

300 and 600 Series – 2" thru 12"

Axial Flow Valves

**Operation, Control Manifold, Capacity Limiter,
Control Loops, Installation and Repair Parts List**



AMERICAN
METER COMPANY

AMERICAN METER COMPANY FIVE-YEAR LIMITED WARRANTY
Industrial Regulators

American Meter Company Industrial Products Division (hereinafter referred to as “the Company”) supplies Industrial Regulators of high quality, materials, and workmanship. The Company will correct any defect(s) of workmanship occurring during the period of one year after shipment (the “Warranty Start Date”) providing the Purchaser has given the Company immediate written notice of the defects.

In addition, a Five-Year Warranty to the original owner in a permanent regulator installation is offered against structural failure, and for individual components (list furnished by writing our general offices) from the Warranty Start Date under normal use, operation, and maintenance.

The Company obligation under this warranty is limited at its option to repayment of the purchase price, repair or furnishing of a similar part upon inspection and confirmation of the defective condition.

THERE ARE NO OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED, AND ANY OTHER WARRANTIES ARE HEREBY DISCLAIMED.

A full copy of the American Meter Company Warranty may be obtained by writing our general offices. Laws of the Commonwealth of Pennsylvania are applicable to this warranty.



WARNING



OUTSIDE Axial Flow Valve installations require that care is taken to prevent pilot vent openings from freezing closed or becoming blocked or allowing water to enter (from any cause). Particular consideration should be given to sites where flooding, freezing, snow, or freezing rain may be experienced. Additional overhead protection of the pilot regulator from weather and/or flooding should be used where necessary.



WARNING



Axial Flow Valves are engineered to accurately control natural gas and other approved gases. *Axial Flow Valves and all related Control System Components require clean, dry, non-aggressive gases for proper function* – gas streams containing liquids, hydrates, hydrogen sulfates, and other contaminants may shorten Axial Flow Valve and related Control System Components life, and may inhibit proper function.

Please consult your American Meter Company representative if there is a question of compatibility of any gas composition, or contact us through our website: www.americanmeter.com

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WARNING



The standard Buna N sleeve (American Meter codes B5, B5-L and B7) contains no hazardous ingredients that would be considered harmful to a person handling the sleeve.

However, it has been determined that the surface of the optional hydrin sleeve (American Meter codes H5, H5-L and H7) contains traces of dioctyl phthalate, a molding agent.

Rubber gloves and an apron should be worn, and you should refrain from eating, drinking and smoking while handling hydrin sleeves.

After handling the hydrin sleeves, the rubber gloves should be washed or discarded, and you should wash your hands thoroughly to safeguard against the ingestion of the above mentioned chemical.

Additional information is available through American Meter Company in Material Safety Data Sheets for dioctyl phthalate, as produced by the chemical supplier, before the hydrin sleeve is molded. American Meter Company can supply copies of these sheets to our customers upon request per the OSHA Hazard Communication Standard.

The information contained herein is based on data available to us and is believed to be correct. However, American Meter company makes no warranty regarding the accuracy of this data or the results to be obtained from the use thereof. American Meter Company assumes no responsibility for the injury from the use of this product.

Axial Flow Valves

The Axial Flow Valve consists of three major structural components and a single moving part. Its unique, wafer design makes it unusually compact, light weight and easy to handle. (**Figure 1**)

Interchangeable Valve-Cage Closures

Each consists of a center barrier, the cage with radial slots, and the closure with communicating passages. The cage closures are investment cast 17-4 stainless steel.

The Valve Body

The axial flow valve steel body is an inside contoured, cylindrical pressure containing housing. A control gallery manifold is welded to the outside of the body.

The Expandable Sleeve

The standard sleeve, the single moving part, is molded from Buna N, known for its resistance to various fuels and oils and for its retention of physical properties over a wide temperature range. The sleeve functions are:

- to provide throttling action in response to pressure differential changes;
- to form the closing seal over the cage barrier;
- to provide a closing preload against cages;
- to separate the control chamber from the flowing medium; and
- to provide a contaminant seal between the valve body and the cage closures.

The Buna N sleeve is sufficiently elastic for a wide range of applications and strong enough for high-pressure operation. The 70 durometer sleeve has therefore been selected as standard. The code number for the 70 durometer standard sleeve is B-7.

The 50 durometer sleeve, though more elastic, is not as rugged as the 70 durometer sleeve and limited to lower pressure applications. The code number for 50 durometer is B-5

Other sleeve materials are available for special applications. See pages 24 and 25.

A single bolt secures the valve assembly while the center barrier seal is completed by the O-Ring seal under the fairing nut. The upstream and downstream cage pressure passages are sealed by roll pin O-rings against the body gallery. The roll pins align the cage closures and the valve body with respect to one another.

Trim

Valve trim includes all components which come into contact with the flowing fluid and are constructed from the following materials:

Buna N: O-rings

Buna N (or as specified): sleeve

Stainless Steel: cage closures, bolts, washer, fairing nut and roll pins

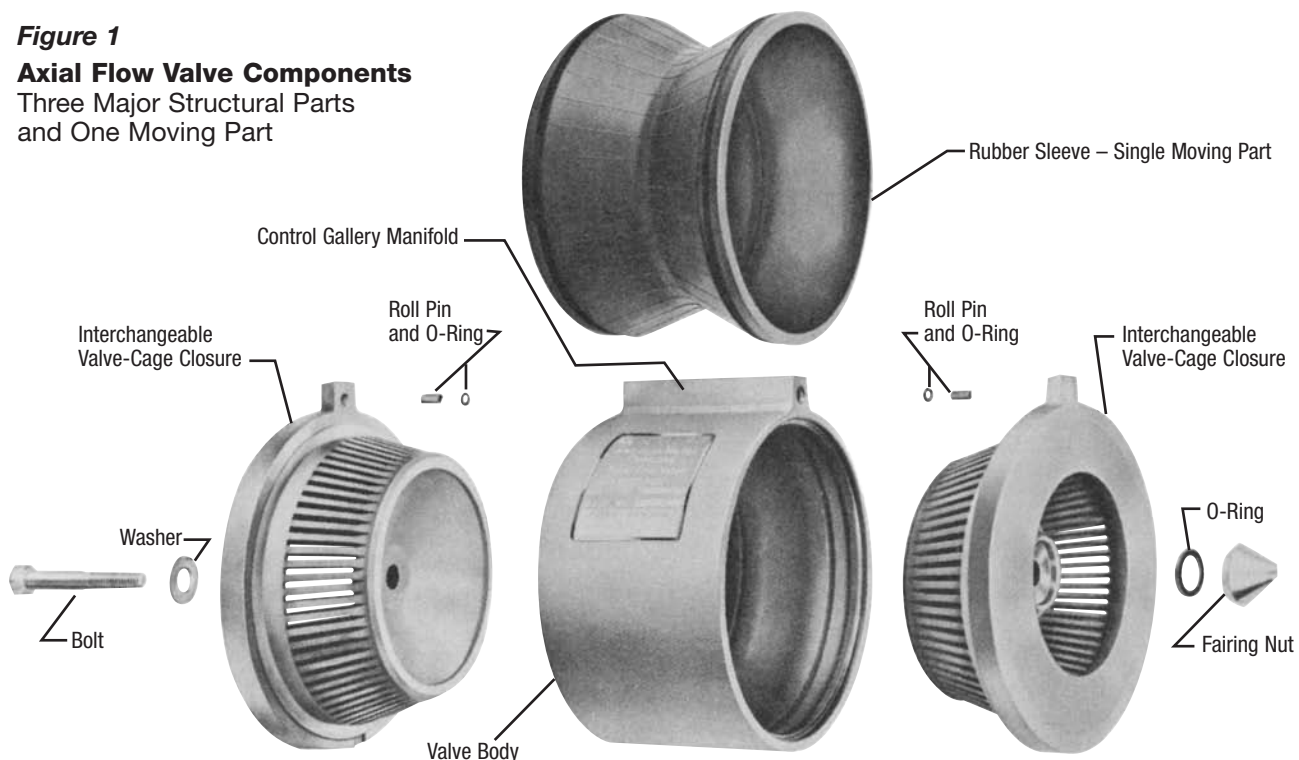
Bi-Directional Flow Capability

The symmetry of the Axial Flow Valve permits control of flow equally well in both directions and is reversible to obtain extended service life. The fairing nut is placed on the downstream side of the valve to contribute to a uniform flow path.

Figure 1

Axial Flow Valve Components

Three Major Structural Parts
and One Moving Part



Axial Flow Valve – Operation

Control Passages (Figure 2)

The gallery of the valve body has three passages:

1. The inlet pressure normally supplies the control pressure. The inlet supply pressure passage is in the upstream closure and connects with the gallery.
2. The control passage branches into two annular grooves in the valve body. The annular grooves distribute control pressure around the sleeve when the sleeve is in the fully open or closed position.
3. The exhaust or downstream bleed passage is normally used to permit reduction in control pressure when opening the valve. The aspirating capability of this passage insures a fully expanded sleeve with minimal pressure differential.

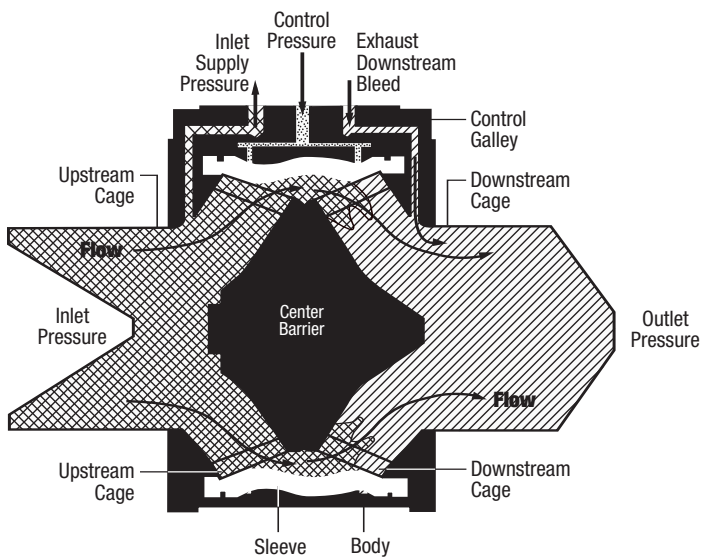


Figure 2

Closed Position (Figure 3)

The sleeve is molded to a smaller diameter than the cage diameter. When assembled in the valve, the sleeve exerts a closing preload on the upstream and downstream cages. The inner upstream surface of the sleeve is exposed to inlet pressure applied.

Control pressure (supplied by and equal to the inlet pressure) is against the exterior of the sleeve. The differential pressure on the upstream portion of the sleeve is 0 psi, but the sleeve preload exerts a closing force. The differential across the downstream portion of sleeve is the difference between the upstream and downstream pressures. This differential plus the sleeve preload provides the closing force.

Throttling (Figure 4)

To open the valve, control pressure must be reduced. A small decrease in the control pressure permits inlet pressure to lift the sleeve from the inlet cage. As the control pressure is further decreased, the central sleeve preload is overcome and the sleeve is peeled progressively away from the downstream cage. Flow through the valve commences when the tapered openings of the outlet cage are uncovered. Further decreases in control pressure uncover a greater area of the outlet cage. Throttling control is maintained when the control pressure reaches equilibrium and flow demand is satisfied.

Open Position (Figure 5)

The valve is fully open when the drop in control pressure is sufficient to completely expose the slots in the downstream cage, and the sleeve is fully expanded against the body inner contour.

The control pressure drop is aided by aspiration through the downstream bleed aspiration port. At high rates of flow, the aspirated pressure in the bleed channel can be significantly lower than the downstream pipe line pressure, thereby minimizing the differential between inlet and outlet pressures required for full valve opening.

Axial Flow Valve Components

Three Major Structural Parts and One Moving Part

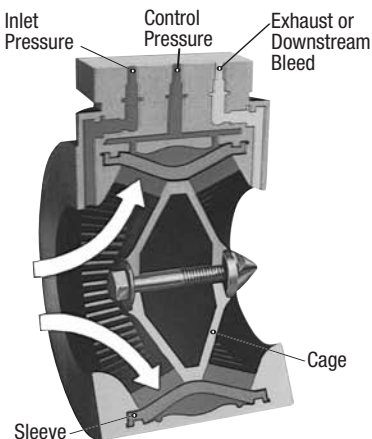


Figure 3

Closed Position

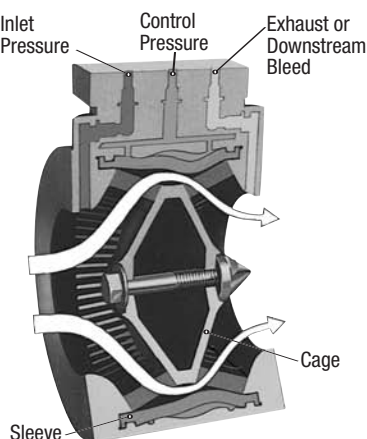


Figure 4

Throttling Position

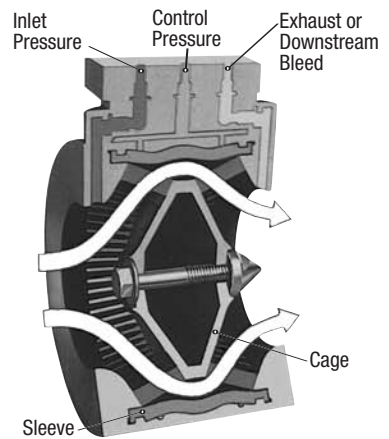


Figure 5

Open Position

Valve Operators (Figure 6)

The Axial Flow Valve is essentially a pneumatic or hydraulic motor valve. To function, the basic valve requires some type of a valve operator.

