**Submittal Package**

## Engineering Specification, Installation, Operation and Maintenance

# Series LF960GD-13-17 / LF660GD-13-17

## Two-Way Flow Altitude Control Valve with Delay Open for Return Flow

Sizes: 1¼" to 24"

**⚠ WARNING**

**Read this Manual BEFORE using this equipment.**

**Failure to read and follow all safety and use information can result in death, serious personal injury, property damage, or damage to the equipment.**

**Keep this Manual for future reference.**

THINK SAFETY FIRST

**⚠ WARNING**

**Local building or plumbing codes may require modifications to the information provided. You are required to consult the local building and plumbing codes prior to installation. If the information provided here is not consistent with local building or plumbing codes, the local codes should be followed. This product must be installed by a licensed contractor in accordance with local codes and ordinances.**

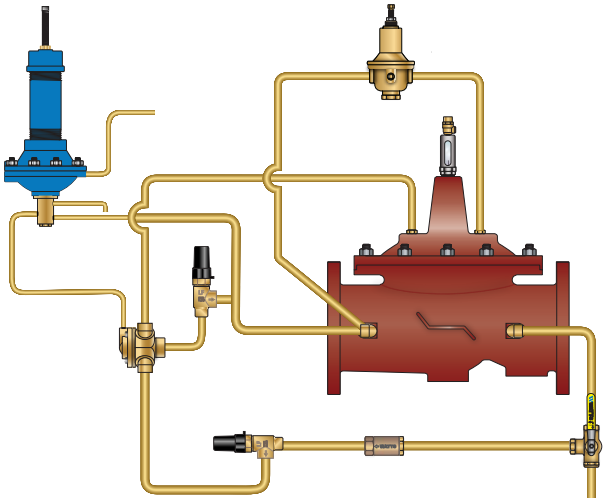
**⚠ WARNING**

**Need for Periodic Inspection/Maintenance:** This product must be tested periodically in compliance with local codes, but at least once per year or more as service conditions warrant. All products must be retested once maintenance has been performed. Corrosive water conditions and/or unauthorized adjustments or repair could render the product ineffective for the service intended. Regular checking and cleaning of the product's internal and external components helps assure maximum life and proper product function.

***NOTICE***

For Australia and New Zealand: Pipeline strainers should be installed between the upstream shutoff valve and the inlet of the backflow preventer.

It's important that this device be tested periodically in compliance with local codes, but at least once per year or more as service conditions warrant. If installed on a fire sprinkler system, all mechanical checks, such as alarm checks and backflow preventers, should be flow tested and inspected internally in accordance with NFPA 13 and NFPA 25.



LF960GD-13-17

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### Engineering Specifications



### Installation, Operation and Maintenance





AMES FIRE & WATERWORKS

A WATTS Brand

**LEAD FREE***

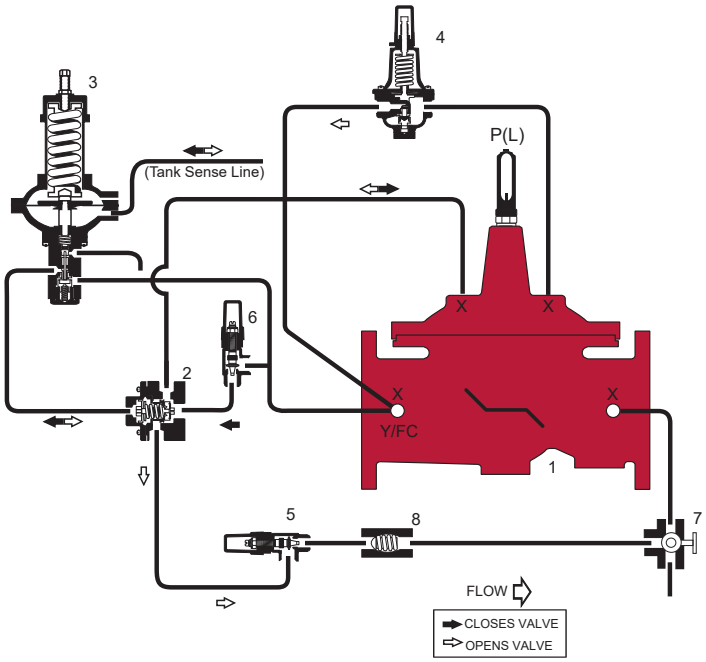
# Series LF960GD-13-17

## Two-Way Flow Altitude Control Valve with Delay Open for Return Flow

### Full Port Ductile Iron Single Chamber Valve

### Features

- Designed for Tank Fill and Discharge applications
- Opens when Tank head pressure is below setpoint
- Closes when Tank head pressure is above setpoint
- Delayed open for return flow when system pressure is below tank head by an adjustable amount
- Tank Sense Line is field installed (to Tank or standpipe)
- Adjustable Opening and Closing Speed
- Altitude setpoint is adjustable




### Standard Components

1 – Main Valve (905GD - Single Chamber)
2 – Model 22-1 Accelerator Control
3 – Altitude Control
4 – Delayed Opening Control
5 – Adjustable Opening Speed
6 – Adjustable Closing Speed
7 – 3-Way Ball Valve
8 – Check Valve
P – Position Indicator
X – Isolation Cocks

### Options and Accessories

O FC – Flo-Clean Strainer
O Y – Y-Strainer (Replaces Flo-Clean)
O L – Limit Switch

### Operation

The Two-Way Flow Altitude Automatic Control Valve (ACV) with Delayed Open for Return Flow Feature is designed to control the maximum water level in elevated water storage tanks and to allow flow from the tank back into the water system after the system water pressure has fallen below the elevated storage tank shut-off head pressure by an adjustable amount of pressure. The high level control is accomplished using a spring loaded 3-way altitude control and a large ported 3-way accelerator control. The altitude pilot responds to the rising water level in the storage tank through a field installed sense line. The altitude pilot will signal the accelerator to open the main valve by venting the main cover chamber or close the main valve by pressurizing the main cover chamber. When the system pressure falls below the tank head pressure the Delayed Open for Return Flow feature is achieved by a normally open pressure control that holds the return flow line closed until the system pressure falls to the set point of the normally open pressure control.

**Specify Tank height PRIOR to ordering.**

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

***NOTICE***

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

# M Series Basic Valves

## Two-Way Flow Altitude Control Valve with Delay Open for Return Flow

### Full Port Ductile Iron Single Chamber Basic Valve

This Ames Automatic Control Valve (ACV) is a full port, single chamber basic valve that incorporates a one-piece disc and diaphragm assembly. This assembly is the only moving part within the valve allowing it to open, close, or modulate as commanded by the pilot control system.

Ames ACV Main Valves are Lead Free. The Ames ACV piloting system contains Lead Free* components, ensuring all of our configurations are Lead Free compliant.

Globe Pattern Single Chamber Basic Valve (905GD)
Angle Pattern Single Chamber Basic Valve (905AD)

### Standard Materials

| | |
|---|---|
| **Body and Cover:** | Ductile Iron ASTM A536 |
| **Coating:** | NSF Listed Fusion Bonded Epoxy Lined and Coated |
| **Trim:** | 316 Stainless Steel |
| **Elastomers:** | Buna-N (standard)<br>EPDM (optional)<br>Viton™ (optional) |
| **Nut, Spring and Stem:** | Stainless Steel |
| **Anti-Scale (Optional):** | Xylan Coated Stem and Seat |

NSF Certified to NSF/ANSI 61-G

Viton™ is a trademark of The Chemours Company FC, LLC

### Operating Pressure

Threaded = 400psi (27.6 bar)
150# Flanged = 250psi (17.2 bar)
300# Flanged = 400psi (27.6 bar)
Grooved End = 400psi (27.6 bar)

### Operating Temperature

Buna-N: 160°F (71°C) Maximum
EPDM: 300°F (140°C) Maximum
Viton™: 250°F (121°C) Maximum
Epoxy Coating**: 225°F (107°C) Maximum

