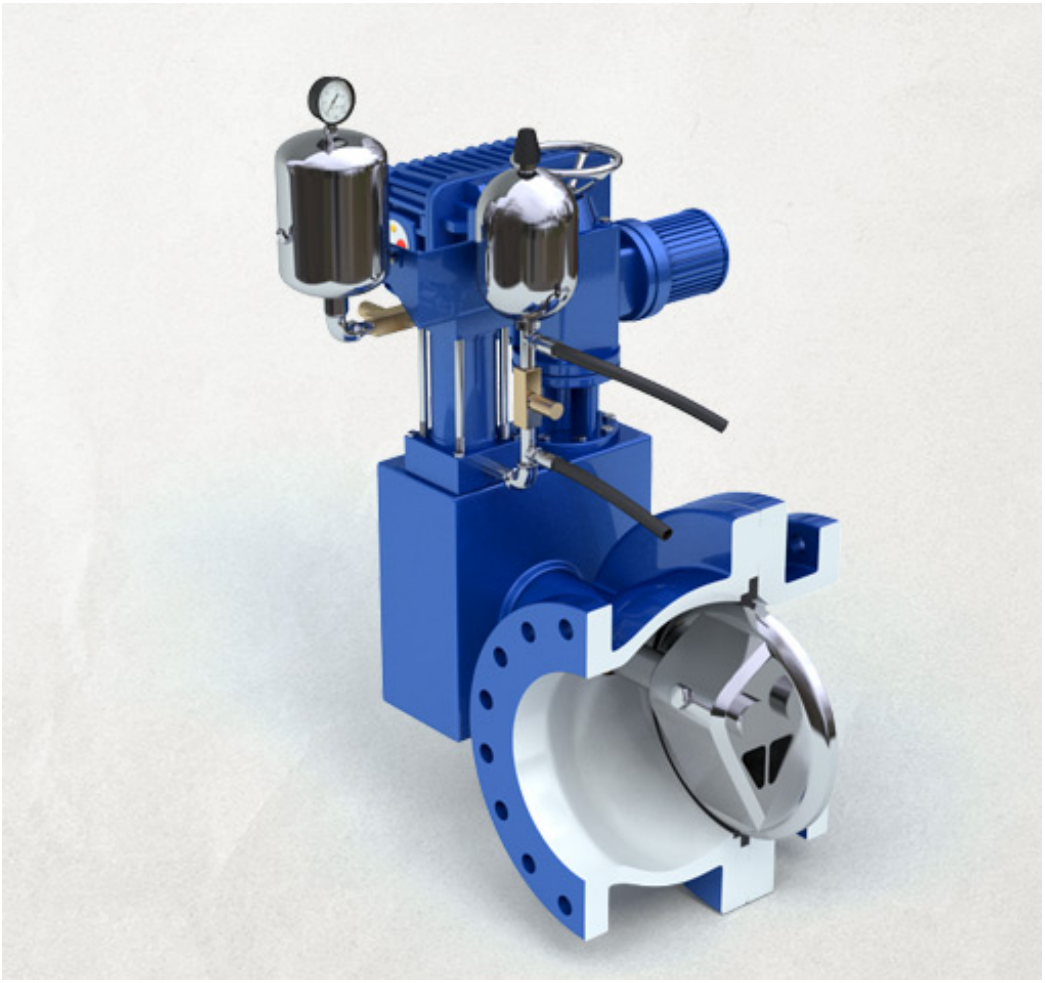
DeZURIK

APCO CAC-8000 AUTOMATIC CONTROL CHECK VALVE



Instruction **D12000**
December 2012

DeZURIK | APCO | HILTON | WILLAMETTE

Instructions

These instructions provide installation, operation and maintenance information for APCO CAC-8000 Automatic Control Check Valves. They are for use by personnel who are responsible for installation, operation and maintenance of APCO CAC-8000 Automatic Control Check Valves.

Safety Messages

All safety messages in the instructions are flagged with an exclamation symbol and the word Caution, Warning or Danger. These messages indicate procedures that must be followed exactly to avoid equipment damage, personal injury or death. Safety label(s) on the product indicate hazards that can cause equipment damage, personal injury or death.

Safety label(s) on the product indicate hazards that can cause equipment damage, personal 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 APCO CAC-8000 Automatic Control Check Valve has been packaged to provide protection during shipment; however, it can be damaged in transport. Carefully inspect the unit for damage upon arrival and file a claim with the carrier if damage is apparent.

Electric Motor Operation and Maintenance Manual

Consult the Electric Motor Operation and Maintenance Manual for the motor installed on this unit. This manual is shipped on the valve from the factory. It is located inside the door of the electric actuator or attached to the door handle. If you cannot locate the manual, consult factory or local DeZURIK Representative for replacement manual.

