

APCO CVS-6000/6000A Swing Check Valves with Air Cushion Cylinder, Oil Controlled Cylinder and Oil Controlled Bottom Mounted Buffer



Instruction **D12006**
March 2023

Instructions

These instructions are for use by personnel who are responsible for the installation, operation and maintenance of DeZURIK valves, actuators or accessories.

Safety Messages

All safety messages in the instructions are identified by a general warning sign and the signal word CAUTION, WARNING or DANGER. These messages indicate procedures to avoid injury or death.

Safety label(s) on the product indicate hazards that can cause injury or death. If a safety label becomes difficult to see or read, or if a label has been removed, please contact DeZURIK for replacement label(s).

WARNING

Personnel involved in the installation or maintenance of valves should be constantly alert to potential emission of pipeline material and take appropriate safety precautions. Always wear suitable protection when dealing with hazardous pipeline materials. Handle valves which have been removed from service with suitable protection for any potential pipeline material in the valve.

Inspection

Your DeZURIK product has been packaged to provide protection during shipment; however, items can be damaged in transport. Carefully inspect the unit for damage upon arrival and file a claim with the carrier if damage is apparent.

Parts

Replaceable wear parts are listed on the assembly drawing. These parts can be stocked to minimize downtime. Order parts from your local DeZURIK sales representative or directly from DeZURIK. When ordering parts please provide the following information:

If the valve has a data plate: please include the 7-digit part number with either 4-digit revision number (example: 9999999R000) or 8-digit serial number (example: S1900001) whichever is applicable. The data plate will be attached to the valve assembly. Also, include the part name, the assembly drawing number, the balloon number and the quantity stated on the assembly drawing.

If there isn't any data plate visible on the valve: please include valve model number, part name, and item number from the assembly drawing. You may contact your local DeZURIK Representative to help you identify your valve.

DeZURIK Service

DeZURIK service personnel are available to maintain and repair all DeZURIK products. DeZURIK also offers customized training programs and consultation services. For more information, contact your local DeZURIK sales representative or visit our website at DeZURIK.com.

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Description

A swing check valve consists of a valve body, a bonnet, and a disc that is connected to a hinge. The disc swings away from the valve seat to allow flow in the forward direction, and returns to the valve seat when upstream flow is stopped to prevent backflow.

The flow from the pump opens the disc and raises the counterweight. When the pump is shut off, the disc closes and is held closed by downstream static pressure. The CVS-6000/6000A valve can be equipped with a weighted counterweight arm and an Air Cushion Cylinder (AC), Oil Controlled Side Mounted Cylinder (OC) or an Oil Controlled Bottom Mounted Buffer (BMB) to control valve closure.

Handling and Storage

Lifting the valve improperly may damage it. Do not fasten lifting devices to the cylinder or through the seat opening in the body. Lift the valve with slings, chains or cables fastened around the valve body, or fastened to bolts or rods through bolt holes in the flanges.

If installation will be delayed, place valve indoors in secure, weather tight storage. If temporary outside storage is unavoidable, make sure a vermin proof rain cover (water shedding tarp, etc.) is secured around/over the valve to keep off rain and mud. Skid and set the assembly on a flat, solid, and well drained surface for protection from ground moisture, runoff and pooled rain water.

Installation

- See figures 2 through 5 for part identification.

NOTICE

The recommendation by Manufacturers Standardization Society of the Valve and Fittings Industry (MSS SP- 92) is to install a check valve at a minimum of 10 pipe diameters of straight pipe on the downstream side from tees, fittings, increasers, or pumps and 5 pipe diameters from elbows to ensure laminar flow with minimum turbulence to minimize disc movement and premature wear. However, many facilities with smaller footprints have achieved acceptable performance in systems with the check valve installed 5 pipe diameter lengths of straight pipe from the downstream side of tees, fittings, increasers, or pumps and 3 pipe diameters lengths from elbows.

- When installed in vertical position, the valve shaft must be perpendicular to the incoming horizontal pipe.
- For valves with BMB or OC, the Oil Reservoir (B58) and for BMB only, the Hydro-Pneumatic Accumulator (B73) must be mounted vertically regardless of the valve installation position.
- Before installation, remove foreign material such as weld spatter, oil, grease, and dirt from the pipeline.
- Prepare pipe ends and install valves in accordance with the pipe manufacturer's instructions for the joint used.

NOTICE

Do not deflect the pipe-valve joint. Minimize bending stresses in the valve end connection with pipe loading.

If excessive seat leakage occurs during start-up, recheck the installation and eliminate any distortion to the valve body.

- Ensure the valve and pipeline flanges are concentric to ensure proper flange sealing.
- Tighten the flange bolts or studs in a crisscross pattern in a minimum of four stages.

Fusion/Powder Coated Valves

NOTICE

Valves with fusion/powder coated exterior paint require flat washers to be installed under the flange nuts when installing the valve to the pipeline flange to prevent the paint from cracking or chipping.

Maintenance

CVS-6000/6000A valves with AC and OC

A periodic (approximately 6 months) lubrication of the cylinder lever pin and eye bracket pin to keep the valve in good operating condition. For the Air Cushion Cylinder, a few drops of oil should be applied to the top and bottom ports of the cylinder by removing the breather caps. Recommended lubricants: SAE 10W/20, WD 40.

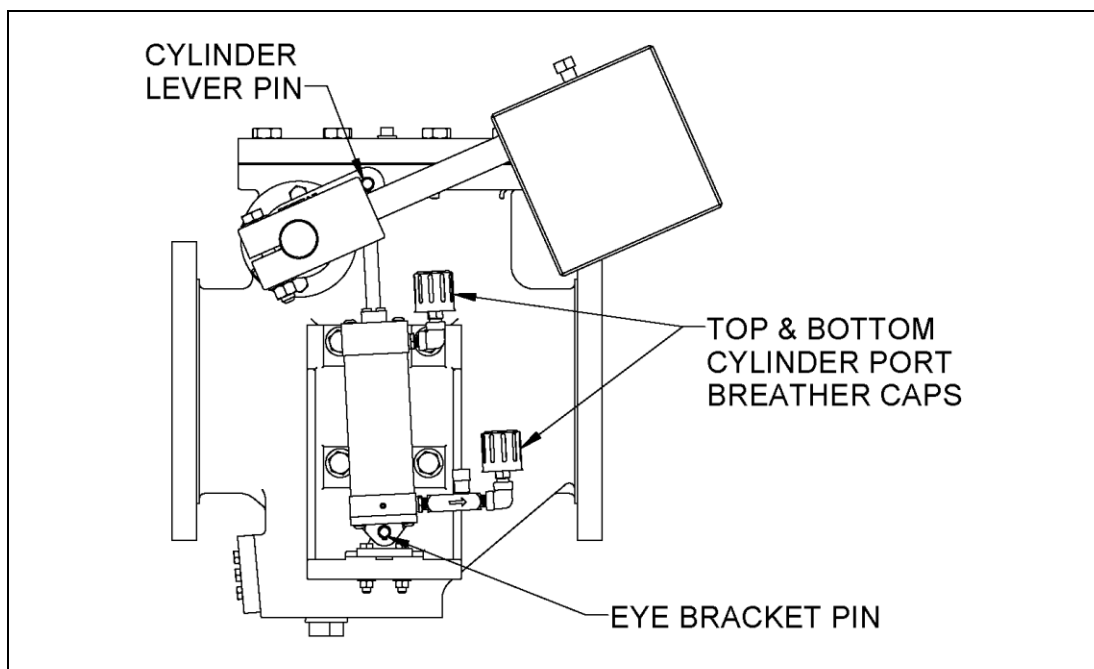


Figure 1 – Lubrication of Cylinder

CVS-6000/6000A Valves with BMB

A periodic (approximately 6 months) lubrication of the exposed area of Buffer Rod (B84) is required to keep the valve in good operating condition.

