ANSI Class 150, 300 and 600

Radial Flow Valves

Installation
Operation
Control Manifold
Control Loops
Repair Parts

RFV®

AMC Quality System
QMI is Accredited by:

ISO 9002 Registered
Dutch Council for Accreditation

AMERICAN METER COMPANY
Measurement Engineers Since 1836
INDEX

Introduction
  Top .................................................. 3
  Diaphragm ........................................ 3
  Cage ............................................... 3
  Body ............................................... 3
  Trim ............................................... 3

Operating principles
  Control passages ................................. 4
  Valve operation and flow positions ............ 4

Valve manifold blocks
  Restrictor manifold block ....................... 5
  Inspirator manifold block ...................... 5

Basic control loops
  Pilot controlled pressure reduction ............ 6
  Relief and back pressure ....................... 6
  Controllers .................................... 6

Installation ..................................... 7

Startup and operation
  Restrictor control .............................. 8
  Inspirator control ................................ 8
  Single stage pressure reduction ............... 8
  Two stage pressure reduction .................. 9
  Back pressure regulation and relief .......... 10
  Single stage pressure reduction with controller .................. 11
  Back pressure regulation with controller .... 12
  Downstream monitoring ......................... 13
  Passive upstream monitoring .................. 14
  Two stage regulation with monitor override .. 15
  Internal manifold plug
    installation instructions ..................... 16
  Inspiration control initial set-up,
    single stage pressure reduction .......... 16

Inspection and maintenance
  Valve internal components ..................... 17
  Control ports .................................. 17

Manifold inspection and maintenance
  Restrictor core .................................. 18
  Manifold filter ................................ 18

Repair parts .................................... 19

Radial Flow Valve

RFV®
The Radial Flow Valve consists of four major structural components: the body, top, flow cage, and a rubber diaphragm. It is designed for easy inspection and service.

**Top**
The cast steel top removes easily for valve inspection; there are no control loop connections to the top. A passage drilled into the top feeds pressure from the manifold block to the control chamber above the diaphragm.

**Diaphragm**
A pan type diaphragm, loaded by a compression spring, seats on the cage providing positive lockup under no-flow conditions. The diaphragm is available in a variety of materials and durometer ratings.

**Cage**
Full flow and partial flow cages seat into a machined bore in the body. No screws are required to hold the cage in place and no special orientation (positioning) is necessary. Cages are available in 100% and reduced capacity trim. They are constructed of investment cast 17-4 PH stainless steel. The O-rings (2) under the cage provide pressure seals.

**Body**
The cast steel body installs permanently in the line, with industry standard flange-to-flange dimensions. All service can be performed without removing the valve body from the line.

**Trim**
Valve trim includes all components which come into contact with the fluid:

- O-rings: Buna-n or Viton
- Spring: Stainless steel
- Optional Strainer: Stainless steel
- Manifold Block: Cadmium plated steel
Control Passages
The front of the body is drilled to provide three control loop passages; inlet supply pressure, control pressure, and outlet (exhaust) pressure. There are also two bolt holes for mounting the restrictor or inspirator type manifold block to the body. These internal passages eliminate the need for external control loop piping (Figure 2).

The control port in the body communicates pressure to the top of the diaphragm through an internal passage in the top. This eliminates an external piping connection, making the removal of the valve's top simpler and quicker.

Valve operation - Figures 3a, 3b, & 3c
The Radial Flow Valve is a pilot unloading type of valve. Under gas flow conditions the pilot opens, exhausting pressure from the control chamber above the diaphragm and causing the diaphragm to lift. When the gas demand decreases or stops completely, outlet pressure builds slightly, closing the pilot and increasing the control pressure.

When flow to the connected load stops the pilot senses a slight rise in outlet set pressure (P₂). The pilot closes, allowing control pressure (P_c) to build to the inlet pressure (P₁). The compression spring presses the diaphragm against the cage, causing lockup around the center opening of the cage.

A demand for gas by the connected load causes a slight drop in the valve's outlet pressure (P₂) which is sensed by the pilot. The pilot opens allowing gas to be exhausted from the control chamber at a faster rate than it is supplied through the restrictor (or inspirator). This lowers the pressure above the diaphragm (P_c) to a value less than the inlet pressure (P₁). When inlet pressure (P₁) exceeds the control pressure (P_c), the diaphragm lifts upwards, gradually opening the cage slots and allowing gas to flow up through the center port and radially outward through the cage slots.

