APCO SWING CHECK VALVES
AIR CUSHIONED/OIL CONTROLLED

Series 6000
6100
6000B
APCO Swing Check Valves

Plain Talk About Plain Swing Check Valves

The advantage “common” variety plain Swing Check Valves offer is a fully unobstructed flow through area. This advantage is accomplished in design by locating the pivot point of the disc well outside its periphery, thus it is possible for the entire disc to lift clear of the flow area. This is a very desirable feature when pumping raw sewage. However, there are better performing check valves.

Many years ago, pumping flow rates of 3 feet per second and pressures of 25 psi were common. Today, these low flow and pressure conditions are rare. Therefore, a plain Swing Check is often misapplied, not adequate and may slam.

Request Brochure 769, “APCO Check Valve Guide”

APCO Cushioned Swing Check Valves

APCO Air Cushion Checks have the full unobstructed flow advantage of the plain Swing Check, but here similarity ends. The Air Cushion Check is a much heavier valve that is designed to withstand shock. The Air Cushion Check Valve utilizes a totally enclosed cushion cylinder externally mounted to the side of the main valve body. In addition, it is designed with a heavy outside lever, positively clamped to an extra large diameter pivot shaft. The weight can be easily moved to various positions on the lever to change the closing time.

It is the outside lever and weight which forces the disc to close immediately upon pump shut down and before reverse flow takes place. In so doing, the weighted lever drives the piston into the cushion chamber, compressing the trapped air and creating the cushion during valve closure.

CAUTION: Air is infinitely compressible and due to this phenomenon, when pumping conditions result in rapid flow reversal at pump shut-off, the high closing speed of the disc may diminish the effectiveness of the air cushioning. Oil control check valves (Model 6000B) should then be considered.

How Cushioned Swing Check Valves Work

(See Diagrams at Right)

1. Discharge velocity head from the pump against disc (10) opens the disc and raises the weighted lever (29) outside of the valve upwards. At the same time the piston inside the cushion cylinder (20) is pulled upwards, drawing free air into the cushion cylinder through the “one way” control check valve (30).

2. When reverse flow occurs against the backside of the disc (10) pressure forces the disc toward the shut-off position against the seat (5) at the same time forcing the cushion cylinder downwards. Moving downwards, the piston compresses the air in the cushion cylinder because the air cannot readily escape through the “one way” control check valve. By restricting the air escape through the adjustable control check (30) air cushioning closing is accomplished.

Note: Because air is infinitely compressible the disc swings to shut-off with minimal resistance. Therefore the Air Cushion Check Valve is rated one speed fast closing, less than two seconds.

3. Air Cushioning is “Field Adjustable,” starting when the valve disc is approximately 90% closed. Therefore, the disc closes very fast through 90% of its swing. Then, air compression develops to cushion close the remaining 10% of valve shut-off. Factory start-up service is available but not essential.
Series 6000 - Air Cushion/Side Mounted

Easily Adjusted To Operating Conditions

Air Cushion Check
The totally enclosed external air cushion cylinder is adjustable as follows:

- Primary control is in the cushion cylinder, by adjusting the flow control valve (30)
- Increased cushioning — screw in (clockwise) control valve (30)
- Decreased cushioning — screw out (counter clockwise) control valve (30)
- For more rapid disc closure — move the weight towards outer end of the lever.
- For less rapid disc closure — move the weight towards pivot shaft.

WARNING: Many Check Valves including Air Cushion Check Valves can experience problems when a Surge/Pressure Tank is being installed on the pipeline in close proximity to the check valves. Contact DeZURIK’s Engineering Department for Check Valve recommendations.

Features by APCO
1. Totally enclosed air cylinders are protected from the elements.
2. Micrometer air control valve-coded for ease of adjustment to achieve air cushion closure.
3. Double Clevis, self aligning disc.
4. Convertible valves can be retrofitted in the field to oil control.
5. Centrifugally cast aluminum bronze tough wearing body seat.
6. All internal parts can be easily replaced, including the body seat, in the field!
7. Through shafts to avoid internal axial forces.
### Series 6000 - Dimensions

#### Series 6000

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<th>Model Size</th>
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*Fast Closing With Cushion at Shut-Off*

### Series 6000

#### 125# & 250# Class

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*To be Supplied by Customer*
**Series 6000B - Oil Control/Bottom Buffer**

**How 6000B Series Oil Control/Bottom Buffer Valves Work**

(See Diagrams at Left)

1. Discharge velocity head from the pump causes the disc (10) to open and raises the outside weighted lever (29).

**Note:** The disc freely swings open.

2. Conversely when pumping stops the outside weighted lever (29), together with the reversing flow, forces the disc (10) downward towards shut off rapidly and freely until the disc tail comes in contact with the buffer rod. Controlled closure takes place during the final (approximately) 10% of disc movement.