Through the course of normal operation, the Hydro-pneumatic Accumulator (B73) must be checked for loss of pressure. It is normal for the Pressure Gauge (B74) to indicate a decrease in pressure when the valve opens due to the transfer of oil from the accumulator to the cylinder. See figure 3 for parts identification.

Special care should be taken on the exposed area of the buffer rod if repainting the valve is required. It should be fully masked to prevent even a small amount of paint getting on the buffer rod. This could damage the cylinder rod seal and cause the cylinder to leak.

Disassembly Procedure

See Figures 2 through 5 for part identification.

⚠WARNING

These valves may open or close, swinging the Counterweight/spring loaded arm without warning due to flow changes from pumps starting and stopping. Servicing or working around these valves while the pipeline is under pressure can cause personal injury or equipment damage.

Workers must be cautious when working around these valves.

Relieve pipeline pressure and lockout the pumps before servicing the valve.

1. Relieve the pressure in the pipeline.

⚠WARNING

Servicing the valve while the pipeline is under pressure can cause personal injury or equipment damage. Relieve pipeline pressure before servicing the valve.

2. If it is necessary to remove valve from pipeline, set valve standing on its inlet flange.
3. Support Counterweight Arm (B28), then unscrew Set Screw (B36) and remove Counterweight (B19).
4. Loosen Lever Arm Bolt/Set Screw (B55) holding Lever Arm (B19) to Pivot Shaft (A13) and remove Counterweight Arm assembly (B19 and B28)
5. **Valves equipped with AC or OC only:**
 - a. Disconnect the pin between Cushion Lever (B27) and Pneumatic Cylinder (B20).
 - b. Unscrew Eye Bracket Mounting Bolts (B25) to remove Pneumatic Cylinder (B20).
 - c. Loosen Cushion Lever Set Screw (B35) to remove Cushion Lever (B27).
6. Remove Cover (A02) by unscrewing Cover Bolts (A04).
7. Unscrew Disc Arm Set screws (A14).
8. Remove Pivot Shaft Cover (A15) and Pivot Shaft Seal Retainer (A37) at both ends of the pivot shaft.
9. Pull Pivot Shaft (A13) from the right side of the valve (facing inlet).
10. Remove Pivot Shaft Flanged Bushing (A12), Pivot Shaft Key (A33), Pivot Shaft Seal (A17) and Pivot Shaft Cover Seal (A18).
11. Remove Disc Pin Retainers (A41) and pull out Disc Pins (A08).
12. Pull out Disc Arm (A09) and Disc (A10).
13. Remove Disc Seat (A06) and Seat Retaining Ring (A31) by unscrewing all Seat Retaining Screws (A32).
14. Unscrew the Body Seat Retaining Set Screws (A40) located in the Body Seat Ring (A05).
15. Evenly pry the Body Seat Ring (A05) out of the Body (A01).

Assembly Procedure

See Figures 2 through 5 for part identification.

1. If valve is removed from pipeline, set body standing on its inlet flange.
2. Install Body Seat Seal (A43) in the groove of Body Seat Ring (A05).
3. Install Body Seat Ring (A05) evenly inside the counterbore of the Body (A01) until it bottoms out.
4. Screw and tighten the Body Seat Retaining Set Screws (A40) into the Body Seat Ring (A05).
5. Set Disc (A10) with seat side up, install Disc Seat (A06) and Seat Retaining Ring (A31) and fasten with Seat Retaining Screws (A32).
6. Connect Disc Arm (A09) assembly to Disc (A10) by inserting Disc Pins (A08) and secure with Disc Pin Retainers (A41).
7. Set Disc (A10) and Disc Arm (A09) assembly on top of Body Seat Seal (A43).
8. Slip the Pivot Shaft Flanged Bushing (A12) on the Pivot Shaft (A13) with the flanged side against the Pivot Shaft Collar (A60).
9. Insert Pivot Shaft Key (A33) in keyway on Pivot Shaft (A13).
10. Install Pivot Shaft (A13) from right side of Body (A01) through Disc Arm (A09) until Pivot Shaft Collar (A60) is flush with Body (A01).
11. Insert Pivot Shaft Straight Bushing (A11) into the Body (A01) at the other end.
12. Insert Pivot Shaft Seal (A17) and Pivot Shaft Cover Seal (A18) in their respective grooves.
13. Insert Pivot Shaft Seal Retainer (A37) on Pivot Shaft Cover (A15) and install on both ends of Pivot Shaft (A13). Install Pivot Shaft Cover Bolts (A16).
14. Install Cover Seal (A03) and Cover (A02), then fasten with Cover Bolts (A04).
15. **Valves equipped with AC or OC:**
 - a. Insert Cushion Lever Key (B34) on the Pivot Shaft (A13) and position Cushion Lever (B27) in line with Pneumatic Cylinder (B20) and tighten Cushion Lever Set Screw (B35).
 - b. Connect Cushion Lever (B27) to Pneumatic Cylinder (B20).
16. Insert Lever Arm Key (B49) on Pivot Shaft (A13) if provided and slip Counterweight Arm assembly (B19 and B28) in place. Set arm at an angle approximately 25° - 30° below horizontal axis and secure with Lever Arm Bolts (B55) and Lever Arm Nuts (B56).
17. Install Counterweight (B29) at desired setting and secure with Counterweight Set Screws (B36).