As the load increases, the pilot opens more, causing the control pressure (P_c) to decrease. The valve is fully open when the difference between the control pressure (P_c) and the inlet pressure (P₁) is sufficient to allow the diaphragm to rise up until it lays against the underside of the top. At this point the cage slots are completely open.
For pressure control (reduction) applications, the RFV can be equipped with either:
- a standard restrictor type manifold block, Figure 4a
- an inspirator manifold block for low differential pressure applications, Figure 4b.

**Restrictor manifold block**

In Figure 4a, the adjustable restrictor in the control block limits the flow of gas to the control chamber and to the pilot. Restrictor settings of 1 thru 8 are possible. The lower the setting, the greater the restriction. Low settings cause the valve to open quickly and close slowly and vice versa. With a setting of 2, the flow through the restrictor will be much less than the flow through the pilot orifice. This allows the pilot to relieve or exhaust the pressure above the diaphragm quickly, opening the valve quickly. At higher restrictor settings, the restrictor can supply gas at a rate closer to the flow through the pilot and it takes longer for the pilot to reduce the control pressure ($P_c$).

**Inspirator manifold block**

In Figure 4b, a venturi, or inspirator, sets the flow rate to the control chamber and pilot. It is not adjustable. The sensitivity control is used to adjust the response of the valve, either slower or faster for opening and closing. For example, a sensitivity control setting of 8 will cause fast opening and closing. A setting of 2 reduces the response to open and close the valve.

The inspirator suppresses (decreases) the control pressure ($P_c$) by increasing the gas velocity in the throat of the inspirator. This suppressed pressure is ported to the control chamber so that it causes the valve to open at lower valve differential conditions ($P_1 - P_2$).

The Following Chart Compares the Differential Pressure Ratings of the Restrictor and Inspirator Manifold Blocks with the various diaphragms available.

<table>
<thead>
<tr>
<th>RFV Series</th>
<th>Diaph. No.</th>
<th>Manifold $\Delta P$</th>
<th>Maximum Valve Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rest. Manifold</td>
<td>Inspir. Manifold</td>
</tr>
<tr>
<td>150/300</td>
<td>H5-L*</td>
<td>1.5</td>
<td>0.75</td>
</tr>
<tr>
<td>150/300</td>
<td>H5*</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>150/300</td>
<td>H7</td>
<td>2.5</td>
<td>20</td>
</tr>
<tr>
<td>150/300</td>
<td>H75</td>
<td>3.0</td>
<td>22</td>
</tr>
<tr>
<td>600</td>
<td>H8</td>
<td>6.0</td>
<td>40</td>
</tr>
</tbody>
</table>

* These diagrams use a light weight main spring to achieve differential pressures listed.
Pilot controlled pressure reduction

Figures 5a and 5b show pilot control loop for pressure regulation applications using restrictor and inspirator control. In pressure regulation applications the pilot senses downstream pressure, as shown in the schematic Figures 5a & 5b, through a sense line connected to the outlet piping.

### Pilots for Pressure Reduction Applications

<table>
<thead>
<tr>
<th>Pilot Type</th>
<th>Outlet Pressure Rating</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZSC-100</td>
<td>1 to 5 psi</td>
<td>71411P010</td>
</tr>
<tr>
<td></td>
<td>2 to 10 psi</td>
<td>71411P043</td>
</tr>
<tr>
<td></td>
<td>3 to 30 psi</td>
<td>71411P011</td>
</tr>
<tr>
<td></td>
<td>10 to 75 psi</td>
<td>71411P012</td>
</tr>
<tr>
<td></td>
<td>25 to 150 psi</td>
<td>71411P014</td>
</tr>
<tr>
<td></td>
<td>100 to 225 psi</td>
<td>71411P009</td>
</tr>
<tr>
<td></td>
<td>200 to 325 psi</td>
<td>71411P046</td>
</tr>
<tr>
<td>ZSC-320-100</td>
<td>200 to 600 psi</td>
<td>71421P008</td>
</tr>
<tr>
<td>1203</td>
<td>5 to 9&quot; W.C.</td>
<td>70017P001</td>
</tr>
<tr>
<td></td>
<td>9 to 15&quot; W.C.</td>
<td>70017P002</td>
</tr>
<tr>
<td></td>
<td>14&quot; W.D. to 2 psi</td>
<td>70017P073</td>
</tr>
<tr>
<td></td>
<td>2 to 5 psi</td>
<td>70017P078</td>
</tr>
</tbody>
</table>

### Relief and back pressure

For relief and back pressure applications the pilot senses upstream pressure as shown in Figure 6.