*** Valves can be provided without internal epoxy coating consult factory*

### Basic Valve Body Options


Globe Flanged


Angle Flanged


Globe Grooved End


Angle Grooved End


Globe Threaded


Angle Threaded

# ACV Schematic - Series LF960GD-13-17

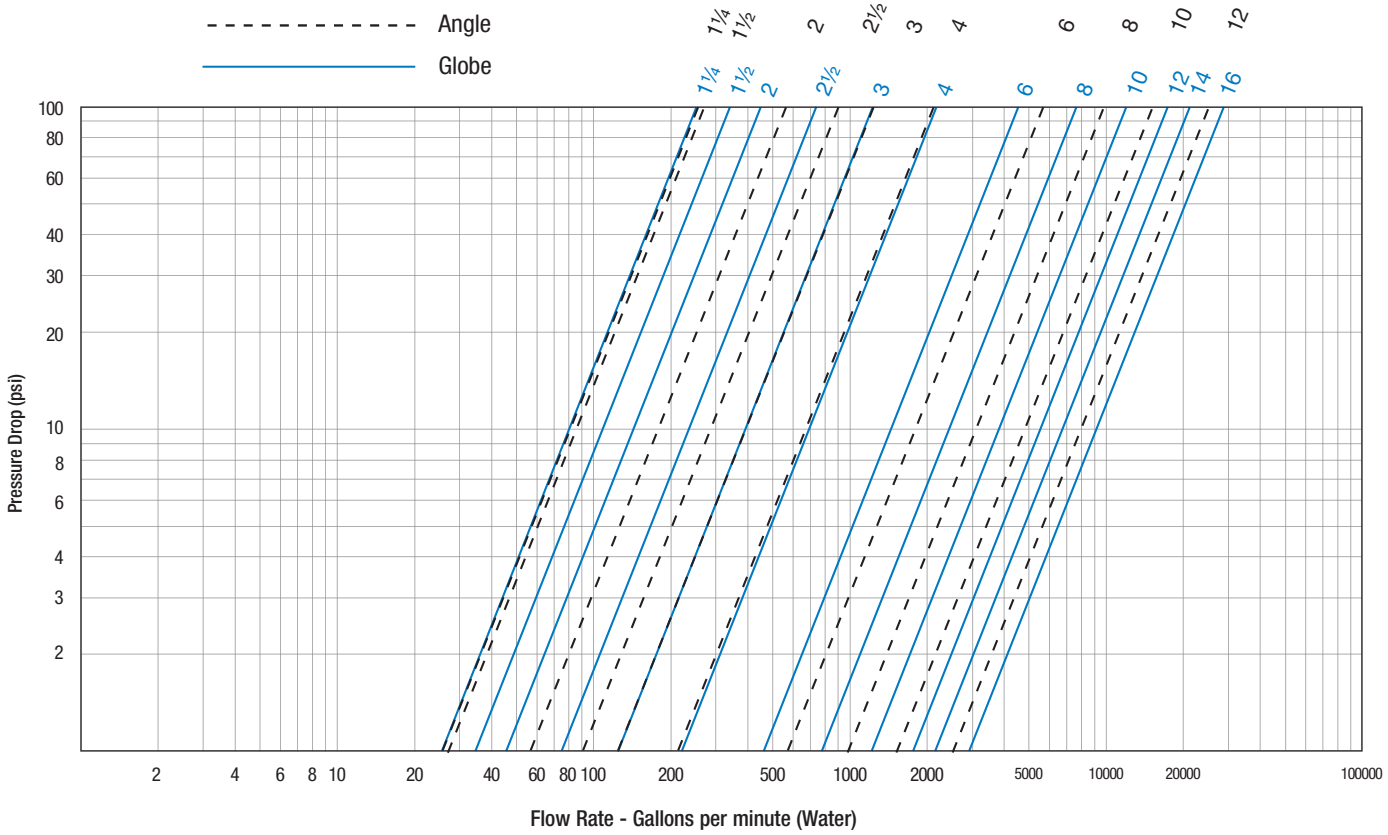
## Flow Data

| | Valve Size - Inches | 1¼ | 1½ | 2 | 2½ | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Suggested | Maximum Continuous Flow Rate Gpm (Water) | 95 | 130 | 210 | 300 | 485 | 800 | 1850 | 3100 | 5000 | 7000 | 8500 | 11100 |
| | Maximum Intermittent Flow Rate Gpm (Water) | 119 | 161 | 265 | 390 | 590 | 1000 | 2300 | 4000 | 6250 | 8900 | 10800 | 14100 |
| | Minimum Flow Rate Gpm (Water) | 3 | 5 | 6 | 9 | 15 | 16 | 17 | 25 | 55 | 70 | 190 | 400 |
| Cv | $C_v$ Factor GPM (Globe) | 26 | 26 | 48 | 75 | 112 | 188 | 387 | 764 | 1215 | 1734 | 2234 | 3131 |
| | $C_v$ Factor GPM (Angle) | 26 | 27 | 57 | 91 | 125 | 207 | 571 | 889 | 1530 | 1945 | | |

- Maximum continuous flow based on velocity of 20 ft. per second.
- Maximum intermittent flow based on velocity of 25 ft. per second.
- Minimum flow rates based on a 20-40 psi pressure drop.
- The $C_v$ Factor of a value is the flow rate in US GPM at 60°F that will cause a 1psi drop in pressure.
- $C_v$ factor can be used in the following equations to determine Flow (Q) and Pressure Drop (ΔP):

  **Q (Flow) = $C_v\sqrt{\Delta P}$** **ΔP (Pressure Drop) = $(Q/C_v)^2$**

- The $C_v$ factors stated are based upon a fully open valve.
- Many factors should be considered in sizing control valves including inlet pressure, outlet pressure and flow rates.
- For sizing questions including cavitation analysis consult Watts with system details.




## Valve Cover Chamber Capacity

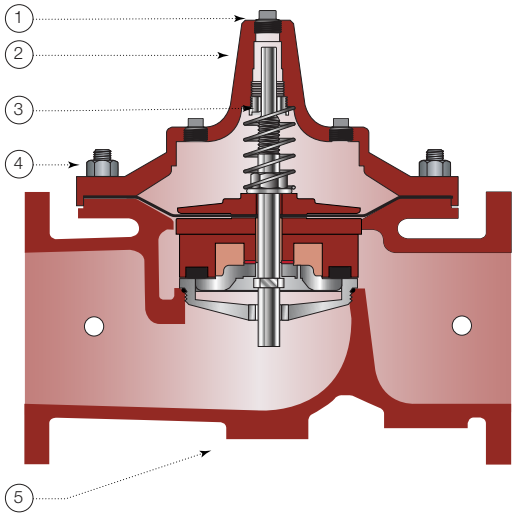
| Valve Size - Inches | 1¼ | 1½ | 2 | 2½ | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| fl.oz. | 4 | 4 | 4 | 10 | 16 | 22 | 70 | | | | | |
| U.S. Gal | | | | | | | | 1¼ | 2½ | 4 | 6½ | 9½ |

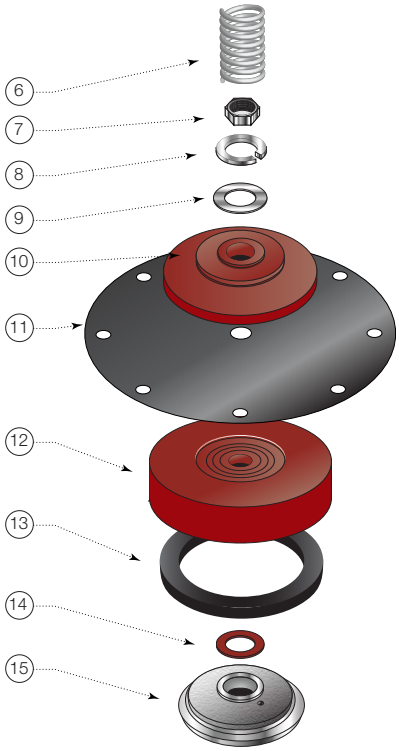
## Valve Travel

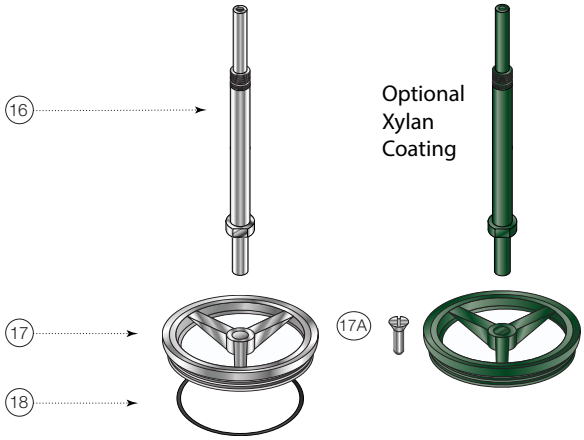
| Valve Size - Inches | 1¼ | 1½ | 2 | 2½ | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Travel - Inches | ⅜ | ⅜ | ½ | ⅝ | ¾ | 1 | 1½ | 2 | 2½ | 3 | 3½ | 4 |

# ACV Schematic - Series LF960GD-13-17

## Basic Valve




| Item | Description | Material |
|---|---|---|
| 1 | Pipe Plug | Lead Free Brass |
| 2 | Cover | ASTM A536 65-45-12 Epoxy Coated Ductile Iron |
| 3 | Cover Bearing | ASTM A276 304 Stainless Steel |
| 4 | Stud with Cover Nut and Washer | ASTM A570 Gr.33 Zinc Plated Steel |
| 5 | Body | ASTM A536 65-45-12 Epoxy Coated Ductile Iron |
| 6 | Spring | ASTM A276 302 Stainless Steel |
| 7 | Stem Nut | ASTM A276 304 Stainless Steel |
| 8 | Lock Washer | ASTM A276 304 Stainless Steel |
| 9 | Stem Washer | ASTM A276 304 Stainless Steel |
| 10 | Diaphragm Washer | ASTM A536 65-45-12 Epoxy Coated Ductile Iron |
| 11 | Diaphragm* | Buna-N (Nitrile) |
| 12 | Disc Retainer | ASTM A536 65-45-12 Epoxy Coated Ductile Iron |
| 13 | Seat Disc* | Buna-N (Nitrile) |
| 14 | Spacer Washer* x5 | NY300 Fiber* |
| 15 | Disc Guide | ASTM A743 CF8M (316) Stainless Steel |
| 16 | Shaft | ASTM A276 304 Stainless Steel |
| 17 | Seat Ring** | ASTM A743 CF8M (316) Stainless Steel |
| 17A | Seat Screw** (8" and Larger) | ASTM A276 304 Stainless Steel |
| 18 | Seat Gasket* | Buna-N (Nitrile) |

** Contained in Main Valve Repair Kit*
***Note: 6 inch and Smaller Valves, Seat Ring is threaded*

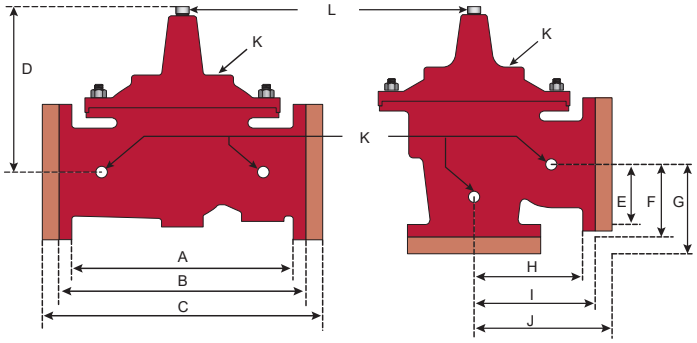
***NOTICE***

Installation: If unit is installed in any orientation other than horizontal (cover up) OR extreme space constraints exist, consult customer service prior to or at the time of order.