Drawings

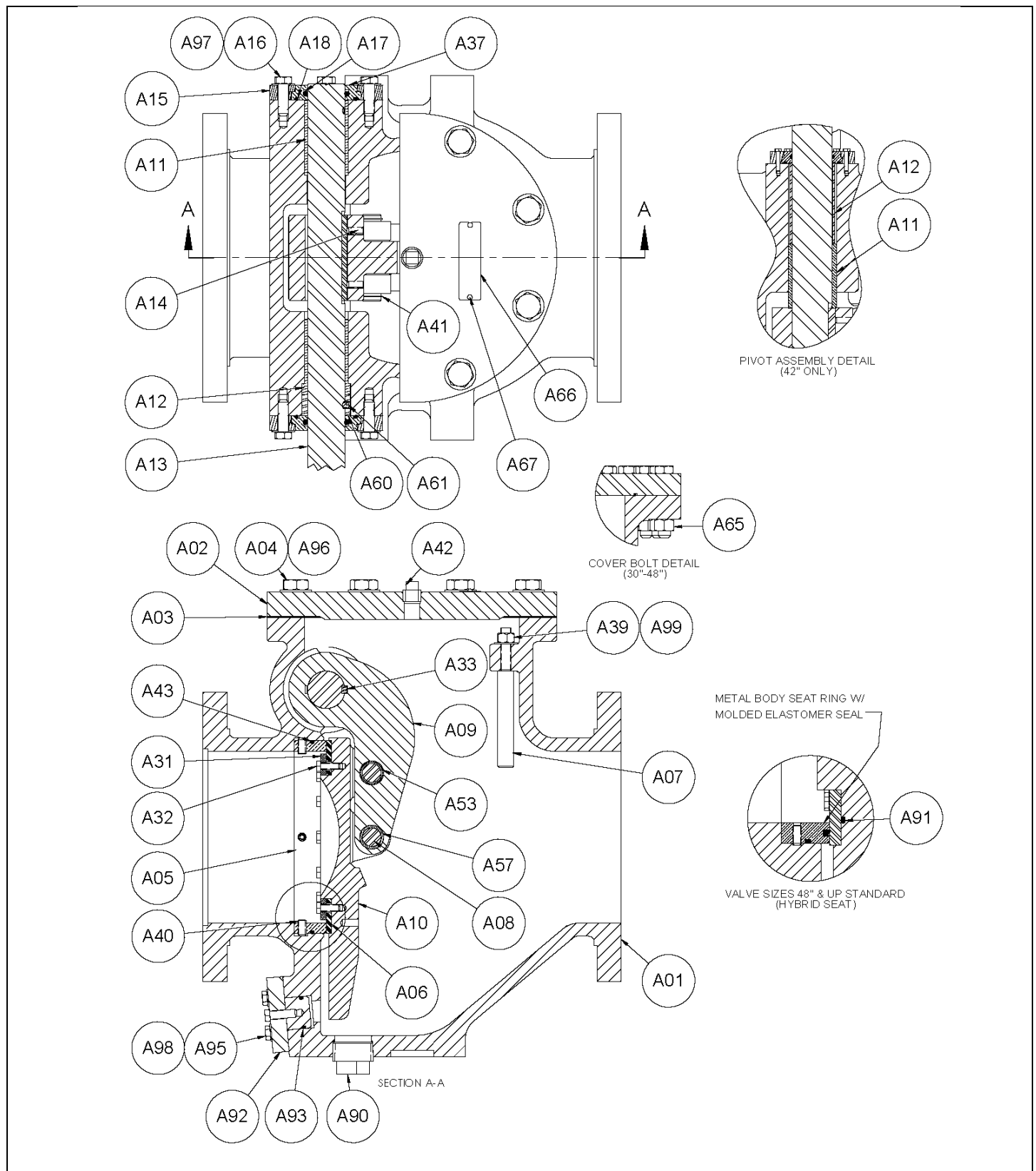


Figure 2 – Valve Assembly

Table 2 : Figure 2 Parts Identification

A01	BODY
A02	COVER
A03	COVER SEAL
A04	COVER BOLTS
A05	BODY SEAT RING
A06	DISC SEAT
A07	DISC STOP
A08	DISC PIN
A09	DISC ARM
A10	DISC
A11	PIVOT SHAFT STRAIGHT BUSHING
A12	PIVOT SHAFT FLANGED BUSHING (ALL EXCEPT 42")
A12	SPACER (42" ONLY)
A13	PIVOT SHAFT
A14	DISC ARM SET SCREW
A15	PIVOT SHAFT COVER
A16	PIVOT SHAFT COVER BOLT
A17	PIVOT SHAFT SEAL
A18	PIVOT SHAFT COVER SEAL
A31	SEAT RETAINING RING
A32	SEAT RETAINING SCREW
A33	PIVOT SHAFT KEY
A37	PIVOT SHAFT SEAL RETAINER
A39	DISC STOP LOCKNUT
A40	BODY SEAT RETAINING SET SCREW
A41	DISC PIN RETAINER
A42	COVER PIPE PLUG
A43	BODY SEAT SEAL
A53	PIVOT SLEEVE BEARING
A57	DISC ARM SLEEVE
A60	PIVOT SHAFT COLLAR (NOTE 2)
A61	PIVOT SHAFT SET SCREW (NOTE 2)
A65	COVER NUT
A66	DATA PLATE
A67	DRIVE SCREW
A90	BODY PIPE PLUG
A91	DISC RING SEAL
A92	BMB PLUG (NOTE 1)
A93	BMB PLUG SEAL (NOTE 1)
A95	BMB PLUG RETAINING SCREW (NOTE 1)
A96	COVER BOLT WASHER
A97	PIVOT SHAFT COVER WASHER
A98	BMB COVER WASHER (NOTE 1)
A99	DISC STOP WASHER

- NOTES:
1. BMB PLUG NOT INCLUDED FOR VALVES WITH BMB CLOSURE CONTROL
 2. VALVE SIZES 2-3", 16-54" & 66" HAVE A SINGLE PIECE, WELDED PIVOT SHAFT