Parts

Recommended spare parts are listed on the assembly drawing. These parts should be stocked to minimize downtime. Order parts from your local DeZURIK sales representative, or directly from DeZURIK. When ordering parts please choose from the following:

If the valve has a DeZURIK APCO nameplate please include the 7-digit part number and 4-digit revision number (example: 9999999R000) located on the data plate 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 nameplate visible on the valve, please include Valve Model number, the part name, and item number from the assembly drawing. You may contact your local DeZURIK APCO Representative to help you identify your valve.

DeZURIK Service

DeZURIK service personnel are available to install, 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 www.dezurik.com.

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Description

APCO CAC-8000 Automatic control check valves are multi-purpose valve, offering the Engineer a new approach to pump discharge control. These valves combine the functions of flow control, check valve, shut-off valve and reverse flow in a single unit. Available in a wide range of materials and sizes, APCO CAC-8000 Automatic Control Check Valves are ideally suited for automatically controlled water pumping stations. Design and operation is simple and understandable. Any maintenance required can be handled by Municipal operating personnel – including – eventual seat replacement and the valve **need not be removed** from the line.

APCO CAC-8000 Automatic Control Check Valves are more efficient than valves of conventional design because of their multi-purpose functions. As a result, system design is simplified. Also, the full flow Globe body compensates for the area occupied by the disc, greatly minimizing the head loss thru the flow section of the valve.

APCO CAC-8000 Automatic Control Check Valves save power costs due to the smooth flow area and valuable space in the Pump House due to their multi-purpose functions.

Handling

Lifting the valve improperly may damage it. Do not fasten lifting devices to the actuator, disc 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.

Maintenance

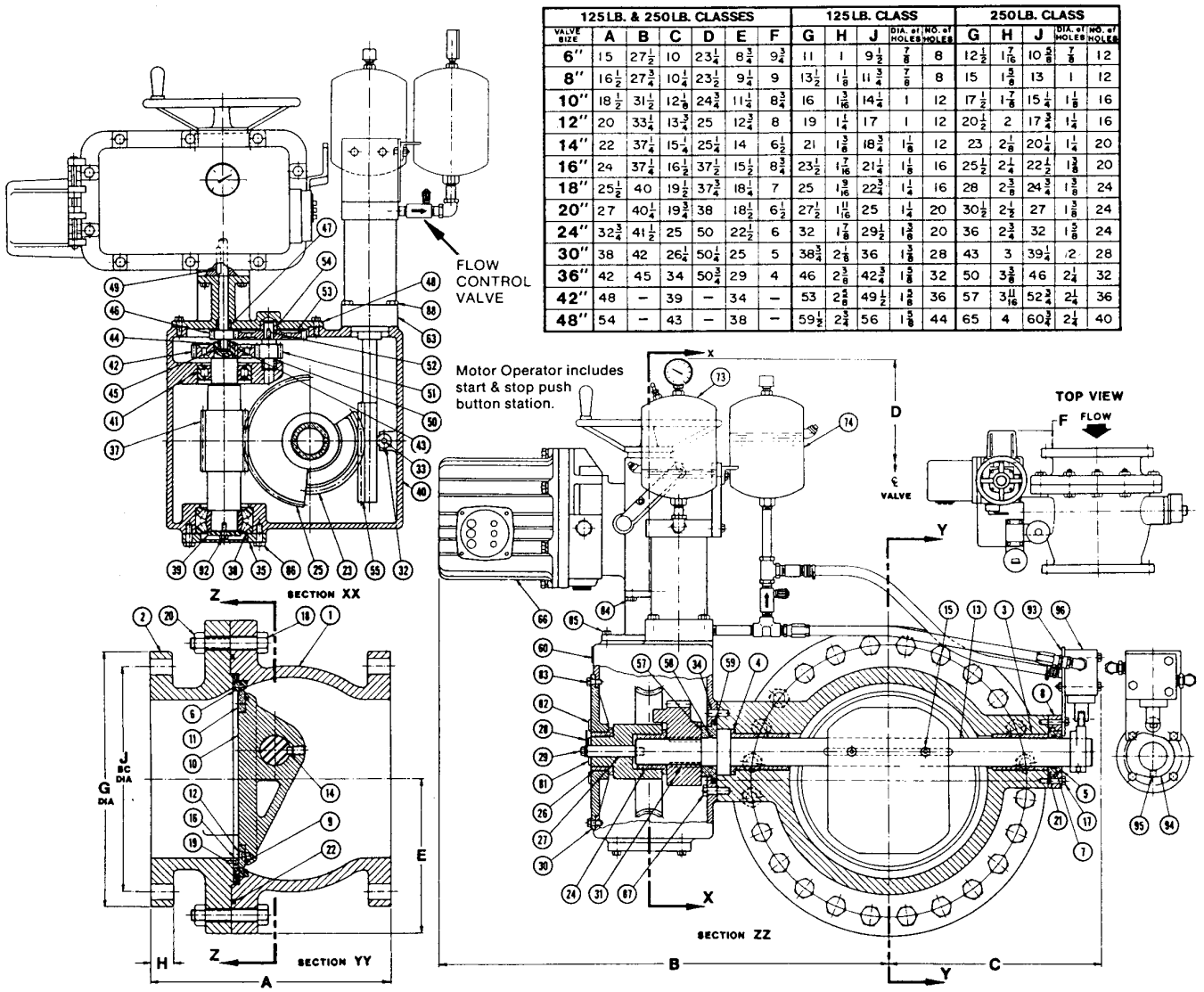
The use of high quality materials of construction makes this valve practically maintenance free. A periodic inspection and possible greasing of the gearing inside the box, perhaps once a year, is all that is needed to keep the mechanism in good operating condition. Removing the cover (#30) will provide access to all the internal moving parts of the gear box. Additionally the reservoirs should be checked for correct oil levels and air pressure and the various piping around the valve inspected for oil leaks.

