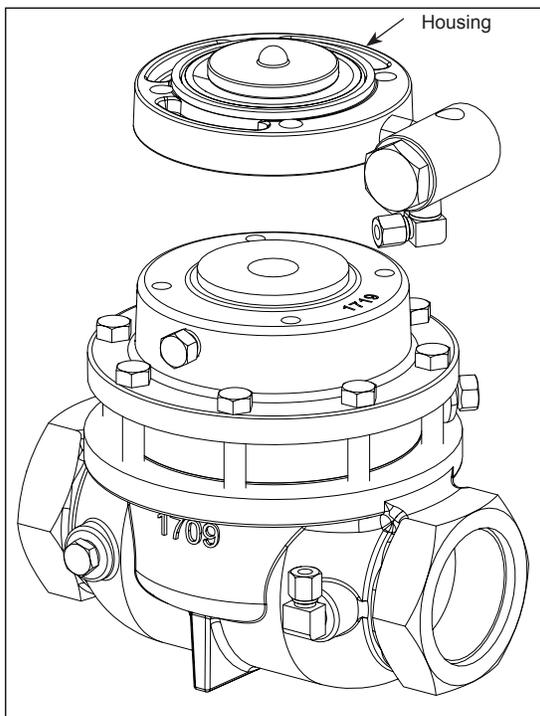


Fig. 5-1

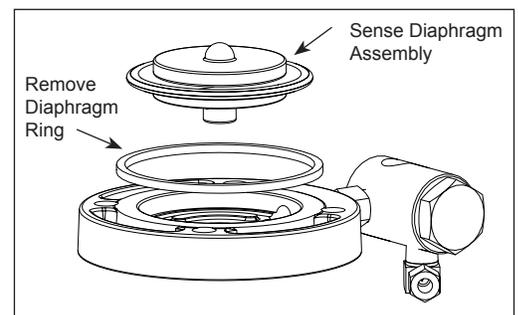


Fig. 5-3

* Recommended spare parts and stocked as repair kits

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DISASSEMBLY

Remove the Spring from the Diaphragm Nut with needle nose pliers

Use pliers to remove the Diaphragm Nut from the Diaphragm Plate.

See Fig. 5-4

Remove the Diaphragm from the Diaphragm Plate.

See Fig. 5-5

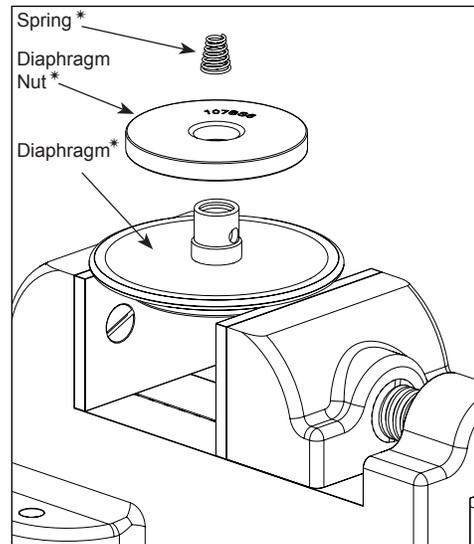


Fig. 5-4

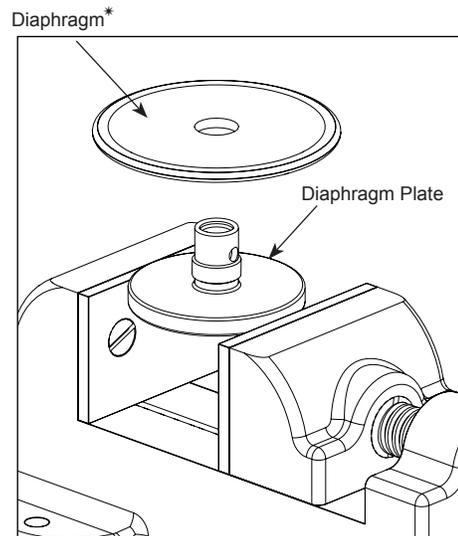


Fig. 5-5

* Recommended spare parts and stocked as repair kits

DISASSEMBLY

6 Filter

Remove the Filter Cap with an adjustable wrench, impact gun or socket.

If the Filter Cap is too tight, tap the Filter Cap with a hammer.

Remove the o-ring from the Filter Cap by using needle nose pliers or a pick.

Use a slender screw driver and needle nose pliers to remove the six filter screens from the inside.
See Fig. 6-1

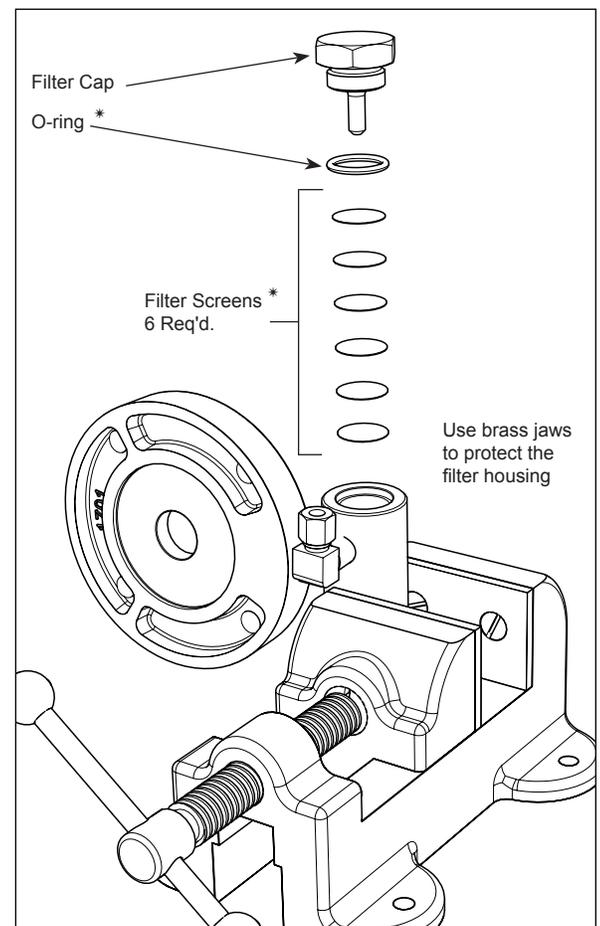


Fig. 6-1

Model: *Pilot Operated*

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DISASSEMBLY

7 Lower Seat

Remove Lower Seat with a socket.
See Fig. 7-1

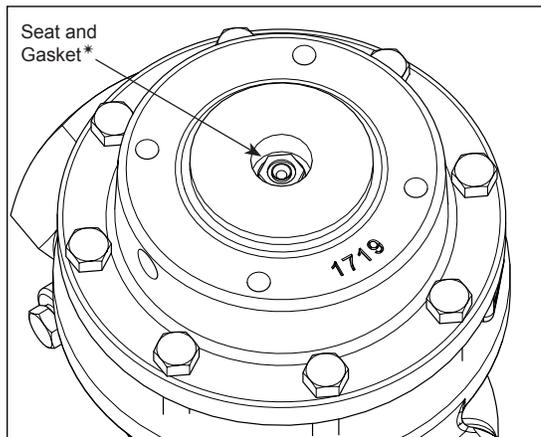


Fig. 7-1

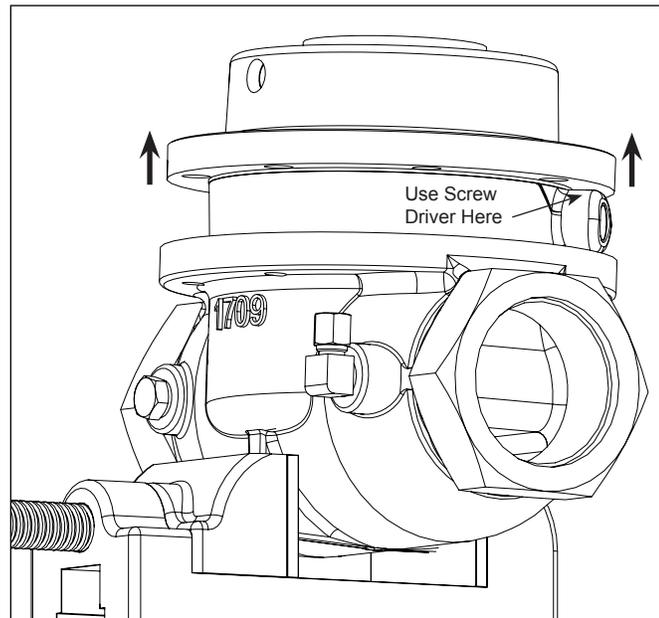


Fig. 8-1

8 Upper Housing

Remove the bolts on the Upper Housing. Use a flat head screw driver and wedge between Upper Housing breather hole and nipple on Housing. Tap the screw driver with a hammer and remove the Housing. See Fig. 8-1

Use a socket to remove the Breather Plug.