The Axial Flow Valve is normally closed (if control and inlet pressure are equal). When closed, the closing forces are control chamber pressure acting on the sleeve exterior plus the elastic preload. The opening forces are inlet pressure acting on the interior of the sleeve through the inlet cage. To crack the valve, control pressure must be decreased so that inlet pressure can overcome the initial preload. To open the valve further, control pressure must be reduced. To open the valve fully, control pressure must be reduced until inlet pressure has fully expanded the sleeve. Any further reduction of control pressures does not affect the valve operation. See page 5 for table of operating pressures.

To change the control chamber pressure, two external valves are required.

Valve A controls the supply pressure. Usually, inlet pressure is used to supply control chamber pressure. Control chamber pressure closes the valve. In the majority of application, Valve A is an adjustable, non-closing restrictor.

Valve B adjusts control chamber pressure and positions the sleeve. Valve B is usually a pilot pressure regulator.

A three-way connector is required to make connections to Valve A, Valve B and to control chamber.

On-Off

For On-Off applications, an adjustable restrictor is used for Valve A, and Valve B can be open or closed.

Manually – by means of handler buttons, levers or foot pedals;

Automatically – by means of electrical operated solenoids, mechanically operated lever or cams and motors.

Throttling

Throttling applications require the feedback of pressure which is utilized in controlling the position of Valve B.

Self-Operated

Self-operated applications are used in pressure control. Sensed pressure (downstream) is used for pressure reducing regulation. Sensed pressure (upstream) is used for relief valve and back pressure service.

Controllers

Controllers are used when precision 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 sleeve but rather must act through a “pilot” or diaphragm motor valve interface.

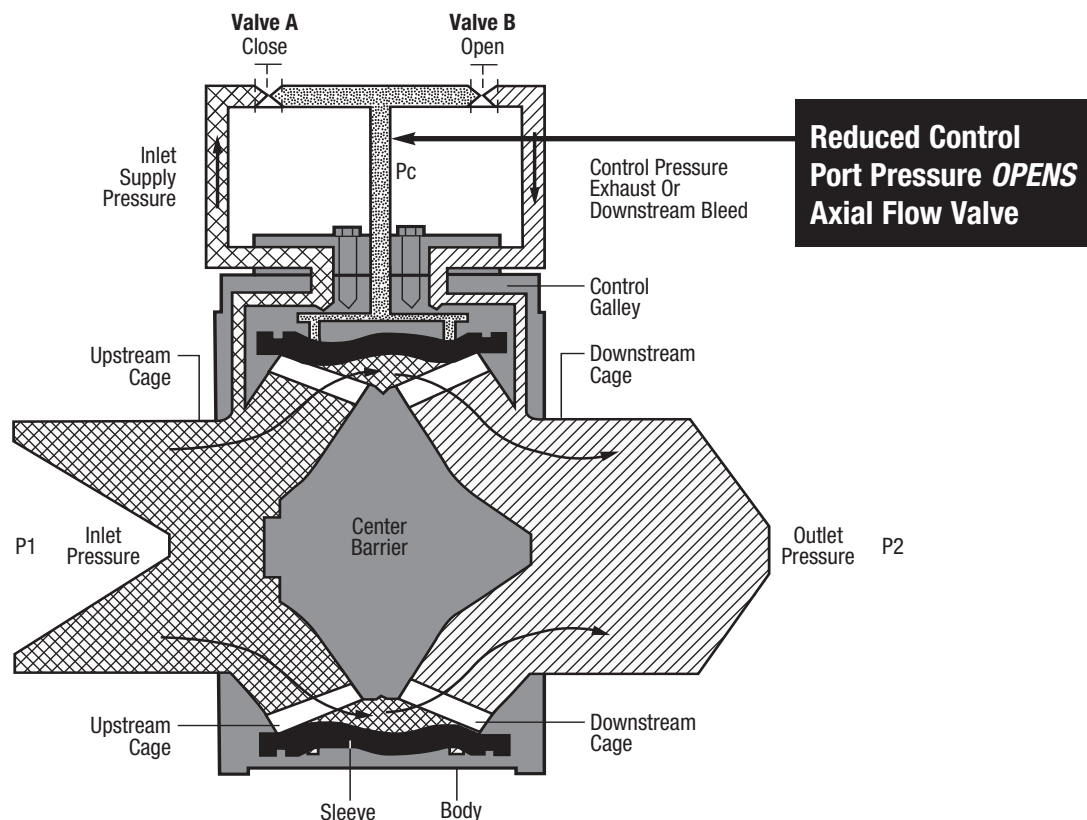


Figure 6
Axial Flow Valve with Manual Operator

Inspirator Control Manifold

Manifold For Low Differential Pressure

When equipped with an optional Inspirator Control Manifold, the American Axial Flow™ Valve provides accurate and proven pressure regulation in applications with very low differential pressures. The manifold extends the operating range of the AFV at low inlet pressures while maintaining the same maximum operating pressure ratings.

The Axial Flow Valve uses an elastomer sleeve which expands or contracts depending on the pressure differential across the sleeve. Once this differential exceeds the minimum cracking pressure, the sleeve expands allowing flow through the valve until downstream demand is supplied and the pressure is balanced across the sleeve.

With a conventional restrictor-type control manifold, the sleeve differential pressure cannot be greater than the total pressure drop across the valve. In some peak load applications, the inlet pressure can be reduced to the point where there is not a sufficient differential between the inlet and the outlet (set) pressure to allow the valve to fully open. Or, in high-pressure applications, the differential needed to fully open the valve may be greater than the available drop across the valve.

the Inspirator Control Manifold incorporates a specially designed nozzle (**Figure 7**). This nozzle reduces the sleeve control pressure (P_c) so that the differential across the sleeve ($P_1 - P_c$) is approximately three times the differential across the valve ($P_1 - P_2$). *The Inspirator Control Manifold, in essence, acts like a differential pressure amplifier with a gain of three.* The maximum differential which the inspirator can generate is approximately 62% of the absolute inlet pressure. The adjustable restrictor shown is used to vary the response time of the sleeve. (Tune for stability.)

The Inspirator Control Manifold extends the application range of Axial Flow Valves by reducing the differential pressure necessary to fully open the valve while maintaining the control sensitivity and control pressure accuracy. The inspirator control can be used in single valve pressure reduction applications and also in worker/monitor sets where the combined pressure loss is generally higher, resulting in less differential per valve. The Inspirator Control Manifold can be supplied for retrofit to Axial Flow Valves in the field or can be ordered in place of the standard composite block manifold for new installations.

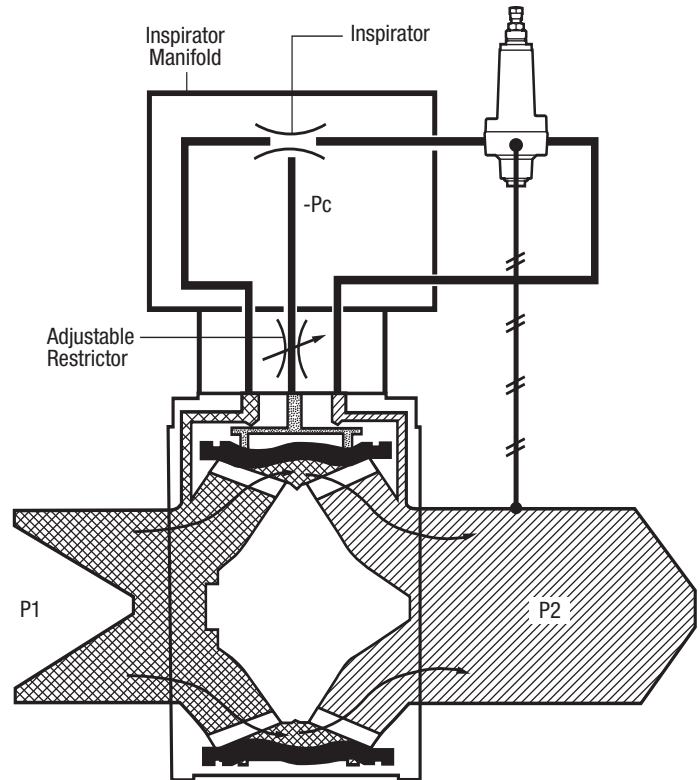


Figure 7 – Inspirator Manifold Mounted on AFV

Axial Flow Valve Operating Pressures

AFV Series	Sleeve Number	Composite Block Manifold Operating Parameters		Inspirator Block Manifold Operating Parameters		Maximum Operating Conditions	
		Cracking	Full Open	Cracking	Full Open	Continuous	Intermittent **
300	5L	1.5 psid	5 psid	0.5 psid	1.7 psid	30 psid	50 psid
300	5	3.5 psid	15 psid	1.5 psid	7.5 psid	125 psid	180 psid
300	7	14 psid	30 psid	6 psid	19 psid	500 psid	720 psid
600 *	7	30 psid	60 psid	12 psid	25 psid	1000 psid	1440 psid

* Series 600 available in 2", 4", 6" and 8" only.

** Intermittent is defined as total time in service \leq 30 days at this intermittent pressure.

Capacity Limiter Kit

This Capacity Limiter Kit (**Figure 8**) is supplied as an option for 2", 3", and 4" standard trim Axial Flow Valves to reduce the full-open capacity to a predetermined percentage of its rated capacity.

Two kits are available to reduce the capacity of an Axial Flow Valve to either 50% or 75% of the valve's rated capacity. Each kit consists of a bolt, a spacer and the Limiter. The flat faces of the Limiter are stamped with a number that reads 2-300-50 or 2-300-75. Check your Capacity Limiter to be certain it is correct for the intended application.

Additional and/or custom size limiters are available upon request.

Kit Installation Instructions

- If the kit is for an AFV, remove the valve from the line.
- Disassemble bolt, washer and fairing nut. Save the bolt and washer in the event future requirements necessitate a return to 100% capacity.
- Assemble Limiter and spacer on new bolt with the desired 300 or 600 designation facing upstream. Install bolt in upstream end of valve as shown in **Figure 8**. Do **NOT** use a washer. The faces of the Limiter and the AFV must be flush within .03". An improperly assembled 2" Capacity Limiter will either project out beyond the AFV flange or be recessed by about .190".
- Check that O-ring is seated in fairing nut groove. Assemble nut and tighten to:
2" and 3" torque to 20 to 30 ft•lbs
4" torque to 40 to 60 ft•lbs
6" torque to 75 to 100 ft•lbs
- Affix the appropriate label to AFV body just below the existing badge. If valve body is dirty, clean before application.
- Reassemble AFV to line.

Capacity Limiter Removal (2" Example)

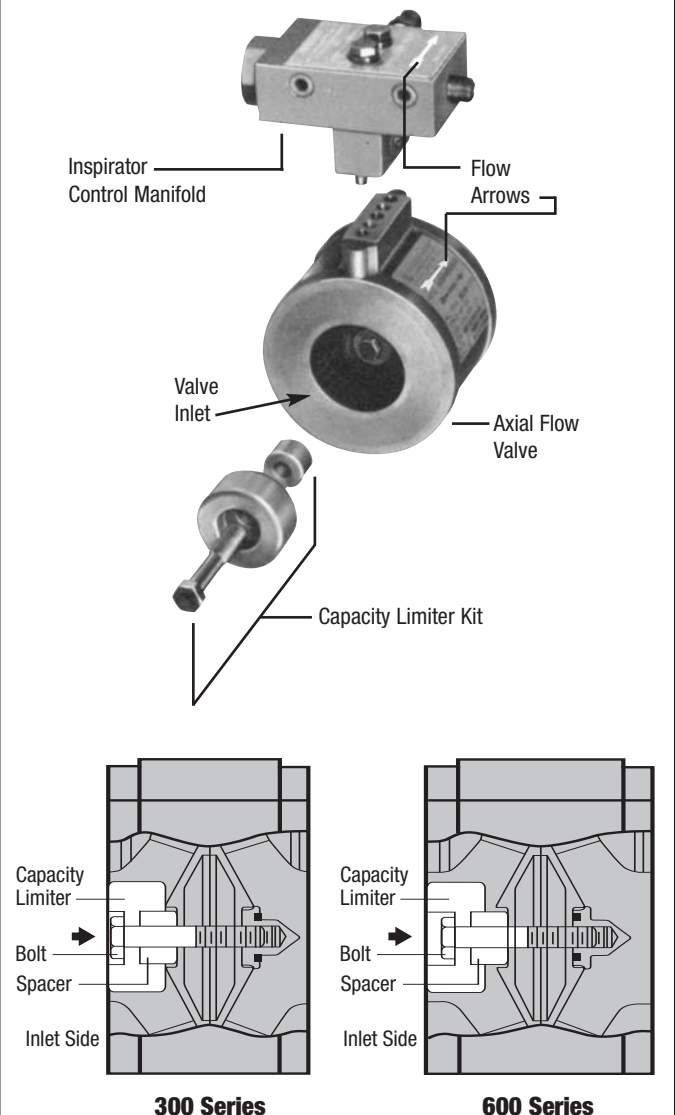
- Depressurize and remove AFV from line.
- Disassemble bolt, Limiter, spacer and fairing nut.
- Install original 1.37" long bolt and washer.
- Remove the reduced capacity label.
- Reassemble AFV to line.