Fusion/Powder Coated Valves

CAUTION!

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.

Drawings



125 LB. & 250 LB. CLASSES							125 LB. CLASS					250 LB. CLASS				
VALVE SIZE	A	B	C	D	E	F	G	H	J	DIA. of HOLES	NO. of HOLES	G	H	J	DIA. of HOLES	NO. of HOLES
6"	15	27 1/2	10	23 1/4	8 3/4	9 3/4	11	1	9 1/2	7/8	8	12 1/2	1 7/16	10 5/8	7/8	12
8"	16 1/2	27 3/4	10 1/4	23 1/2	9 1/4	9	13 1/2	1 1/8	11 3/4	7/8	8	15	1 5/8	13	1	12
10"	18 1/2	31 1/2	12 1/8	24 3/4	11 1/4	8 3/4	16	1 3/16	14 1/4	1	12	17 1/2	1 7/8	15 1/4	1 1/8	16
12"	20	33 1/4	13 3/4	25	12 3/4	8	19	1 1/4	17	1	12	20 1/2	2	17 3/4	1 1/4	16
14"	22	37 1/4	15 1/4	25 1/4	14	6 1/2	21	1 3/8	18 3/4	1 1/8	12	23	2 1/8	20 1/4	1 1/4	20
16"	24	37 1/4	16 1/2	37 1/2	15 1/2	8 3/4	23 1/2	1 7/16	21 1/4	1 1/8	16	25 1/2	2 1/4	22 1/2	1 3/8	20
18"	25 1/2	40	19 1/2	37 3/4	18 1/4	7	25	1 3/16	22 3/4	1 1/4	16	28	2 3/8	24 3/4	1 3/8	24
20"	27	40 1/4	19 3/4	38	18 1/2	6 1/2	27 1/2	1 11/16	25	1 1/4	20	30 1/2	2 1/2	27	1 3/8	24
24"	32 3/4	41 1/2	25	50	22 1/2	6	32	1 7/8	29 1/2	1 3/8	20	36	2 3/4	32	1 5/8	24
30"	38	42	26 1/4	50 1/4	25	5	38 3/4	2 1/8	36	1 3/8	28	43	3	39 1/4	2	28
36"	42	45	34	50 3/4	29	4	46	2 3/8	42 3/4	1 3/8	32	50	3 3/8	46	2 1/4	32
42"	48	–	39	–	34	–	53	2 5/8	49 1/2	1 3/8	36	57	3 11/16	52 3/4	2 1/4	36
48"	54	–	43	–	38	–	59 1/2	2 3/4	56	1 5/8	44	65	4	60 3/4	2 1/4	40

DET.	DESCRIPTION	DET.	DESCRIPTION	DET.	DESCRIPTION	DET.	DESCRIPTION
1	Body Pivot Half	20	Flange Nut	40	Gear Housing	60	Name Plate
2	Valve Body Half	21	Pivot Shaft Cover Seal	41	Worm Shaft Radial Bearing	63	Dashpot Cylinder
3	Straight Pivot Bushing	22	Flange Seal	42	2nd Reduction Radial Bearing	66	Motor Operator
4	Flanged Pivot Bushing	23	Gear Segment	43	2nd Reduction Spur Gear Key	73	Hydro-Pneumatic Accumulator
5	Pivot Shaft Seal Retainer	24	Wormwheel Internal Bushing	44	Spur Gear Retaining Ring	74	Oil Reservoir
6	Body Seat Ring w/Reinforcing Ring	25	Wormwheel	45	Drive Pinion Shaft Bottom Bushing	81	Control Position Indicator
7	Pivot Shaft End Seal	26	Wormwheel External Bushing	46	Drive Pinion Shaft	82	Dial
8	Pivot Shaft Cover	27	Indicator Shaft	47	Drive Pinion Shaft Top Bushing	83	Wormwheel Cover Bolt
9	Disc Ring Seal	28	Disc Position Indicator	48	Top Cover Plate	84	Operator Mounting Bolt
10	Disc	29	Disc Position Indicator Set Screw	49	Operator Key	85	Gear Housing Top Cover Bolt
11	Disc Ring	30	Wormwheel Cover	50	Pinion Shaft Bottom Bushing	86	Wormshaft Cover Bolt
12	Disc Ring Retaining Screw	31	Gear Segment Key	51	Pinion Shaft	87	Gear Housing Retaining Bolt
13	Pivot Shaft	32	Rack Roller	52	1st Reduction Spur Gear Key	88	Dashpot Retaining Bolt
14	Pivot Shaft Key	33	Rack Roller Shaft	53	1st Reduction Spur Gear	92	Thrust Bearing Lock Screw
15	Pivot Shaft Set Screw	34	Gear Housing Polarizing Pin	54	Pinion Shaft Top Bushing	93	Timing Valve Bracket
16	Disc Stop	35	Worm Shaft Cover	55	Rack	94	Timing Valve Cam
17	Pivot Shaft Cover Bolt	37	Worm Shaft	57	Pivot Shaft Thrust Bearing	95	Cam Set Screw
18	Flange Bolt	38	Worm Shaft Thrust Bearing	58	Pivot Shaft Seal	96	Timing Valve
19	Disc Stop Retaining Screw	39	Thrust Bearing Lock Washer	59	Pivot Shaft Thrust Bearing Seal		