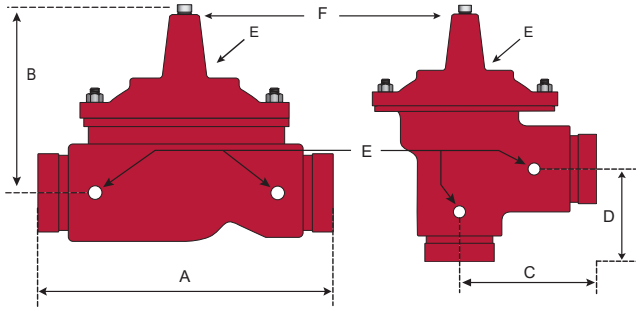
# ACV Schematic - Series LF960GD-13-17

## Dimensions

Flanged and Threaded




Grooved End




### Flanged and Threaded Dimensions

| Valve Size | Globe Thread | | Globe 150# | | Globe 300# | | Cover To Center | | Angle Thread | | Angle 150# | | Angle 300# | | Angle Thread | | Angle 150# | | Angle 300# | | Port Size NPT | Port Size NPT | Shipping Weights* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | | B | | C | | D | | E | | F | | G | | H | | I | | J | | K | L | | |
| *in.* | *in.* | *mm* | *in.* | *mm* | *in.* | *mm* | *in.* | *mm* | *in.* | *mm* | *in.* | *mm* | *in.* | *mm* | *in.* | *mm* | *in.* | *mm* | *in.* | *mm* | *in.* | *in.* | *lbs.* | *kgs.* |
| 1¼ | 7¼ | 184 | | | | | 5½ | 140 | | | | | | | | | | | | | ⅜ | ¼ | 20 | 9 |
| 1½ | 7¼ | 184 | 8½ | 216 | | | 5½ | 140 | 3¼ | 83 | | | | | 1⅞ | 48 | | | | | ⅜ | ¼ | 25 | 11 |
| 2 | 9⅜ | 238 | 9⅜ | 238 | 10 | 254 | 6¾ | 171 | 4¾ | 120 | 4¾ | 121 | 5 | 127 | 3¼ | 83 | 3¼ | 83 | 3½ | 89 | ⅜ | ½ | 40 | 18 |
| 2½ | 11 | 279 | 11 | 279 | 11⅝ | 295 | 7½ | 191 | 5½ | 140 | 5½ | 140 | 5⅞ | 149 | 4 | 102 | 4 | 102 | 4 5/16 | 110 | ½ | ½ | 65 | 29 |
| 3 | 12½ | 318 | 12 | 305 | 13¼ | 337 | 8¼ | 210 | 6¼ | 159 | 6 | 152 | 6⅜ | 162 | 4½ | 114 | 4 | 102 | 4⅜ | 111 | ½ | ½ | 95 | 43 |
| 4 | | | 15 | 381 | 15⅝ | 397 | 10⅝ | 270 | | | 7½ | 191 | 7⅞ | 200 | | | 5 | 127 | 5 5/16 | 135 | ¾ | ¾ | 190 | 86 |
| 6 | | | 20 | 508 | 21 | 533 | 13 | 330 | | | 10 | 254 | 10½ | 267 | | | 6 | 152 | 6½ | 165 | ¾ | ¾ | 320 | 145 |
| 8 | | | 25⅜ | 645 | 26⅜ | 670 | 16 | 406 | | | 12¾ | 324 | 13¼ | 337 | | | 8 | 203 | 8½ | 216 | 1 | 1 | 650 | 295 |
| 10 | | | 29¾ | 756 | 31⅛ | 791 | 17 | 430 | | | 14⅞ | 378 | 15 9/16 | 395 | | | 8⅝ | 219 | 9 5/16 | 237 | 1 | 1 | 940 | 426 |
| 12 | | | 34 | 864 | 35½ | 902 | 20⅞ | 530 | | | 17 | 432 | 17¾ | 451 | | | 13¾ | 349 | 14½ | 368 | 1 | 1¼ | 1500 | 680 |
| 14 | | | 39 | 991 | 40½ | 1029 | 24¼ | 616 | | | | | | | | | | | | | 1 | 1½ | 1675 | 760 |
| 16 | | | 41⅜ | 1051 | 43½ | 1105 | 25¼ | 640 | | | | | | | | | | | | | 1 | 2 | 3100 | 1406 |

### Grooved End Dimensions

| Valve Size | Globe Grooved | | Cover To Center | | Angle Grooved | | Angle Grooved | | Port Size (npt) | Port Size (npt) | Shipping Weights* | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | | B | | C | | D | | E | F | | |
| *in.* | *in.* | *mm* | *in.* | *mm* | *in.* | *mm* | *in.* | *mm* | *in.* | *in.* | *lbs.* | *kgs.* |
| 1¼ | 8½ | 216 | 5½ | 140 | 4¼ | 108 | 3¼ | 83 | ⅜ | ¼ | 25 | 11 |
| 1½ | 8½ | 216 | 5½ | 140 | 4¼ | 108 | 3¼ | 83 | ⅜ | ¼ | 25 | 11 |
| 2 | 9 | 229 | 6½ | 165 | 4¾ | 121 | 3¼ | 83 | ⅜ | ½ | 40 | 18 |
| 2½ | 11 | 279 | 7½ | 191 | 5½ | 140 | 4 | 102 | ½ | ½ | 65 | 29 |
| 3 | 12½ | 318 | 8¼ | 210 | 6 | 152 | 4¼ | 108 | ½ | ½ | 95 | 43 |
| 4 | 15 | 381 | 10⅝ | 270 | 7½ | 191 | 5 | 127 | ¾ | ¾ | 190 | 86 |
| 6 | 20 | 508 | 13⅜ | 340 | | | | | ¾ | ¾ | 320 | 145 |
| 8 | 25⅜ | 645 | 16 | 406 | | | | | 1 | 1 | 650 | 295 |

LEAD FREE*

# Model 27

## Altitude Pilot

### Size: ⅛" NPT Actuation Ports (¼" NPT Sense Line Port)

The Model 27 Altitude Pilot is a hydraulically operated, diaphragm actuated, spring loaded 3-port pilot designed to open or close based upon static tank head pressure versus an adjustable spring setting. It directly monitors tank head pressure by a contractor field installed Sensing Line. The large diaphragm area causes the Model 27 to be sensitive to slight changes in tank head pressure.

The Model 27 Altitude Pilot works in conjunction with a 3-Way Accelerator Pilot (Model 22 or Model 22-1) to open and close the Main Valve.

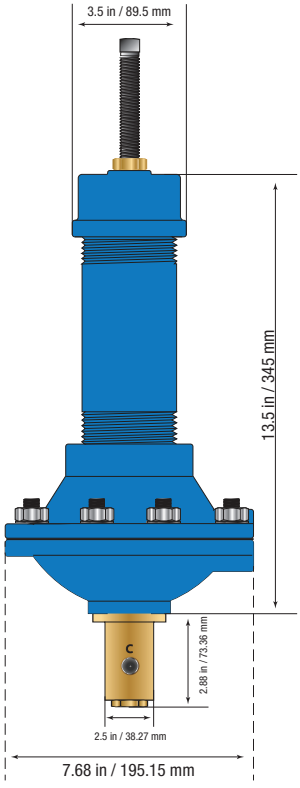
As water level decreases, the sensed tank head pressure falls below the control setpoint of the Model 27, causing it to pressurize the cover of the 3-Way Accelerator, allowing the Main Valve to open for filling operations. The valve will either open fully or regulate to fill the tank based upon the pilot control system installed on the Main Valve.

As water level increases, the sensed tank head pressure increases above the control setpoint of the Model 27, causing it to depressurize the cover of the 3-Way Accelerator, closing the Main Valve.

Turning the Adjusting Screw clockwise increases the control setting, increasing tank level. Turning the Adjustment Screw counterclockwise lowers the control setting, decreasing tank level.

The Model 27 may be equipped with an optional Altitude Gauge or Delayed Opening Pilot in the sensing line to allow for increased tank turn-over. Consult your factory representative for details.

Model LF27



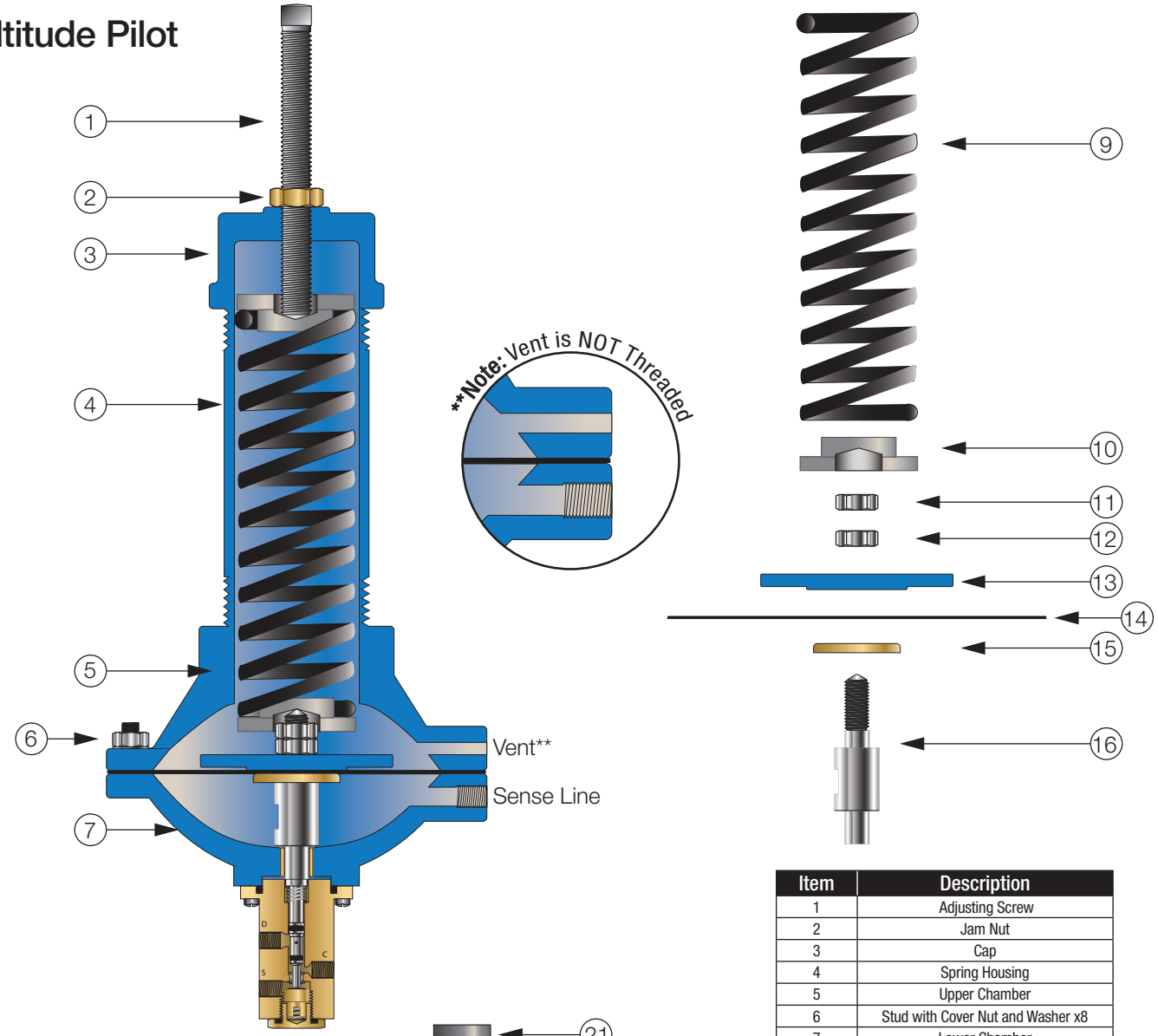

## Specifications

| | |
|---|---|
| Body: | Brass Alloy C46500 (standard)<br>Stainless Steel (optional) |
| Adjustment Spring: | Steel |
| Adjustment Range: | 5-20 feet (2 - 6 meters)<br>10-75 feet (3 - 23 meters)<br>50-225 feet (15- 69 meters) |
| Elastomers: | Buna-N (standard)<br>EPDM (optional) |

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

# Model 27

## Altitude Pilot




| Item | Description |
|---|---|
| 1 | Adjusting Screw |
| 2 | Jam Nut |
| 3 | Cap |
| 4 | Spring Housing |
| 5 | Upper Chamber |
| 6 | Stud with Cover Nut and Washer x8 |
| 7 | Lower Chamber |
| 8 | Upper Spring Guide |
| 9 | Spring (see below) |
| 10 | Lower Spring Guide |
| 11 | Upper Jam Nut |
| 12 | Lower Jam Nut |
| 13 | Upper Diaphragm Washer |
| 14 | Diaphragm* |
| 15 | Lower Diaphragm Washer |
| 16 | Shaft |
| 17 | Bearing |
| 18 | O-Ring* |
| 19 | Machine Screw |
| 20 | F23 Body |
| 21 | Stem |
| 22 | Spring |
| 23 | O-Ring* |
| 24 | F23 Seat |
| 25 | Disc and Retainer* |
| 26 | Spring |
| 27 | Lower Cap |
| 28 | O-Ring* |