Remove Diaphragm. See Fig. 8-2

Use a flat head screw driver and wedge between breather hole and nipple on Housing. Tap the screw driver with a hammer and remove the Upper Housing.

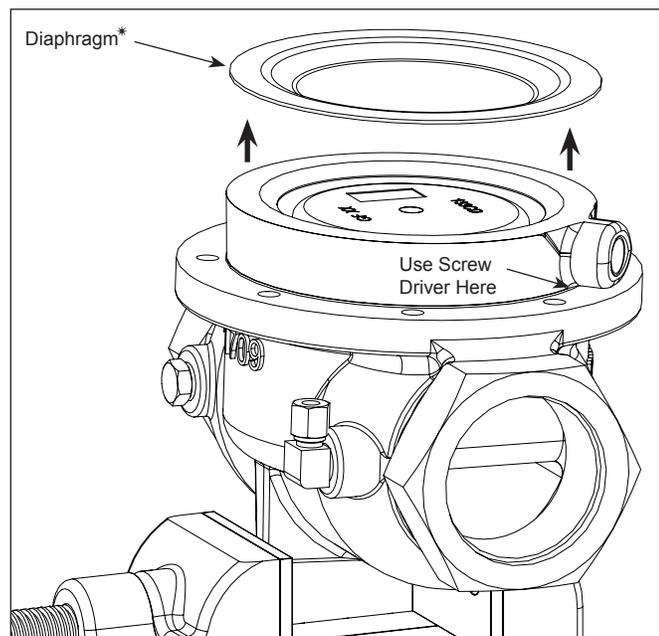


Fig. 8-2

* Recommended spare parts and stocked as repair kits

DISASSEMBLY

9 Lower Housing, Body

! NOTE:

Be sure the oil has been drained from the lower Housing.

Use a flat screw driver and wedge it between breather hole nipple in Lower Housing and Body. Tap screw driver with a hammer and remove Lower Housing. See Fig. 9-1

Flip Lower Housing over and remove the Diaphragm Plate. See Fig. 9-2

Remove the Stem along with the Disc, Seat, Ratio Plug and Lock Nut. See Fig. 9-3

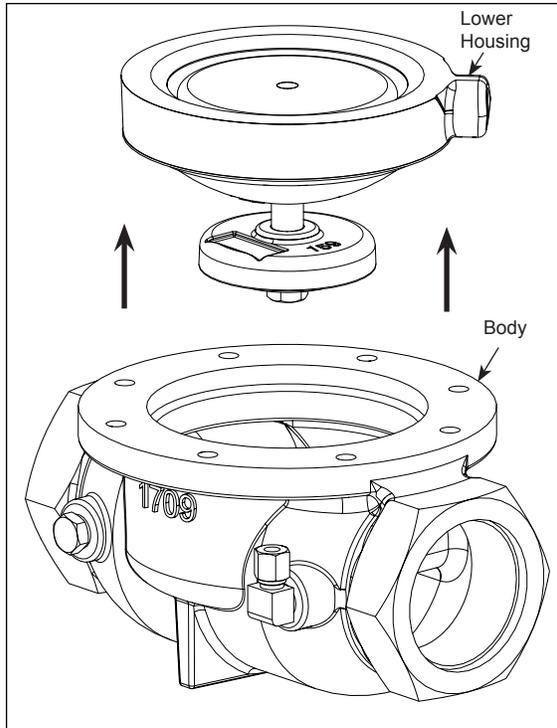


Fig. 9-1

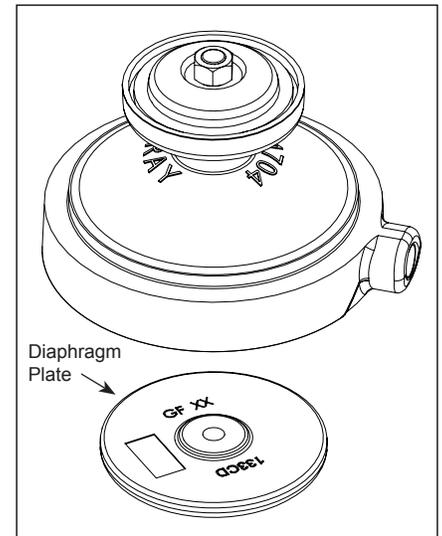


Fig. 9-2

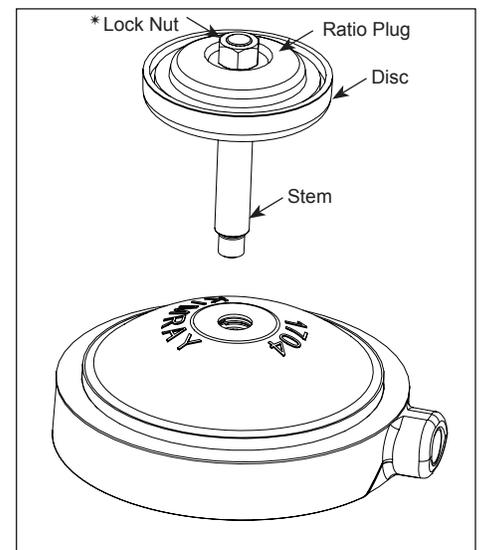


Fig. 9-3

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DISASSEMBLY

Insert brass jaws on vice (not shown). Tighten the Stem in the vice and remove Lock Nut. See Fig. 9-4

Remove the Seat and Ratio Plug from the Disc.

Remove the O-ring and two Back Ups from the Lower Housing. See Fig. 9-5

CAUTION:

Use putty knife to remove the Gasket from the body. See Fig. 9-6

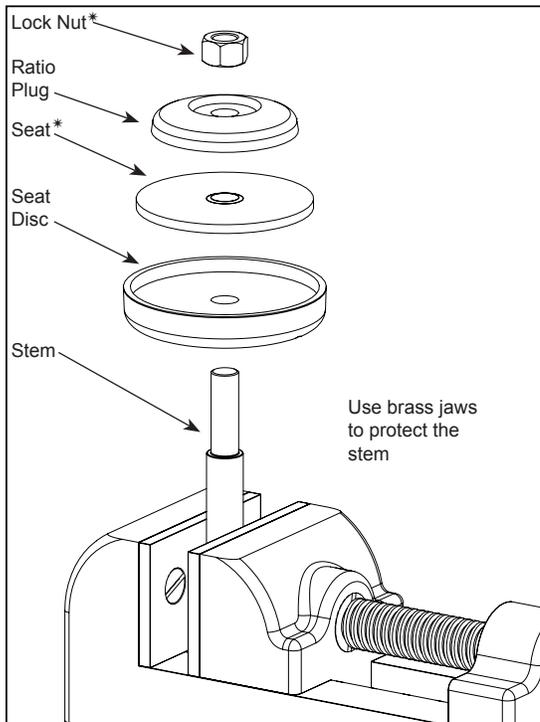


Fig. 9-4

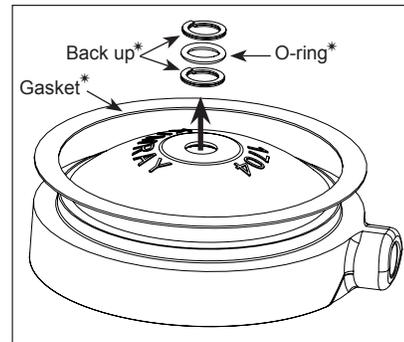


Fig. 9-5

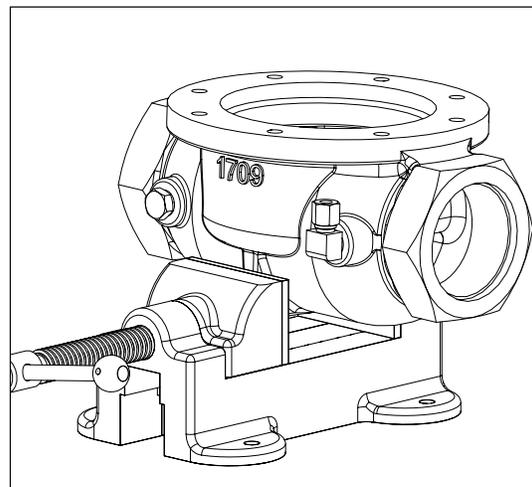


Fig. 9-6

* Recommended spare parts and stocked as repair kits

INSPECTION

10 Inspection & Cleaning

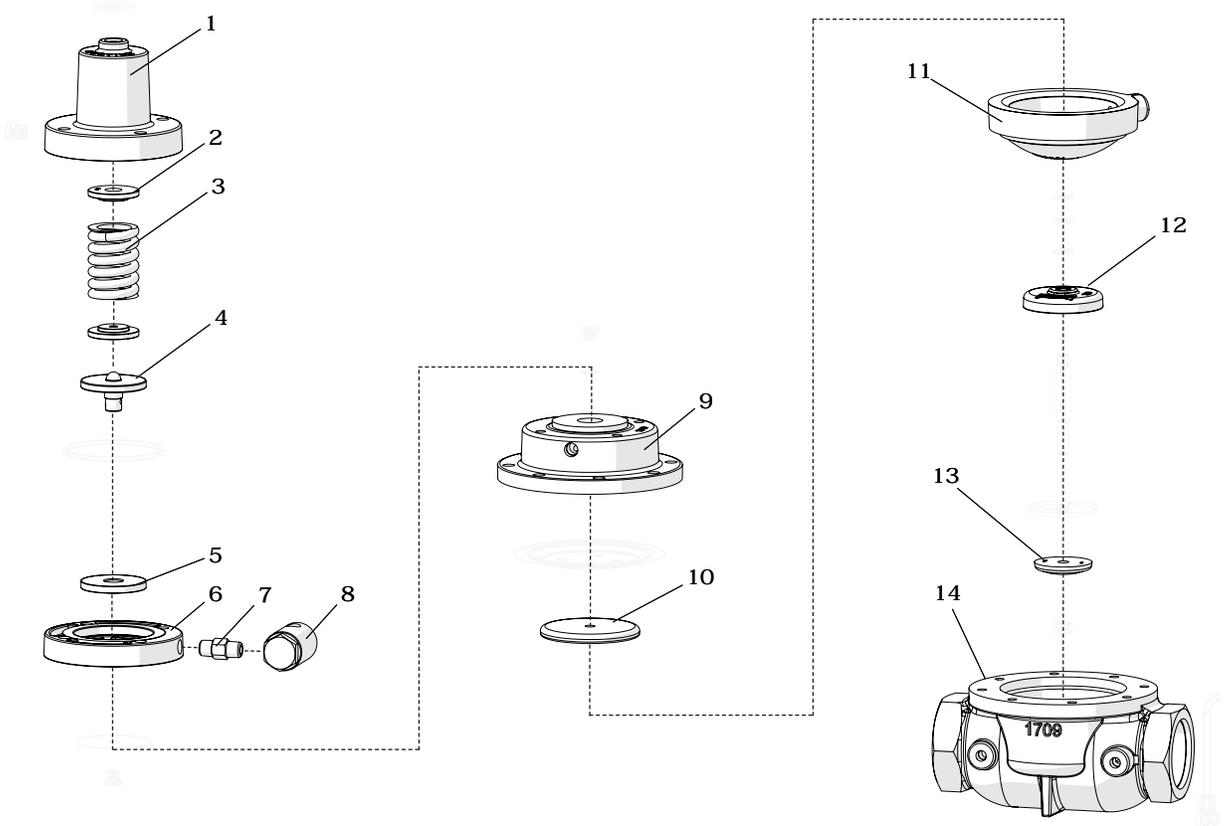


Fig. 10-1

Item numbers 1-15 should be sandblasted or cleaned

Item	Description	Qty
1	Bonnet	1
2	Spring Plates	2
3	Spring	1
4	Diaphragm Plate	1
5	Diaphragm Nut	1
6	Housing	1
7	Nipple	1
8	Filter	1
9	Housing	1
10	Plate	1
11	Housing	1
12	Disk	1
13	Ratio Plug	1
14	Body	1

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INSPECTION

Diaphragm Plate: Cleaning

Wire brush to clean the diaphragm plate. See Fig. 10-2

Use an air nozzle to blow out the particles from inside.

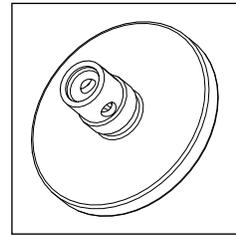


Fig. 10-2

NOTE:

It is important to get every part of the filter clean. Any loose particles left inside could cause leakage in the pilot plug.

Filter Cleaning:

Wire brush the Filter hole. See Fig. 10-3

Use an air nozzle to blow out the particles from inside.

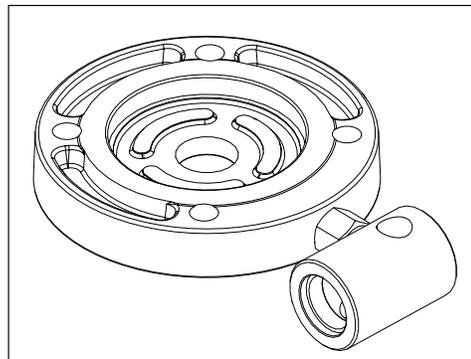


Fig. 10-3

NOTE:

It is important to get every part of the Upper Housing clean. Any loose particles left inside could cause leakage in the Pilot Plug. See Fig. 10-4.

Filter: Cleaning

Wire brush the filter holes in the Upper Housing.

Use an air nozzle to blow out the particles from inside.

Flip Housing over and verify that communication hole is clear and free of debris.

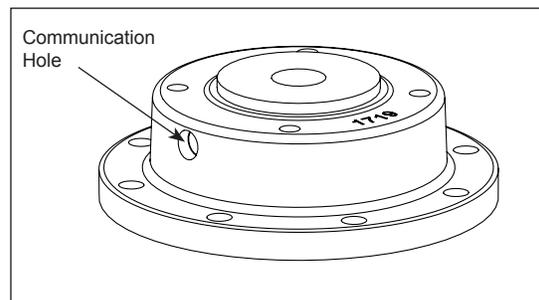


Fig. 10-4

INSPECTION

! NOTE:

Nicks or fragments of gasket material can cause misalignment on the body surface. This can be repaired by using a flat file. See Fig. 10-5

Repair:

If there are dings in the Lower Housing.

Cleaning:

Wire brush both the breather hole and the Lower Housing. See Fig. 10-6

Use an air nozzle to blow out the particales from inside the Lower Housing.

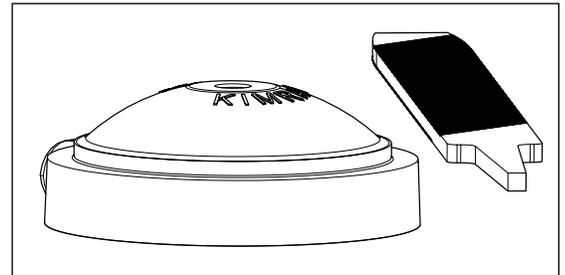


Fig. 10-5

! NOTE:

Roll the Stem on a flat surface to check for straightness See Fig. 10-7

Replace:

If Stem is bent.

! NOTE:

If light scratches or galling is present, repair the Stem by sanding the surface with a 220 grit or finer sand paper. If repair is not possible Kimray recommends replacement.

Repair:

If Stem surface shows light scratches.

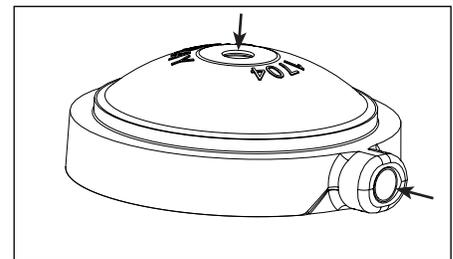


Fig. 10-6

! NOTE:

Use putty knife to remove the Gasket from the flange face. See Fig. 10-8

Cleaning:

Use an air nozzle to clear any particles on flange face.