Figure 1: CAC-8000 Automatic Control Check Valve with Motor Operator

Operation

Check Valve Function

The gap between the contact surfaces of the wormwheel and gear segment is called the “slip gear travel”. This slip gear allows the check valve feature to function. Operating as a Check Valve the dashpot cylinder assembly fully controls disc movement with the adjustability to open/close timing to suit the installation, thereby controlling the pressure surges and water hammer. The dashpot has three adjustable controlling stages:

1. The primary control is the Timing Valve (#96).
2. The secondary control is the Flow Control Valve (No. 64, Fig. 2).
3. The third controlling stage is located in the cylinder and provides additional control over the last 10% of disc travel. The top Flow Control Valve controls rate of opening while the bottom one controls rate of closing. The dashpot cylinder is self-contained and uses oil as a controlling media, creating a completely closed system which eliminates potential problems of corrosion, electrolysis and mineral deposits, all too often present in water operated dashpots.

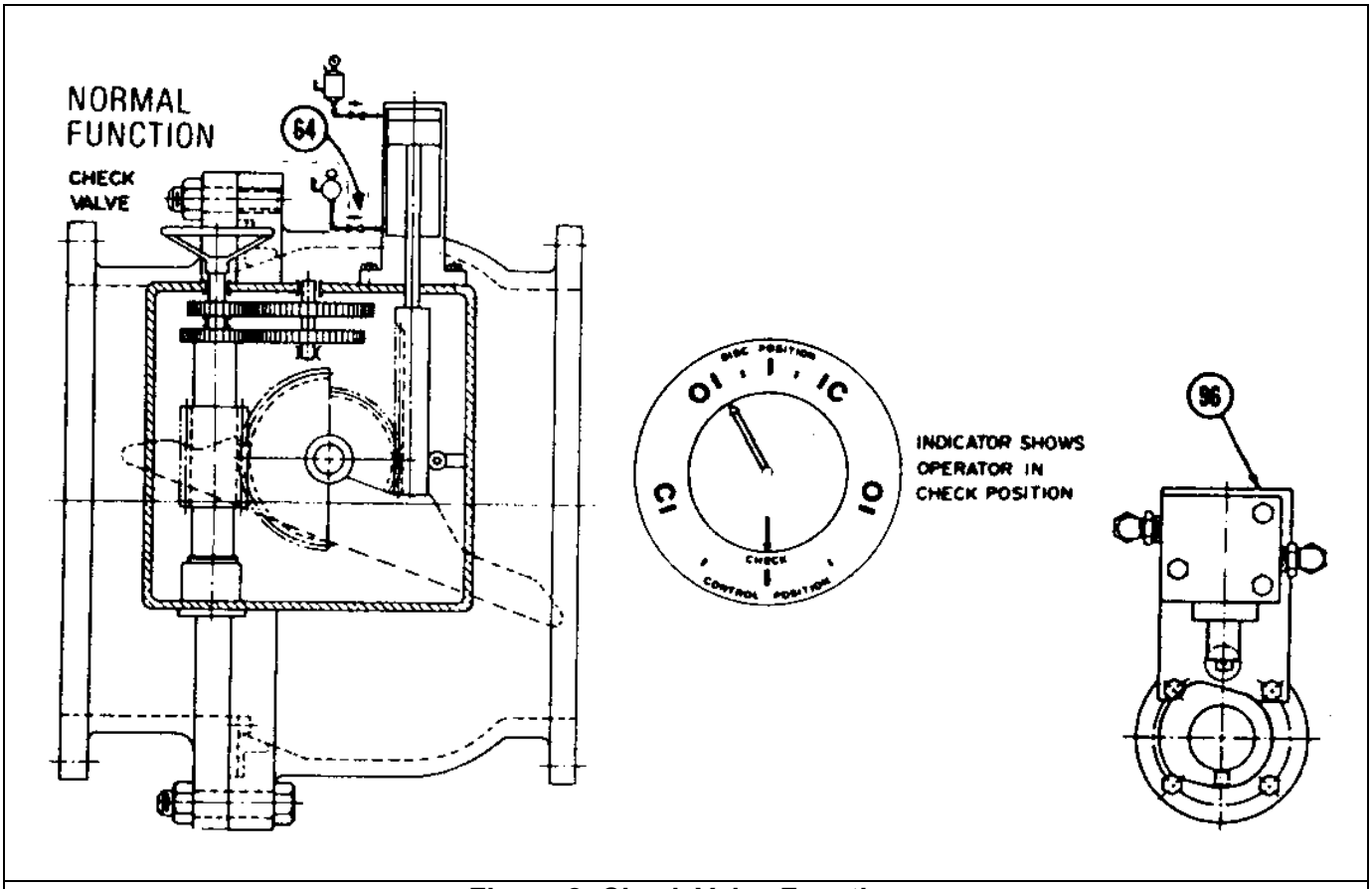


Figure 2: Check Valve Function

Flow Control (Throttling) Function

The valve can be set to function as a Flow Control Valve in the normal flow direction as in Figure 3 or as a Flow Control Valve in the reverse direction as in Figure 4. This is attainable by positioning the wormwheel in the desired position as in Figure 3, the disc is free to move from set position to fully closed, therefore still able to perform as a check valve. However, when set to function as a back flow control valve as in Figure 4, the disc is free to move from the set position to full open.