Capacity Limiter Kits for Axial Flow Valves

Valve Size	Percent of Full-Open Capacity	Class 300 Part Number	Class 600 Part Number
2" AFV	50%	74075G036	74075G036
2" AFV	75%	74075G041	74075G041
3" AFV	50%	74075G055	N.A.
3" AFV	75%	74075G060	N.A.
4" AFV	50%	74075G074	74075G093
4" AFV	75%	74075G079	74075G098
6" AFV	50%	74075G112	N.A.
6" AFV	75%	74075G117	N.A.

Figure 8

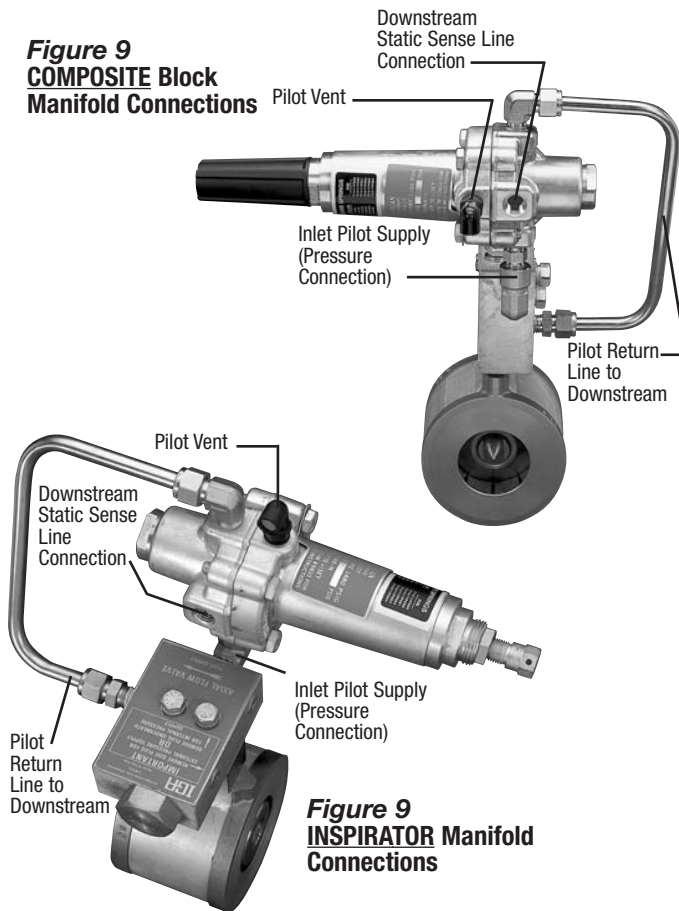
Installation drawing showing proper position of Capacity Limiter for 300 and 600 Series.



Basic AFV Control Loops

Refer to Figures 9, 10, 11

**Figure 9
COMPOSITE Block
Manifold Connections**



**Figure 9
INSPIRATOR Manifold
Connections**

Axial Flow Valve – Valve Operation

The valve is closed when the pilot regulator is closed and the upstream pressure has equalized through the restrictor acting against the exterior of the sleeve as a valve closing force.

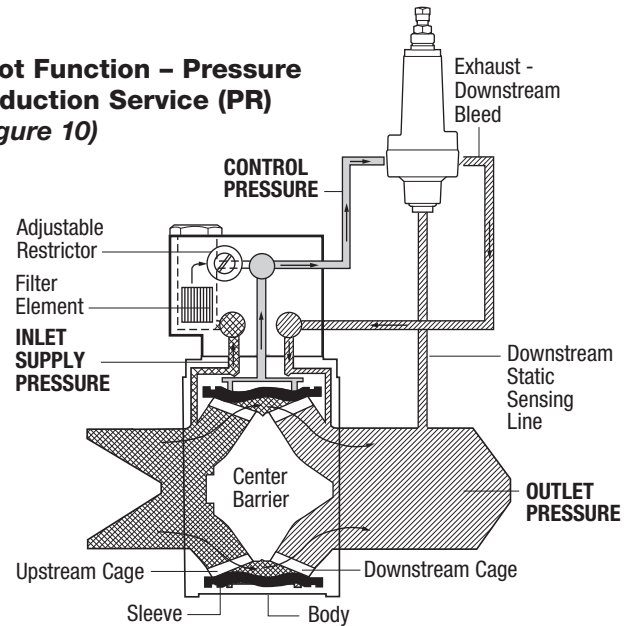
- The valve is closed when the control pressure is equal to the inlet pressure.
- The valve begins to open when there is a reduction in control pressure which is greater than the sleeve preload.
- The valve is fully open when the drop in control pressure is sufficient to permit inlet pressure to completely expand the sleeve.

Valve Downstream Bleed

The valve downstream bleed on the AFV is aspirated at high rates of flow by a venturi effect. This aspiration induces a drop in pressure in the valve downstream port. The induced drop in pressure aids the pilot to lower the control pressure when the valve approaches full open.

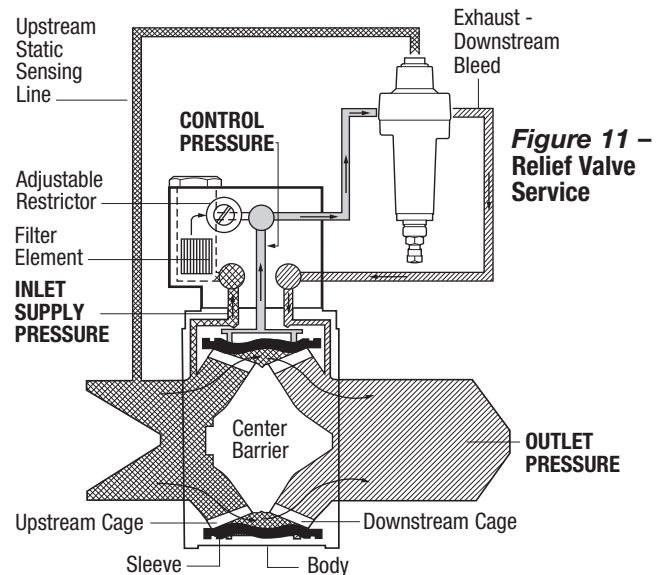
Do not use the AFV downstream bleed port for pressure sensing. A stable pressure location *MUST* be used for feedback to the pilot.

Pilot Function – Pressure Reduction Service (PR) (Figure 10)



For pressure regulation, the pilot senses downstream pressure. A demand for flow will slightly reduce downstream pressure and will open the pilot valve. The effective opening of the pilot valve is regulated by changes in the downstream pressure sensed.

Pilot Function – Back Pressure Service and Relief Valve Operation (RV) (Figure 11)



**Figure 11 –
Relief Valve
Service**

For back-pressure regulation and relief-valve operation, the pilot senses upstream pressure. An increase in upstream pressure above the dead-end shut-off† pressure causes the pilot valve to open and exhaust control pressure.

The effective opening of the pilot valve is regulated by upstream pressure changes sensed.

Adjustable Restrictor Function and Setting

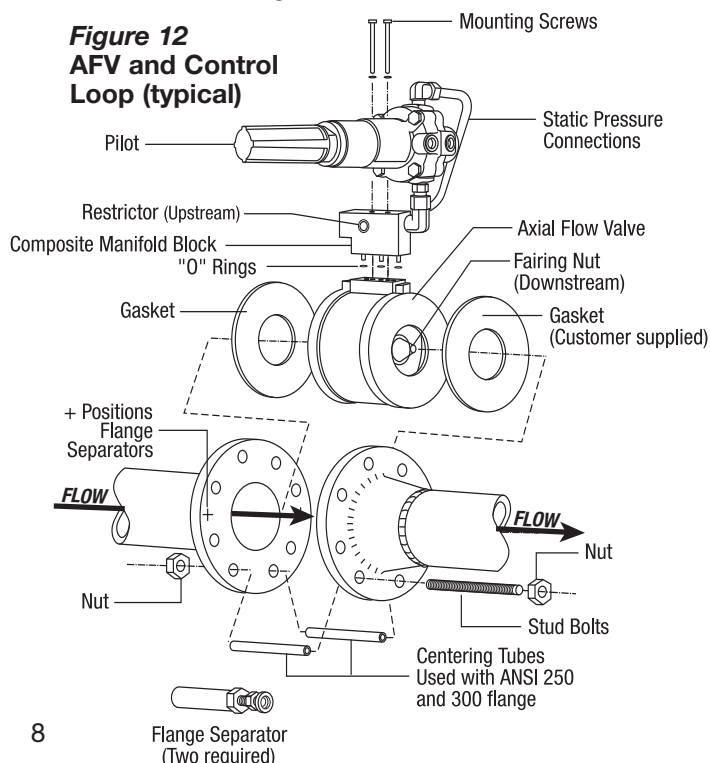
The adjustable restrictor supplies makeup gas to the AFV control port in opposition to the gas bled away by the pilot regulator (or motor valve). Standard composite block settings are typically “3”. Inspirator Block Settings are typically 5-6. (Careful tuning is required for good control and stability.)

† Dead-end shut off in this application is called relief pressure setting.

Installation (Figure 12)

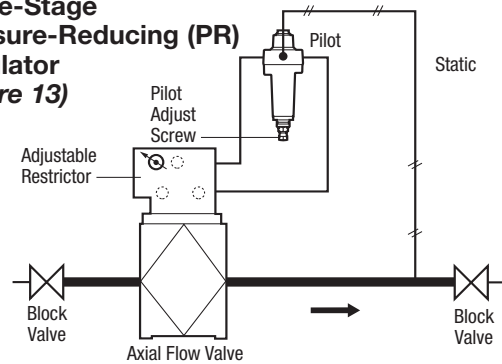
1. Assemble the control loop as indicated below (Figure 12) with restrictor inlet position at the upstream of the Axial Flow Valve.
2. The Control Loop assembly may be mounted on the smaller AFVs before the valve is mounted between the pipe flanges. Three O-rings are required. (Six with Inspirator) The O-rings slip on the roll pins which align the ports in the composite manifold with the ports in the Axial Flow Valve gallery. Larger Axial Flow Valves should be mounted between the pipe flanges before the control loop is mounted on the Axial Flow Valve. To facilitate the handling of heavier valves, a lifting plate, Part Number 73672P001, is available. The lifting plate is attached to the gallery on the valve body with the composite manifold mounting screws and has a lifting opening (1/2" x 1-1/2") which is suitable for engagement by a hook or cable.
3. Align the pipe flanges and insert the lower stud bolts. Optional centering tubes can be placed over the two lowest stud bolts for the 250 and 300 ANSI flange installations.
4. If the pull-up space is less than desired, use the flange separators to increase the space. The Axial Flow Valve must be installed with its fairing nut on downstream side of the valve. Place the valve and gaskets between the flange. Place the nuts on the stud bolts.
5. Remove the flange separators (if used). Tighten the nuts evenly around the bolt circle. Assure that a minimum of one and one-half or more threads show beyond the nut.
6. Check the control loop and system for leaks to assure all the connections are tightened properly and that no tubing has been nicked or bent.

Figure 12
AFV and Control
Loop (typical)

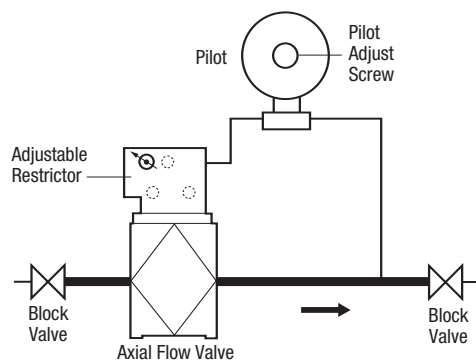


AFV with Composite Block Control

Single-Stage Pressure-Reducing (PR) Regulator (Figure 13)



Pilot With Secondary Diaph.
60 Series Pilot



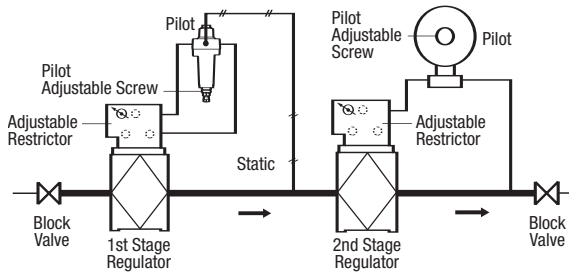
Pilot W/O Secondary Diaph.
1203

1. Set restrictor to maximum (No. 8) setting.
2. Relax pressure spring of pilot regulator by backing out adjustment screw until spring tension is at minimum.
3. Crack downstream block valve.
4. Crack upstream block valve to pressurize Axial Flow Valve (AFV).
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 No. 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.
10. Slowly close downstream block valve to check for AFV lockup.
11. Gradually open downstream block valve.