The bottom buffer principal of control closure has been used for decades on slanting disc check valves... it works and it’s reliable.
**Series 6000B - Dimensions**

*Note: Buffer may be lower than shown on drawing.*

**Note:**
1. Sizes 8", 10" and 12" (200, 250, 300 mm) have only one counterweight. (right side)
2. Lever arm extends beyond outlet flange on some sizes.
3. Specify if other than horizontal installation because angle of weight lever and oil reservoir must be changed.
4. We recommend the bottom mount 6000B for vertical flow up installations.
5. The bottom mount is far superior to the side mount in larger sized valves and maintains a full ANSI rating.

**Additional Information: APCO 6000B Found on Page 9**
How 6100 Series Valves Work

1. Opening
Discharge velocity head from the pump causes the disc (10) to open and raises the outside weighted lever. (29) Except for frictional resistance, the disc is free opening.

2. Three Stages of Controlled Closure
The cylinders provide two stages and a third stage is developed by the Timing Valve (45). The Timing Valve is most important because it allows very fast closure of the disc from full open to any degree of closure. This feature greatly reduces the volume of backflow and flow reversal that occurs with only 2 stage closure valves (by others) on the market.

The three-stage closure function is as follows:
1st stage: Rapid closure from full open to any degree of closing. (45- Timing Valve)
2nd stage: Variable speed towards final closure. (30- Flow Control Valve)
3rd stage: Variable speed closure to shut-off. (20- Internal Cushion Adjustment of the Cylinder)

Each stage is independently adjustable.

Additional closing adjustments:
Faster disc closing — move weight towards outer end of lever
Slower disc closing — move weight towards pivot shaft

Features by APCO
1. Three stage closure with fail safe oil accumulator system.
2. Totally enclosed oil cylinders protected from the elements.
3. Timing valve.
5. Double clevis self aligning disc.
6. All internal parts can be easily replaced, including body seat, in the field without removing the valve from the line.
7. Through shafts to avoid internal axial forces.

Control closing is achieved by the Oil Dashpot/Timing Valve System. This will minimize damaging water hammer. Adjusting the Timing Valve/Oil Dashpot System is easily accomplished to suit each application. The graph shows flow rate as a function of closing time and illustrates clearly the superiority of the APCO three stage Oil Control Check Valves.
Series 6100 (125# Class) - Dimensions

Note: Oil reservoir must be mounted vertically regardless of valve installation position. Specify mounting position when ordering.

Note: For 250# class or larger sizes depending on pressure differential across disc and flow, contact factory, or use 6000B. Contact factory for application.

<table>
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Flange Holes

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Timing Valve in Close Position

To Rod End

10" - 16" (250 - 400mm)

Adjustment Screw Internal Cushioned

Close Position Timing Valve not supplied on sizes 2" - 4" (50 - 100mm)

From cap end of cylinder on other side of valve

Note: Oil reservoir must be mounted vertically regardless of valve installation position.

Specify mounting position when ordering.

Vertically regardless of valve installation position.

Inch

Millimeter

Series 6100

No. Dia. B.C.D.

No. of Cyl. Arm

No. of Cyl.

J
**Additional Information: Bottom Mounted Buffer**

*(Free Opening and Controlled Closing)*

This unique buffer arrangement allows the valve disc (10) to open fully without interference and to close freely for approximately 90% of its stroke. After the disc is 90% closed, it then comes in contact with the buffer rod (33). At this point, speed of closing of the last 10% is established.

The flow control valve (41) on the cylinder (39) is easily adjusted to allow a closing time adjustment to suit pipeline flow conditions. Slamming is prevented and pipeline pressure surges are greatly reduced.

- We recommend the Bottom Mounted Buffer for vertical upward flow installations and whenever there is a hydro pneumatic surge tank in close proximity to the pump discharge.

- The Bottom Mounted Buffer is far superior to a side mounted oil control for larger sized valves. With the Bottom Mounted Buffer the larger size valves still maintain a full ANSI rating.

**Did you know?**

- Any APCO (convertible) controlled movement valve can be modified in the field to meet your specific conditions.