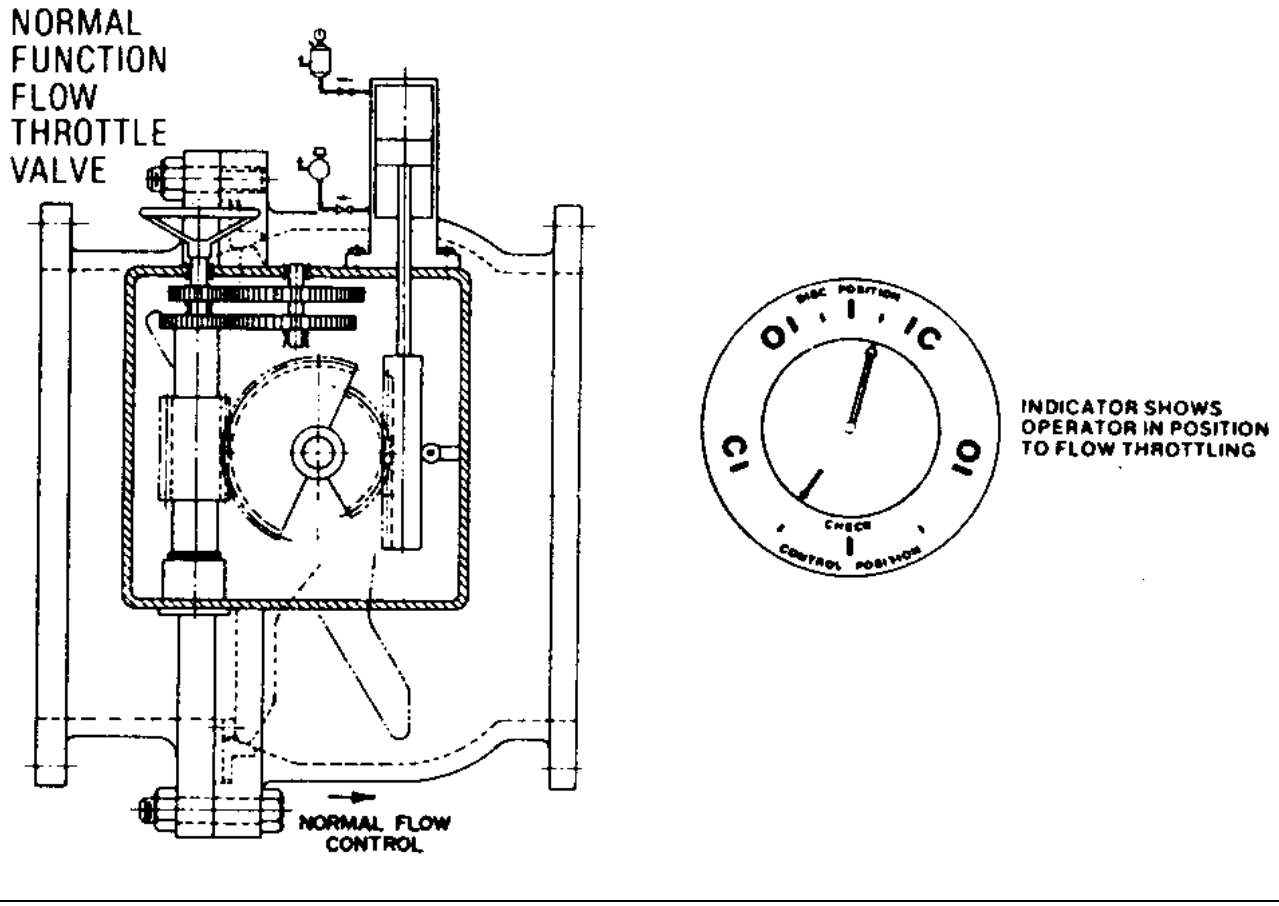


Figure 3: Normal Function Flow Throttle Valve