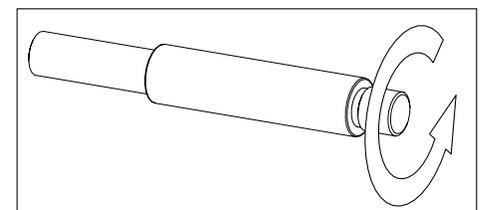


Fig. 10-7

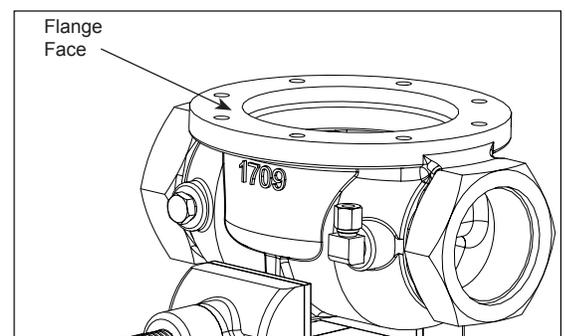


Fig. 10-8

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INSPECTION

Inspect the Removable Seat for excessive wear or scratches. If the Seat is in good shape leave it in place. Removing the Seat could result in additional damage.

If the Seat needs to be replaced, insert the Seat Wrench and use a rubber hammer to break the seat loose.



NOTE:

For larger regulator sizes, the Seat might not easily come apart. If this is the case try the following. See Fig. 10-9



CAUTION:

Tap the handle with a shop hammer. Insert a cheater pipe over the handle for additional leverage. Heat the seat with a torch if necessary for removal.



NOTE:

Lower pressure valves **DO NOT** have a removable seat.

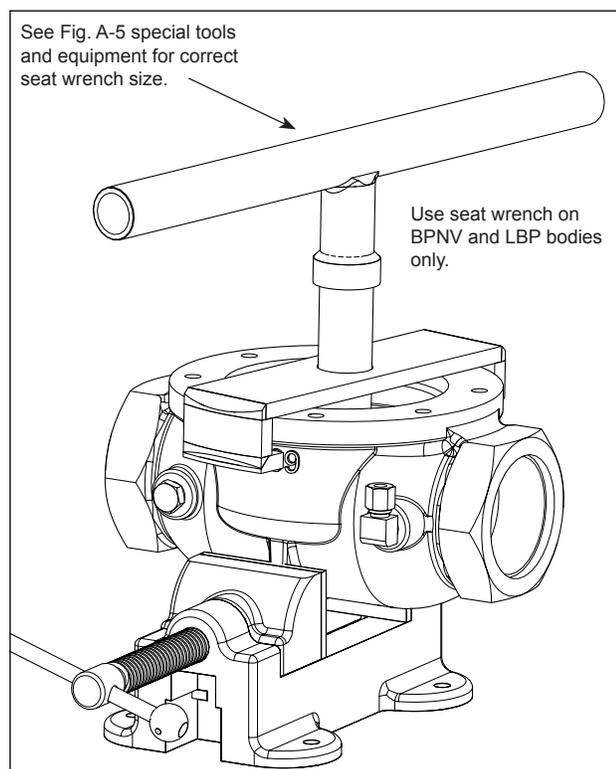


Fig. 10-9

ASSEMBLY

11 Lower Housing Assembly

Insert the first Back Up in the Lower Housing groove. The Back Up will spiral into the groove. See Fig. 11-1

Using a narrow screw driver, insert the O-ring on top of the Back Up.

Insert the second Back Up in the Lower Housing groove.

Use a brush to grease Back Ups and O-rings.

Before assembling, apply primer and Blue Loctite® to short end of the Stem. Hand tighten the Stem into the machined side of the Diaphragm Plate. See Fig. 11-2

To prevent shearing the O-ring, insert the Stem Guide on Stem with the radius side on top. See Fig. 11-3

Place the Lower Housing onto the Stem. Remove the Stem Guide from the Stem. See Fig. 11-4

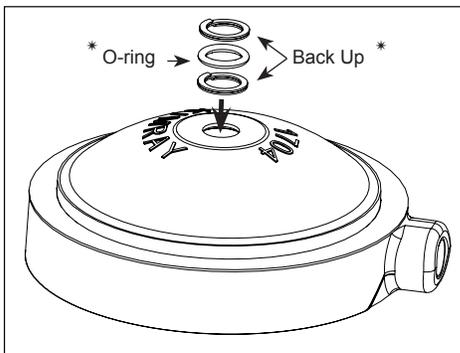


Fig. 11-1

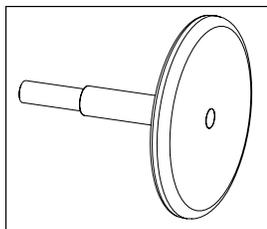


Fig. 11-2

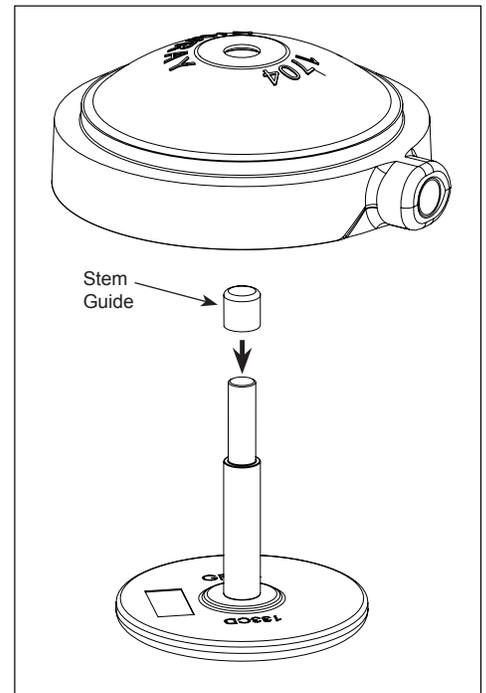


Fig. 11-3

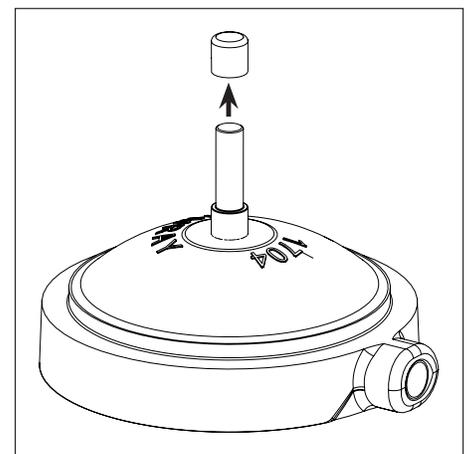


Fig. 11-4

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ASSEMBLY

Place the Seat Disc on the Stem. See Fig. 11-5

Insert the Seat into the Seat Disc.

Insert the Ratio Plug on top of the Seat.

Apply all purpose grease to threads of Stem and hand start the Lock Nut threads. See Fig. 11-6

Hold the Seat Disc in one hand and use a socket to tighten the Lock Nut. Stop when you start to feel the Seat Disc turning in your hand. **DO NOT OVER TIGHTEN**, but you do not want the Disc spinning on the Stem.

Apply all purpose grease to the Lower Housing shoulder. See Fig. 11-7

Place the Gasket on the Lower Housing shoulder.

Apply all purpose grease the top side of the Gasket.

Insert the Lower Housing into the Body. See Fig. 11-8
Make sure the breather hole aligns with the back side of the flow arrow.