NOTE: The Composite Block adjustable restrictor controls the rate of AFV 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. Composite Block restrictor settings of 2 or 3 are normal under most conditions. (Inspirator Block restrictor should be set at 5-6.)

AFV with Composite Block Control

Two-Stage Pressure Reduction (PR) (Figure 14)

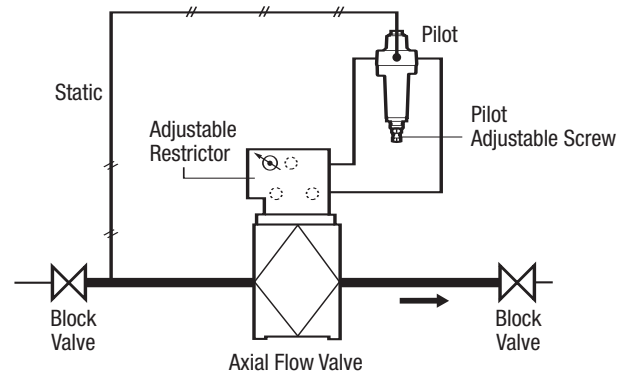


1. Set restrictors of both first- and second-stage regulators to maximum (No. 8) setting.
2. Relax the pressure spring of both pilot regulators by backing out adjustment screw until spring tension is at minimum.
3. Crack downstream block valve.
4. Crack upstream block valve to pressurize Axial Flow Valve (AFV).
5. Fully open upstream and downstream block valves.
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 No. 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 No. 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 AFV lockup.
13. Gradually open downstream block valve.

NOTE: The Composite Block adjustable restrictor controls the rate of AFV 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. Composite Block restrictor settings of 2 or 3 are normal under most conditions. (Inspirator Block restrictor should be set at 5-6.)

AFV with Composite Block Control

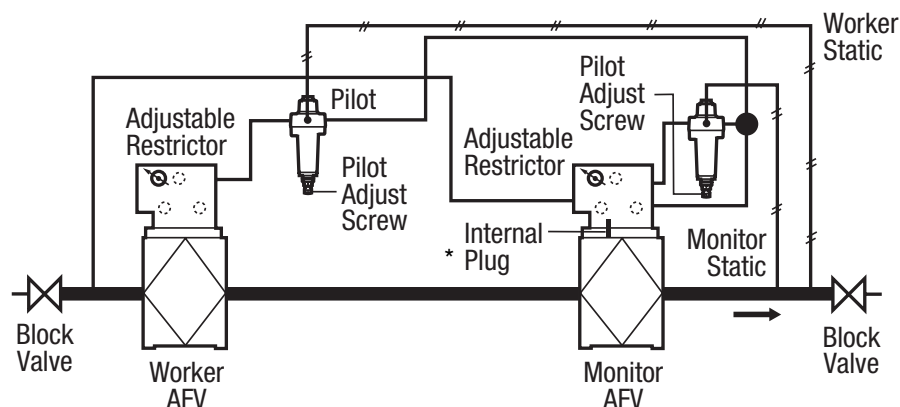
Relief Valve (RV) and Back-Pressure Regulation (Figure 15)



1. Set restrictor to maximum (No. 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 AFV.
5. Gradually decrease pilot pressure spring tension until:
Back pressure – some downstream flow is achieved
Relief valve – the desired set point is reached.
6. Reset restrictor to:
Back pressure – No. 4 setting
Relief valve – the correct restrictor setting is determined at time of installation. Use the lowest restrictor setting which permits the Axial Flow Valve to reseat at a pressure greater than the normal line pressure. Settings from No. 3 to No. 4 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.

NOTE: The Composite Block adjustable restrictor controls the rate of AFV 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. Composite Block restrictor settings of 2 or 3 are normal under most conditions. (Inspirator Block restrictor should be set at 5-6.)

AFV with Composite Block Control Worker/Monitor with Downstream Monitoring (Figure 16)



1. Set restrictors of both worker and monitor to maximum (No. 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.
5. Slowly crack upstream block valve open to pressurize Axial Flow Valves.
6. Fully open upstream and downstream block valves.
7. Reset monitor restrictor to No. 4 setting.
8. Reset worker restrictor to No. 2 setting
9. Slowly increase monitor pilot pressure spring tension until downstream pressure approximates desired monitor set pressure.

NOTE: See table below of 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 are achieved at the lowest possible restrictor setting under normal flow conditions.
11. Reset worker restrictor to No. 4 setting.
12. Slowly decrease 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 10.
14. Close downstream block valve to check for AFV lockup.
15. Gradually open downstream block valve.

* See Internal Plug Installation, Figure 21 on page 15.

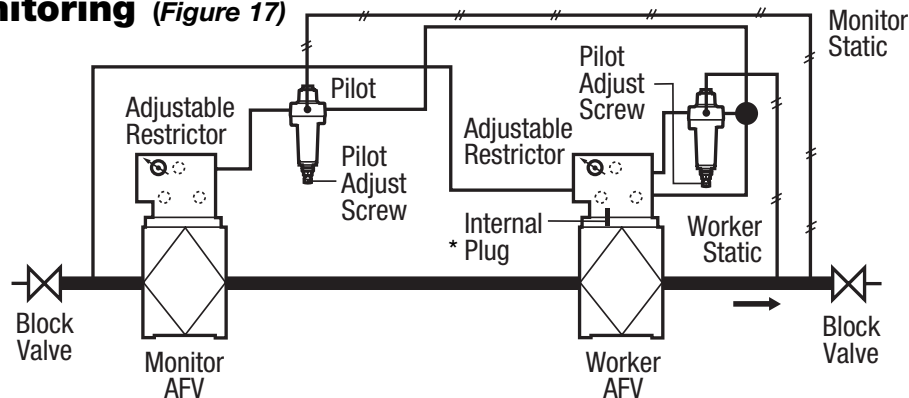
NOTE: The Composite Block adjustable restrictor controls the rate of AFV opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above 4 tend to flood the control system; therefore, high settings should be avoided unless required for control stability. Composite Block restrictor settings of 2 or 3 are normal under most conditions. (Inspirator Block restrictor should be set at 5-6.)

Table of Suggested Set Points for Worker and Monitor Regulators

Set Pressure Differentials	
Working Regulator Set Points	Monitor Regulator Set Points
8" w.c. to 28" w.c.	2" to 5" w.c. above worker
1 psig to 5 psig	1/4 to 3/4 psig above worker
5 psig to 10 psig	1/2 to 1 psig above worker
10 psig to 30 psig	1 to 2 psig above worker
30 psig – Up	5% of maximum adjustment above worker set pressure

AFV with Composite Block Control Worker/Monitor with Passive Upstream Monitoring (Figure 17)

* See Internal Plug Installation,
Figure 21 on page 15.



Setting Worker in Service

1. Set restrictors of both worker and monitor to maximum No. 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 Axial Flow Valve (AFV).
6. Fully open upstream and downstream block valves.
7. Reset monitor restrictor to No. 2.
8. Slowly increase pilot pressure spring tension of worker until some downstream flow is achieved.
9. Slowly reset worker restrictor less than No. 4 setting.
10. Slowly increase worker pilot pressure spring tension until downstream pressure approximates desired worker set pressure.
11. Tune AFV worker by alternately adjusting the pilot pressure spring and restrictor until both the required set point and stable control are 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 Step 2 above.
5. Close downstream block valve to check for AFV lockup.
6. Gradually open downstream block valve.

NOTE: The Composite Block adjustable restrictor controls the rate of AFV 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. Composite Block restrictor settings of 2 or 3 are normal under most conditions. (Inspirator Block restrictor should be set at 5-6.)

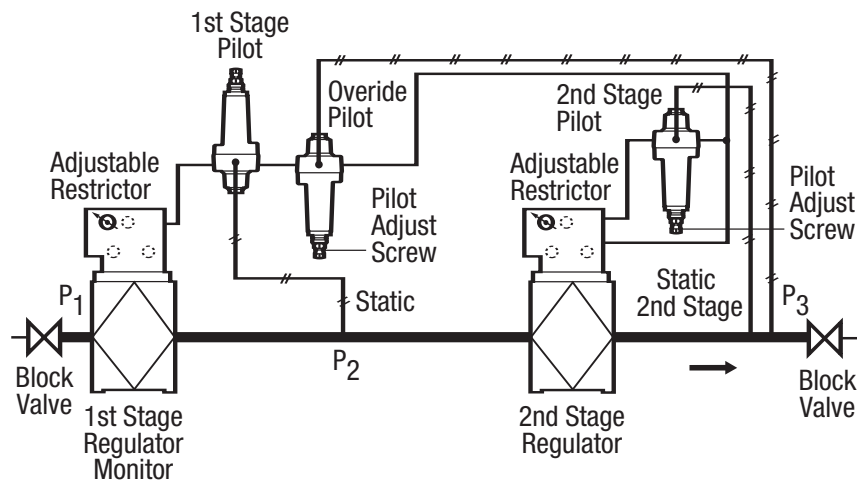
Table of Suggested Set Points for Worker and Monitor Regulators

Set Pressure Differentials	
Working Regulator Set Points	Monitor Regulator Set Points
8" w.c. to 28" w.c.	2" to 5" w.c. above worker
1 psig to 5 psig	1/4 to 3/4 psig above worker
5 psig to 10 psig	1/2 to 1 psig above worker
10 psig to 30 psig	1 to 2 psig above worker
30 psig – Up	5% of maximum adjustment above worker set pressure

AFV with Composite Block Control

Axial Flow Valve Worker-Monitor

Figure 18 Two-Stage Regulation with Monitor Override



- 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 PSIG for 60L-PR pilots).

1. Set restrictors of both first- and second-stage regulators to maximum No. 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 Axial Flow Valve (AFV).
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 No. 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 No. 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 are achieved at the lowest possible restrictor setting under normal flow conditions.
12. Tune second-stage regulator in the same manner.

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 set in Step 8 above.
4. Place worker back in operation by reversing action Step 2.
5. Close downstream block valve to check for AFV lockup.
6. Gradually open downstream block valve.

NOTE: The Composite Block adjustable restrictor controls the rate of AFV 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.

A numerically combined restrictor setting total is limited to 3-1/2 when two pilots share a single aspirator port and full open AFVs are required at minimum pressure drops.

Complete lockup of station will not be achieved until the second stage outlet pressure (P2) reaches the lockup pressure of the override pilot

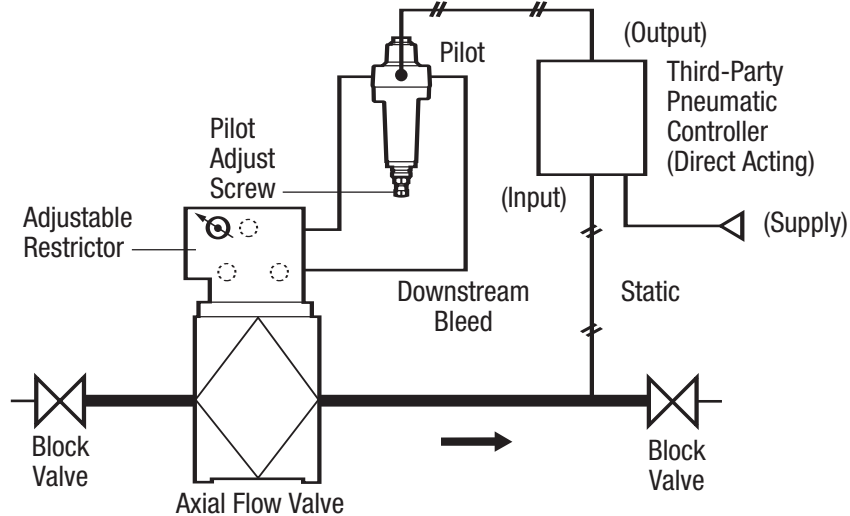
Composite Block restrictor settings of 2 or 3 are normal under most conditions.