- Good pump station design suggests at least 3 pipe diameters of straight pipe on the down stream side of a check valve and in some cases the upstream side.

- The APCO buffer may be added to a convertible check valve in the field.

- DeZURIK offers factory trained engineers for field start up.

**About the Buffer**

Bottom Mounted Buffers have been used successfully for decades to eliminate slamming of the valve disc and resultant water hammer.

Recommended where instantaneous flow reversal caused by a Hydro-Pneumatic Surge Tank or Open Line Discharge is so fast a free closing check valve cannot shut prior to reverse flow and therefore slams. With the buffer, the disc will stop at approximately 90% (adjustable) of closure and closure is controlled to shut-off without slamming and with minimal pressure rise.
### Valve Size

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<td>6100</td>
<td>Stainless Steel 17-4PH</td>
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For Full ANSI Rating Use Series 6000B

Yield Strength: Stainless Steel 17-4PH = 165,000 PSI; Stainless Steel T303 = 40,000 PSI

Note: Above shaft diameters and materials are designed for maximum torque. A superior grade 17-4PH Stainless Steel shaft material is used on Oil Control Check Valves. This material is approximately 4 times stronger than T303, T304 or T316 stainless steel.

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**Head Loss Characteristics for Swing Check Valves**

The graph shows the head loss in feet as a function of flow in gallons per minute for various valve sizes. The x-axis represents the flow in gallons per minute, while the y-axis represents the head loss in feet. The graph is divided into different sections for various valve sizes and materials, allowing for the selection of the appropriate valve based on flow requirements and desired head loss characteristics.
How to Install

APCO Cushion Swing Check Valves may be installed horizontally or vertically on the discharge side of the pump to suit available space in the pump station.

The lever weight arm is fitted with a movable weight No. 29. This weight acts as the force to hold the disc No. 10 against the seat to keep the valve closed. Occasionally the weight is not required and can be removed (or additional weights may be required at minimum cost).

Each valve comes with installation instructions fixed to the weight.

*Note: APCO Swing Checks are recommended for raw sewage.*

<table>
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<tr>
<th>Valve</th>
<th>Inch</th>
<th>Millimeter</th>
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| V     | 4.5" | 114        |
| W     | 6"   | 152        |
| X     | 8.5" | 216        |
| Y     | 5.5" | 139        |
| Z     | 3.5" | 89         |

Inch   Millimeter

**APCO Air Cushion or Oil Control Check Valves** operate equally well in the vertical position.

For vertical installation the angle of the lever must be changed.
Specifications

Series 6000 Cushion Swing Check Valve - Air Cushion Side Mounted

Air Cushion Swing Check Valve body shall be cast iron per AWWA C508 having integral (not wafer) flanges.

The seat shall be centrifugally cast bronze with an o-ring seal and be locked in place with stainless steel lock screws and be field replaceable without the use of special tools.

The shaft shall be single and continuous stainless steel, extending both sides of the body with a lever and weight, using an air cushion cylinder side mounted.

The air cushion cylinder shall be constructed of corrosion-resistant material and the piston shall be totally enclosed within the cylinder and not open at one end.

The cushion cylinder assembly shall be externally attached to either or both sides of the valve body and will permit adjustability to cushion the closure of the valve. Cushioning shall be air trapped in the cushion cylinder which shall be fitted with a one way adjustable control check valve to cushion disc contact to the seat at the shut-off point. The bottom cylinder head shall be swivel mounted and not rigid to follow the change of force angles as the lever raises or lowers to open or close the check valve.

This valve shall prevent backflow of the media on normal pump shut-off or power failure, and be water tight.

The disc shall be cast iron utilizing a double clevis connected to a ductile iron disc arm. The disc arm assembly shall be suspended from a stainless steel shaft which passes through a seal retainer on both sides of the valve body. (Specify if other than horizontal installation.)

Valve exterior to be painted with universal metal primer paint as accepted by the FDA for use in contact with potable water.

Materials shall be certified to the following ASTM specifications:

- Body, Cover, Disc: Cast Iron - ASTM A126 GR.B
- Disc Arm: Ductile Iron - ASTM A536
- Seat: Aluminum Bronze or Stainless Steel - ASTM B148
- Disc seat: Buna-N or Metal - To suit
- Cylinder: Corrosion-Resistant Material - Commercial
Specifications

**Series 6000B Swing Check Valve - Oil Controlled Bottom Buffer**

The Oil Control Bottom Buffer Swing Check Valve body shall be cast iron per AWWA C508 having integral flanges (not wafer) and have a centrifugally cast bronze body seat.