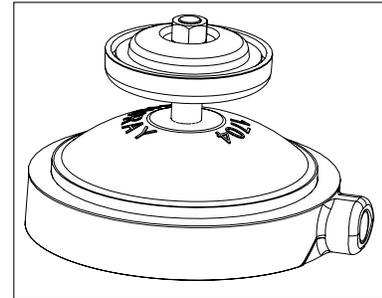


Fig. 11-6

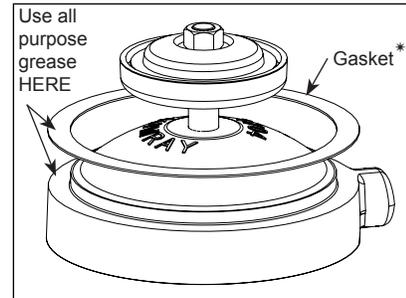


Fig. 11-7

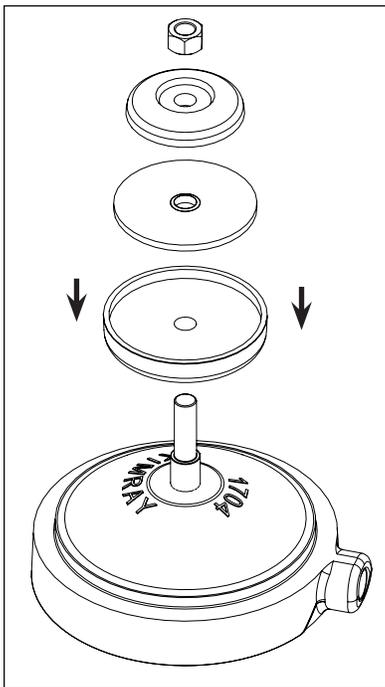


Fig. 11-5

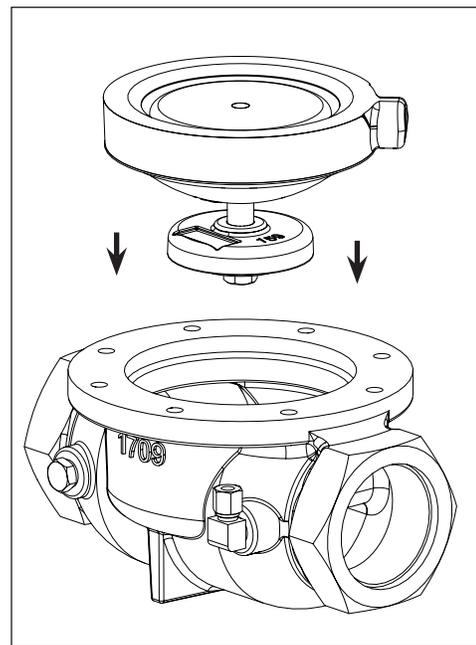


Fig. 11-8

* Recommended spare parts and stocked as repair kits

ASSEMBLY

Fig. 11-9 shows the orientation of Lower Housing boss to Body.

Add all purpose oil to the Lower Housing until the oil is above the lower communication hole and below the upper communication hole. See Fig. 11-10, 11-11

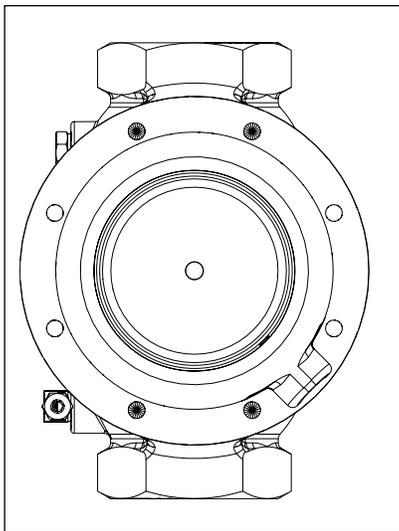


Fig. 11-9

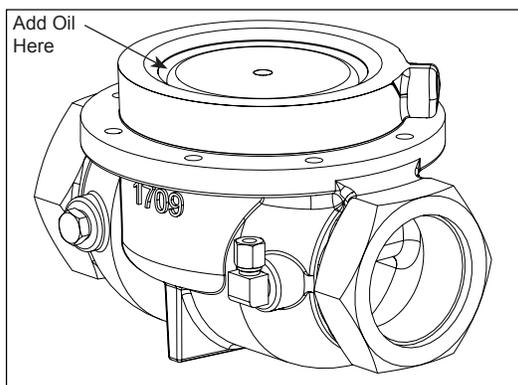


Fig. 11-10

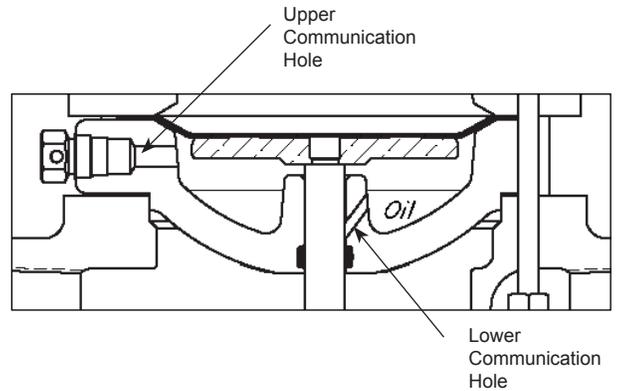


Fig. 11-11

12 Diaphragm

Install Diaphragm onto Lower Housing assembly.
See Fig. 12-1



NOTE:
Be sure Diaphragm is placed in a 'bowl' position inside the Lower Housing.

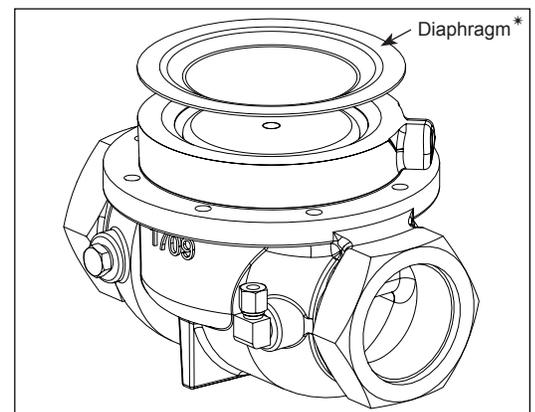


Fig. 12-1

Model: *Pilot Operated*

Installation, Operation & Maintenance Guide

ASSEMBLY

13 Upper Housing, Lower Seat

Place the Upper Housing on top of the Lower Housing. Start all Bolts at least three rotations into Body and run one Bolt down to the shoulder. Hand tighten the remaining Bolts using the torque star pattern. See Fig. 13-1

Align the breather hole between outlet holes in Body. See Fig. 13-2

Install Gasket and Lower Seat into the Upper Housing. DO NOT OVER TIGHTEN. See Fig. 13-3



NOTE:

Make sure you tighten the Bolts in a criss-cross pattern to avoid any miss alignment. For 2in., 3in., and 4in. tighten bolts to 25-30 ft/lbs torque.

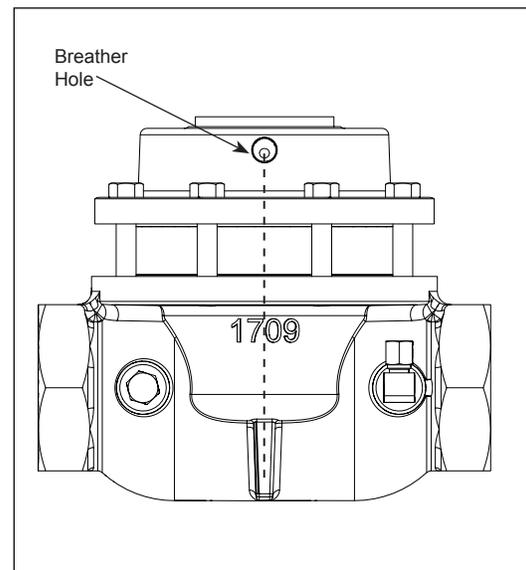


Fig. 13-2

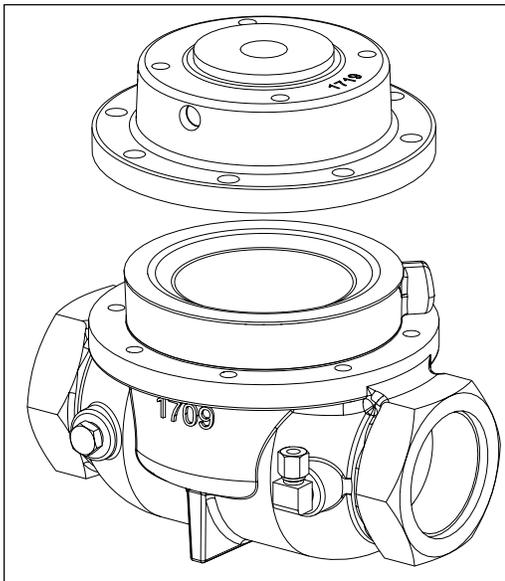


Fig. 13-1

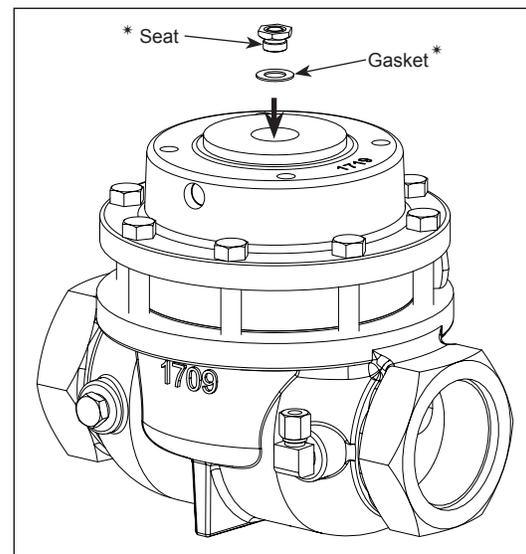


Fig. 13-3

ASSEMBLY

14 Filter

Apply primer and blue Loctite™ to both ends of Nipple and thread one end into Filter and the other end into pressure port of Diaphragm Housing. See Fig. 14-1



NOTE:

Clamp Filter Body into the vice using brass jaw (not shown) and tighten.