To fully realize the relief capacity of the RFV, the discharge should be to atmosphere or not more than 5 pipe diameters of equivalent pipe at the outlet. If outlet piping is required, an expander 15° cone is advisable. At outlet piping velocities in excess of 100 ft/sec, the relieved gas generates excessive reactive forces, and the relief system must be supported.

Other parameters necessary to obtain the full relief capacity are as follows:

- pilot downstream bleed should be connected to the RFV outlet pressure taps
- restrictor setting should be 3 or less, consistent with stability and speed of opening
- the upstream sensing line tap should be 2 to 3 pipe diameters from the inlet of the RFV

### Pilots for Pressure Relief Applications

<table>
<thead>
<tr>
<th>Pilot Type</th>
<th>Outlet Pressure Rating</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZSC-150</td>
<td>1 to 5 psi</td>
<td>71411P010</td>
</tr>
<tr>
<td></td>
<td>2 to 10 psi</td>
<td>71411P043</td>
</tr>
<tr>
<td></td>
<td>3 to 30 psi</td>
<td>71411P011</td>
</tr>
<tr>
<td></td>
<td>10 to 75 psi</td>
<td>71411P012</td>
</tr>
<tr>
<td></td>
<td>25 to 150 psi</td>
<td>71411P014</td>
</tr>
<tr>
<td></td>
<td>100 to 225 psi</td>
<td>71411P009</td>
</tr>
<tr>
<td></td>
<td>200 to 325 psi</td>
<td>71411P046</td>
</tr>
<tr>
<td>ZSC-320-150</td>
<td>200 to 600 psi</td>
<td>71421P008</td>
</tr>
</tbody>
</table>

### Controllers

Controllers are used when precise control is required for severe operating conditions. Many combinations of pilots and pneumatic controllers can be used for flow, pressure, temperature or process control. A controller does not normally act directly to position the valve but rather must act through a pilot or diaphragm motor valve interface.
Install the valve in the line before assembling the control loop assembly, observing the flow direction arrow on the valve housing and top. Align inlet/outlet gaskets and insert flange bolts. Tighten the bolts/nuts evenly around the flange.

Assemble the control loop and manifold block to the front of the valve using two bolts and washers supplied. Note that O-rings go over the roll pins extending out of the manifold block.

Check the control loop and system for leaks to assure all connections are tightened properly and that no tubing has been nicked or bent.

NOTE: Mating flange bolts, nuts, and gaskets are supplied by customer.
**Restrictor control**

The instructions that follow from here through page 15 cover commonly used pressure reduction and back pressure/relief applications - all with restrictor control manifold blocks. The restrictor adjustment sets the flow rate to the pilot and controls the response time of the valve.

The adjustable restrictor controls the rate of RFV opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above 4 tend to flood the control system; therefore high settings should be avoided, unless required for control stability. Restrictor settings of 2 or 3 are normal under most conditions.

**Inspirator control**

When using the inspirator manifold block, the inspirator (venturi) sets the flow rate to the pilot and is not adjustable. There is, however, sensitivity control on the inspirator block that is used to set the response time of the valve.

The sensitivity control adjusts the rate of valve opening and closing. High sensitivity settings cause the valve to open and close faster while lower settings reduce the response. A setting of 4 is normal under most conditions.

See page 16 for an example of the sensitivity control adjustment in a single stage pressure reduction application. For this and other inspirator control applications, tune the system by adjusting the pilot pressure spring and sensitivity control until the set point and stable control are achieved at the highest possible sensitivity control setting under normal flow conditions.

**Single stage pressure reduction**

1. Set restrictor to the number 8 setting.
2. Relax pressure spring of pilot regulator by backing out adjustment screw until spring tension is at a minimum.
3. Crack downstream block valve.
4. Slowly crack upstream block valve to pressurize the Radial Flow Valve (RFV).
5. Fully open upstream and downstream block valves.
6. Slowly increase pilot pressure spring tension until some downstream flow is achieved.
7. Reset restrictor (slowly) to the number 4 setting.
8. Slowly increase pilot pressure spring tension until downstream pressure approximates desired set pressure.
9. Tune system by alternately adjusting the pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions. (Restrictor settings of 2 or 3 are normal under most conditions.)
10. Close downstream block valve to check for RFV lockup.