*Included in Repair Kit

LEAD FREE*

# Model LFCP15

## Pressure Reducing Pilot

### Size: ⅜" NPT

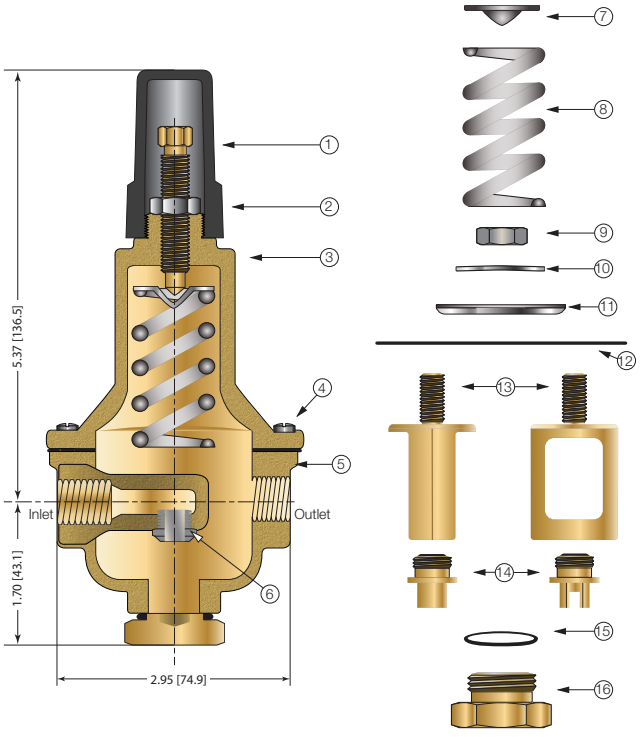
The Model LFCP-15 is a direct acting, diaphragm actuated Pilot that automatically reduces a higher upstream (inlet) pressure to a constant downstream (outlet) pressure. It is normally held open by the force of the adjustable spring setting above the diaphragm.

The Pilot modulates towards a closed position when outlet pressure exceeds the spring setpoint, lowering the delivery pressure. It modulates towards an open position when the outlet pressure falls below the spring setpoint, increasing the delivery pressure.

When a Model LFCP-15 is installed in the piping circuit of an Automatic Control Valve, its throttling action causes the Main Valve to throttle open or closed accordingly. Turning the adjustment screw clockwise raises the control setpoint, increasing main valve outlet pressure. Turning the adjustment screw counterclockwise lowers the control setpoint, decreasing Main Valve outlet pressure.

The Model LFCP-15 is equipped with one ⅜" NPT inlet and two outlet ports for ease of installation. The unused outlet port may be plugged or used as a pressure gauge connection.

Model LFCP15




## Specifications

| | |
|---|---|
| Body Material: | Lead Free Copper Silicon Alloy<br>CF8M (316) Stainless Steel (optional) |
| Seat: | 316 Stainless Steel |
| Elastomers: | Buna-N (standard)<br>Viton™ (optional)<br>EPDM (optional) |
| Inlet Pressure Rating: | 400psi (27.6 bar) maximum |
| Adjustment Range: | 30-300psi (2.1 - 20.7 bar) (standard)<br>2-30psi (0.15-2 bar) (optional) |

Viton™ is a trademark of The Chemours Company FC, LLC

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

| Item | Description |
|---|---|
| 1 | Adjusting Screw |
| 2 | Nut |
| 3 | Spring Housing |
| 4 | Cap Screw |
| 5 | Body |
| 6 | Seat |
| 7 | Spring Guide |
| 8 | Spring |
| 9 | Nut |
| 10 | Belleville Washer |
| 11 | Diaphragm Washer |
| 12 | Diaphragm* |
| 13 | Yoke |
| 14 | Disc and Retainer Assembly* |
| 15 | O-Ring* |
| 16 | Bottom Cap |

**Included in Repair Kit*

LEAD FREE*

# Model 22-1

## 3-Way Accelerator Control

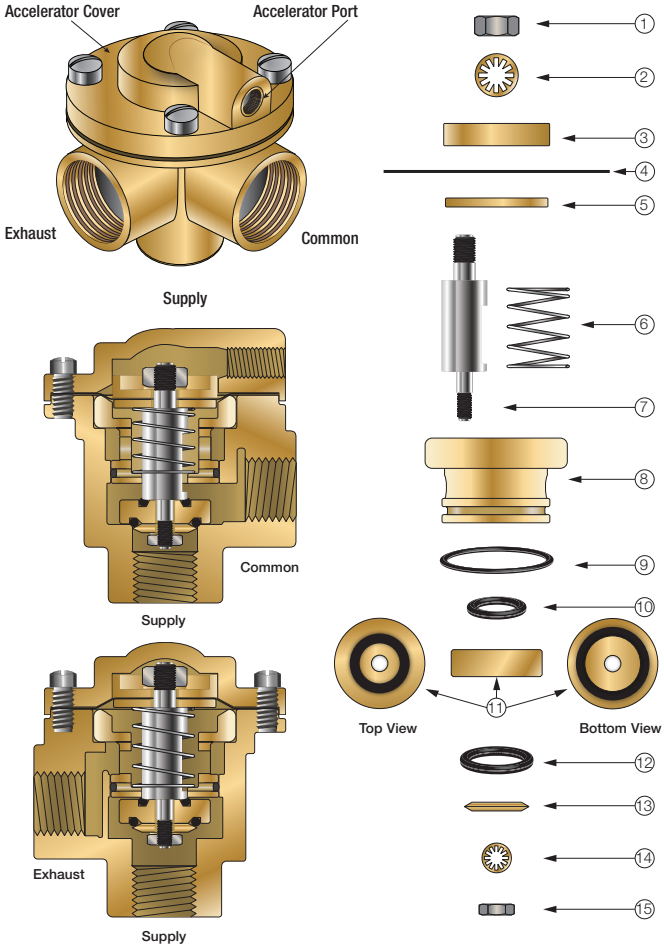
### Size: ½"

The Model 22-1 3-Way Accelerator Pilot is a diaphragm-actuated control with three separate ports: Supply, Common and Exhaust. It is normally installed in the pilot control circuit of an Automatic Control Valve, with the supply port connected to upstream pressure, the common port connected to the Main Valve cover chamber, and the exhaust port vented either downstream or to atmosphere. Its large ½" ports offer increased capacity, and allow smaller ported devices, such as a 3-Way Solenoid, Float or Altitude Pilot, to operate the Main Valve open and closed.

When the cover of the Accelerator Pilot is de-pressurized, the main valve cover chamber is connected to upstream pressure, causing the valve to close drip tight.

When the cover of the Accelerator Pilot is pressurized, the main valve cover chamber is vented downstream (dry drain) or to atmosphere (wet drain), causing the valve to open fully.

Model LF22-1




## Specifications

| | |
|---|---|
| Size: | ½" |
| Body Material: | C87800 Silicone Bronze (std)<br>CF8M Stainless Steel (opt) |
| Elastomers: | Buna-N (std)<br>Viton™ (opt)<br>EPDM (opt) |
| Inlet Pressure Rating: | 400 psi maximum |

Viton™ is a trademark of The Chemours Company FC, LLC

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

| Item | Description |
|---|---|
| 1 | Nut |
| 2 | Lock Washer |
| 3 | Upper Diaphragm |
| 4 | Diaphragm* |
| 5 | Lower Diaphragm Washer |
| 6 | Spring |
| 7 | Stem |
| 8 | Spool |
| 9 | O-Ring* |
| 10 | O-Ring* |
| 11 | Retainer |
| 12 | O-Ring* |
| 13 | O-Ring Washer |
| 14 | Lock Washer |
| 15 | Nut |

*Included in Repair Kit*

**LEAD FREE***

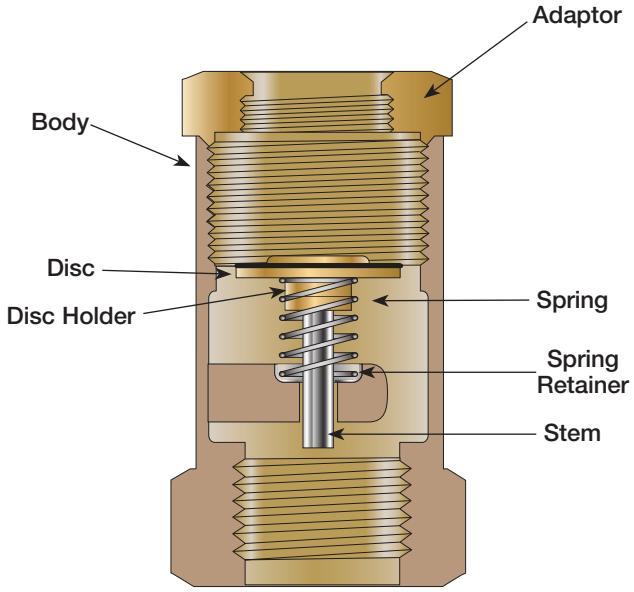
# Model CK

## Check Valve

### Size: ¼" – 1" NPT

Model CK Check Valves are pilot line check valves. In typical applications these low cracking pressure in-line checks provide a hydraulic check feature to a pilot system. When the main valve outlet pressure exceeds inlet pressure, fluid is directed from the outlet to the main valve cover. This causes the main valve to close until inlet pressure is again greater than outlet.

Model LFCK




## Specifications

| | |
|---|---|
| Standard Material: | Brass Housing and Body<br>Stainless Steel Indicating Rod |
| Optional Material: | Stainless Steel Housing and Body Disc<br>Viton™ (¼" – ½")<br>PTFE (1") |
| Pressure Rating: | 400psi (27.6 bar) |

Viton™ is a trademark of The Chemours Company FC, LLC

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

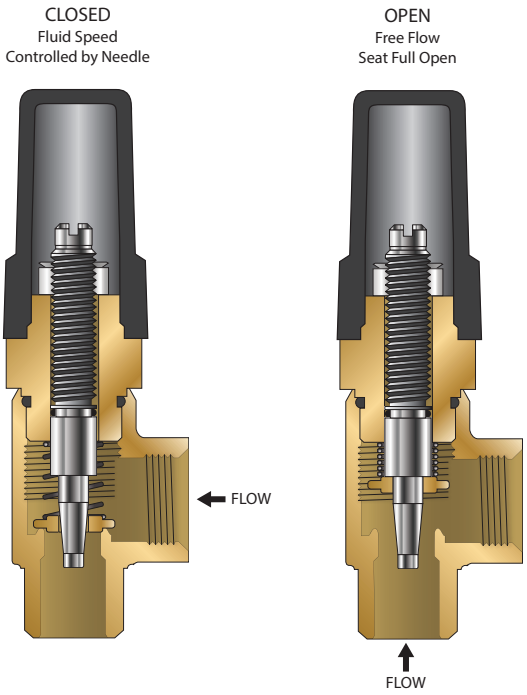
LEAD FREE*

# Model LFFC

## Flow Control

### Size: ½" NPT

A Flow Control is an adjustable device used for tuning valve performance. It can be installed to either control the opening or closing the speed of the automatic control main valve. When the flow is in the direction of the needle the flow control is an adjustable restriction. In the free flow direction the seat moves out of the flow path to all unrestricted flow.