Operation

Pressure Reduction Service (PR) with Controller

Figure 19

Pressure-Reducing Regulator with 60 Series Pilot and Controller

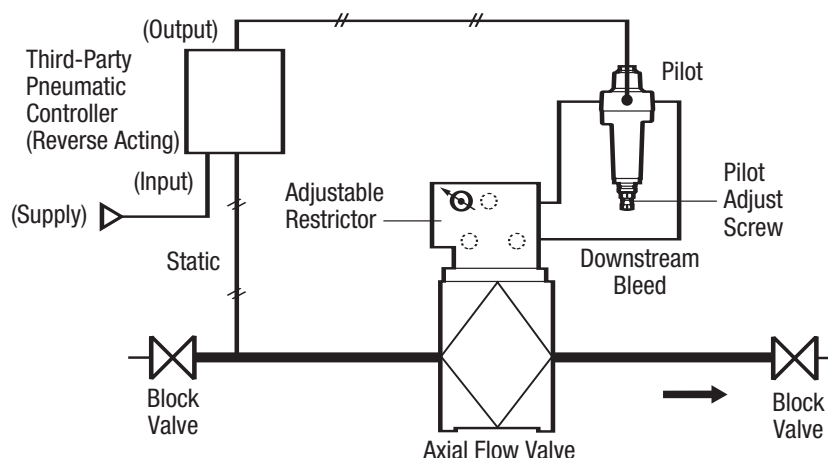


1. Set the restrictor to the number 3 setting.
2. Relax the pressure spring of the pilot regulator by backing out (turning counter clockwise) the adjustment screw.
3. Set the controller's proportional band and reset rate controls as recommended by the manufacturer for initial operation.
4. Set the controller's 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 Axial Flow Valve (AFV) lockup, then slowly reopen this valve.
11. Adjust controller set point to desired outlet pressure value.
12. Open the downstream block value 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 (instability) 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 Composite Block adjustable restrictor controls the rate of AFV 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. Composite Block restrictor settings of 2 or 3 are normal under most conditions. (Inspirator Block restrictor should be set at 5-6.)

Back-Pressure Regulation (RV) with Controller

Figure 20



1. Set restrictor to No. 8 setting.
2. Preset the pilot regulator by first fully backing out (turning counter clockwise) the adjusting screw, then advancing (turning clockwise) the adjusting screw until it contacts the adjusting springs, 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. Crack and then slowly open the downstream block valve.
7. Crack and then slowly open the upstream block valve.
8. Slowly decrease (turn counterclockwise) the controller regulator's adjustment screw until the controller outlet pressure gauge reads 9 psig.
9. Set the restrictor to the No. 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 14. 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.

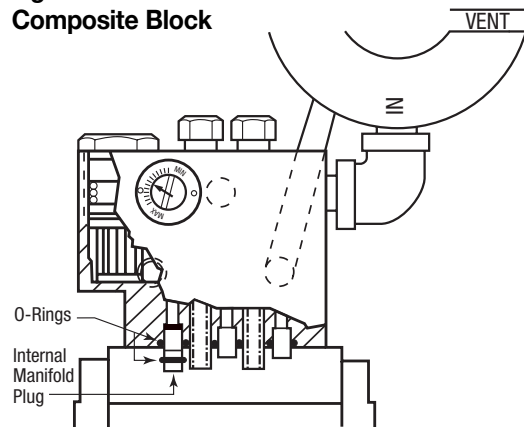
NOTE: The Composite Block adjustable restrictor controls the rate of AFV opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above 4 tend to flood the control system; therefore, high settings should be avoided unless required for control stability. Composite Block restrictor settings of 2 or 3 are normal under most conditions. (Inspirator Block restrictor should be set at 5-6.)

AFV Composite and Inspirator Control Block

Use of Control Block Plug Kits

Internal Manifold Plug

**Figure 21 – Installation Instructions
Composite Block**



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 Axial Flow Valves. This plug is available as a retrofit kit; order Kit No. 74036K001. (Composite Block)

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

1. Depressurize system, remove two hex-head cap screws and separate the Block from the AFV.
2. The Composite Block 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.
3. Spread a small amount of silicone grease or petroleum jelly over the O-Ring and wipe so that the ring is covered with a thin film of lubricant.
4. Carefully slide the O-Ring over the plug and into the O-Ring groove machined into the plug.
5. Inspect the inlet port in the AFV gallery and remove all water or solid debris.
6. Slide the plug into this port so that the O-Ring is completely covered by the port in the gallery.
7. The plug will protrude from the gallery.
8. 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. Torque bolts 5-8 ft.*lb. Do NOT over-torque.
9. CAUTION: The plug must also be inserted into one of the O-Rings mentioned in Step 7, or a joint leak will result. (NOTE: two O-Rings in Figure 21.)
10. Establish pressure supply to the AFV 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.

Axial Flow Valve

Plug Kits

Composite Block
Inspirator Block

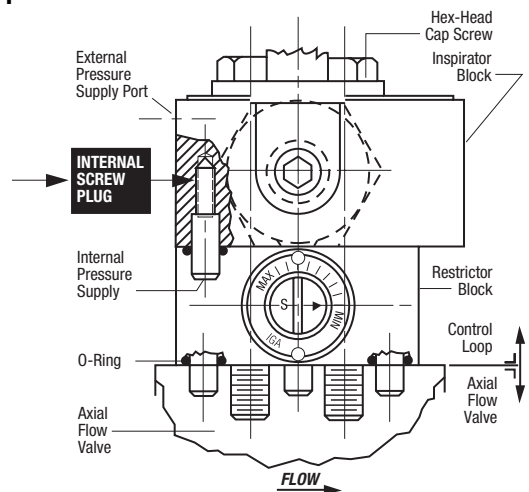
AMCO Part No.

74036K001
74036K002

AFV plug kits are used for the following:

- To block off the pilot inlet port so that pilot inlet gas is delivered from a heater and/or filter, and not from the AFV directly. *NOTE: It is important that all AFVs and controls receive clean, dry gas so heaters, filters, and/or dryers may be required in your installation.*
- To block the pilot return line of upstream worker/ monitors so that the upstream pilot flow is returned fully downstream to a "tee" fitting.
- To block off the pilot inlet port of the downstream worker/monitor AFVs so that full inlet pressure can be delivered to the downstream inlet using the 1/4" NPT block access plug.

**Figure 22 – Installation Instructions
Internal Manifold Plug Kit
Inspirator Block**



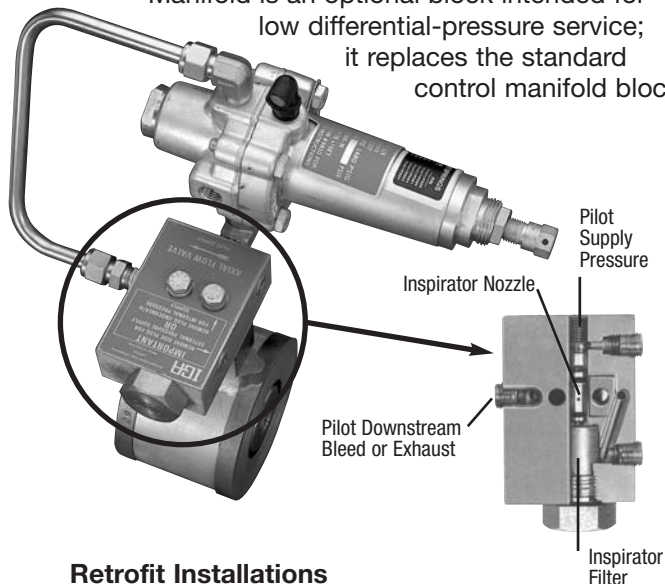
1. Use 74036K002 Plug Kits to block off Inspirator Block inlet ports.
2. Depressurize system, remove two hex-head cap screws and separate the Inspirator Block from the Restrictor Block. Do not lose any of the six O-Rings.
3. Inspect the inlet port of the Inspirator Valve. Clean as necessary.
4. Using the 3mm hex wrench provided, install the M6x1.0x12mm hex screw into the Inspirator Block inlet pressure supply port.
5. Lightly grease the six O-Rings with silicone grease and reassemble Inspirator Block to Manifold Block. Assemble block assembly to AFV with 80-120 in. lb. torque. Do not overtighten.
6. Re-establish pressure and conduct leak test. *NOTE: It is permissible to use "blue" Loctite to retain the block plug.*

With the Inspirator Block Plug Kit installed, the inlet Allen plug can be removed and a remote inlet pressure supply connected to the control loop.

Inspirator Control Manifold

Introduction

The following instructions cover the installation of the Inspirator Control Manifold (**Figure 22**) in both new and retrofit applications. The Inspirator Control Manifold is an optional block intended for low differential-pressure service; it replaces the standard control manifold block.



Retrofit Installations

Begin installation by closing block valves up and downstream of the existing Axial Flow Valve and sense lines. Bleed the valve pressure to zero.

Disconnect the bleed and sense lines from the pilot. Remove the two bolts holding the existing manifold to the valve body. Lift off the manifold and pilot. Disconnect the pilot from the manifold.

Bolt the new Inspirator Control Manifold to the Axial Flow Valve using the bolts supplied so that the flow direction arrow is pointed in the right direction.

New Installations

For new installations, follow the Inspirator Control Manifold assembly instructions above.

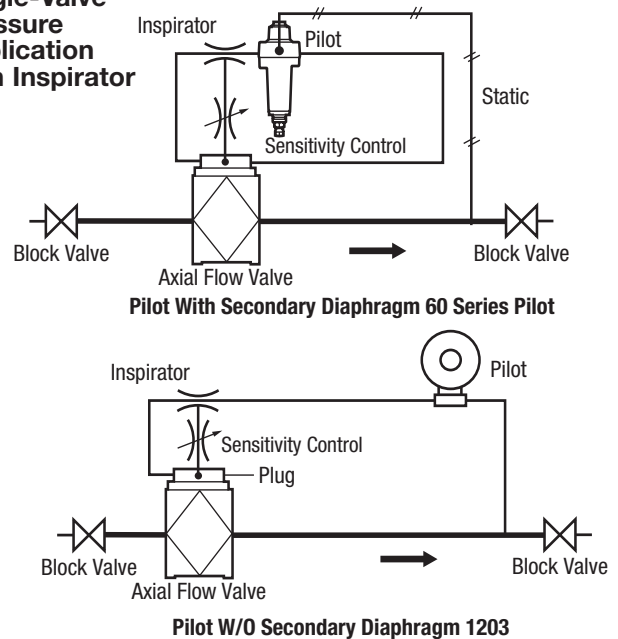
Refer to the schematic diagrams for installation of sense and bleed lines in single valve (**Figure 23**), worker/monitor (**Figure 24**), and relief/back pressure applications (**Figure 25**).

IMPORTANT NOTE – In worker/monitor installations where the worker is downstream of the monitor and worker inlet pressure sense line is connected upstream of the monitor (**Figure 24**), a modification to the worker control manifold is necessary. The inlet pressure sense line is connected to the left side of the manifold block and a plug, Part Number 74036K002, is inserted in the inlet pressure supply port. Refer to **Figure 26** and its instructions for installation of the worker manifold plug.

AFV with Inspirator Control

Initial Setup, Single-Stage Pressure Reduction (PR)

Figure 23
Single-Valve
Pressure
Application
with Inspirator

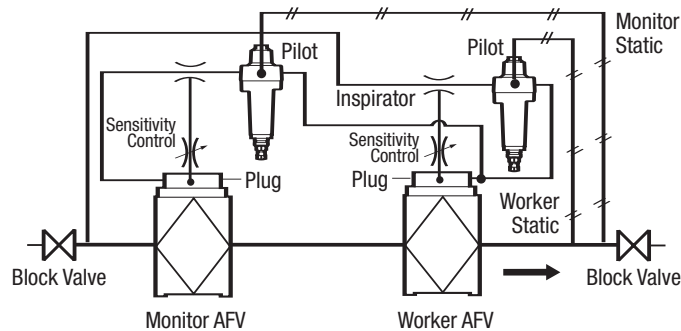


1. Set the Inspirator sensitivity control to maximum setting No. 8*.
2. Relax pressure spring of pilot regulator by backing out adjustment screw until spring tension is at a minimum.
3. Crack downstream block valve.
4. Crack upstream block valve to pressure Axial Flow Valve.
5. Fully open upstream and 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 AFV lockup.
10. Gradually open downstream block valve.

* The Inspirator 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 5-6 is normal under most conditions.

AFV with Inspirator Control

Initial Setup, Worker/Monitor Pressure Reduction (PR) (Figure 24)



Setting the Worker

1. Set the Inspirator sensitivity control of both worker and monitor to maximum setting No. 8*.
2. Relax the pressure spring of worker pilot by backing out the adjustment screw until spring tension is at a minimum.
3. Increase pressure spring tension of monitor to maximum of pressure spring range by turning adjusting screw inward.
4. Crack downstream block valve.
5. Crack upstream block valve to pressure Axial Flow Valve.
6. Fully open upstream and downstream block valves.