---

Figure 8
Two stage pressure reduction

1. Set restrictors of both first and second stage regulators to the number 8 setting.
2. Relax pressure spring of both pilot regulators by backing out adjustment screw until spring tension is a minimum.
3. Crack downstream block valve.
4. Slowly crack upstream block valve to pressurize Radial Flow Valve (RFV).
5. Fully open upstream and downstream block valve.
6. Slowly increase pilot pressure spring tension of first stage until approximate desired intermediate pressure is indicated to inlet of second stage.
7. Slowly reset first stage restrictor to number 4 setting.
8. Slowly increase pilot pressure spring tension of second stage regulator until approximate downstream pressure is achieved.
9. Gradually reset second stage restrictor to number 4 setting.
10. Tune first stage regulator by alternately adjusting the pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.
11. Tune second stage regulator in same manner.
12. Close downstream block valve to check for RFV lockup.

**NOTE:** The adjustable restrictor controls rate of RFV opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above 4 tend to flood the control system; therefore high settings should be avoided, unless required for control stability. Restrictor settings of 2 or 3 are normal under most conditions.
**Back pressure regulation and relief**

1. Set restrictor to the number 8 setting.

2. Increase pressure spring tension of pilot regulator by turning adjusting screw inward until maximum tension is attained.

3. Open downstream block valve (if used).

4. Gradually introduce inlet pressure to the RFV.

5. Gradually decrease pilot pressure spring tension until:
   (a) **Back pressure**—some downstream flow is achieved.
   (b) **Relief valve**—the desired set point is reached.

6. Reset restrictor to:
   (a) **Back pressure**—the number 4 setting.
   (b) **Relief valve**—The correct restrictor setting is determined at time of installation. Use the lowest restrictor setting which permits the Radial Flow Valve to reseat at a pressure greater than the normal line pressure. Settings from 4 to 8 are normal.

7. **Back Pressure only**—Slowly decrease pilot pressure spring tension until upstream pressure approximates desired set pressure.

8. **Back Pressure only**—Tune system by alternately adjusting the pilot pressure spring and restrictor until both required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.

---

**Figure 10**
Single stage pressure reduction with controller

Diaphragm motor valve with instrument controller

1. Set the restrictor to the number 3 setting.
2. Relax the pressure spring of the pilot regulator by backing out (turning counter clockwise) the adjustment screw.
3. Set the controller's proportional band and reset rate controls as recommended by the manufacturer for initial operation.
4. Set the controller's setpoint adjustment at the desired pressure.
5. Increase the controller's supply pressure to 20 psig.
6. Crack and then slowly open the downstream block valve.
7. Crack and then slowly open the upstream block valve.
8. Slowly increase (turn clockwise) the pilot regulator's adjustment screw until the controller outlet pressure gauge reads 9 psig.
9. Tune the controller in accordance with the manufacturer's recommendations.
10. Close the downstream block valve to check for Radial Flow Valve (RFV) lockup; then slowly reopen this valve.
11. Adjust controller set point to desired outlet pressure value.

12. Open the downstream block valve fully and allow system to stabilize. Flowing conditions must be present through the system at this time, preferably at the minimum anticipated rate if possible.

13. Incrementally narrow (reduce) the proportional band setting in small steps, such as from 50% to 40% to 30%. During this adjustment process, upset the system either by changing flow rate or shifting the set point reference slightly. Allow ample time between each change in the proportional band for the full effect of the adjustment to be observed. Repeat adjustment of proportional band until the narrowest proportional band setting that will not product objectionable cycling is reached.

14. If reset action is used, incrementally increase (open) reset rate to the system while upsetting the system as outlined in Step 13. Allow ample time after each adjustment for the effect of adjustment to be observed and the system again stabilizes. In general, use the fastest reset rate that can be applied without increasing instability.