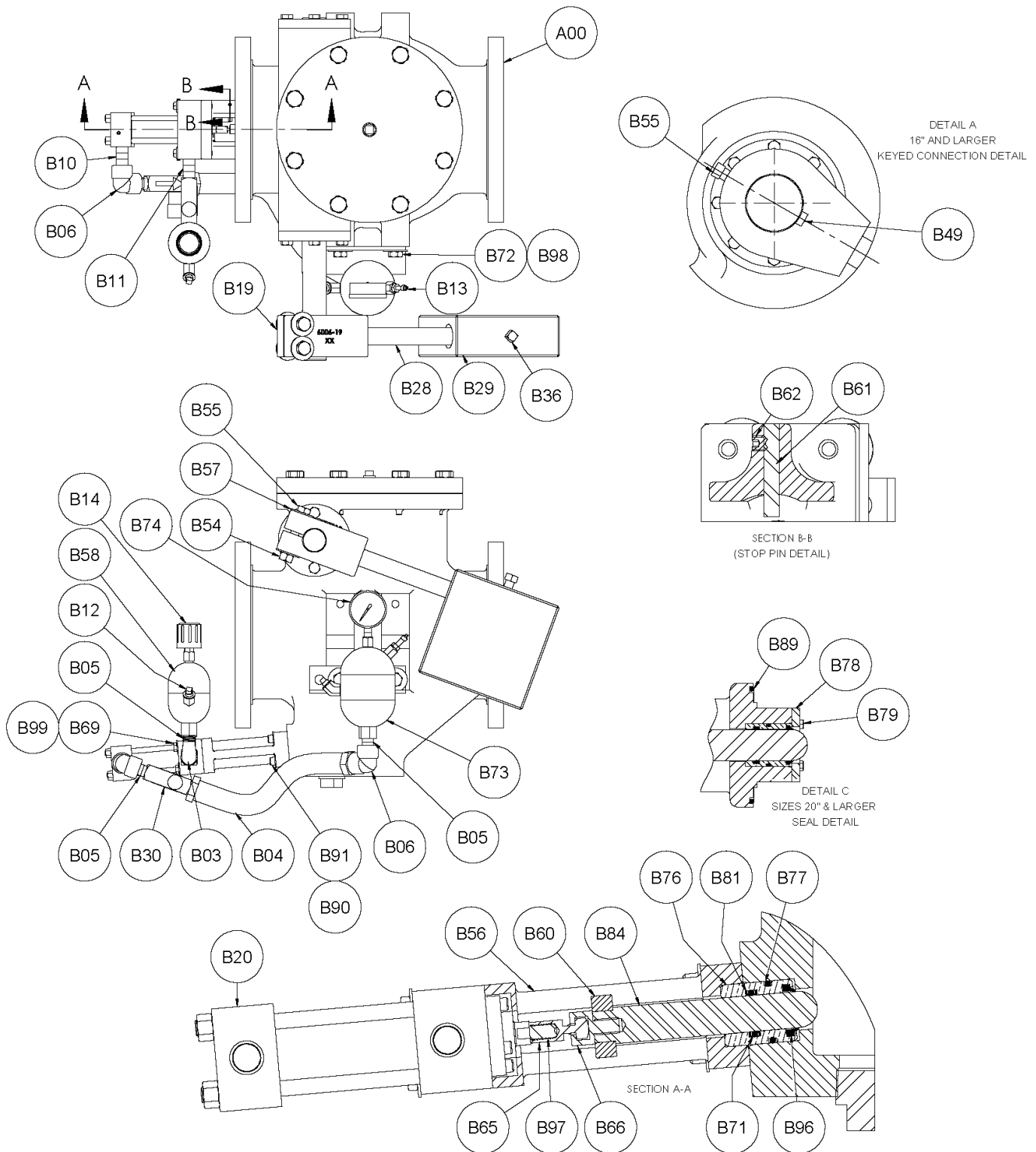


Figure 3 – Valve Assembly with BMB

Table 3: Figure 3 Parts Identification

A00	VALVE ASSEMBLY
B03	STREET ELBOW
B04	HOSE
B05	CLOSE NIPPLE
B06	ELBOW – 3000 PSI
B08	REDUCER (TO CYLINDER PORTS, NOT SHOWN)
B10	NIPPLE
B11	NIPPLE
B12	PIPE PLUG
B13	TANK VALVE
B14	AIR BREATHER (NOTE 1)
B19	LEVER ARM
B20	PNEUMATIC CYLINDER
B28	COUNTERWEIGHT ARM
B29	COUNTERWEIGHT
B30	FLOW CONTROL VALVE (NOTE 2)
B36	SET SCREW
B49	LEVER ARM KEY
B54	NUT
B55	LEVER ARM BOLT/SET SCREW
B56	CYLINDER SPACER
B57	WASHER
B58	OIL RESERVOIR
B60	SPLIT SHAFT COLLAR
B61	BUFFER ROD STOP
B62	BUFFER ROD STOP SET SCREW
B65	CYLINDER ROD COUPLER
B66	CYLINDER ROD ADAPTOR
B69	CYLINDER MTG. BOLT
B71	BUFFER ROD SEAL
B72	HYDRO PNEUMATIC ACCUMULATOR MTG. BOLT
B73	HYDRO PNEUMATIC ACCUMULATOR
B74	PRESSURE GAUGE
B76	BUFFER ROD BUSHING
B77	BUSHING SEAL
B78	BUFFER ROD BUSHING RET. RING
B79	RETAINING RING SCREW
B81	BUFFER ROD SEAL BACK-UP
B84	BUFFER ROD
B89	CYLINDER SPACER SEAL
B90	WASHER
B91	CYLINDER SPACER MTG. BOLT
B96	BUFFER ROD SCRAPER
B97	SET SCREW
B98	WASHER
B99	WASHER

- NOTES
1. DO NOT SHIP WITH AIR BREATHER (B14) INSTALLED. INSTALL PIPE PLUG (B12) INSTEAD
 2. FLOW CONTROL VALVE (B30) IS TO BE INSTALLED SO THAT FLOW IS CONTROLLED FLOWING OUT OF THE CYLINDER AND FREE FLOW TOWARDS THE CYLINDER.
 3. VALVE SIZES 14" & LARGER HAVE TWO COUNTERWEIGHT ASSEMBLIES (B19, B28 and B29), ONE ON EITHER SIDE OF THE VALVE.