Insert Screens (rough edge up) in the Filter.
See Fig. 14-2

Place O-ring onto the Filter Cap.

Hand start Filter Cap into Filter Body and tighten with a wrench. See Fig. 14-2

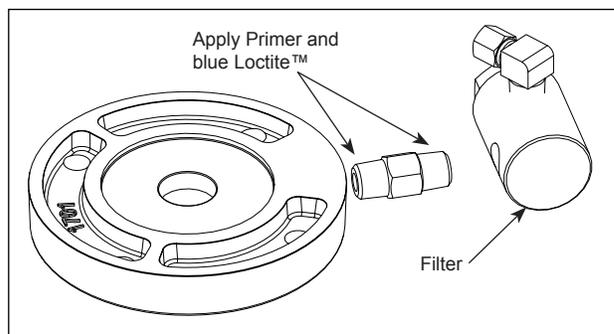


Fig. 14-1

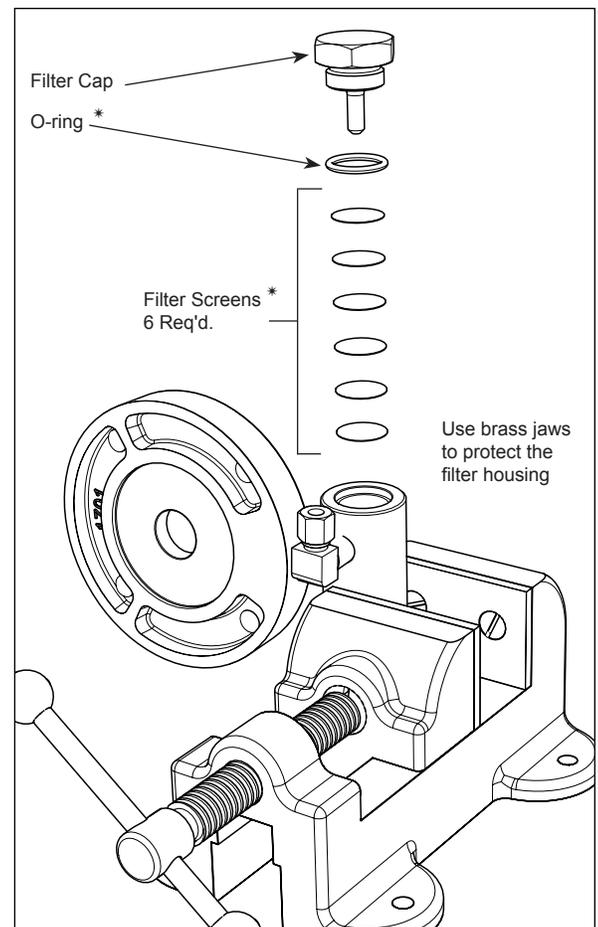


Fig. 14-2

Model: *Pilot Operated*
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ASSEMBLY

15 Diaphragm Plate

Place the Pilot Diaphragm onto the Plate.
See Fig. 15-1

Thread the Nut onto the Plate and tighten with pliers.
See Fig. 15-2

Insert the Spring with the wider side on bottom.
See Fig. 15-3.

Insert the Pilot Diaphragm Assembly underneath the Diaphragm Housing. See Fig. 15-4.

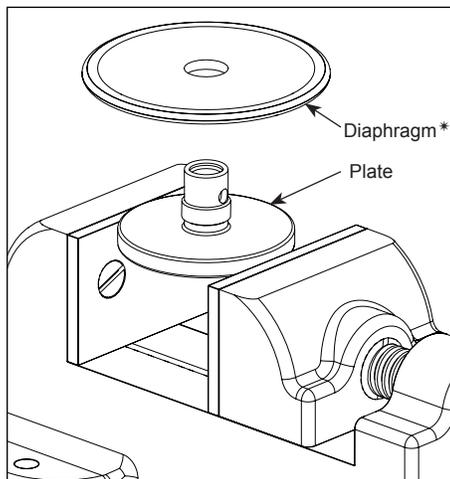


Fig. 15-1

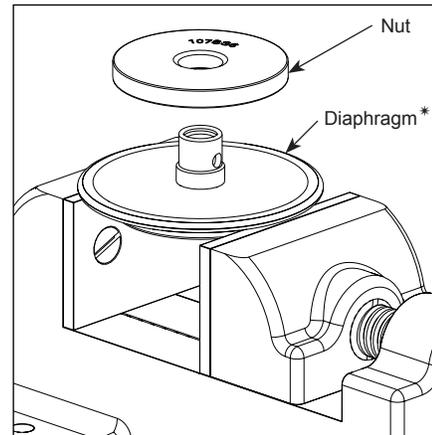


Fig. 15-2

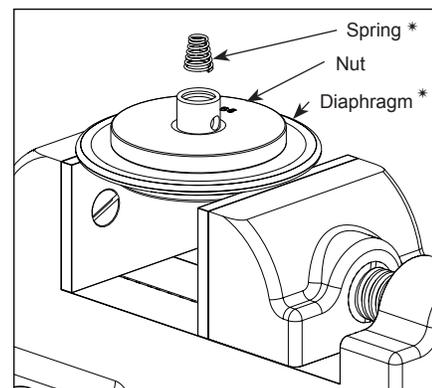


Fig. 15-3

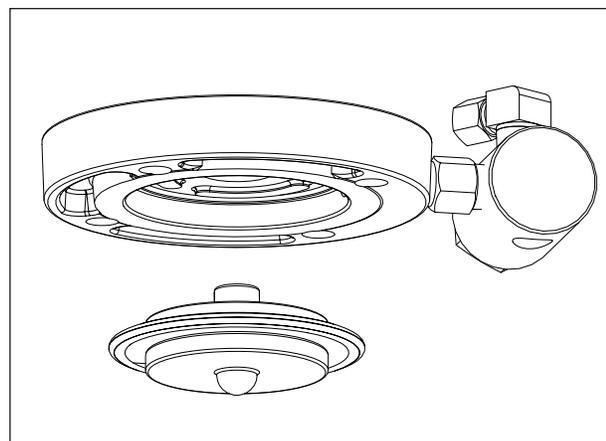


Fig. 15-4

* Recommended spare parts and stocked as repair kits

ASSEMBLY

Insert the Pilot Plug with the larger ball diameter contacting the Spring. See Fig. 15-5



NOTE:

Clean Pilot Seat if necessary.

Insert the Pilot Seat through the Diaphragm.

DO NOT shear the Diaphragm with the Pilot Seat threads. See Fig. 15-6

Install small end of Pilot Plug through Pilot Seat.



NOTE:

Plate or Pilot Seat edges may cut Diaphragm

Thread by hand to hand tight.

Using wrench or nut driver, tighten to 1/8 turn (15 in-lb) See Fig. 15-7

Center Diaphragm and the Pilot Diaphragm into counter-bore of Diaphragm Housing.

Tighten Pilot Seat with socket. **DO NOT OVER TIGHTEN.**



NOTE:

Diaphragm Plate may cut the Diaphragm.