NOTE: The adjustable restrictor controls rate of RFV opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above 4 tend to flood the control system; therefore high settings should be avoided, unless required for control stability. Restrictor settings of 2 or 3 are normal under most conditions.
Back pressure regulation with controller

1. Set the restrictor to the number 8 setting.
2. Preset the pilot regulator by first fully backing out (turning counterclockwise) the adjusting screw, then advancing (turning clockwise) the adjusting screw until it contacts the adjusting spring, and finally advancing the adjusting screw two (2) complete turns.
3. Set the controller’s proportional band and reset rate controls as recommended by the manufacturer for initial operation.
4. Set the controller’s setpoint adjustment at the desired pressure.
5. Increase the controller’s supply pressure to 20 psig.
6. Open the downstream block valve.
7. Crack and then slowly open the downstream block valve.
8. Slowly decrease (turn counterclockwise) the pilot regulator’s adjustment screw until the controller outlet pressure gauge reads 9 psig.
9. Set the restrictor to the number 3 setting.
10. Tune the controller in accordance with the manufacturer’s recommendations.
11. Adjust controller set point to desired outlet pressure value.
12. Open the downstream block valve fully and allow system to stabilize. Flowing conditions must be present through the system at this time, preferably at the minimum anticipated rate if possible.
13. Incrementally narrow (reduce) the proportional band setting in small steps, such as from 50% to 40% to 30%. During this adjustment process, upset the system either by changing flow rate or shifting the set point reference slightly. Allow ample time between each change in the proportional band for the full effect of the adjustment to be observed. Repeat adjustment of proportional band until the narrowest proportional band setting that will not produce objectionable cycling is reached.
14. If reset action is used, incrementally increase (open) reset rate to the system while upsetting the system as outlined in Step 13. Allow ample time after each adjustment for the effect of adjustment to be observed and the system to again stabilize. In general, use the fastest reset rate that can be applied without increasing instability.

**NOTE:** The adjustment restrictor controls the rate of RFV opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above 4 tend to flood the control system; therefore, high settings should be avoided, unless required for control stability. Restrictor settings of 2 or 3 are normal under most conditions.
**Downstream monitoring**

1. Set restrictors of both worker and monitor to the number 8 setting.
2. Relax pressure spring of monitor pilot regulator by backing out the adjustment screw until spring tension is at minimum.
3. Increase pressure spring tension of worker pilot regulator to maximum by turning adjusting screw inward.
4. Crack downstream valve slightly open.
   *See internal plug installation on page 16.*
5. Slowly crack upstream block valve open to pressurize Radial Flow Valves.
6. Fully open upstream and downstream block valves.
7. Reset monitor restrictor to the number 4 setting.
8. Reset worker restrictor to the number 2 setting.
9. Slowly increase monitor pilot pressure spring tension until downstream pressure approximates desired monitor set pressure.

**NOTE:** See table at right for "suggested monitor/regulator set point differentials."

10. Tune monitor by alternately adjusting the pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.
11. Reset worker restrictor to the number 4 setting.
12. Slowly increase worker pilot pressure spring tension until worker regulator assumes control and the downstream pressure approximates desired worker set pressure.
13. Tune worker in same manner as outlined in step No. 10.
14. Close downstream block valve to check for RFV lockup.
15. Gradually open downstream block valve.

**NOTE:** The adjustable restrictor controls the rate of valve opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above No. 4 tend to flood the control system; therefore they should be avoided unless required for control stability.

### Table of Suggested Working and Monitor Regulator

<table>
<thead>
<tr>
<th>Working Regulator Set Points</th>
<th>Monitor Regulator Set Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>8” w.c. to 28” w.c.</td>
<td>2’’ to 5’’ w.c. above worker</td>
</tr>
<tr>
<td>1 psig to 5 psig</td>
<td>1/4 to 3/4 psig above worker</td>
</tr>
<tr>
<td>5 psig to 10 psig</td>
<td>1/2 to 1 psig above worker</td>
</tr>
<tr>
<td>10 psig to 30 psig</td>
<td>1 to 2 psig above worker</td>
</tr>
<tr>
<td>30 psig - Up</td>
<td>5% of maximum spring range adjustment above worker set pressure</td>
</tr>
</tbody>
</table>

**NOTE:** The differentials in set pressures listed are intended as a guide only. Differentials in settings greater than those listed can be used if desired. Differentials less than those listed are possible in many systems.