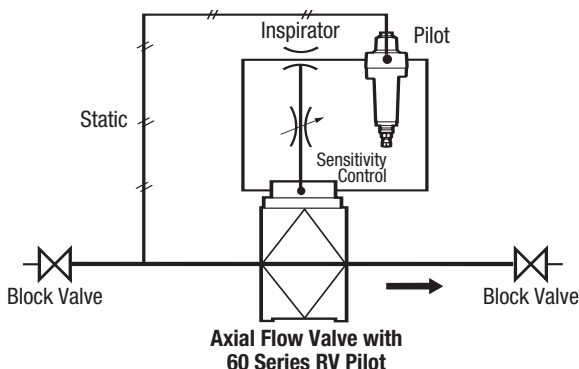
7. Slowly increase pilot pressure spring tension of worker until some flow is achieved.
8. Slowly increase worker pilot pressure spring tension until downstream pressure approximates desired set pressure.
9. Tune AFV worker by alternately adjusting the pilot pressure spring and the sensitivity control until both the required set point and stable control are achieved at the highest possible sensitivity setting under normal flow conditions.

Setting the Monitor

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 adjusting pilot-pressure spring and sensitivity control until both the required set point and stable control are achieved at the highest possible sensitivity control setting under normal flow conditions.
4. Place worker in operation by reversing action of Step 2 above.
5. Close downstream block valve to check for AFV lockup.
6. Gradually open downstream block valve.

* The Inspirator sensitivity control adjusts the rate of valve opening and closing. High sensitivity settings cause the valve to open faster while lower settings reduce the response time. A restrictor setting of 5-6 is normal under most conditions.

Initial Setup, Back Pressure and Relief (RV) (Figure 25)



1. Set Inspirator sensitivity control to maximum setting 8*.
2. Increase pressure spring tension of pilot by turning adjusting screw inward until maximum tension is attained.
3. Open downstream block valve if used.
4. Gradually introduce inlet pressure to the AFV.
5. Gradually decrease pilot pressure spring tension until:
Back Pressure – some downstream flow is achieved
Relief Valve – the desired set point is reached.
6. *Back Pressure only* – slowly decrease pilot pressure spring tension until upstream pressure approximates desired set pressure. Tune system by alternately adjusting the pilot pressure spring and the sensitivity control until both the required set point and stable control are achieved at the highest possible under normal flow conditions.

* The Inspirator sensitivity control adjusts the rate of valve opening and closing. High sensitivity settings cause the valve to open faster while lower settings reduce the response time. A restrictor setting of 5-6 is normal under most conditions.

AFV with Inspirator and Composite Controls

Manifold Inspection and Maintenance

Inspirator Core (Venturi)

The restrictor core should be inspected at all normal service periods, or when the 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 composite 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. Inspect both O-rings for any sign of wear, replace if necessary and always lubricate the O-rings with silicone grease or oil before reinstalling the restrictor core.

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

Composite Manifold Filter

The composite 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 Number 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.

Inspirator Manifold Filter

The inspirator manifold filter 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 the valve and unscrew the large hex-head plug on the side of the manifold.

The filter utilizes a compression fit inside of the hex head plug. Simply remove the old filter element and replace with the new element (Part Number 74074K001) making sure a secure fit is achieved.

Next, replace the hex head O-ring with the new O-ring

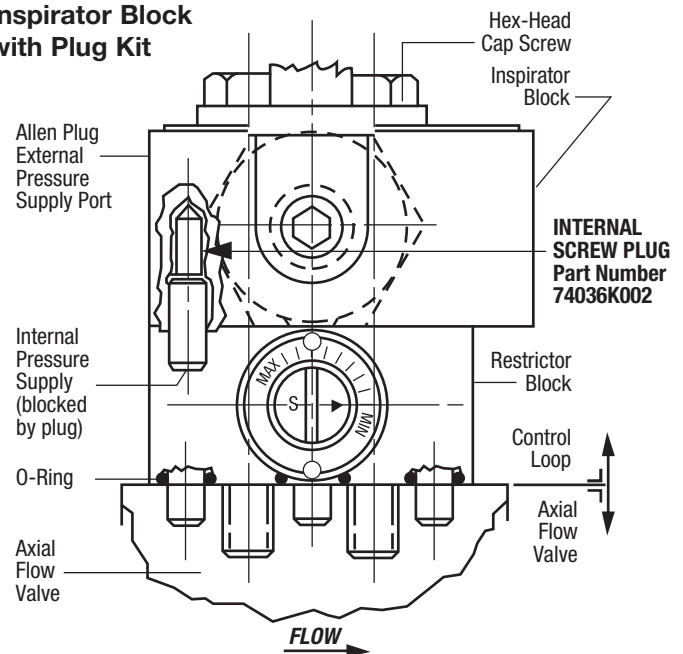
supplied, lubricate the O-ring and screw the hex-head plug with filter back into the manifold port until tight.

Inspirator Worker Manifold Plug Installation (Figure 26)

NOTE: System must be depressurized before servicing.

1. Remove the Inspirator Composite Manifold Block Assembly from the Axial Flow Valve by removing the hex head cap and screws.
2. Separate the Inspirator Block Assembly from the Restrictor Block. (Be sure not to lose the O-rings).
3. Inspect the inlet port in both blocks and remove any moisture or debris.
4. Install internal screw plug (set screw, cone point, MG X 1.0 X 6g. 12 mm long) into internal pressure supply port of the Inspirator Block.
5. Reassemble the Inspirator and Restrictor Blocks, making sure the three (3) O-rings between Restrictor Block and Inspirator Block are in place.
6. Reassemble the Inspirator Composite Manifold Block Assembly to the Axial Flow Valve, making sure the three (3) O-rings are properly seated between the AFV and the Manifold Block Assembly. Torque bolts to 5-8 ft.*lb. Do NOT over-torque.
7. Establish pressure supply to the AFV and be sure to inspect the joints between the AFV and Restrictor Block and between the Restrictor Block and Inspirator Block for leaks using a soap solution.

Figure 26
Inspirator Block with Plug Kit

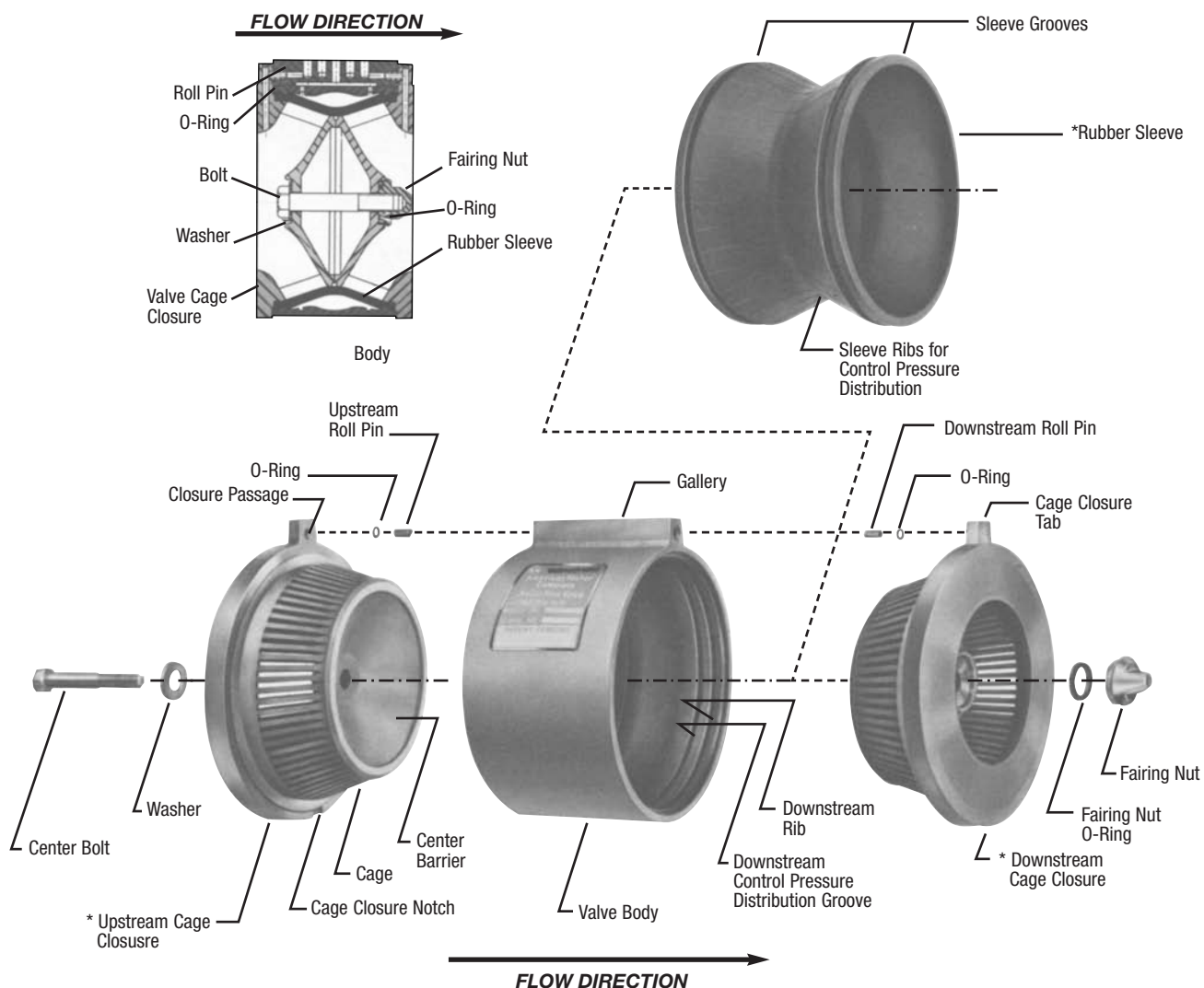


Axial Flow Valves – Maintenance

CAUTION:

“As a knowledgeable user of American Meter Company products, you should be aware that parts in the Company’s meters and regulators contain or are coated with heavy metals such as cadmium, zinc, lead and chromate. Obviously, therefore, repair and refurbishment of this equipment should take into account the presence of these materials and should comply with all state and federal requirements concerning worker protection, proper repair procedure and proper disposal.”

Figure 27 – Axial Flow Valve Components (typical)



** Cage closures are interchangeable. Rubber sleeve can be installed in either direction.
The Axial Flow Valve is capable of bi-directional flow control.*

WARNING – EXPLOSION HAZARD

Read carefully and follow all instructions shipped with this regulator. The incorrect specification or installation of this equipment could result in escaping gas and pose a potential explosion hazard. Refer to AMCO documents SB 9509, IMP 9710 and TDB 9610 (Axial Flow Valves) and SB 9800, PL 9810, SB 8545 and RPL 8845 for technical information, including recommended installation guidelines.

Axial Flow Valves

Disassembly

Under normal operating conditions, the Axial Flow Valve is capable of long service. The service life can be markedly increased by timely inspections and by reversing the upstream and downstream ends of the rubber sleeve.

1. Clean exterior of Valve.
2. To remove the single center bolt, it is necessary to stop the fairing nut from turning by use of a wrench on the nut flats. Loosen the center bolt by using a socket wrench on the hex head of the bolt. **(Figure 28)**
***NOTE:** The fairing nut has been provided with flat wrench surfaces for holding the nut. Some models have a slotted fairing nut which requires the use of a screwdriver. Do not turn the fairing nut to loosen the center bolt. This could result in O-ring damage.*
3. Remove bolt and washer, fairing nut and O-ring. **(Figure 29)**
4. Insert screwdriver in the cage closure notch **(Figure 30)** and turn to loosen cage from body. Continue to raise cage closure with screwdriver until the screwdriver can be inserted near the gallery. Pry the cage closure from the roll pin in the gallery. The cage closure can now be removed. Take care not to damage the machined faces of the body or cage closure.
5. Carefully remove O-ring from roll pin. **(Figure 31)**
6. Repeat Step 4 and remove the other cage closure. Keep downstream cage closure to the right for purpose of identification.
7. Carefully remove O-ring from roll pin.
8. Mark downstream edge of a sleeve with chalk or soft pencil.
9. Loosen sleeve from both ends of body by pulling sleeve toward center and breaking seal. (If prying is necessary, use a smooth rounded instrument). **(Figure 32)**
10. Using your hand, force a section of the sleeve toward the opposite side. **(Figure 33)**
11. Grasp the fold in the sleeve, make sure the sleeve is free of both annular ribs in the body, and lift sleeve from body. **(Figure 34)**

Refer to important handling information on page 1.