Flip the Diaphragm Housing over and install Diaphragm Ring. place on top of the Upper Housing. See Fig. 15-8

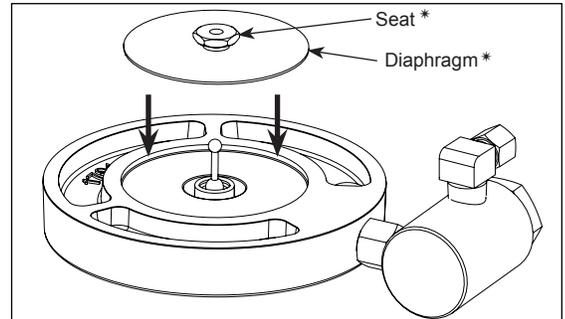


Fig. 15-6

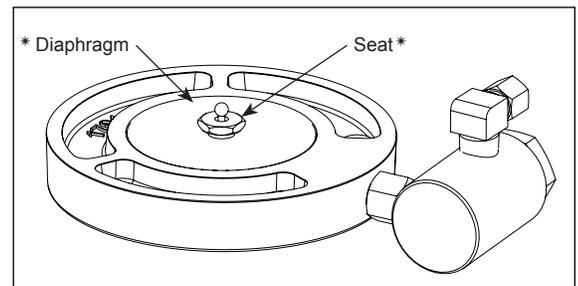


Fig. 15-7

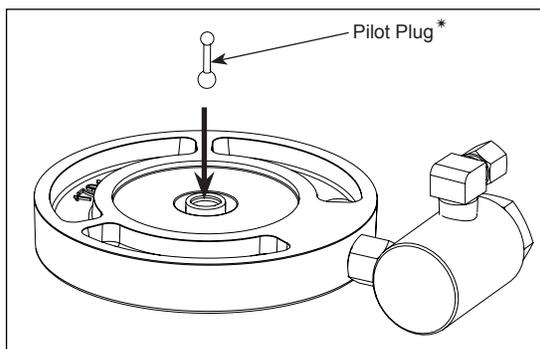


Fig. 15-5

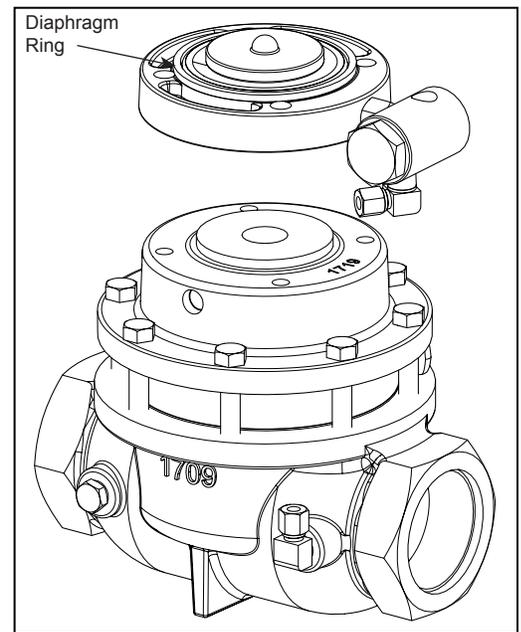


Fig. 15-8

Model: *Pilot Operated*

Installation, Operation & Maintenance Guide

ASSEMBLY

16 Spring, Bonnet

Apply all purpose grease on the top surface of the Plate and place the Spring Plate on top. See Fig. 16-1

Place the Spring on top of the Spring Plate.

Install Spring Plate on top of Spring. Apply all purpose grease to bevel of Spring Plate.

Install the Bonnet on top of the Spring Assembly. See Fig. 16-2

Insert Bolts and tighten with a speed wrench.



NOTE:

Tighten Screws in a criss-cross pattern to avoid any miss alignment. Tighten bolts to 25-30 ft/lbs torque.

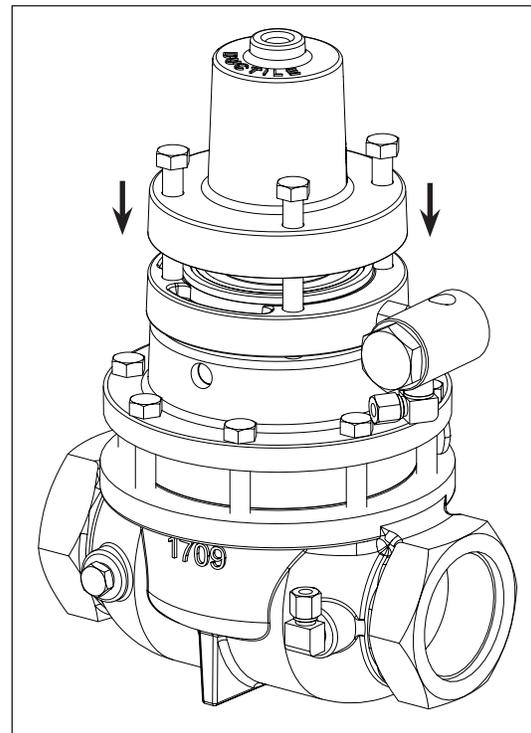


Fig. 16-2

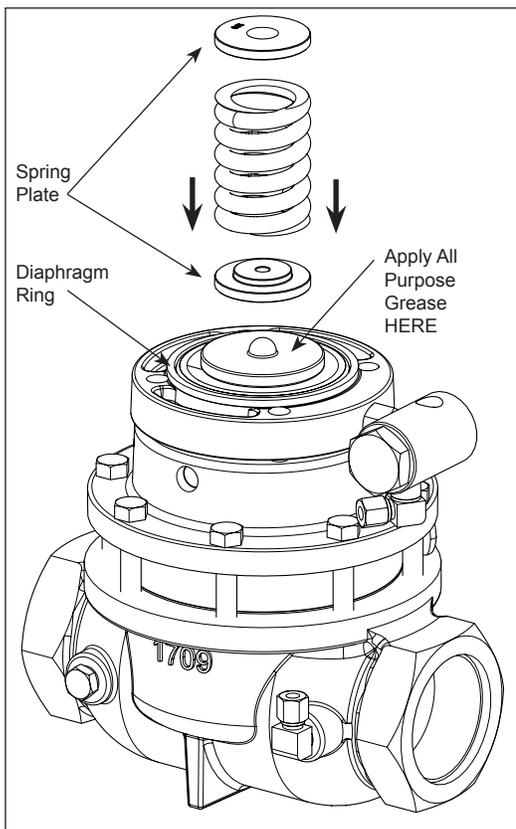


Fig. 16-1

ASSEMBLY

17 Breather Plugs



NOTE:

Apply blue Loctite™ to Breather Plugs and hand start into both Upper and Lower Housing bosses.

Insert Breather Plug in Upper Housing. See Fig. 17-1.

Insert Breather Plug in Lower Housing.

The Breather Plug hole should stop in the five to eight o'clock position.

Install small Red Plug into the breather hole of the Lower Housing Breather Plug. (Red Plug not shown) and remove after installation. See Fig. 17-2.

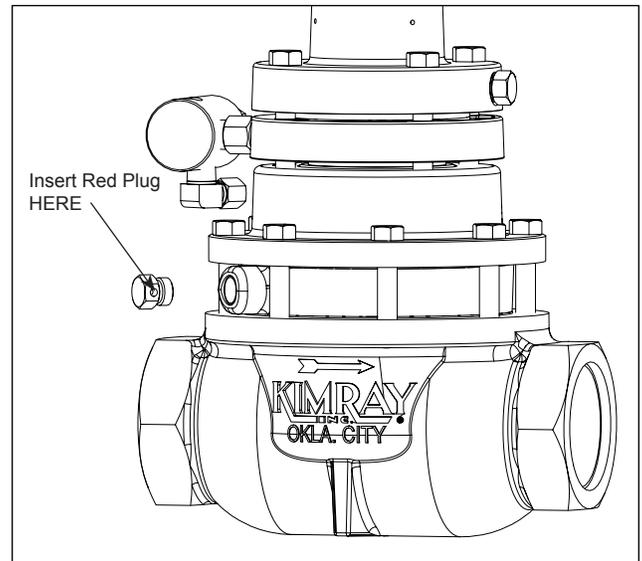


Fig. 17-2

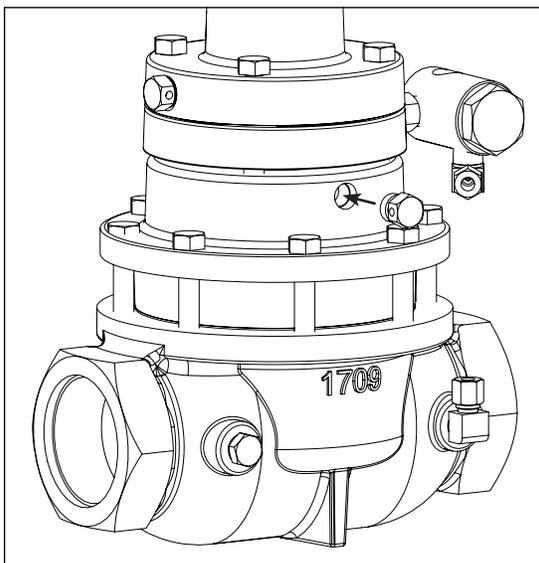


Fig. 17-1

Model: *Pilot Operated*

Installation, Operation & Maintenance Guide

ASSEMBLY

18 Adjusting Screw, Tubing



NOTE:

Apply all purpose grease to the first few threads of the Adjusting Screw.