Model LFFC

### Specifications

| | |
|---|---|
| Size: | ½" NPT |
| Body Material: | Lead Free Brass<br>Stainless Steel (optional) |
| Seat: | Lead Free Brass |
| Needle: | Stainless Steel (304) |
| Elastomers: | Buna-N (standard) |

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

**LEAD FREE***

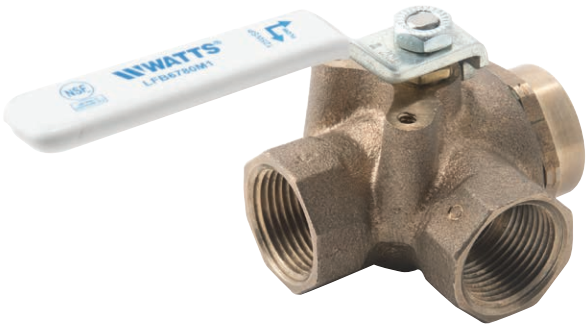
# Series LFB6780-M1

## 2-Piece, Full Port,

## Lead Free* Diverter Ball Valves

### Sizes: ¼" – 2"

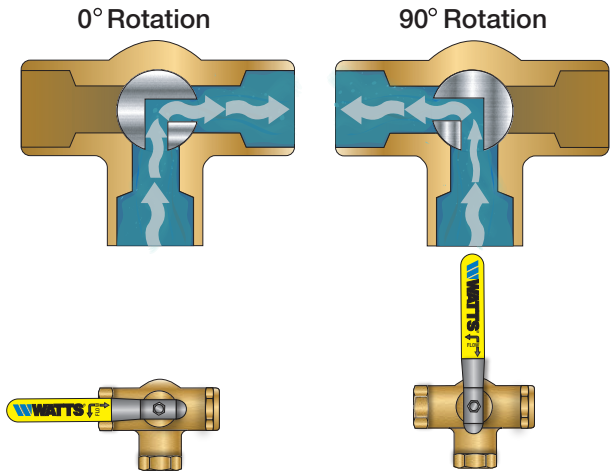
Series LFB6780-M1 2-Piece, Full Port, Lead Free* Copper Silicon Alloy Diverter Ball Valves are designed to divert liquids and gases in commercial and industrial applications. The LFB6780-M1 full port orifice ensures minimal pressure drop, while PTFE seats and stainless steel ball provide lasting service. The LFB6780-M1 features Lead Free* construction to comply with Lead Free* installation requirements.

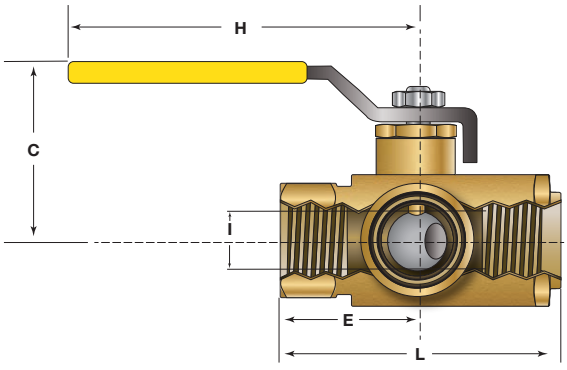



LFB6780-M1

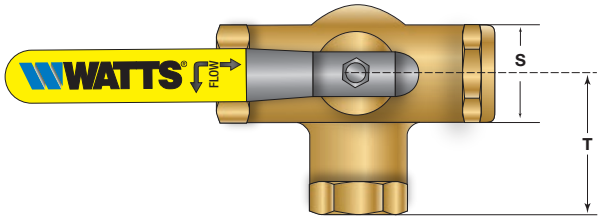
## Materials

| | |
|---|---|
| Handle Nut: | Zinc Plated Carbon Steel |
| Handle: | Zinc Plated Carbon Steel with Vinyl Insulator |
| Packing Nut: | Brass |
| Stem Packing: | PTFE |
| Thrust Bearing: | PTFE |
| Stem: | Stainless Steel |
| Body: | Lead Free Copper Silicon Alloy |
| Seats: | PTFE |
| Ball: | Stainless Steel |
| Adapter: | Lead Free Copper Silicon Alloy |
| Body Seal: | PTFE (1¼" – 2") |




| Temperature Range | Maximum Working Pressure |
|---|---|
| 0°F - 350°F (-18°C – 177°C) @ 50psi (3.5 bar) | 400psi (28 bar) WOG non-shock @ 100°F (38°C) |




| SIZE | DIMENSIONS | | | | | | | | | | | | | | | | WEIGHT | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C | | E | | H | | I | | J | | L | | S | | T | | | |
| | Center to Handle | | Center to End | | Radius of Handle | | Ball Orifice | | Diameter Solder Connection | | End to End | | Diameter | | Center to Side | | | |
| in | in | mm. | in | mm. | in | mm. | in | mm. | in | mm. | in | mm. | in | mm. | in | mm. | lbs. | kg. |
| ¼, ⅜, ½ | 1⅝ | 41.3 | 1¼ | 31.7 | ¾ | 95.3 | ½ | 12.7 | – | – | 2 9/32 | 57.9 | 1¼ | 31.7 | 1¼ | 31.7 | 0.66 | 0.30 |
| ¾ | 1¾ | 44.5 | 1 9/16 | 39.7 | ¾ | 95.3 | ¾ | 19.1 | – | – | 2 13/16 | 71.4 | 1 19/32 | 40.5 | 1 9/16 | 39.7 | 1.00 | 0.45 |
| 1 | 2 1/16 | 52.4 | 1⅞ | 47.6 | ¾ | 95.3 | 1 | 25.4 | – | – | 3 9/16 | 90.5 | 2⅛ | 54.0 | 1⅞ | 47.6 | 1.88 | 0.85 |

*This product is produced with NPT threaded or solder end connections.*
*NOTE: Seat rating based on pressure entering side port.*

LEAD FREE*

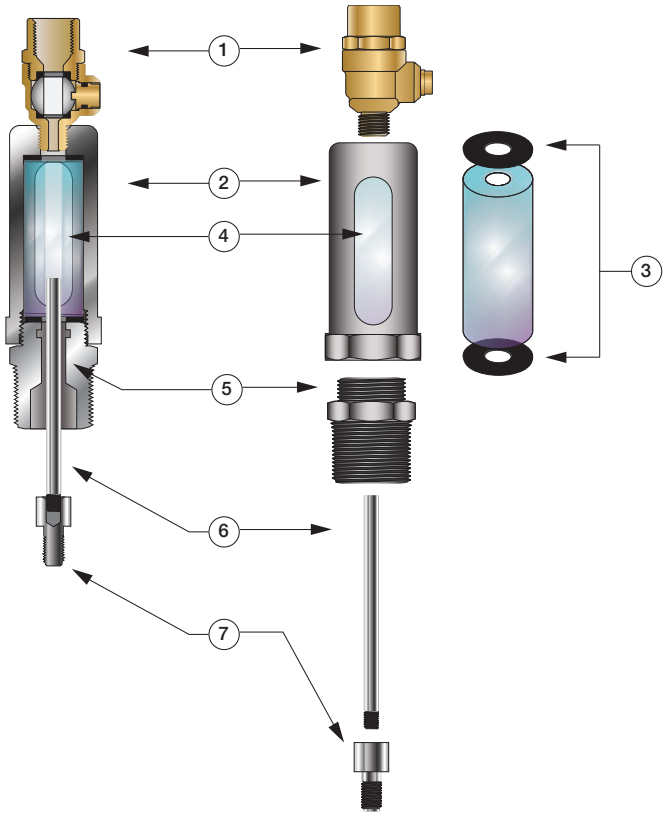
# Model 50

## Position Indicator

When specified as an option on a Control Valve, the Model 50 Position Indicator is installed in the topmost cover port of the Main Valve and allows for visual indication of valve position. The Model 50 is also very useful during valve start-up and troubleshooting procedures.

A stainless steel indicating rod threads into the tapped portion of the Main Valve stem and moves inside of a cylindrical Pyrex sight tube. The indicating rod travels up and down, following Main Valve stem movement. The housing protects the sight tube and indicating rod, and allows visibility on two sides. The screw driver operated test cock installed on the top of the Model 50 housing provides a controlled method of removal of air from the cover chamber during start-up or troubleshooting of the Main Valve.

Model LF50




| Item | Description |
|---|---|
| 1 | Test Cock |
| 2 | Housing |
| 3 | Gasket |
| 4 | Pyrex Sight Tube |
| 5 | Body |
| 6 | Indicating Rod |
| 7 | Stem Adaptor (8" or Larger) |

## Specifications

| | |
|---|---|
| Standard Material: | Stainless Steel Housing and Body<br>Stainless Steel Indicating Rod<br>Lead Free Test Cock<br>Pyrex Sight Tube |
| Optional Material: | Stainless Steel Test Cock |
| Pressure Rating: | 400psi (27.6 bar) |

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

## Dimensions

| Valve Size (in) | Dimension (in) |
|---|---|
| 1¼ - 1½ | 7⅜ |
| 2 | 4⅞ |
| 2½ | 4⅞ |
| 3 | 4⅞ |
| 4 | 5 |
| 6 | 5 |
| 8 | 5⅞ |
| 10 | 5⅞ |
| 12 | 7¼ |
| 14 | 7¼ |
| 16 | 7¼ |
| 18* | 7¼ |
| 20* | 7¼ |
| 24* | 7¼ |

**Reduced Port*

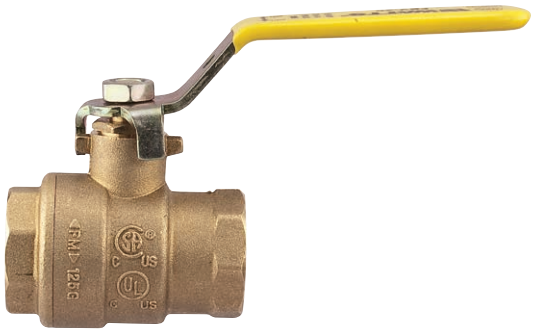
**LEAD FREE***

# Model BV

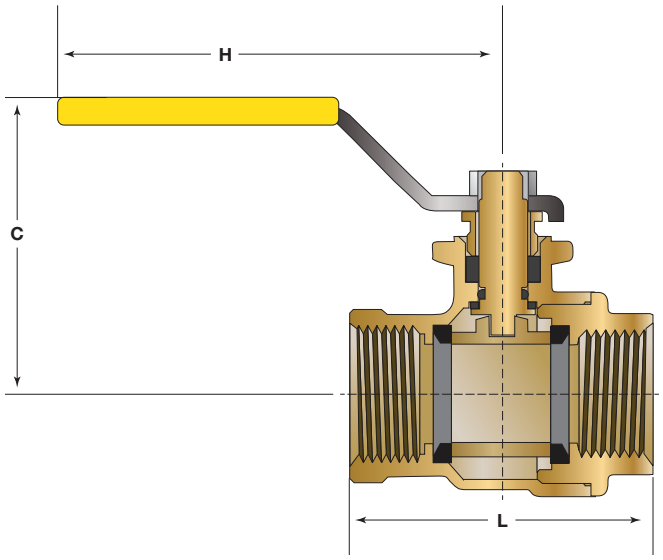
## Ball Valve

### Size: ¼" – 1" NPT

Model BV Ball Valves are used in pilot lines to provide a positive shutoff in any override or maintenance situation for simple trouble shooting. This 2-piece, full port valve features: bottom loaded stems, PTFE seats and packing.