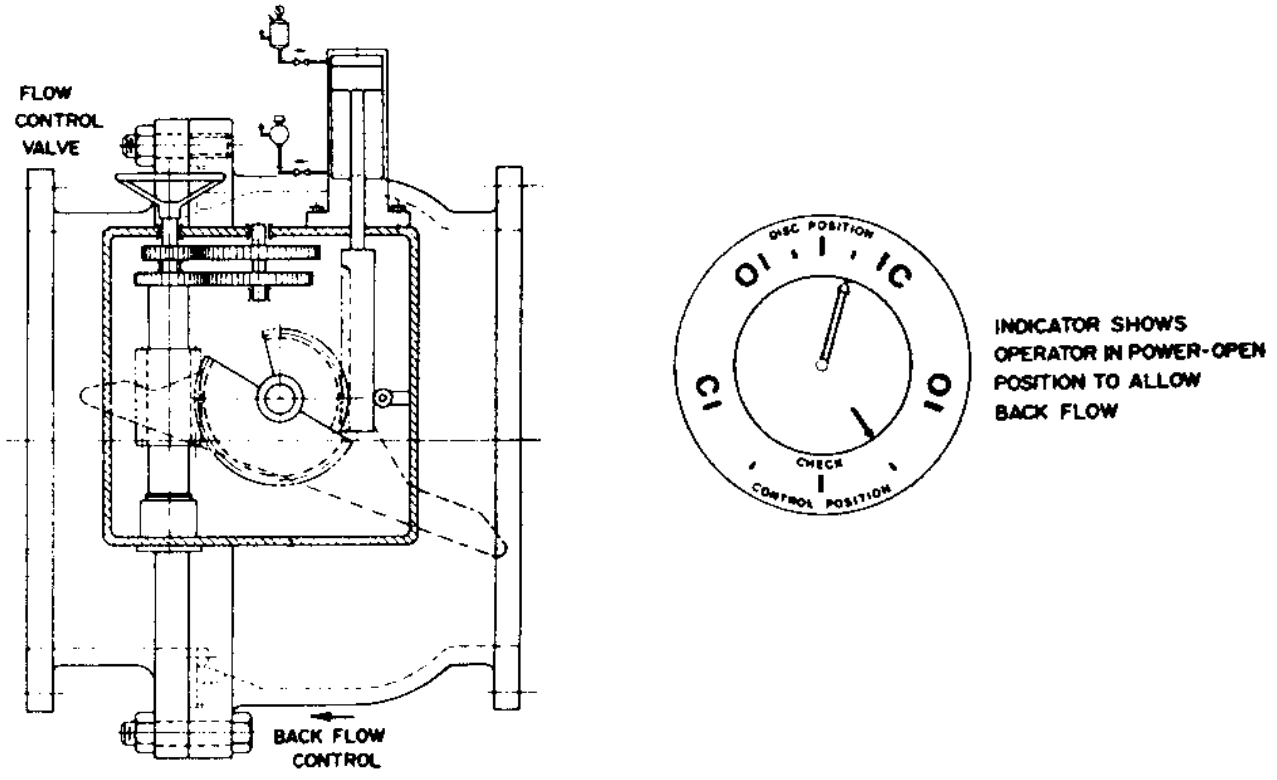
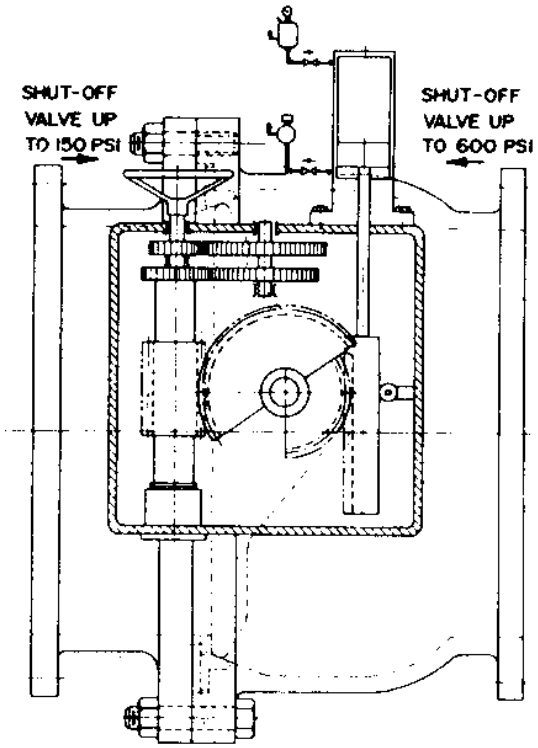
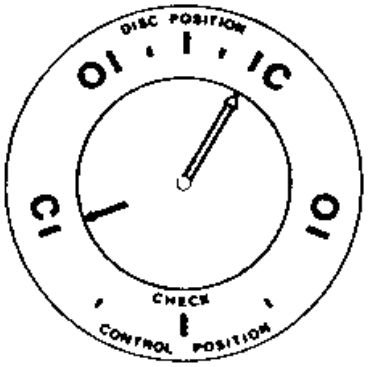