Thread the Adjusting Screw with Nut, Washer and Packing Seal on top of the Bonnet. See Fig. 18-1

Connect the Tubing from the upstream communication hole to the Filter. See Fig. 18-2

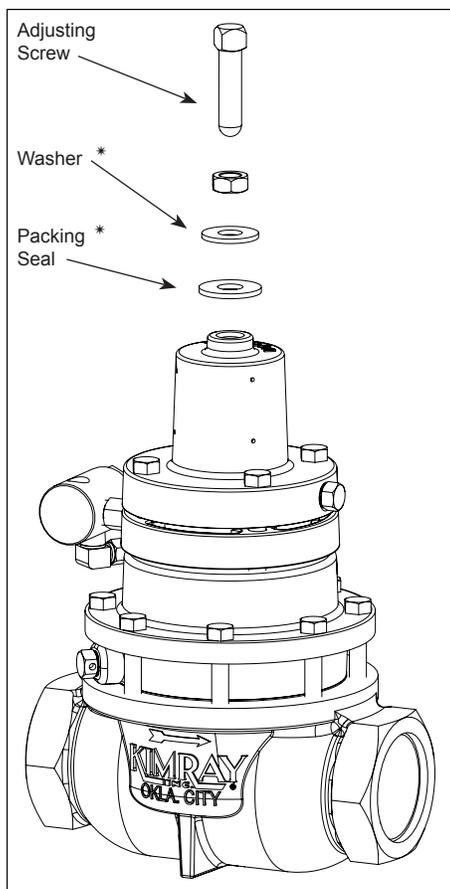


Fig. 18-1

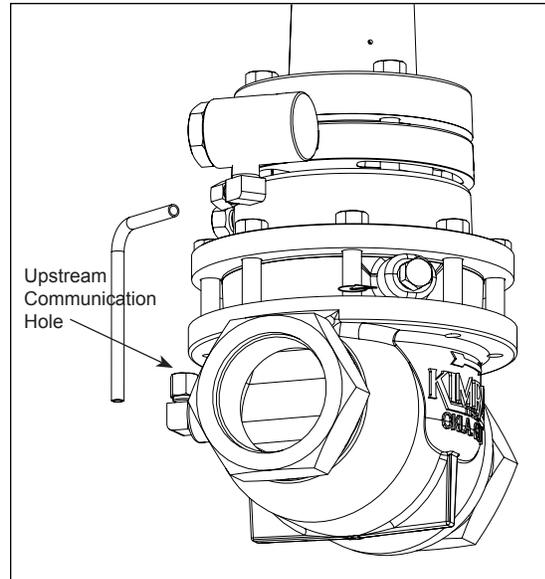


Fig. 18-2

* Recommended spare parts and stocked as repair kits

ASSEMBLY

19 Gauge

Verify the needle is in the correct position.



NOTE:

Apply blue Loctite™ to the Gauge threads.

Thread the Gauge into the Filter and tighten with an adjustable wrench. See Fig. 19-1

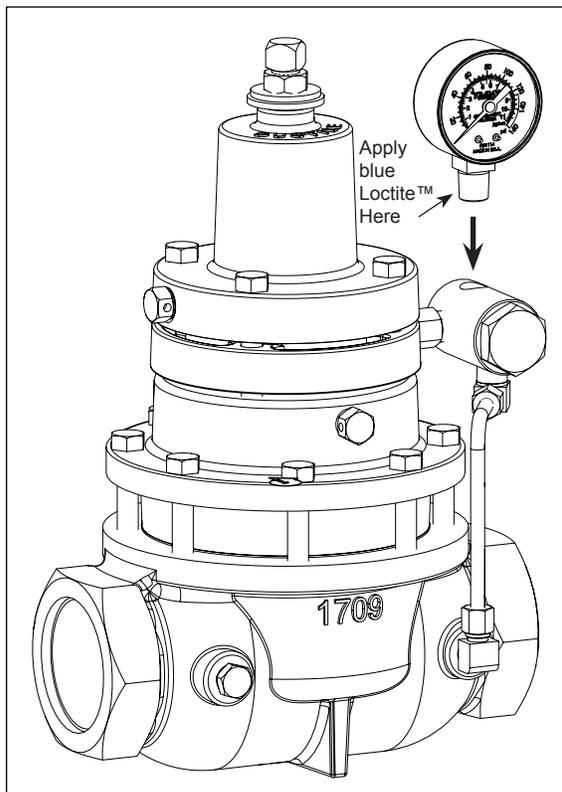


Fig. 19-1

Model: *Pilot Operated*
Installation, Operation & Maintenance Guide

TESTING

20 Flow Direction, Adjusting Screw, Check For Leakage

Flow Direction

Make sure the air is flowing from upstream to downstream. Regulators have an arrow showing the direction of flow. See Fig. 20-1

Adjusting Screw

Use an adjustable wrench to run the Adjusting Screw all the way down. See Fig. 20-1

Check for Leakage

Turn supply air off and make sure the Gauge is holding pressure on the upstream side. If Gauge falls off then you have leakage. See Fig. 20-2

Check if any leakage is coming out the downstream side.

Spray soaped water on Tubing, Housings, Breather Plugs and Plugs. The identification of leakage will be noted if any bubble shows up. See Fig. 20-2

Regulator Test

Once no leakage is detected, close upstream flow.

NOTE:

Make sure the regulator holds various levels of pressure. (100 psi down to 5 psi by turning the Adjusting Screw out).

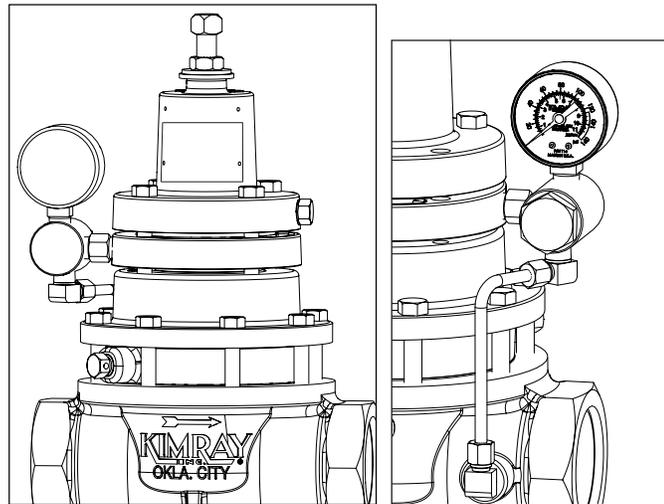


Fig. 20-1

Fig. 20-2

Troubleshooting		
Problem	Possible Cause(s)	Possible Solution
Regulator appears to be stuck in ON position.	Stopper has not been removed from breather plug in lower housing. (BP Regulator)	Remove the stopper.
Regulator leaks through to downstream.	Over tightened seat nut can cause seat to bulge and leak.	DO NOT OVER TIGHTEN seat.
Pilot bleeds gas continuously.	The pilot plug seat may be dirty.	Clean the pilot plug seat.
Minimum set point cannot be set.	Bonnet screws are over tightened.	DO NOT OVER TIGHTEN bonnet screws.
Regulator will not open.	A pilot seat may be loose. (BP Regulator)	Tighten the pilot seat.

Kimray is an ISO 9001- certified manufacturer.
Kimray quality assurance process maintains strict controls
of materials and the certification of parts used in Kimray pressure regulators.

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