![Diagram of downstream monitoring setup](image-url)
Passive upstream monitoring

**Setting worker in service**

1. Set restrictors of both worker and monitor to the number 8 setting.
2. Relax pressure spring of worker pilot regulator by backing out the adjustment screw until spring tension is at minimum.
3. Increase pressure spring tension of monitor pilot to maximum by turning adjusting screw inward.
4. Crack downstream block valve.
5. Slowly crack upstream block valve to pressurize Radial Flow Valve (RFV).
6. Fully open upstream and downstream block valves.
7. Reset monitor restrictor to the number 2 setting.
8. Slowly increase pilot pressure spring tension of worker until some downstream flow is achieved.
9. Slowly reset worker restrictor less than the number 4 setting.
10. Slowly increase worker pilot pressure spring tension until downstream pressure approximates desired worker set pressure.
11. Tune RFV worker by alternately adjusting the pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.

**Setting monitor in service**

1. Slowly decrease monitor pilot pressure spring tension until it begins to assume control from the worker.
2. Fail worker wide open by disconnecting sense line or increasing set point above desired monitor set pressure.
3. Tune monitor by alternately adjusting pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.
4. Place worker back in operation by reversing action No. 2 above.
5. Close downstream block valve to check for RFV lockup.

**NOTE:** The adjustable restrictor controls the rate of valve opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above No. 4 tend to flood the control system therefore they should be avoided unless required for control stability. Restrictor settings of 2 or 3 are normal under most conditions.

![Diagram of Radial Flow Valve setup](Figure 14)
**Two stage regulation with monitor override**

1. Set restrictors of both first and second stage regulators to the number 8 setting.
2. Relax pressure spring of both first and second stage pilot regulators by backing out adjustment screw until spring tension is at minimum.
3. Increase pressure spring tension of override pilot to maximum by turning adjusting screw inward.
4. Crack downstream block valve.
5. Crack upstream block valve to pressurize Radial Flow Valve (RFV).
6. Fully open upstream and downstream block valves.
7. Slowly increase pilot pressure of first stage until approximate desired intermediate pressure is indicated to the inlet of second stage.
8. Slowly reset first stage restrictor to the number 4 setting.
9. Slowly increase pilot pressure spring tension of second stage regulator until approximate downstream pressure is achieved.
10. Gradually reset second stage restrictor to the number 4 setting.
11. Tune first stage regulator by alternately adjusting the pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.
12. Tune second stage regulator in the same manner.

**NOTE:** The maximum inlet pressure (P1) for this system is limited to the maximum first stage pilot spring adjustment of the highest standard spring range (325 psi for ZSC or 600 psi for ZSC-320).

**Setting monitor override in service**

1. Slowly decrease monitor override pilot pressure spring tension until it begins to assume control from the second stage regulator.
2. Fail second stage regulator wide open by disconnecting the second stage pilot static line or increasing set point above desired monitor set pressure.
3. Adjust monitor override pilot pressure spring to desired monitor set point without adjusting first stage restrictor as previously set in step number 8.
4. Place worker back in operation by reversing action of step number 2 above.
5. Close downstream block valve to check for RFV lockup.

**NOTES:**

1. The adjustable restrictor controls the rate of valve opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above No. 4 tend to flood the control system; therefore they should be avoided unless required for control stability.
2. A numerically combined restrictor setting total is limited to 3 1/2 when two pilots share a single aspirator port and full open RFV’s are required at minimum pressure drops.
3. Complete lockup of station will not be achieved until the second stage outlet pressure (P3) reaches the lockup pressure of the override pilot.
4. Restrictor settings of 2 or 3 are normal under most conditions.
Internal manifold plug installation instructions

1. The control loop normally has three (3) roll pins pressed into the manifold at the gallery interface surface. Remove the roll pin at the inlet port with a pair of pliers.

2. Spread a small amount of silicon grease or petroleum jelly over the O-ring and wipe so that the ring is covered with a thin film of lubricant.

3. Carefully slide the O-ring over the plug and into the O-ring groove machined into the plug.

4. Inspect the inlet port in the RFV gallery and remove all water or solid debris.

5. Slide the larger end of the plug into the RFV port so that the O-ring is completely covered by the port in the gallery.

6. The plug will protrude from the gallery.

7. Reassemble the control loop to the gallery, after visually inspecting the O-rings that fit into the grooves in the manifold around the roll pins.

8. **CAUTION:** The plug must also be inserted into one of the O-rings mentioned in step #7, or a joint leak will result.