Figure 28

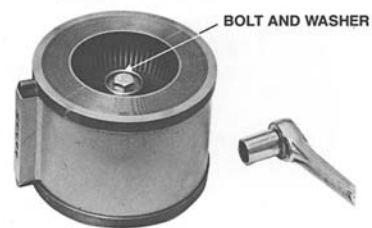


Figure 29



Figure 30



Figure 31

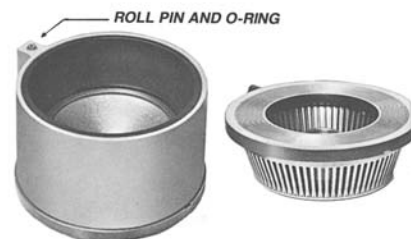


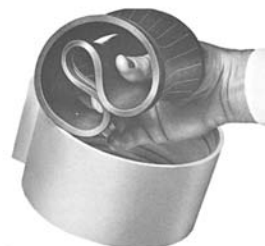
Figure 32



Figure 33



Figure 34



Axial Flow Valves

Inspection

1. Inspect upstream and downstream cage closure roll pins. Replace if damaged.
2. Inspect interior of valve body for unusual marks or corrosion. Clean thoroughly. Blow out gallery passages (**Figure 35**). The central control pressure passage has two interior ports. Be certain both have no blockage.
3. Inspect exterior of body for damage. Inspect weld between body and gallery.
4. Clean cage closure (**Figure 36**). Inspect for erosion and keep track of downstream cage closure by placing it to the right. Discard cage closure that shows noticeable erosion or has reduced the thickness or width of the cage ribs. (A slight rounding of the edges of the ribs will not affect the valve.)
5. Inspect sleeve before cleaning. Note any unusual marks and imprints. Check the sleeve for swelling or any noticeable change in hardness (flexibility).
6. Clean the sleeve carefully, checking the areas where unusual marks or imprints were observed. Look for wear and breaks in sleeve surface.
7. Discard and replace with new sleeve if any defects other than normal wear are observed.
8. Inspect bolt, washer, and fairing nut for pits and corrosion.
9. It is usually good practice to replace O-rings. If there is no distortion, nicks, excessive swelling or hardening, it is possible to reuse the O-rings.

Figure 35

Axial Flow Valve Body

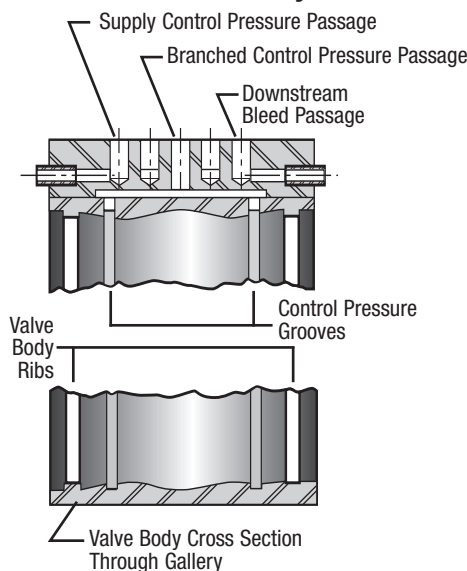
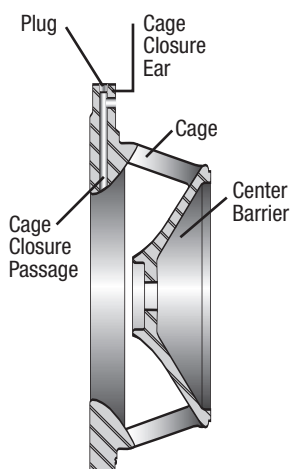


Figure 36
Axial Flow Valve Closure



Axial Flow Valves

Reassembly

1. Use the former downstream cage in the upstream side. Turn the sleeve so that the former downstream side faces upstream. **Using spray-type silicone lubricant, lightly lubricate the sleeve grooves and opposing internal surfaces. Lightly lubricate the two gallery O-rings.**
2. Push the section of the sleeve toward the opposite side and grasp the fold. (**Figure 37**)
3. Insert the folded sleeve in the body and engage the sleeve grooves on the internal annular ribs—both upstream and downstream. (**Figure 38**)
4. Gradually seat the sleeve groove on the ribs and release the fold. Press until the seating is complete on both ribs.
5. (Replace damaged roll pins). Gently press gallery O-rings around both upstream and downstream roll pins.
6. Place former downstream cage closure over upstream side of body so that the passage in the closure tab engages the roll pin. This aligns the cage closure.
7. Press the cage closure down as far as possible (**Figure 39**) Check for proper alignment of passage and roll pin.

Continued on page 22.

Figure 37



Figure 38



Figure 39



Axial Flow Valves

Reassembly *Continued*

8. Install downstream cage closure. Steps 6 and 7.
9. Place washer under head of center bolt, apply anti-seize compound to threads. Push bolt with washer through upstream cage to extend through downstream cage closure.
10. Do not lubricate fairing nut O-ring. This will facilitate torquing center bolt without need of holding the nut. Insert fairing nut O-ring into groove of fairing nut.
11. Thread fairing nut onto bolt until finger tight.
12. Torque center bolt to the following torques:

300 and 600 Series	
Valve Size	Torque
2" and 3"	20 to 30 ft. lbs.
4"	40 to 60 ft. lbs.
6"	75 to 100 ft. lbs.
8"	140 to 180 ft. lbs.
12"	375 to 475 ft. lbs.

Note: The fairing nut is provided with flat wrench surfaces for holding the nut. This should not be necessary if the fairing nut O-ring is dry.

Do not torque the center bolt by turning the fairing nut.

Axial Flow Valve

Storage

The Axial Flow Valve is ruggedly constructed from corrosion-resistant steel. The rubber products used in the standard valves are durable and resistant to aging. Valves can be stored in conditions commonly found in most warehouses and tool rooms. A clean, cool, dry area is ideal for storage.

New Valves can be stored in shipping containers.

Valve Storage – Ideally, Axial Flow Valves should be stored in original shipping containers. Plastic bags may also be used and will prevent foreign material and insects from entering valve passages. When removing an Axial Flow Valve from service, it is recommended the valve be thoroughly cleaned and inspected prior to being stored.

Sleeve Storage – Sleeves 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.

Axial Flow Valve sleeves should be stored in their polyethylene bags inside a box or in polyethylene-lined paper bags.

It may not be practical to keep certain rubber parts in containers due to the possibility of shape deformation. Sleeves should be stored in such a way as to minimize the effects of the above noted contaminants.

Approximate shelf life for Axial Flow Valve Sleeves:

Sleeve Type	Years
Buna N and HNBR	2
Natural Rubber	2
Hydriin	5
Viton	10
Fluorosilicone	10

Sleeve Data Stamp (Figure 40)

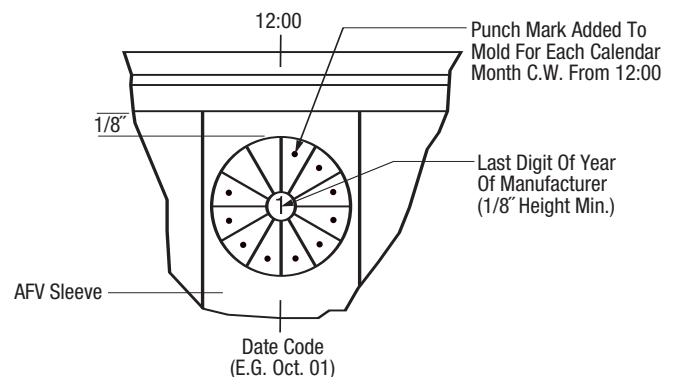
All Axial Flow Valve sleeves utilize a manufacturer's date stamp found below the sleeves' ID code next to the color code.

Because each sleeve has a specific shelf life, the data stamp will be useful in determining the proper time to use the sleeve.

Figure 40 below illustrates the stamp showing the numeric digit in the center of the circle representing the latest manufactured year by utilizing the last digit of that specific year.

The punch marks in the outer circle represent each calendar month for the year moving clockwise from the 12 o'clock position.

Figure 40
Sleeve Data Stamp



Axial Flow Valves – Repair Parts and Accessories

Stud Bolts and Nuts – 300 Series

Valve Size	ANSI Flange	Diameter (inches)	No. of Threads per inch	Length (inches)	Stud Bolt Part No.†	No. Required	Nut Part No.	No. Required
2, 2R	125-150	5/8	11 UNC	7	78018P029	4	78019P033	8
	250-300	5/8	11 UNC	7-1/4	78018P030	8	78019P033	16
3	125-150	5/8	11 UNC	8	78018P031	4	78019P033	8
	250-300	3/4	10 UNC	8-1/2	78018P032	8	78019P036	16
4	125-150	5/8	11 UNC	8-3/4	78018P033	8	78019P033	16
	250-300	3/4	10 UNC	9-3/4	78018P034	8	78019P036	16
6	125-150	3/4	10 UNC	10-1/4	78018P035	8	78019P036	16
	250-300	3/4	10 UNC	11	78018P036	12	78019P036	24
8	125-150	3/4	10 UNC	11-1/2	78018P037	8	78019P036	16
	250-300	7/8	9 UNC	12-3/4	78018P038	12	78019P039	24
12	125-150	7/8	9 UNC	14-3/4	78018P041	12	78019P039	24
	250-300	1-1/8	8 UNC	16-3/4	78018P042	16	78019P045	32

Stud Bolts and Nuts – 600 Series

2, 2R	600	5/8	11 UNC	8-1/4	78018P050	8	78019P033	16
4	600	7/8	9 UNC	11-3/4	78018P052	8	78019P039	16
6	600	1	8 UNC	14-1/4	78018P053	12	78019P041	24
8	600	1-1/8	8 UNC	16-1/2	78018P054	12	78019P045	24

† Continuous threads

Material – ASTM Specification A 307 Grade B – Plating Zinc per AMD T-1015

Optional Accessory – 300 Series Centering Tubes

Description	Valve Size (in.)	Quantity	Part No.
Centering Tubes	2, 2R	2	73552P001
	3	2	73552P002
	4	2	73552P003
	6	2	73552P004
	8	2	73552P005
	12	2	73552P007

300 and 600 Series Accessories

Flange Separator* (300 Series Only)	2, 2R, 3, 4	2	73593G001
	6, 8	2	73593G002
	12	2	73593G003
Lifting Plate **	2 thru 12	1	73672P001
1203 Pressure Adjusting Screw Retrofit Kit	2 thru 12	1	74073K001
New or Replacement Inspirator Block Assy. Complete w/Plug	2 thru 12	1	74067K001
New or Replacement Composite Block Assy. Complete Pressure-Tested Assy.	2 thru 12	1	73957G014
			73957W014
New or Replacement Bare AFV Block. No Adjuster – NPT Tapped	2 thru 12	1	73573W004
Internal Composite Manifold Plug	2 thru 12	1	74036K001
Inspirator Control Manifold Plug		1	74036K002

* **Flange Separators** – The installation and removal of the valve may be facilitated by the use of two flange separators. Flange separators are placed on each side of the valve to jack the flanges apart and thereby relieve a piping strain to facilitate valve removal and replacement.

** **Lifting Plate** – Provides a 1" x 1-1/2" aperture for engagement by hook, chain, or cable for lifting the Axial Flow Valve. The lifting plate is particularly useful for handling the 8-inch and 12-inch valve. The lifting plate attaches to the valve gallery utilizing the same two 5/16" x 2" bolts required for the manifold block.

Axial Flow Valve Sizes and Weights

Valve Size (inches)	Weight (lbs)	Width (inches)
300 Series		
2, 2R	5-3/4	3-1/32
3	9	3-23/32
4	19	4-1/2
6	38	5-1/2
8	80	6-23/32
12	177	9-7/16
600 Series		
2	7-1/2	3-13/32
4	31-1/2	5-1/4
6	73-1/2	6-7/8
8	122	8-5/64

For additional literature and product information, please refer to the following bulletins:

- SB 8545** Z Pilot Regulators
- RPL 8845** Z Pilot Regulators
- SB 9509** Axial Flow Valves
- SB 9510** Axial Flow Valves
- TDB 9610** AFV Capacity Tables
- SB 9800** 60 Series Pilot Regulators
- PL 9810** 60 Series Pilot Regulators

Axial Flow Valve – Repair Parts

150/300 Series (Figure 41)

Valve Size	Qty.	Part Number
2 Closure , Valve Cage, 17-4 Stainless Steel		
2	2	73402P001
3	2	73402P002
4	2	73402P003
6	2	73402P004
8	2	73402P005
12	2	73402P007
2A Reduced-Capacity Valve Cage		
2R10	1	73402P016
2R25	1	73402P015
2R50	2	73402P008
3 Sleeve , Buna N – Durometer 50, Low Delta Pressure Code B5-L Orange Stripe		
2, 2R	1	73404P067
3	1	73404P068
4	1	73404P069
6	1	73404P070
8	1	73404P072
12	1	73404P074
3 Sleeve , Buna N – Durometer 50, Code B7, Blue Stripe		
2, 2R	1	73404P055
3	1	73404P057
4	1	73404P059
6	1	73404P061
8	1	73404P063
12	1	73404P065
3 Sleeve , Buna N – Durometer 70, Code B7, Blue Stripe		
2, 2R	1	73404P056
3	1	73404P058
4	1	73404P060
6	1	73404P062
8	1	73404P063
12	1	73404P066
3 Sleeve , Hydrin 200† - Durometer 50, Low Delta Pressure Code H-5L, Orange Stripe		
2, 2R	1	73404P051
3	1	73404P052
4	1	73404P053
6	1	73404P054
8	1	73404P071
12	1	73404P073
3 Sleeve , Hydrin 200† - Durometer 50, Code H5, Blue Stripe		
2, 2R	1	73404P008
3	1	73404P009
4	1	73404P010
6	1	73404P011
8	1	73404P012
12	1	73404P014
3 Sleeve , Hydrin 200† - Durometer 70, Code H7, Blue Stripe		
2, 2R	1	73404P002
3	1	73404P003
4	1	73404P001
6	1	73404P004
8	1	73404P005
12	1	73404P007
3 Sleeve , Viton – Durometer 70, Code V7, Blue Stripe		
2, 2R	1	73404P015
3	1	73404P016
4	1	73404P017
6	1	73404P018

† Trademark B F Goodrich Co.