Figure 4: Back Flow Control in Reverse Direction

Shut-Off Function

The ability to function as a shut-off valve is shown in Figure 5. The Valve disc is tightly closed when the wormwheel is rotated clockwise to its closed position. In this position the wormwheel has locked the segment gear and disc in the closed position and the disc cannot move regardless of pressure or any changes in pressure on either side of the disc. The factor of pressure tightness as noted on the normal flow side of the disc in Figure 5 (150 psi) is in reality a pressure differential factor. In other words, if the pressure in the reverse flow direction against the disc is 100 psi, a pressure of 250 psi on the normal flow side of the disc would be held.





INDICATOR SHOWS OPERATOR IN POWER-CLOSED POSITION

Figure 5: Shut-off Function

Drain Valve Function

See “Flow Control (Throttling) Function” Figure 4.

Start-up Procedure

1. Observe Disc Position Indicator to be sure the disc inside the valve is fully closed and the Hydro-pneumatic and Oil Reservoir tanks are in a vertical position. Check oil levels in these tanks and fill, if necessary, up to the street elbow level located on the side of the tank with oil. See "Oil Filling Procedure".

   Note: The oil reservoir tank has a ¼" pipe plug in the top for shipping purposes only. Remove this plug and screw in the ¼" Air Breather Cap (taped to the piping) to maintain the tank at atmospheric pressure at all times.

2. Open each Flow Control Valve (#64) adjacent to the Cylinder (#63) as follows:

   a. Open the top Flow Control Valve which controls the rate of opening, 4 turns counter-clockwise from fully closed.

   b. Open the bottom Flow Control Valve which controls the rate of closing, **only** 2½ turns counter-clockwise from fully closed position. See "Adjustment of Flow Control Valve".

3. Turn Cushion Adjustment Screw, in the rod end of cylinder, 1½ turns counter-clockwise from fully closed position. See "Operation of Internal Cushion".

4. Set Timing Valve Cam (#94) so that the arrow on Cam is pointing to the center line of the Timing Valve Roller while the disc is in the closed position. See "Timing Valve Operation".

5. Manually or electrically turn the Slip Gear Operator, to set the Disc Position Indicator in the check position. See "All Telling Indicator".

6. Pressurize Hydro-pneumatic Tank to 15 psi for first tests.

   Note: At this point pumps may be started, but **first** throttle the gate or butterfly valve downstream of the APCO Automatic Control Check Valve to 75% closed to minimize full column reversal on pump stop.

7. Start pump and observe rate of disc opening time.

8. Stop pump and observe rate of disc closing time.

9. Repeat above trial runs and make necessary adjustments to Timing Valve, Flow Control Valve and Cylinder Cushion to establish smooth three stage closure. Additionally during this sequence of pump start and stops gradually open the gate or butterfly valve downstream of the APCO Automatic Control Check Valve until it is fully open.

10. When a shutdown sequence is established resulting in a closure of the disc without excessive pressure surge or check or shock, lock each Flow Control Valve knob in place; lock the set screws on the Timing Valve Cam in place to prevent tampering of setting.

Oil Filling Procedure (dashpot piping partially drained of oil)

Use “Mobil” DTE 24, Motor oil SAE 20 or Industrial oil #31.

1. Shut down pump.
2. Relieve Hydro-Pneumatic tank of any pressure, NOTE PRESSURE READING!
3. Make note of the setting of each Flow Control Valve, and then fully open each one to permit filling the piping solid with oil.
4. Manually lift roller of the Timing Valve (#96) and hold in that position until Step 6.
5. Remove piping plugs in street elbows located on the side of the Hydro-Pneumatic tank and Oil Reservoir and fill each tank **slowly** until oil level in the street elbow is visible, then replace pipe plugs. DO NOT OVERFILL!
6. Release Cam Follower and re-set Flow Control Valves to original settings noted in step 3.
7. Re-pressurize the Hydro-Pneumatic tank to 15 psi or original pressure setting noted in step 2, with a tire pump.

Oil Filling Procedure (dashpot piping completely drained of oil)

Follow steps 1 thru 5 above.

6. Loosen the 4 dashpot retaining bolts (#88) to allow the cylinder to be lifted approximately 3/8” from its’ mounting.
7. Manually lift dashpot cylinder or with the use of a tire pump, pressurize the Hydro-pneumatic tank until the piston bottoms to the rod end of the cylinder. The cylinder head should move approximately ¼” away from gear box.
8. Fill Oil Reservoir tank to proper level then replace pipe plug.
9. Relieve Hydro-pneumatic tank of air pressure and re-tighten 4 dashpot retaining bolts (#88).
10. Release Cam Follower and re-set Flow Control Valves to original settings, noted in step 3.
11. Re-pressurize Hydro-pneumatic tank to 15 psi with a tire pump.