9. Establish pressure supply to the RFV and inspect the joint between the gallery and manifold block for leaks, using a soap solution in warm water or removing the valve from the site to a heated building and test with air in cold weather environments.

Downstream monitoring and passive upstream monitoring applications require the use of an internal inlet plug to block the pilot supply and to prevent pressure build-up in the intermediate piping between the two Radial Flow Valves. This plug is available as a retrofit kit; order Kit Number 74036K001.

**NOTE:** The internal manifold plug must be used in the downstream valve only.

---

Inspirator control initial set-up, single stage pressure reduction

1. Set the sensitivity control to the number 8 setting.*

2. Relax pressure spring of pilot regulator by backing out adjustment screw until spring tension is at a minimum.

3. Crack downstream block valve.

4. Crack upstream block valve to pressure Radial Flow Valve.

5. Fully open upstream and downstream block valves.

6. Slowly increase pilot pressure spring tension until some downstream flow is achieved.

7. Slowly increase pilot pressure spring tension until downstream pressure approximates desired set pressure.

8. Tune system by alternately adjusting the pilot pressure spring and the sensitivity control until the set point and stable control are achieved at the highest possible sensitivity setting under normal flow conditions.

9. Close downstream block valve to check for RFV lockup.

10. Gradually open downstream block valve.

*The sensitivity control adjusts the rate of valve opening and closing. High sensitivity settings cause the valve to open and close faster while lower settings reduce the response. A restrictor setting of 4 is normal under most conditions.

For all other inspirator control application including 2 stage reduction and worker/monitor sets, follow the instructions previously listed, adjusting the sensitivity control as described on this page.
Valve internal components

WARNING: Valve must be depressurized prior to removal of top.

Remove the valve top and diaphragm loading spring. Next, remove the diaphragm by gripping the spring guide in the center of the diaphragm by hand or with pliers. Do not pry the outside edge of the diaphragm, as this beaded edge is a seal for the valve top.

After the diaphragm is removed, lift out the cage and the two O-rings under the cage. Check the diaphragm for abrasion and/or nicks on the underside. If it shows signs of wear it should be replaced. Check the cage for erosion of the sealing area near the center port opening.

If the valve is equipped with an optional strainer in the inlet channel, remove the strainer and check it for damage. Also, remove any debris that may have collected ahead of the strainer.1

When re-assembling the valve, check the O-rings that fit under the cage. Replace if necessary, using a light coating of grease to hold them in the cage slots. There is no special orientation of the cage.

Re-install the diaphragm so that the outside edge is flat against the cage. Install the loading spring and top, being certain the lower end of the spring stays in the guide cup.

Control ports

Remove the manifold block and control loop by removing the two bolts in the back of the block. (Refer to Fig. 7, page 7 for disassembly.) Check the inlet pressure port in the body for dirt buildup using a long wire or pin. Also, check for possible dirt buildup in the exhaust port in the body and the control port in the top.
**Restrictor core**

The restrictor core should be inspected at all normal service periods, or when control pressure begins to deteriorate, for dirt build up on the restrictor groove and wear of the two O-rings.

To remove the restrictor core from either the inspirator or restrictor manifold, depressurize the valve, remove the retaining ring holding the core in place and slide the core out from the manifold.

Inspect the restrictor core and clean any debris that may have collected in the restrictor groove. Also inspect both O-rings for any sign of wear, replace if necessary and always lightly lubricate the O-rings before reinstalling the restrictor core.

On completion, slide the restrictor core back in place, reattach the retaining ring to the restrictor core and adjust restrictor to the previous setting.

---

**Manifold filter**

The restrictor manifold filter element should be inspected at all normal service periods or when set control pressure begins to deteriorate.

To remove the filter for inspection or replacement, depressurize and unscrew the large hex head plug with O-ring on top of the manifold.