Lead Free Ball Valve




| Size | Dimensions | | | | | | Weight | |
|---|---|---|---|---|---|---|---|---|
| | C | | H | | L | | | |
| *in.* | *in.* | *mm* | *in.* | *mm* | *in.* | *mm* | *lbs.* | *kg.* |
| ¼ | 1 13/16 | 46 | 3 7/16 | 87 | 1 ¾ | 45 | 0.4 | 0.2 |
| ⅜ | 1 13/16 | 46 | 3 7/16 | 87 | 1 ¾ | 45 | 0.4 | 0.2 |
| ½ | 1 13/16 | 46 | 3 7/16 | 87 | 1 15/16 | 50 | 0.4 | 0.2 |
| ¾ | 2¼ | 57 | 4 | 101 | 2 5/16 | 59 | 0.8 | 0.3 |

## Specifications

| | |
|---|---|
| Standard Material: | Copper Silicon Alloy Body and Adaptor<br>Chrome Plated Ball |
| Optional Material: | Stainless Steel Housing, Body and Adaptor<br>Stainless Steel Ball |
| Pressure Rating: | 600psi (41 bar) Non Shock |
| Temp Rating: | -40°F - 400°F |

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

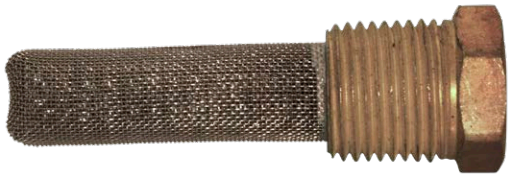
LEAD FREE*

# Model LF60

## Flo-Clean Strainer

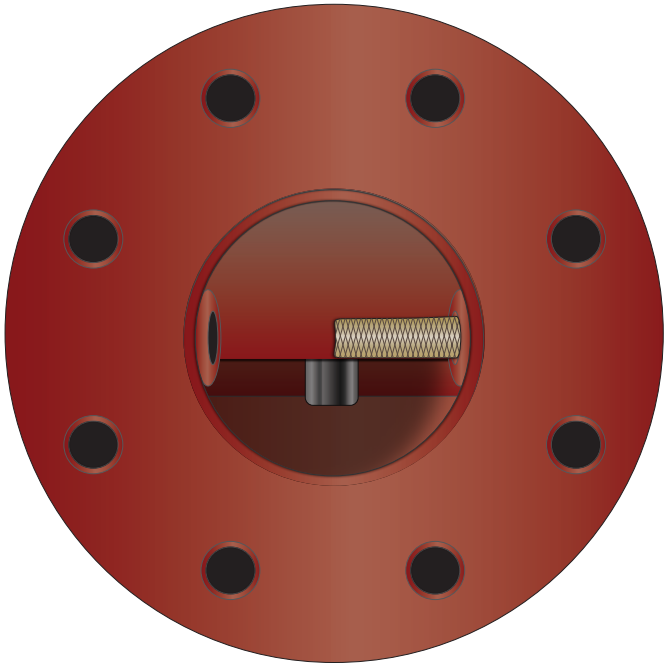
### Size: ¼" – ¾" NPT

Model LF60 Flo-Clean Strainers are used to filter the fluid passing through the pilot circuit, and provide protection to pilot circuit speed controls and pilots. It is installed in the inlet body port of the Main Valve, exposing the strainer element to main line flow. The currents and flow across the screen create a self-scouring effect, cleaning the filter element.



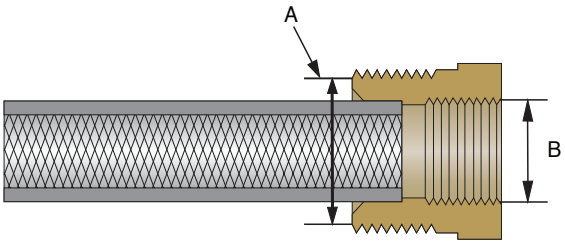
Model LF60

### Valve inlet with Filter installed



### Specifications

| | |
|---|---|
| Body Material: | Lead Free Brass (standard)<br>Stainless Steel (optional) |
| Pressure Rating: | 400psi (27.6 bar) |
| Filter Element: | Monel |
| Screen Mesh: | 40 Mesh (standard) |




| A | B |
|---|---|
| *Male Pipe Thread* in. | *Female Pipe Thread* in. |
| ¼ | ⅛ |
| ⅜ | ¼ |
| ½ | ⅜ |

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

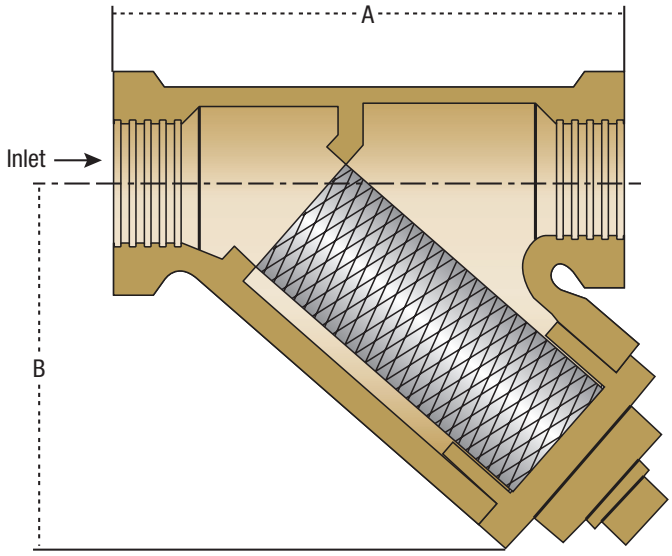
**LEAD FREE***

# Model LF60-1

## Y-Pattern Strainer

### Size: ¼" – ¾" NPT

Model LF60-1 Y-Pattern Strainers are used to filter the fluid passing through the pilot circuit, and provide protection to pilot circuit speed controls and pilots. The filter element can be accessed for cleaning by removing the clean-out cap, or may be cleaned by installing an optional "blow-down" ball valve.





Model LF60-1

## Dimensions

| SIZE | DIMENSIONS | | | | WEIGHT | |
|---|---|---|---|---|---|---|
| | A | | B | | | |
| in. | in | mm | in | mm | lbs. | kgs. |
| ¼ | 2 11/16 | 68 | 1 11/16 | 43 | 1.7 | 0.77 |
| ⅜ | 2 11/16 | 68 | 1 11/16 | 43 | 1.7 | 0.77 |
| ½ | 3 | 76 | 2 | 51 | 1.7 | 0.77 |
| ¾ | 3 5/16 | 84 | 2 5/16 | 59 | 1.7 | 0.77 |

## Specifications

| | |
|---|---|
| Body Material: | Lead Free Copper Silicon Alloy<br>CF8M (316) Stainless Steel (optional) |
| Retainer Cap: | Lead Free Copper Silicon Alloy |
| Cap Gasket: | EPDM |
| Pressure Rating: | 400psi (27.6 bar) |
| Filter Element: | 304 Stainless Steel |
| Mesh Options: | 60 Mesh (standard)<br>100 Mesh (optional) |

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

LEAD FREE*

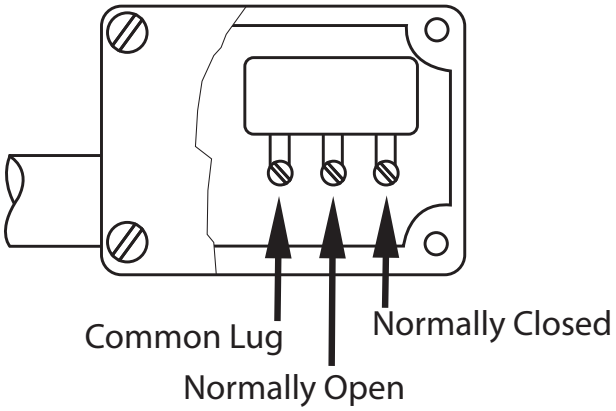
# Model 51

## Single Limit Switch

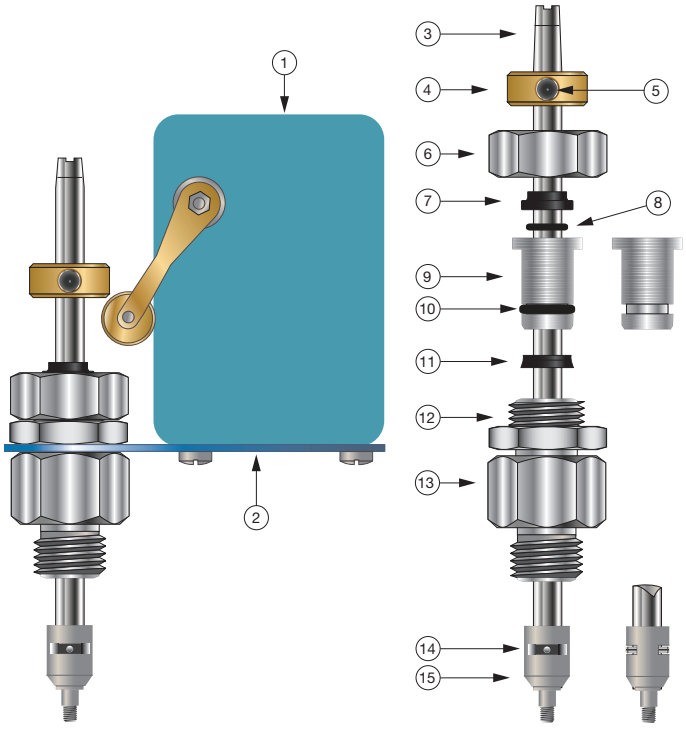
The Model 51 Single Limit Switch provides visual indication of valve position, as well as remote electrical indication of "valve open" or "valve closed". The single pole double throw Micro-Switch can be connected to open or close an electrical circuit when the valve opens or closes.