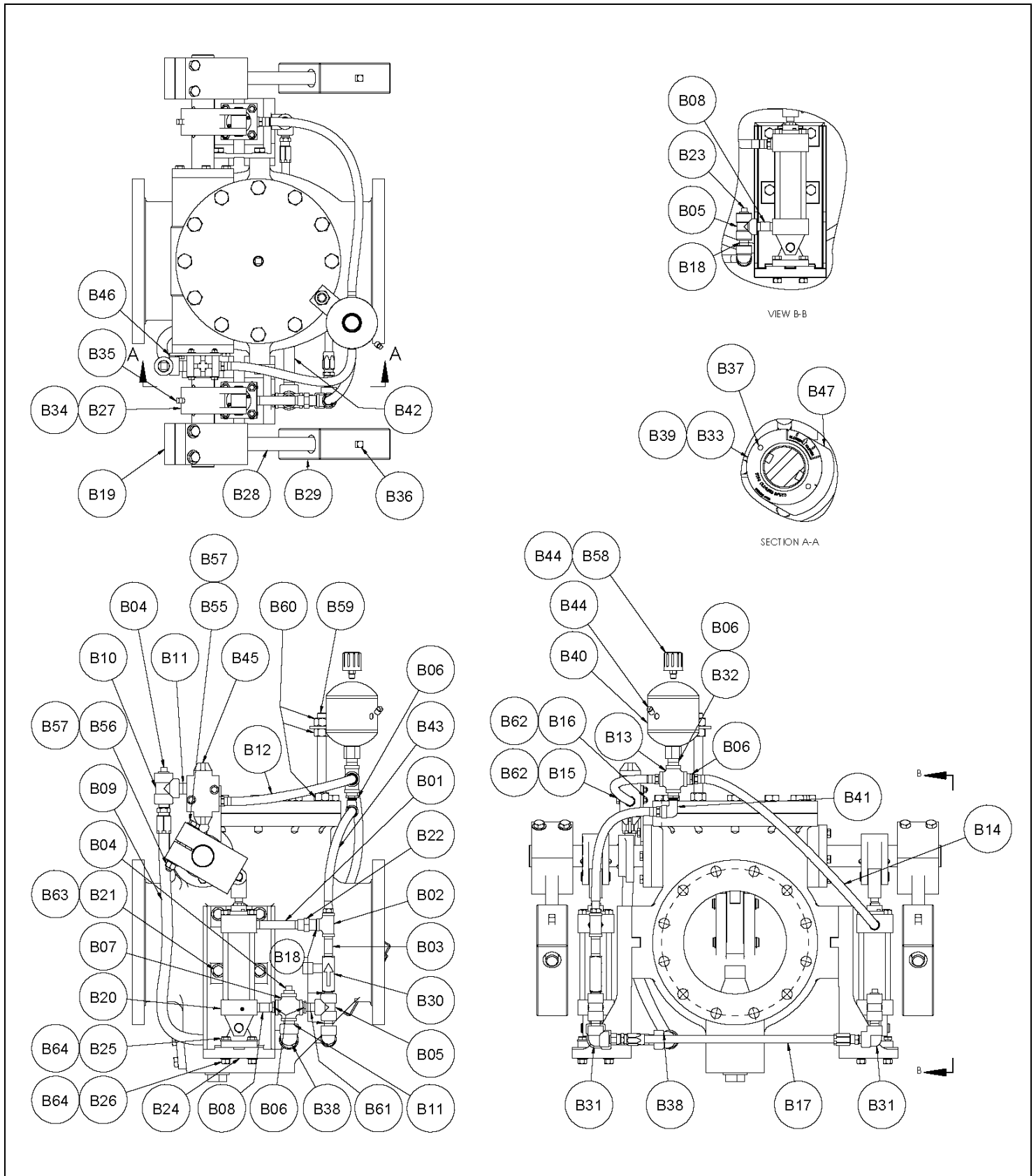


Figure 4 – Valve Assembly with OC

Table 4: Figure 4 Parts Identification

B01	NIPPLE
B02	TEE
B03	NIPPLE
B04	PIPE PLUG
B05	TEE
B06	REDUCING BUSHING (SEE NOTE 3)
B07	CROSS
B08	NIPPLE
B09	HOSE
B10	TEE
B11	NIPPLE
B12	HOSE
B13	CROSS
B14	HOSE
B15	TIMING VALVE SCREW
B16	TIMING VALVE NUT
B17	HOSE
B18	NIPPLE
B19	COUNTERWEIGHT LEVER ARM
B20	PNEUMATIC CYLINDER
B21	CYLINDER BRACKET MOUNTING BOLT
B22	UNION
B23	PIPE PLUG
B24	CYLINDER BRACKET
B25	CYLINDER BRACKET MOUNTING BOLT
B26	CYLINDER BRACKET MOUNTING NUT
B27	CYLINDER LEVER
B28	COUNTERWEIGHT ARM
B29	COUNTERWEIGHT
B30	FLOW CONTROL VALVE
B31	ELBOW
B32	NIPPLE
B33	TIMING VALVE CAM DIAL
B34	CUSHION LEVER KEY
B35	CUSHION LEVER SET SCREW
B36	COUNTERWEIGHT SET SCREW
B37	DRIVE SCREW
B38	ELBOW
B39	CAM SET SCREW
B40	OIL RESERVOIR TANK
B41	ELBOW
B42	NIPPLE
B43	HOSE
B44	PIPE PLUG (SEE NOTE 2)
B45	TIMING VALVE
B46	TIMING VALVE MOUNTING BRACKET
B47	CAM
B49	LEVER ARM KEY (NOT SHOWN)
B55	LEVER ARM BOLT/SET SCREW
B56	LEVER ARM NUT
B57	WASHER
B58	AIR BREATHER
B59	THREADED ROD (SEE NOTE 1)
B60	HEX NUT (SEE NOTE 1)
B61	NIPPLE
B62	WASHER
B63	WASHER
B64	WASHER

- NOTES
1. B59 & B60 ARE REPLACED WITH A SINGLE BRACKET (NOT SHOWN) WHEN VALVE IS USED IN VERTICAL ORIENTATION
 2. VALVE IS SHIPPED WITH PIPE PLUG IN PLACE OF BREATHER ON RESERVOIR, BREATHER SHIPPED LOOSE
 3. ADDITIONAL REDUCER ON 14-20" IS USED TO CONNECT OIL RESERVOIR TO 1" NPT CROSS

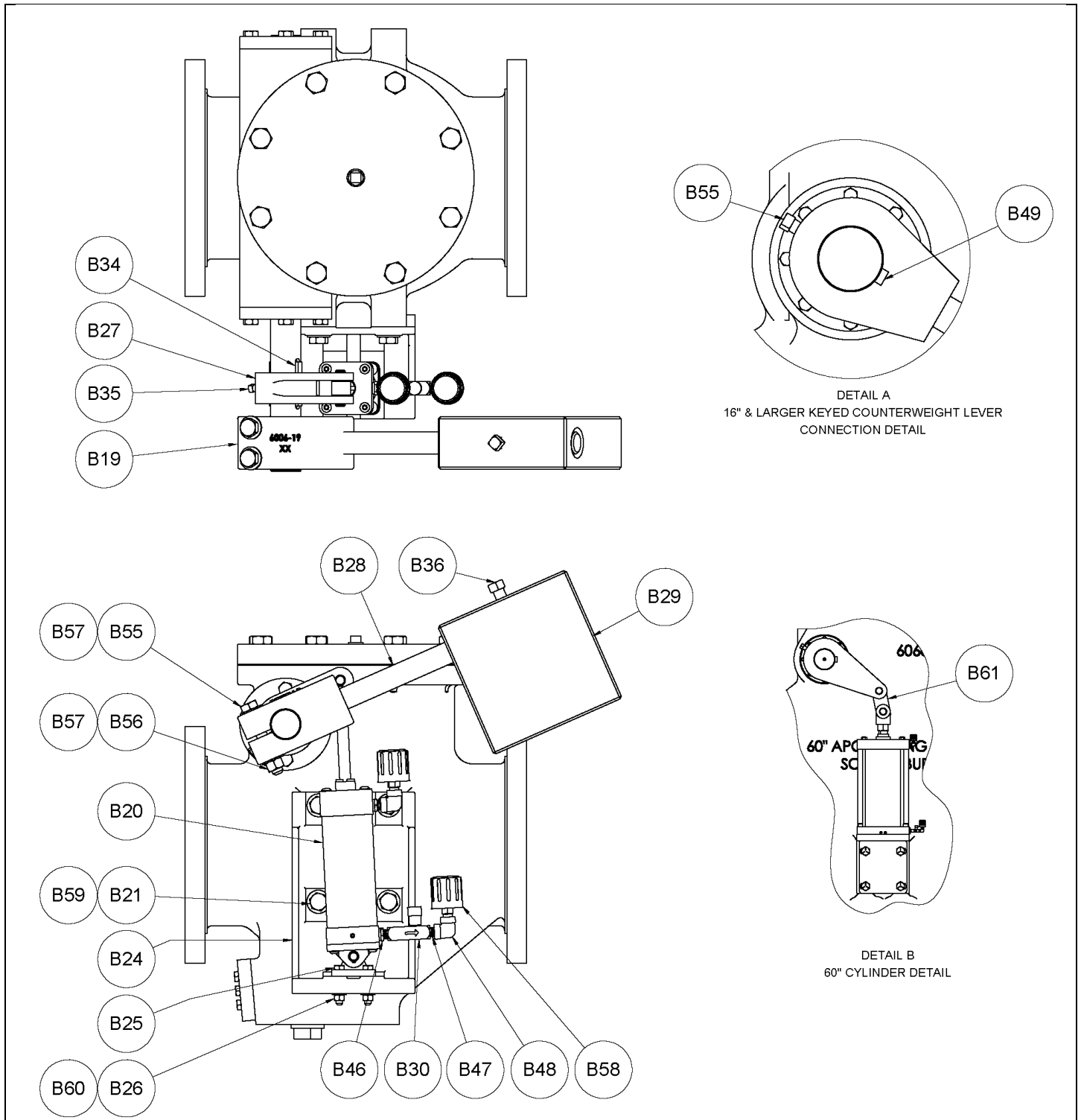


Figure 5 – Valve Assembly with AC

Table 5: Figure 5 Parts Identification

B19	COUNTERWEIGHT LEVER ARM
B20	PNEUMATIC CYLINDER
B21	CYLINDER BRACKET MOUNTING BOLT
B24	CYLINDER BRACKET
B25	EYE BRACKET MOUNTING BOLT
B26	EYE BRACKET MOUNTING NUT
B27	CUSHION LEVER
B28	COUNTERWEIGHT ARM
B29	COUNTERWEIGHT
B30	FLOW CONTROL VALVE
B34	CUSHION LEVER KEY
B35	CUSHION LEVER SET SCREW
B36	COUNTERWEIGHT SET SCREW
B46	REDUCING BUSHING
B47	PIPE NIPPLE
B48	PIPE ELBOW
B49	LEVER ARM KEY
B55	LEVER ARM SET SCREW(16-66")/BOLT(2-3", 14")
B56	LEVER ARM NUT
B57	COUNTERWEIGHT LEVER ARM WASHER
B58	AIR BREATHER
B59	CYLINDER BRACKET WASHER
B60	EYE BRACKET WASHER
B61	LINK

Operation

The flow from the pump opens the Disc (A10) and raises the Counterweight (B29). When the pump is shut off, the decreased flow allows gravity to close the Disc (A10) toward the Body Seat Ring (A05). The Counterweight (B29) causes the Disc (A10) to close faster or slower depending on its position along the Counterweight Arm (B28).