Valve Size	Qty.	Part Number
3 Sleeve , Fluorosilicone Rubber, Durometer 50, Code F5, Blue Stripe		
2, 2R	1	73404P033
3	1	73404P034
4	1	73404P035
6	1	73404P036
3 Sleeve , Natural Rubber, Durometer 70, Code N7, Blue Stripe		
2, 2R	1	73404P039
3	1	73404P040
4	1	73404P041
6	1	73404P042
8	1	73404P043
12	1	73404P044
3 Sleeve , HNBR, Durometer 65, Code HB (Maximum toughness for Buna applications)		
2, 2R	1	73404P076
3	1	73404P077
4	1	73404P078
6	1	73404P079
8	1	73404P080
12	1	73404P081
4 Fairing Nut , Stainless Steel		
2, 2R	1	73401P001
3	1	73401P001
4	1	73401P002
6	1	73401P003
8	1	73401P004
12	1	73401P005
5 Screw Cap , Stainless Steel		
2, 2R	1	78000P090
3	1	78000P093
4	1	78000P087
6	1	78000P094
8	1	78000P095
12	1	78000P091
6 Washer , Stainless Steel		
2, 2R	1	70176P041
3	1	70176P041
4	1	70176P039
6	1	78034P013
8	1	70176P043
12	1	78034P012
7 O-Ring , (Fairing Nut) Buna N (standard)		
2, 2R	1	42710P150
3	1	42710P150
4	1	42710P081
6	1	42710P155
8	1	42710P156
12	1	42710P160
7 O-Ring , Fairing Nut, Viton A		
2, 2R	1	78037P096
3	1	78037P096
4	1	78037P097
6	1	78037P098
8 O-Ring , Roll Pin, Buna A (Standard)		
All	2	42710P146
8 O-Ring , Roll Pin, Viton A		
All	2	78037P094
9 Roll Pin 1/4"D x 3/8"L Steel (Standard)		
2, 2R	2	78137P004
3, 4, 6, 8, 12	2	78137P003
9 Roll Pin 1/4"D x 1/2"L Stainless Steel		
2, 2R	2	N/A
3,4,6,8,12	2	78137P005

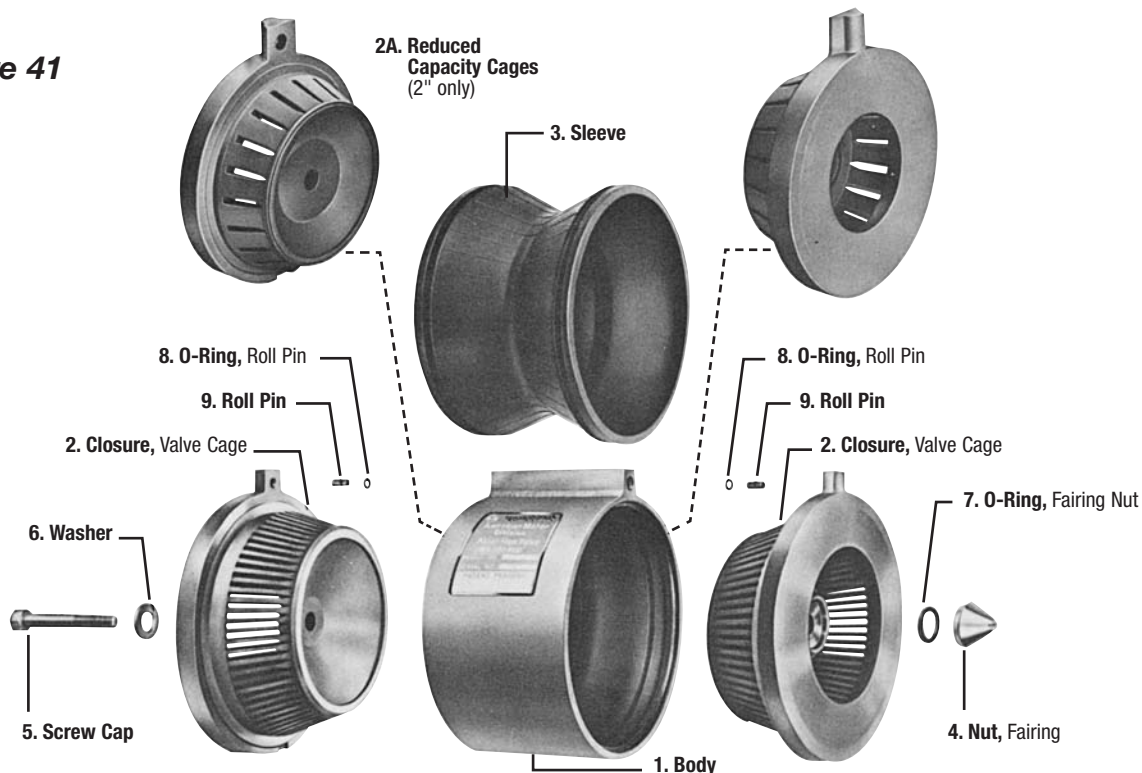
Axial Flow Valve – Repair Parts

600 Series – High Pressure (Figure 41)

Valve Size	Qty.	Part Number
2 Closure, Valve Cage, 17-4 Stainless Steel		
2	2	73679P001
4	2	73679P003
6	2	73679P004
8	2	73679P005
2A Reduced Capacity Valve Cage		
2R10	1	73679P009
2R25	1	73679P008
2R50	2	73679P007
3 Sleeve, Buna N (Std.) Durometer 70, Code B7, Red Stripe		
2, 2R	1	73677P007
4	1	73677P008
6	1	73677P009
8	1	73677P010
3 Sleeve, Viton Durometer 70, Code V7, Red Stripe		
2, 2R	1	73677P011
4	1	73677P012
6	1	73677P013
8	1	73677P014
3 Sleeve, Hydrin Durometer 70, Code H7, Red Stripe		
2, 2R	1	73677P001
4	1	73677P003
6	1	73677P004
8	1	73677P005
3 Sleeve, HNBR, Durometer 65, Code HB, Red Stripe (Maximum toughness for Buna applications)		
2, 2R	1	73677P015
4	1	73677P016
6	1	73677P017
8	1	73677P018

Valve Size	Qty.	Part Number
4 Nut, Fairing, Stainless Steel (Center Bolt)		
2, 2R	1	73401P001
4	1	73401P002
6	1	73401P003
8	1	73401P004
5 Screw Cap, Stainless Steel		
2, 2R	1	78000P090
4	1	78000P087
6	1	78000P094
8	1	78000P095
6 Washer, Stainless Steel		
2, 2R	1	70176P041
4	1	70176P039
6	1	78034P013
8	1	70176P043
7 O-Ring, Fairing Nut, Buna N		
2, 2R	1	42710P150
4	1	42710P080
6	1	42710P155
8	1	42710P156
8 O-Ring, Roll Pin, Buna N		
All	2	78037P003
9 Roll Pin, 1/4"D x 3/8"L, 1/4"D x 1/2"L		
2, 2R	2	78137P004
4	2	78137P003
6	2	78137P003
8	2	78137P003
6	2	78137P005
8	2	78137P005
12	2	78137P005

Figure 41



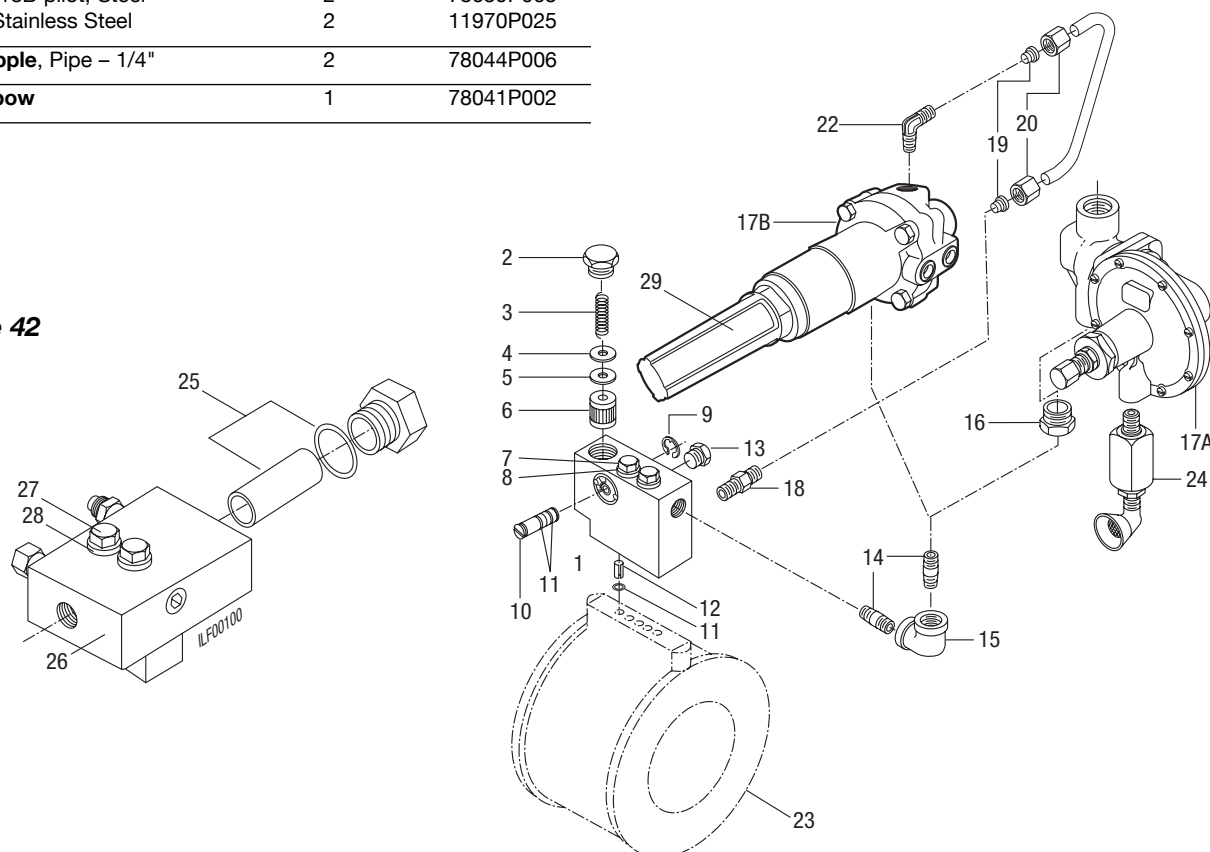
Control Loop Assemblies

Description	Quantity Per Unit	Part No.
1 Block , Manifold – Assembly (includes items #2 thru 13)	1	73957G001
2 Plug , Hex Hd. W/O-Ring	1	78479P001
3 Spring	1	71403P012
4 Washer	1	78034P016
5 Gasket	1	70019P106
6 Filter Assembly	1	78480P001
7 Screw , Hex Head, Steel	2	78999P106
Stainless Steel	2	12369P041
8 Washer , Steel	2	70176P040
Stainless Steel	2	70176P045
9 Ring , Retaining	1	78074P029
10 Core , Restrictor	1	73659P003
11 O-Ring	5	78037P003
12 Roll Pin	3	78137P003
13 Plug , Pipe 1/4"		
W/17A pilot, Steel	3	78039P003
Stainless Steel	3	11970P025
W/18B pilot, Steel	2	78039P003
Stainless Steel	2	11970P025
14 Nipple , Pipe – 1/4"	2	78044P006
15 Elbow	1	78041P002

Control Loop Assemblies *Continued*

Description	Quantity Per Unit	Part No.
16 Bushing , Reducing (use with 17A only)	1	78041P002
17A Model 1203 – 180 – Pilot	1	73958G017
17B Type 60 Series	1	See SB9800
18 Connector , Tube	1	78109P001
19 Sleeve	2	78109P004
20 Nut , Tube Connector	2	78109P003
21 Tubing – 3/8"	1	72201P013
22 Elbow	1	78109P002
23 Valve , Axial Flow	1	
24 Restrictor , Dampening	1	73688G002
25 Filter Assembly , Inspirator Block (optional)	1	74074K001
26 Inspirator Assembly	1	74067K001
27 Screw , Hex Head, Steel	2	78000P107
28 Washer , Flat, Steel	2	70176P040
29 Cap , 60 Series	1	55472P005

Figure 42



AMERICAN METER

132 Welsh Road, Suite 140
Horsham, PA 19044 U.S.A.
Phone: 215/830-1800
Fax: 215/830-1890
Website: americanmeter.com

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CANADIAN METER

275 Industrial Road
Cambridge, Ontario N3H 4R7 Canada
Phone: 877/461-2626 (toll free)
Phone: 519/650-1900
Fax: 519/650-1917
Website: canadianmeter.com