The body shall have a flush and drain hole. The seat shall be locked in place with stainless steel lock screws and be field replaceable without the use of special tools. The shaft shall be one piece T303 steel, extending through both sides of the body with a lever and weight mounted on each side. Except 8", 10", and 12".

The disc shall be ductile iron, utilizing a double clevis and be connected to a ductile iron disc arm. The disc seat shall be Buna-N (replaceable) to provide water tight shut-off. The disc arm assembly shall be suspended from the stainless steel shaft.

The valve must have a bottom hydraulic buffer to permit free open and positive non-slam control closure of the disc. The hydraulic buffer shall make contact with the disc during the last 10% of closure to instantly control the valve disc until shut-off in a manner to prevent slam and water hammer. The last 10% of closure shall be externally adjustable and variable to suit operating conditions. The hydraulic buffer and oil system shall be separate from the main line media. (Specify if other than horizontal installation.)

Materials shall be certified to the following ASTM specifications:

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<tr>
<td>Disc seat</td>
<td>Buna-N or Metal</td>
</tr>
<tr>
<td>Buffer cylinder</td>
<td>Steel</td>
</tr>
<tr>
<td>Buffer rod</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>Exterior paint</td>
<td>Universal Metal Primer</td>
</tr>
</tbody>
</table>

ASTM A126, GR.B
ASTM A536
ASTM B148 or ASTM A276 (Engineer select one)
ASTM A582 T303
To suit
Per N.F.P.A. Standards
ASTM A582 T303
FDA Approved For Potable Water Contact
Specifications

Series 6100 Swing Check Valve - Oil Control Side Mounted

The Oil Controlled Swing Check Valve body shall be cast iron per AWWA C508 with integral flanges (not wafer) and have a centrifugally cast bronze body seat. The seat shall be locked in place with stainless steel lock screws and be field replaceable without the use of special tools.

The shaft shall be one piece hi-strength Type 17-4PH stainless, extending through both sides of the valve body.

Oil control side mounted hydraulic cylinders shall provide three stage control closing for the prevention of surge and water hammer. The cylinder must have two stages of control during the closing cycle and a third stage by means of a timing valve to permit rapid closure of the disc from full open to any degree of closure on pump stop. Typically as follows:

1st stage: Rapid closure to any degree
2nd stage: Variable slow closure towards final closure
3rd stage: Variable closure to shut-off

Each stage shall be independently adjustable and the oil system self-contained and separate from the main line media.

The valve shall control close while flow reverses in the pipeline during normal pump shut-off or power failure in a time sequence to prevent or minimize water hammer. Each stage closure shall be field adjustable. (Specify if other than horizontal installation.)

The disc shall have a double clevis connected to a ductile iron disc arm. The disc arm assembly shall be suspended from the stainless steel shaft. The disc seat shall be Buna-N (replaceable) to provide water tight shut-off.

Materials shall be certified to the following ASTM specifications:

<table>
<thead>
<tr>
<th>Component</th>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body &amp; cover</td>
<td>Cast Iron</td>
<td>ASTM A126, GR.B</td>
</tr>
<tr>
<td>Disc</td>
<td>Cast or Ductile Iron</td>
<td>ASTM A126, GR.B OR ASTM A536</td>
</tr>
<tr>
<td>Disc arm</td>
<td>Ductile Iron</td>
<td>ASTM A536</td>
</tr>
<tr>
<td>Body seat ring</td>
<td>Aluminum Bronze or Stainless Steel</td>
<td>ASTM A148 or ASTM A226 (Engineer to select one)</td>
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<tr>
<td>Disc seat</td>
<td>Buna-N or Metal</td>
<td>Per N.F.P.A. Standards to suit</td>
</tr>
<tr>
<td>Dashpot cylinder</td>
<td>Steel</td>
<td>Type 17-4PH</td>
</tr>
<tr>
<td>Pivot shaft</td>
<td>Stainless Steel</td>
<td>FDA Approved For Potable Water Contact</td>
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<tr>
<td>Exterior paint</td>
<td>Universal Metal Primer</td>
<td></td>
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</tbody>
</table>
Sales and Service

For information about our worldwide locations, approvals, certifications and local representative:
Web Site: www.dezurik.com   E-Mail: info@dezurik.com

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