The adjustable collar is normally set to contact the trip arm when the main valve is closed. The collar can be positioned on the stem by loosening the set-screw to actuate the switch at the desired point of valve travel.

Model LF51




Single Pole Double Throw Switch




## Specifications

| | |
|---|---|
| Body Material: | Stainless Steel |
| Elastomers: | Buna-N (standard)<br>EPDM (optional)<br>Viton™ (optional) |
| Enclosure: | NEMA 1, 3, 4 and 13 General Purpose (standard)<br>NEMA 1,7 and 9 Explosion Proof (optional) |
| Electrical: | Form C SPDT Switch<br>15 amp. 125, 250 or 480 VAC<br>½ amp. 125 VDC<br>¼ amp. 250 VDC<br>½" Conduit Connection |

Viton™ is a trademark of The Chemours Company FC, LLC

***The wetted surface of this product contacted by consumable water contains less than 0.25% of lead by weight.**

## Parts List

| Item | Description |
|---|---|
| 1 | Limit Switch |
| 2 | Bracket |
| 3 | Stem |
| 4 | Trip collar |
| 5 | Set Screw |
| 6 | Cap |
| 7 | Wiper Ring* |
| 8 | O-Ring* |
| 9 | Guide |
| 10 | O-Ring* |
| 11 | Polypak* |
| 12 | Locknut |
| 13 | Body |
| 14 | Pin |
| 15 | Coupling |

**Included in Repair Kit*

# Installation

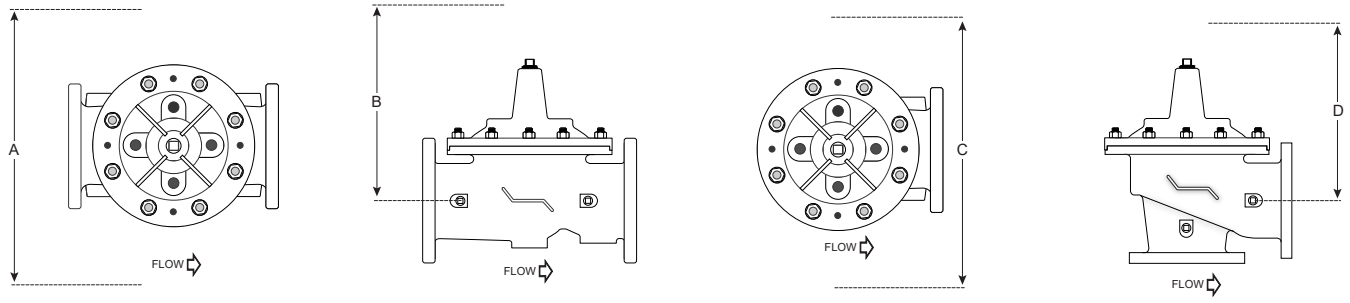
Start-up of an automatic control valve requires that proper procedures be followed. Time must be allowed for the valve to react to adjustments and the system to stabilize. The objective is to bring the valve into service in a controlled manner to protect the system from damaging over-pressure.

1. Prior to installation, flush line to remove debris.
2. Install valve so the flow arrow matches flow through the line, and gauges to monitor valve inlet and outlet pressures. A Position Indicator can be installed to provide visual indication of valve position and operation without disassembly.
3. Install isolation valves upstream and downstream of the main valve.

**Note:** If using butterfly valves, ensure valve disc does not contact the main valve.

4. Provide adequate clearance for valve servicing and maintenance. Refer to valve servicing dimensions on next page. Avoid installing valves 6" and larger in the vertical position (main valve stem horizontal). Automatic Control Valves (ACVs) are designed for horizontal in-line installation, with the cover facing up (main valve stem vertical). Slow operation or premature stem and guide wear may occur if valve is not installed according to factory recommendations. Consult factory for detailed engineering review prior to ordering if valve is to be installed other than horizontally in-line.
5. If valve is equipped with a pilot control system, extra precautions should be made during installation to protect the piping circuit from damage. Only remove the pilot control system from the valve if necessary. Tubing and fittings should be kept clean and replaced exactly as removed. Consult appropriate hydraulic schematic to ensure proper re-assembly.
6. Check to confirm that the sense line is installed and connected.
7. Installation of a pressure gauge on the sense line of the tank full-delayed opening system will assist in adjustment of setpoint. The amount of pressure drop can be read at the time the main valve starts opening.
8. After installation, vent entrapped air from valve cover and pilot system by following instructions in the **Setting the Altitude Controls** section on the following page.

# Valve Servicing Dimensions




The following tables detail the recommended minimum valve servicing dimensions.

## Globe

| Size (in) | 1¼ | 1½ | 2 | 2½ | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 20 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A (in) | 16 | 16 | 20 | 22 | 22 | 24 | 32 | 34 | 38 | 44 | 48 | 52 | 56 | 56 |
| B (in) | 10 | 10 | 12 | 14 | 14 | 16 | 24 | 26 | 28 | 30 | 34 | 40 | 48 | 48 |

## Angle

| Size (in) | 1¼ | 1½ | 2 | 2½ | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C (in) | 16 | 16 | 20 | 22 | 22 | 24 | 32 | 34 | 38 | 44 | 48 | 52 |
| D (in) | 10 | 10 | 12 | 14 | 14 | 16 | 24 | 26 | 28 | 30 | 34 | 40 |

# Setting the Altitude Controls

## STEP 1

Pre-set pilots as noted:

Altitude Control – Adjust OUT, counterclockwise, backing pressure off the spring. This simulates a low tank setting which can be gradually increased to the desired setting.

Opening and Closing Speed – Turn the adjustment screws on the Closing Speed and Opening Speed Controls, if the main valve is so equipped, OUT, counterclockwise, 1½ to 2½ turns from full closed position.

Reverse Flow Control – Adjust OUT, counterclockwise, backing pressure off the spring, preventing possible over-pressuring of the system.

Delayed Opening Control – Turn the adjustment screw OUT, counterclockwise, to allow for the drop in level prior to the valve opening.

## STEP 2

To ensure proper operation, any trapped air will need to be bled off the valve cover during startup. The ACV includes a bleed valve, use a flat head screwdriver to slowly open the valve (See Figure 1).

## STEP 3

Pressure the line, by opening the upstream isolation valve slowly. Air is vented through the air bleed valve. Tighten the fitting when liquid begins to vent (See Figure 1).

Repeat the process until no air is trapped in the system.


**Figure 1**
**Position Indicator**

**Figure 2**
**Position Indicator Stem in Down Position**
**Indicating Valve Closed**

# Setting the Altitude Pilot

## STEP 4

Slowly open the downstream isolation valve.

## STEP 5

If the valve remains closed as indicated by the stem position in the position indicator (See Figure 2) and the tank level is known to be below the desired level, SLOWLY turn the adjustment screw IN, clockwise, by ¼ to ½ turn increments (See Figure 3).

This will cause the valve to start opening, filling the tank. Additional clockwise adjustment may be necessary to raise the level to the overflow line.


**Figure 3**
**Model 27 - Altitude Pilot**

### STEP 6

When the required level is reached, or if the tank is overflowing, SLOWLY turn the adjustment screw OUT, counterclockwise, in ¼ to ½ turn increments (See Figure 4). A small amount of water will discharge from the vent/exhaust line of the Altitude control, signaling the port connection changes of both the Altitude Control and accelerator. The valve will start closing as indicated by the position indicator stem movement.

The following is dependent upon the installation/application and may not be required on all valves: When the valve is closed, the Altitude control screw adjustment may be turned OUT, counterclockwise, an additional ¼ to ½ turn (See Figure 4). This will lower the shut-off level slightly below the tank over-flow mark, eliminating any wave action discharge from the over-flow pipe.


**Figure 4**
**Model 27 - Altitude Pilot**

## Setting the Delayed Opening Control

Adjust the tank draw-down Delayed Opening Control by turning the adjustment screw IN, clockwise, to increase (See Figure 5A), or OUT, counterclockwise, to decrease opening delay (See Figure 5B) .

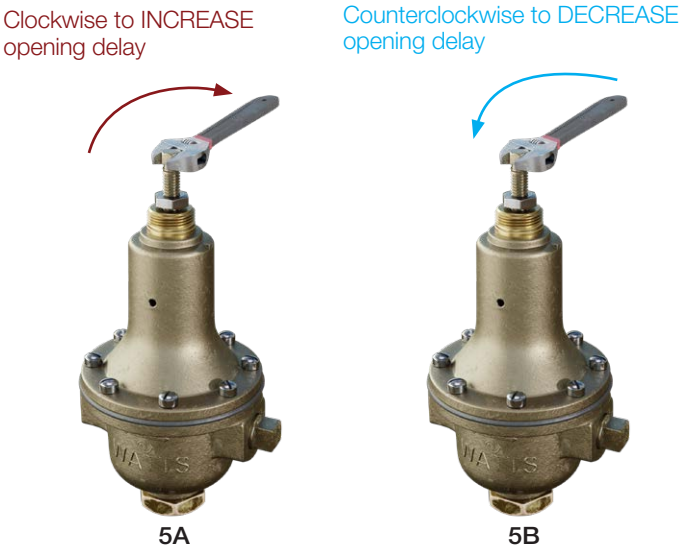



**Figure 5**
**CP15 — Delayed Opening Control**

# Automatic Control Valve Maintenance Schedule

To ensure peak performance and longevity of your automatic control valve, Watts/Ames recommends following the below standard maintenance schedule.

- **Monthly Maintenance**
  - – Visual inspection of valve(s) for leaks
  - – Inspect for proper operation(s); exercise valve.
- **Quarterly Maintenance**
  - – Conduct monthly inspection.
  - – Validate/Re-establish necessary setpoints of controls/pilots.
- **Annual Maintenance**
  - – Conduct monthly & quarterly inspections.
  - – Inspect & clean all strainers.
  - – Inspect valve coating, touch up as required.
- **3-5 Year Maintenance**
  - – Conduct monthly, quarterly, & annual maintenance.
  - – Inspect & replace valve elastomers (diaphragm, O-rings, valve/pilot seats)
  - – Re-establish necessary set points of controls/pilots.

# Troubleshooting Guide

**⚠ WARNING**

**Warning:** The valve cannot be serviced under pressure. Upstream and downstream Isolation Valves must be installed to protect system piping. Accurate diagnosis and troubleshooting requires the valve to open fully, and may subject downstream piping and equipment to high pressure and/or flow rates. The downstream Isolation Valve should be kept closed while diagnosing the valve.

**Extreme caution should be used while performing the troubleshooting techniques listed below.**

Recommended tools for diagnosis: (3) PRESSURE GAUGES, installed to monitor the inlet pressure, outlet pressure, and cover chamber pressure. If included, a POSITION INDICATOR should be installed to visually assess the position of the disc & diaphragm assembly.