System static pressure (downstream of the swing check valve) keeps the Disc (A10) and Disc Seat (A06) closed and seated against the Body Seat Seal (A43).

Closing Hard Versus Slamming:

1. Counterweight (B29) position along the Counterweight Arm (B28) controls the speed of valve closure. It is ideal to close the valve when or slightly before flow in the pipe reverses.
2. If the weight is adjusted too far out on the lever, the check valve can close hard and cause stress to valve components. This is not considered slamming. See "Closing Speed Adjustment".
3. An Air Cushion Cylinder (AC) will minimize hard contact between the Disc Seat (A06) and Body Seat Seal (A43) (closing hard). Air cushions cannot prevent slamming.
4. Slamming occurs when the valve is not able to close fast enough with the Counterweight (B29) alone and flow reverses, grabbing the Disc (A10) and slamming it shut. Either an Oil Controlled Cylinder (OC) or Bottom Mounted Buffer (BMB) can prevent slamming.

NOTICE

Surges can be generated during pump starts and stops. Make sure pump station safety devices are operational and that the time between each pump start and stop is sufficient for system pressures to return to steady condition.

CVS-6000-AC Valves Start-up Procedure

As the Disc (A10) opens, the Air Cushion Cylinder Assembly (fig. 5) piston is pulled upward, drawing air freely into the Pneumatic Cylinder (B20) through the Flow Control Valve (B30).

As the Disc (A10) closes, the Pneumatic Cylinder (B20) piston is pushed downward and the compressed air escapes through the Flow Control Valve (B30) on the bottom of the Pneumatic Cylinder (B20). Closure can be dampened by the Pneumatic Cylinder (B20). The exhausting air can be adjusted with the Flow Control Valve (B30) to suit the best performance for the installation. For the last 10% of disc travel, an internal cushion adjustment in the Pneumatic Cylinder (B20) head provides additional control.

Start-up Procedure

1. Position Counterweight(s) (B29) midway on the Counterweight Arm (B28).
2. Set lever arm 25°-30° below horizontal (not to interfere with cylinder).
3. Open Flow Control Valve (B30) two complete turns counter-clockwise from fully closed position. See "Adjustment of Flow Control Valve".
4. Turn Internal Cushion Adjustment screw one complete turn counter-clockwise from fully closed position. See "Operation of Internal Cushion".
5. Throttle the isolation valve on the discharge side of the Swing Check Valve to approximately 1/3 open to prevent full column reversal and slamming when the pump stops.
6. Start and stop pump and observe rate of closing.
7. Adjust Counterweight(s) (B29) to set closing speed. See "Closing Speed Adjustment".
8. Adjust Flow Control Valve to set cushioning. See "Adjustment of Flow Control Valve".

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9. If necessary, adjust Internal Cushion Adjusting Screw for additional cushioning during last 10% of operation. See "Operation of Internal Cushion".
10. During this sequence of pump start and stops, gradually open the downstream isolation valve until it is full open.
11. Repeat steps 6 through 10 as necessary until satisfactory performance is achieved.
12. If satisfactory performance cannot be achieved after making these adjustments, contact the DeZURIK Representative or Field Service for assistance.

CVS-6000-OC Valves Start-up Procedure

Valves equipped with Oil Control Side Mounted (OC) have Two Stage (2-4") or Three Stage (6-20") adjustable control. The Timing Valve (6-20" only) allows unrestricted Primary Control until a preset travel distance is achieved. Secondary control is provided by the Flow Control Valve. The third control is the Internal Cushion located in the cylinder head and provides additional control over the last 10% of disc travel. The hydraulic cylinder is self-contained and uses oil as a controlling media, creating a completely closed system.

Start-up Procedure

1. Position Counterweight (B29) midway on the Counterweight Arm (B28).
2. Set outside lever arm 25°-30° below horizontal (not to interfere with cylinder).
3. **Size 6"-20" only:** Set Cam (B47) on the Timing Valve (B45) so that arrow on cam is pointing to the center line of the roller on the Timing Valve while the disc is in closed position. See "Timing Valve Adjustment".
4. Turn Internal Cushion Adjusting Screw one complete turn counter-clockwise from fully closed position. See "Operation of Internal Cushion".
5. Throttle the isolation valve on the discharge side of the Swing Check Valve to approximately 1/3 open to prevent full column reversal and slamming when the pump stops.
6. Remove Pipe Plug (B44) on top of Oil Reservoir Tank (B40) and install the Air Breather (B58), which is shipped with the valve.
7. Check for proper oil levels. Make sure Oil Reservoir Tank is in vertical position. The oil level should be checked when the valve is closed. Oil should be visible in the elbow, which is the oil fill level. Add if necessary. See "Oil Filling Procedure".
8. Start and stop pump and observe rate of closing.
9. Adjust Counterweights to set Primary Stage closing speed. See "Closing Speed Adjustment".
10. Adjust Timing Valve (6"-20" only) to set the disc position when the Second Stage control should activate. See "Timing Valve Adjustment".
11. Adjust Flow Control Valve (B30) to set the Second Stage closing speed. See "Adjustment of Flow Control Valve".
12. If necessary, adjust Internal Cushion Adjusting Screw for additional cushioning during the Third Stage (last 10%). See "Operation of Internal Cushion".
13. During this sequence of pump start and stops, gradually open the downstream isolation valve until it is fully open.
14. Repeat steps 8 through 13 as necessary until satisfactory performance is achieved.
15. When shut-down sequence is established, lock the Flow Control Valve knob and tighten Timing Valve set screws to prevent tampering of settings.
16. If satisfactory performance cannot be achieved after making these adjustments, contact your local DeZURIK Representative or DeZURIK Field Service for assistance.

CVS-6000-BMB Valves Start-up Procedure

Oil Control Bottom Buffer allows check valves to open freely and provide control of the disc movement while closing. This allows the valve disc to close freely for 90% of its stroke. The disc then comes in contact with the Buffer Rod, which controls the speed of closing over the last 10% of disc travel.

The Oil Control Bottom Buffer has two controlling stages during the last 10% of closing. The Flow Control Valve provides primary control. Secondary control over the last 5% of disc closure is provided by the Internal Cushion.

The Cylinder (B20) incorporates the use of a Hydro Pneumatic Accumulator (B73), a device that activates and pushes the Buffer Rod (B84) into the valve body. The Cylinder is self-contained and uses oil as a controlling media, creating a completely closed system.

Start-up Procedure

1. Position Counterweight (B29) midway on the Counterweight Arm (B28).
2. Set outside lever arm 25°-30° below horizontal (not to interfere with cylinder).
3. Open Flow Control Valve (B30) three complete turns counter-clockwise from fully closed position. See "Adjustment of Flow Control Valve".
4. Fully open Flow Control Valve connected to Oil Reservoir (B58)
5. Turn Internal Cushion Adjusting Screw one complete turn counter-clockwise from fully closed position. See "Operation of Internal Cushion".
6. Throttle the isolation valve on the discharge side of the Swing Check Valve to approximately 1/3 open to prevent full column reversal and slamming when the pump stops.
7. Remove pipe plug on top of Oil Reservoir (B58) and install the Air Breather (B14), which is shipped with the valve.
8. Check for proper oil levels. Make sure oil tanks are in vertical position.
 - a. Hydro Pneumatic Accumulator (B73): Release air pressure and remove pipe plug on the side of the tank. Oil should be visible in the elbow, which is the oil fill level. Add if necessary. (See "Oil Filling Procedure").
 - b. Oil Reservoir (B58): The oil level should be checked when the valve is open. Oil should be visible in the elbow, which is the oil fill level. Add if necessary. See "Oil Filling Procedure".