Remove the spring, washer, and gasket in this order. Remove the filter and replace with a new filter element, (part no. 78480P001) making sure the closed end of the filter element goes in first. Reverse the removal steps above for replacement making sure the hex head O-ring is lubricated.
<table>
<thead>
<tr>
<th>Item</th>
<th>Qty</th>
<th>Description</th>
<th>Radial Flow Valve Size/Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>1</td>
<td>Compression</td>
<td>Std (H5-L)</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Cage</td>
<td>25%</td>
</tr>
<tr>
<td>4A</td>
<td>1</td>
<td>O-Ring</td>
<td>Buna (Cage)</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>Spacer</td>
<td>(See Note 1)</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>O-Ring</td>
<td>Buna (Cage)</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>Casket</td>
<td>(Cage)</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>Hex Bolt</td>
<td>Steel</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>Spring Pin</td>
<td></td>
</tr>
</tbody>
</table>

**Standard RFV Kits, Accessories and Control Pilot Repair Parts**

<table>
<thead>
<tr>
<th>Description</th>
<th>Valve Size/ANSI Class</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-Rings (Buna) Kit</td>
<td>2&quot; ANSI 150, 300 and 600</td>
<td>52917K002</td>
</tr>
<tr>
<td>O-Rings (Viton) Kit</td>
<td></td>
<td>52917K007</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H5-L)</td>
<td></td>
<td>52917K008</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H7)</td>
<td></td>
<td>52917K005</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H75)</td>
<td></td>
<td>52917K001</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H8)</td>
<td></td>
<td>52917K002</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H85)</td>
<td></td>
<td>52917K009</td>
</tr>
<tr>
<td>O-Rings (Viton) &amp; Diaphragm (V7) Kit</td>
<td>3&quot; ANSI 150, 300 and 600</td>
<td>52917K007</td>
</tr>
<tr>
<td>O-Rings (Viton)</td>
<td></td>
<td>52917K008</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H5-L)</td>
<td></td>
<td>52917K009</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H8)</td>
<td></td>
<td>52917K002</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H7)</td>
<td></td>
<td>52917K001</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H75)</td>
<td></td>
<td>52917K009</td>
</tr>
<tr>
<td>O-Rings (Viton) &amp; Diaphragm (V7) Kit</td>
<td>4&quot; ANSI 150, 300 and 600</td>
<td>52917K007</td>
</tr>
<tr>
<td>O-Rings (Viton)</td>
<td></td>
<td>52917K008</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H5-L)</td>
<td></td>
<td>52917K009</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H8)</td>
<td></td>
<td>52917K002</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H7)</td>
<td></td>
<td>52917K001</td>
</tr>
<tr>
<td>O-Rings &amp; Diaphragm (H75)</td>
<td></td>
<td>52917K009</td>
</tr>
</tbody>
</table>

**Diaphragm Removal Tool**

- All Sizes & ANSI Classes: 52917K005
- 100%: 52919K001

**Manifold Plug Kit**

- All Sizes & ANSI Classes: 52959K001
- 100%: 52959K002

**Restrictor/Composite Manifold Assembly**

- All Sizes & ANSI Classes: 73957W014

**Inspirator Manifold Assembly**

- All Sizes & ANSI Classes: 74067W006

**Z-138, ZSC-100, ZSC-150, ZSC-325-100 and ZSC-325-150 Control Pilots**

- All Sizes & ANSI Classes: See Bulletin RPL-8845

**1203-190 Control Pilot**

- All Sizes & ANSI Classes: See Bulletin RPL-8810

**NOTE:** Stored diaphragms should be kept out of direct sunlight and away from contaminants, radiation and ozone producing electrical equipment. Temperatures above 100°F are to be avoided. Store diaphragms in their polyethylene bags in a box.
A Complete Family of Gas Measurement, Pressure Regulation, and Testing Systems

Diaphragm Meters
American Meter's compact, lightweight, aluminum case meters are designed to provide positive displacement accuracy for industrial or commercial loads. See bulletin SB 3510 for more information.

Rotary Gas Meters
RPM Series Rotary Meters are designed for commercial and industrial loads to provide accurate flow measurement and outstanding performance in the most adverse conditions. See bulletin SB 5500 for more information.

Pressure Regulators
Inlet- and outlet-pressure regulators with a wide range of capacities. These regulators have optional overpressure and under-pressure shutoff and full-capacity internal relief.

Pilot-Loaded Regulators
1800 PFM industrial regulators are designed for applications requiring medium-to-high capacity, extremely precise outlet-pressure control, and fast response to changing loads. See bulletin SB 8551 for more information.

American Meter Company is committed to a program of continuous quality enhancement. All equipment designed and manufactured by American Meter Company benefits from the company's quality assurance standards, which are approved to ISO 9001 or ISO 9002.

American Meter Company has a program of continuous product development and improvement; and, therefore, the information in this bulletin is subject to change or modification without notice.