## Test 1: Diaphragm Seal Test

1. Close upstream & downstream isolation valves. Close pilot isolation valves or remove pilot control tubing to isolate valve cover from incoming fluid & pressure. Remove uppermost cover plug, test cock, or limit switch.
2. With the valve cover chamber vented to atmosphere, partially open the upstream isolation valve, allowing incoming pressure to lift the disc & diaphragm assembly. A volume of water will be displaced from the cover chamber as the valve opens; consult valve specification sheets for approximate cover capacity. A continuous flow of water from the open port indicates a damaged diaphragm or loose disc & diaphragm assembly. Disassemble valve and replace diaphragm or tighten disc & diaphragm assembly.

## Test 2: Seat Seal Test

1. Close downstream isolation valve and install pressure gauges on an open inlet and outlet port of main valve.
2. Open upstream isolation valve to allow pressure on to the valve cover. Allow valve to fully close.
3. Monitor downstream pressure gauge; reading should hold steady below incoming pressure. If pressure on downstream side rises to match upstream pressure, leakage is occurring through the seat of the main valve. Disassemble valve, inspect and repair/replace any required parts.
   a. If gauge pressure rises to match outlet pressure (downstream of closed isolation valve) yet remains below inlet pressure, the isolation valve may be leaking as opposed to main valve seat.

## Test 3: Freedom of Movement/Valve Travel Test

1. Close upstream and downstream isolation valves. Install valve position indicator.
2. Partially open upstream isolation valve and allow cover to fill with fluid & pressure, closing the valve fully. Mark the position indicator's full closed position.
3. Isolate cover chamber from receiving fluid and pressure by closing isolation valves or removing control tubing.
4. Carefully vent cover chamber to atmosphere by opening test cock or removing a cover plug. Observe the valve position indicator as the valve travels to the full-open position. The disc & diaphragm assembly should move freely from fully closed to fully open position without binding or "grabbing" at any point during its movement.
   a. The disc & diaphragm assembly may momentarily "hesitate" while travelling from fully closed to fully open position – this is a normal characteristic of diaphragm operated control valves, and does not indicate mechanical binding or improper valve operation.
   b. A continuous discharge of water from the cover chamber after venting to atmosphere indicates leakage past the diaphragm.
5. If necessary, disassemble valve and inspect/repair disc & diaphragm assembly.

# Troubleshooting Guide

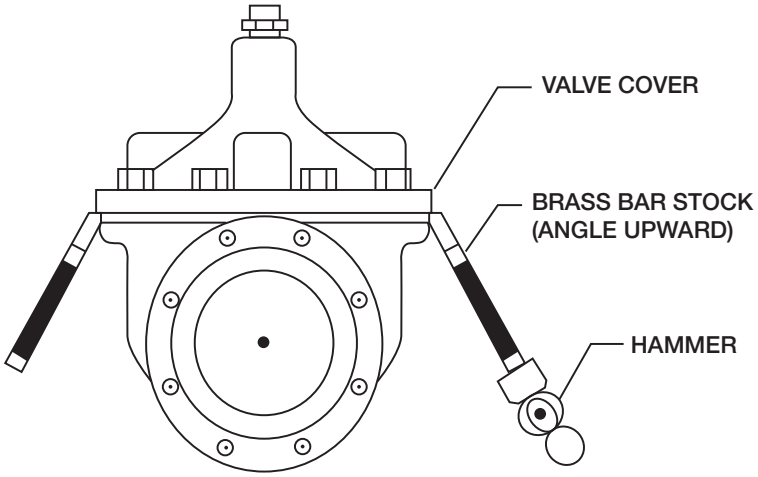
| Issue | Possible Cause | Corrective Action | Notes |
|---|---|---|---|
| **Main Valve will not open** | Closed isolation valves in pilot system. | Check isolation valves, ensure open. | |
| | Insufficient supply pressure. | Check upstream pressure. | Depending on water source, supply pressure may not be controlled by valve operator. |
| | Main valve stem assembly corroded/ damaged | Inspect stem assembly, clean/ replace if necessary. | |
| | Blockage in pilot system. | Inspect & clean any installed pilot system strainers, check orifice/speed controls for blockages. | |
| | Improperly configured opening speed control. | Adjust opening speed control to verify functionality, adjust as required. | Standard setting for opening speed control is 1½ - 2½ turns open from full closed position. Can be adjusted in field. |
| **Main Valve will not close** | Closed isolation valves in pilot system | Check isolation valves, ensure open. | |
| | Diaphragm is damaged | Conduct diaphragm seal test, repair and replace if necessary. | |
| | Main valve stem assembly corroded/ damaged. | Inspect stem assembly, clean/ replace if necessary. | |
| | Blockage in main valve. | Perform freedom of movement test; if valve does not close, disassemble and remove blockage. | |
| | Worn/damaged valve seat. | Perform seat sealing check; disassemble and inspect/repair seat if required. | |
| | Improperly configured closing speed control. | Adjust closing speed control to verify functionality, adjust as required. | Standard setting for closing speed control is 1½ - 2½ turns open from full closed position. Can be adjusted in field. |

# Valve Disassembly Instructions

Before undertaking valve disassembly, it is recommended to gather the following tools to aid you during the process:

- Small & large adjustable wrenches
- Screwdriver set
- Machinist fine metal file
- Fine wire brush
- Bench vise
- Basic valve IO&M manual
- Hammer & dull cold chisel
- Heavy-duty ratchet & socket set
- Hexagonal wrench set
- 320 grit/fine Emery cloth
- Appropriate technical bulletins for valve start-up procedures.




1. Isolate the valve from line pressure and depressurize it to ensure safe working conditions. Disconnect any electrical connections if so equipped.
2. Carefully remove Position Indicator or Limit Switches if equipped. Remove all tubing, fittings, and Control Pilots necessary to easily access and remove the cover. Remove cover nuts and washers.
3. Remove the cover. If cover is not free to be removed, loosen it by tapping upward along its outside edge with a dull cold chisel, pictured above.
   a. Large valves may require the installation of lifting “eye” bolts in order to facilitate cover removal; installation ports are provided on the cover for this purpose.
4. Remove the Disc and Diaphragm Assembly from the valve body by lifting straight up.
   a. Large diameter valves may require a lifting “eye” bolt to be installed in the valve stem accessory threads located on the very top of the valve stem.
5. Before removing Stem Nut, examine stem threads for mineral build-up. Remove deposits with a fine wire brush. Extreme care should be taken not to damage the finish on stem guiding surfaces when disassembling. Avoid applying pipe wrenches to top or bottom stem guide surfaces.
6. After removing the Stem Nut, the remainder of the Disc & Diaphragm Assembly should disassemble easily. Polish stem guide surfaces with fine emery cloth to remove any mineral deposits and inspect for excessive wear. Remove any mineral build-up from other components with wire brush or by using a Mineral Dissolving Solution. Inspect parts for wear and replace if necessary.
7. Inspect valve seat. If seat is not damaged, removal is not necessary. Valve seats 6" and smaller are threaded into the body of the valve and require a seat removal tool (Figure 6) (Table 1 details the tool dimensions for seat removal). Valve seats 8" and larger are held in the valve body with stainless steel cap screws. Remove seat retaining screws and lift seat straight up (Figure 7).

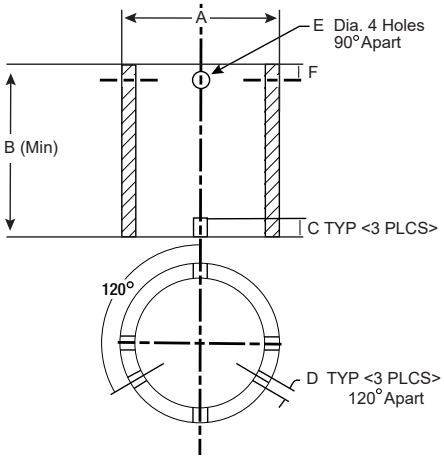



Figure 6

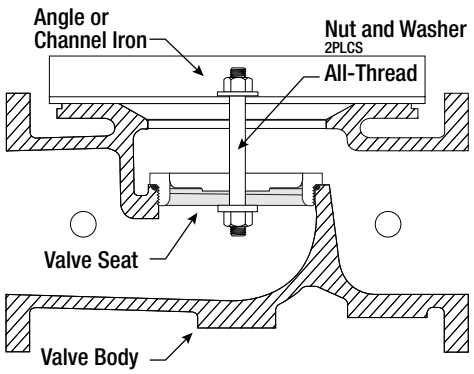



Figure 7

## Table 1: Seat Removal Tool Dimension

| Size | A | B | C | D | E (Dia.) | F |
|---|---|---|---|---|---|---|
| *in* | *Pipe Size (in)* | *Min. Length (in)* | *in* | *in* | *in* | *in* |
| 1¼ | 1 | 3.12 | 0.38 | 0.25 | 0.44 | 0.55 |
| 1½ | 1 | 3.12 | 0.38 | 0.25 | 0.44 | 0.50 |
| 2 | 1¼ | 3.38 | 0.38 | 0.25 | 0.44 | 0.50 |
| 2½ | 2 | 4.0 | 0.38 | 0.38 | 0.56 | 0.62 |
| 3 | 2½ | 4.5 | 0.50 | 0.38 | 0.56 | 0.62 |
| 4 | 3 | 5.0 | 0.50 | 0.44 | 0.56 | 0.62 |
| 6 | 5 | 6.50 | 0.62 | 0.44 | 0.56 | 0.62 |

*Schedule 40 steel pipe

8. Replace Seat Disc, Diaphragm and Spacer Washers provided in Main Valve repair kit (refer to Table 2 or 3 for correct repair kit part number). Re-assemble in the reverse order of disassembly.

## Table 2: Full Port Valve (905GD/905AD) Repair Kits

| Size (in) | 1¼ | 1½ | 2 | 2½ | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P/N | 0677-01 | 0677-01 | 0677-02 | 0677-03 | 0677-04 | 0677-05 | 0677-06 | 0677-07 | 0677-08 | 0677-09 | 0677-10 | 0677-11 |

## Table 3: Reduced Port Valve (605GD/605AD) Repair Kits

| Size (in) | 3 | 4 | 6 | 8 | 10 | 12 | 16 | 20 & 24 |
|---|---|---|---|---|---|---|---|---|
| P/N | 0677-02 | 0677-04 | 0677-05 | 0677-06 | 0677-07 | 0677-08 | 0677-09 | 0677-11 |

9. Re-Install Disc and Diaphragm Assembly in the valve, taking care not to damage the lower guide area in the center of the valve seat.
10. Re-install Cover Spring. Replace Valve Cover and tighten Cover Nuts in a crossing pattern to ensure even distribution. Test the Disc and Diaphragm Assembly for smooth travel by following the Freedom of Movement Test procedure in previous section.
11. Test the integrity of the Seat Seal by following the Seat Seal Test procedure in previous section.
12. Return valve to service by following instructions in the **Setting the Altitude Controls** section matching the valve function.

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