Pressurize Hydro Pneumatic Accumulator (B73) according to this formula:

$$\text{Tank pressure} = (\text{Line pressure} \div 4) + 5 \text{ psi}$$

This is the pressure necessary to extend the buffer rod into the valve body
9. Start pump. While valve is opening, visually verify that Buffer Rod (B84) fully extends into the valve body. If not, pressurize Hydro Pneumatic Accumulator (B73) until it does. Table 6 shows the maximum stroke length of the Buffer Rod (B84).

Valve Size	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"	42"	48"	54"	66"
Stroke, (inches)	1½	2	2	3	4	5	6	4	5	6	7	6	9	11

Table 6: Maximum Stroke Length of Buffer Rod

10. Shut-off the pump and observe rate of closing.
11. Adjust Counterweight to set closing speed until the disc contacts the buffer rod. See "Closing Speed Adjustment" Procedure.

Start-up Procedure (cont.)

12. Adjust Flow Control Valve to set the closing speed of the Cylinder (for the last 10% of travel). See “Adjustment of Flow Control Valve”.
13. If necessary, adjust Internal Cushion Adjusting Screw for addition cushioning during the last 5% of closure. See “Operation of Internal Cushion”.
14. During this sequence of pump start and stops, gradually open the downstream isolation valve until it is fully open.
15. Repeat steps 10 through 15 as necessary until satisfactory performance is achieved.
16. When shut-down sequence is established, lock the Flow Control Valve knob.
17. If satisfactory performance cannot be achieved after making these adjustments, contact your local DeZURIK Representative or DeZURIK Field Service for assistance.

Closing Speed Adjustment

It is ideal to close the valve when or slightly before flow in the pipe reverses. Testing must be conducted carefully and adjustments made in small increments.

All Valves with Counterweights:

- For faster Disc closing - Move Counterweight(s) (B29) away from the Pivot Shaft (A13).
- For slower Disc closing – Move Counterweight(s) (B29) toward Pivot Shaft (A13).

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1. Throttle the isolation valve on the discharge side of the Swing Check Valve to approximately 1/3 open to prevent full column reversal and slamming when the pump stops.
2. If Swing Check Valve closes hard, move Counterweight (B29) inward toward Pivot Shaft (A13) 1-2 inches. Start and stop the pump to determine if hard closing is resolved.
3. If cushioning is required, turn the adjusting screw of Flow Control Valve (B30) one-half ($\frac{1}{2}$) turn clockwise. (See “Adjustment of Flow Control Valve”). Start and stop the pump. If hard closure persists, continue turning adjusting screw in $\frac{1}{2}$ turn increments. Do not fully close the Needle Valve.
4. Additional cushioning is possible by adjusting the Internal Cushion Adjusting Screw. See “Operation of Internal Cushion”.
5. Continue repeating above steps until satisfactory closing is achieved. During this sequence of pump starts and stops, gradually open the downstream isolation valve until it is fully open.

Adjustment of Flow Control Valve

The Flow Control Valve has a micrometer type adjustment which incorporates a color-coded reference scale to simplify setting, resetting and adjusting.

A set screw on the knob is provided for locking the valve setting. Turning the knob clockwise closes the valve and turning counterclockwise opens the valve and increases rate of closure of the Check Valve.

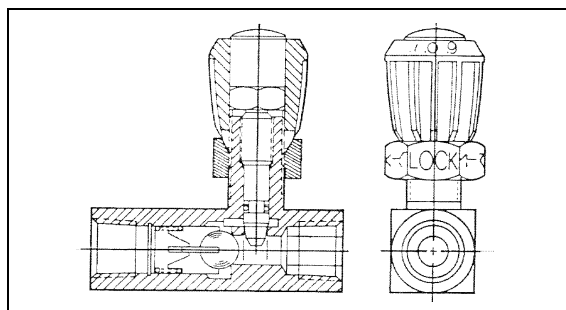


Figure 6 – Flow Control Valve

Operation of Internal Cushion

As illustrated below, the cushioning of a pneumatic/hydraulic cylinder stroke is obtained by trapping the exhaust air/oil as the piston assembly nears the end of its stroke. In Figure 7, as the Cushion Plunger (1) enters Cushion Cavity (2), the exhaust air/oil is almost completely trapped by the Ball Check (3) and the Adjusting Screw (4) creating back-pressure against Piston Assembly. The back-pressure cushions and slows the final part of the Piston stroke thus, reducing impact of the Piston Assembly against the Cylinder Cap.

Turning the Adjusting Screw to allow more or less air/oil to escape regulates the degree of cushioning as desired.

In Figure 8, when air/oil enters the Cylinder Cap End to stroke the Piston Assembly in the opposite direction, the air/oil moves the Ball Check (3) off its seat, opening the passage for more air/oil to act against the Piston, thus speeding its start-up movement as the Cushion Plunger (1) is immediately forced out of its cavity (2).

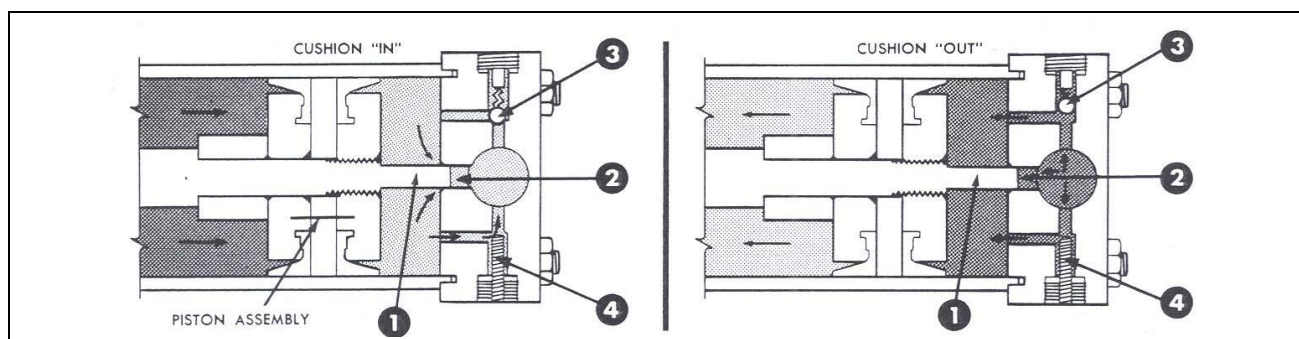


Figure 7 – Cushion “IN” Stroke

Figure 8 – Cushion “OUT” Stroke

Timing Valve Adjustment (CVS-6000-OC Valves)

The Timing Valve (B45) automatically starts the second stage of closure control. When the Cam (B47) is depressed, the Disc (A10) can travel toward closed freely. Oil flows directly from the Cylinder (B20) to the Oil Reservoir Tank (B40), bypassing the Flow Control Valve (B30). The unrestricted flow of oil allows rapid disc travel toward closed. When the Cam is released, Disc speed of travel is controlled by the adjustable Flow Control Valve. The travel distance before the second stage of closure control begins is set by adjusting the Cam.

- Turning the Cam **counter-clockwise** will **increase** the Disc travel distance before the Roller releases the Cam, permitting the Disc to close at a fast rate for **longer** travel distance.
- Turning the Cam **clockwise** will **decrease** the Disc travel distance before the Roller releases the Cam, permitting the Disc to close at a fast rate for **shorter** travel distance.
- If the Cam is adjusted so the Cam and Roller do not make contact at all, the second stage Flow Control Valve will control the Disc movement from full open to 90% closed. At 90% closed, the third stage of control starts (See "Operation of Internal Cushion")

Figure 9 shows position of the Cam in relation to Cam Follower with check valve in closed position. The cam is connected to the valve Pivot Shaft and rotates in the same direction as the disc travels. In this example, the Cam is set to allow the disc to rapidly close from full open to 50% open before second stage closure control begins.

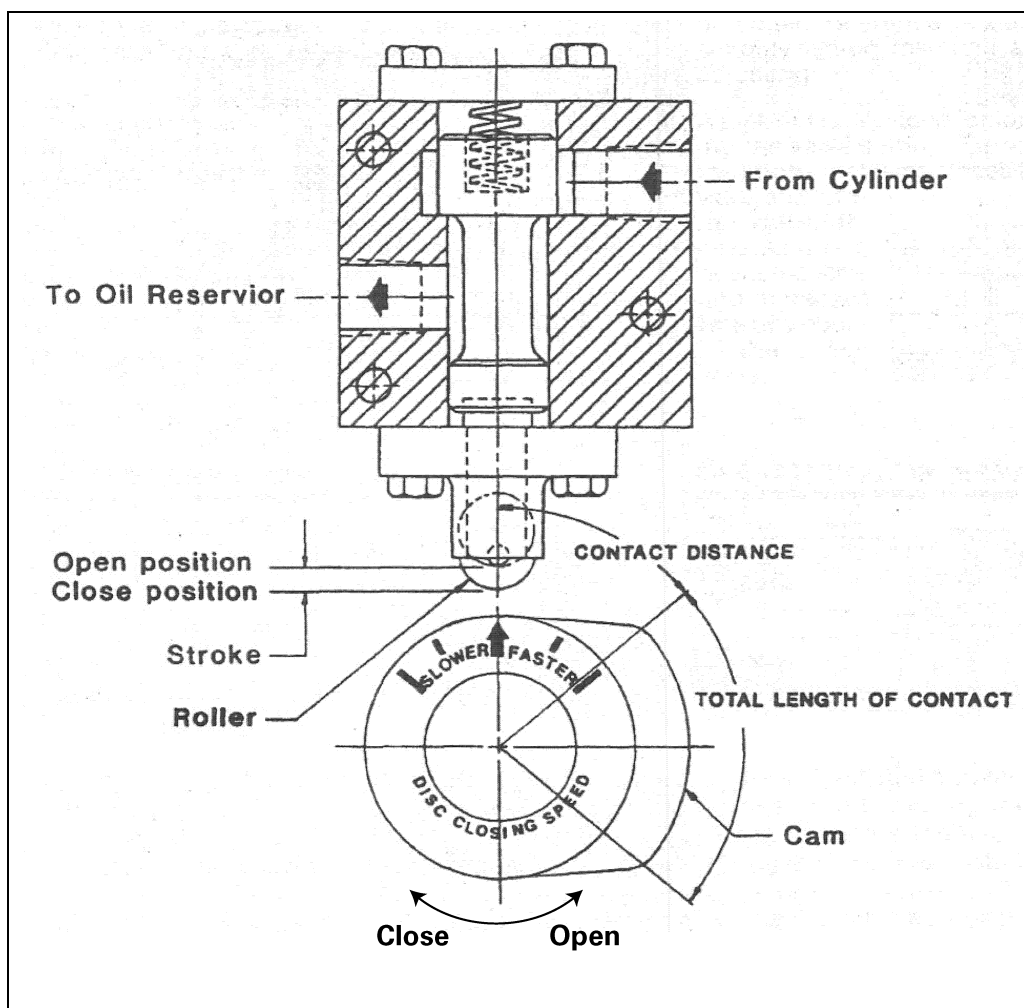


Figure 9 – Timing Valve

Oil Filling Procedure

See Figures 2 through 5 for part identification. Recommended Oils: Motor oil SAE 20, Mobil DTE 24, Castrol Hyspin AW 32.

CVS-6000-OC Valves

1. Fully close swing check valve.
2. Fully open Flow Control Valve (B30). (Make note of setting before turning knob.)
3. Manually lift roller of Timing Valve (B45) and hold in that position until step 5.
4. Remove pipe plug in street elbow located on side of Oil Reservoir (B58) and slowly fill with oil until oil level is visible in street elbow, then replace pipe plug.
5. Manually open and close swing check valve by lifting Counterweight Arm (B28) at least three times to force out any entrapped air in the cylinder(s).
6. Remove pipe plug in street elbow located on side of Oil Reservoir Tank (B40) and check oil level. Refill if necessary and repeat step 5 until proper oil level is maintained when the swing check valve is fully closed.
7. Check system for any entrapped air by manually opening the swing check valve by lifting Counterweight Arm (B28), then closing the Flow Control Valve (B30) while still on the open position. The Disc (A10) should remain in the open position, otherwise, repeat steps 2 thru 7.
8. Reset Flow Control Valve (B30) to original setting noted in Step 2.

CVS-6000-BMB Valves

Step 1: Hydro Pneumatic Accumulator (B73)

1. Shut down pump.
2. Release pressure of Hydro Pneumatic Tank and remove pipe plug located on the side of the tank and also either the Pressure Gauge (B74) or Air Valve.
3. Fully open Flow Control Valve (B30). (Make note of setting before turning knob.)
4. Slowly fill cylinder with oil until it spills out of the side port. This is the oil fill level.
5. Replace both fittings and pressurize tank according to this formula:
6. Tank pressure = (Line pressure/4) + 5 psi
7. Start pump and observe if Buffer Rod (B84) extends. If not, while valve is still open add more pressure until it does.
8. Reset Flow Control Valve (B30) to original setting noted in step 3.

Step 2: Oil Reservoir (B58)

1. Start pump.
2. Fully open Flow Control Valve (B30). (Make note of setting before turning knob.)
3. Remove side Pipe Plug (B12) and Air Breather (B14) and slowly fill with oil until it spills out of the side port.
4. Replace both fittings.
5. Shut down pump.
6. Reset Flow Control Valve (B30) to original setting noted in step 2.

NOTE: The Oil Reservoir should be under atmospheric condition at all times.

Troubleshooting

Condition	Possible Cause	Corrective Action
Shaft seal leaks.	Seal is worn.	Replace seal.
Valve leaks excessively from one side of the disc to the other.	Foreign matter caught between disc and seat.	Fully open valve to remove object.
	Disc seat is worn or damaged.	Replace disc seat.
Valve leaks at flange joint.	Loose flange bolting.	Tighten flange bolting.
	Blown flange gasket.	Replace flange gasket.
	Miss-alignment or damage to field piping and supports.	Adjust miss-alignment or repair piping or supports.
	Damaged flange face/s or improper flange connections.	Repair flange, replace valve body or adjust flange connections.
Valve does not fully close.	Object is wedged between seat and disc.	Fully open valve to remove object.

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