    Note: Before starting the pump, it is essential the APCO CAC-8000 Automatic Control Check Valve be manually or electrically opened and closed a few time to ensure the release of any entrapped air in the oil system. Check oil levels and refill, if necessary. LACK OF OIL OR PRESSENCE OF ENTRAPPED AIR IN PIPING SYSTEM CAN CAUSE ERRATIC OPERATION OR SEVERE SLAM OF THE VALVE.

Timing Valve Operation

The Timing Valve is an extremely reliable and convenient means to automatically open or close the oil passage. The built-in roller is activated by the Timing Valve Cam, causing a resultant movement of the Timing Valve stem to open or close the oil passage. The Timing Valve is closed when the roller is fully extended and it is open when the roller is depressed as illustrated in Figure 6.

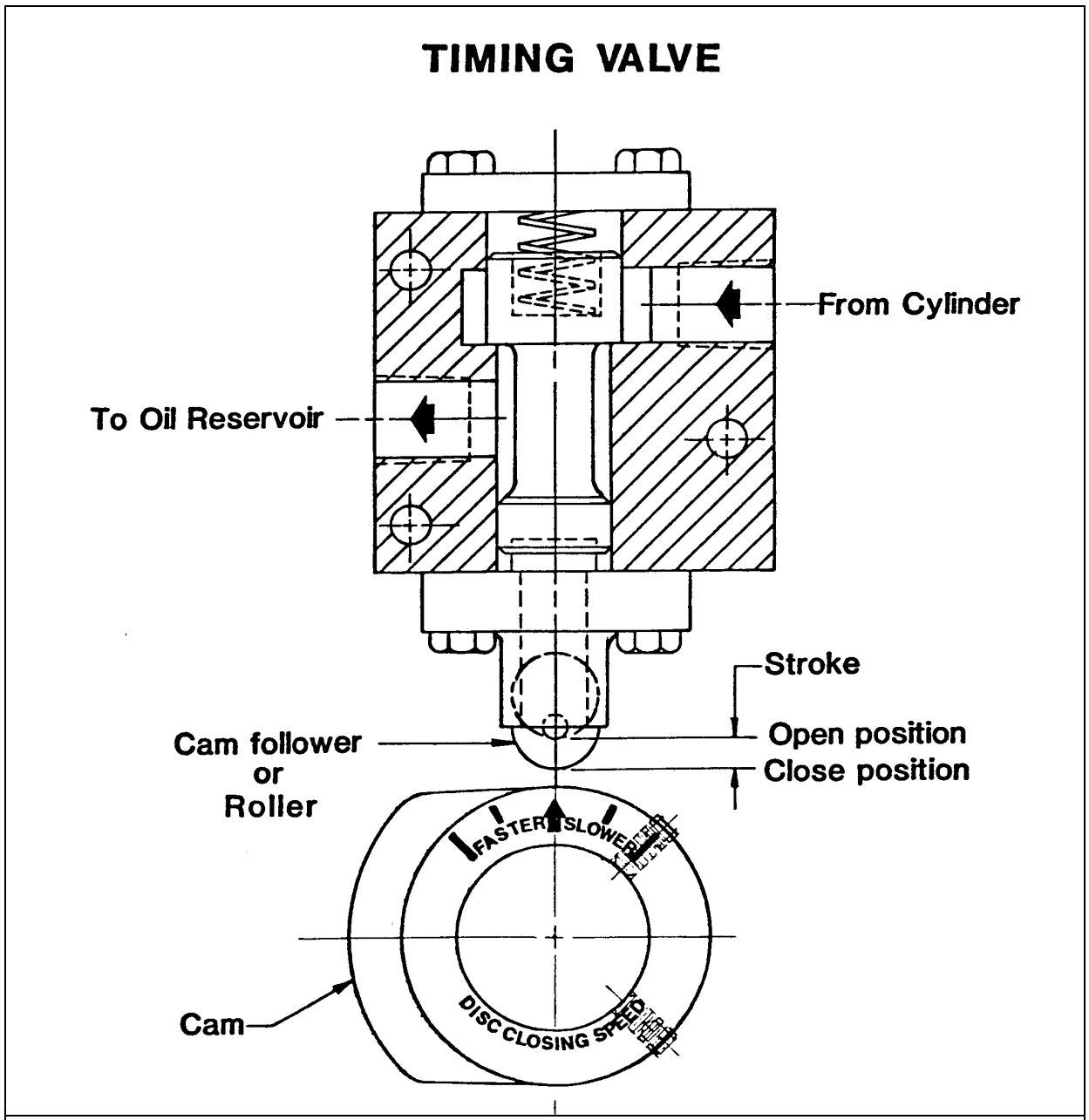


Figure 6: Timing Valve

Timing Valve Operation (continued)

The Timing Valve Roller when depressed permits oil to flow directly from the Dashpot Cylinder (#63) to the atmospheric Oil Reservoir, bypassing the Flow Control Valve (#64). The unrestricted flow of oil allows virtually instant movement of the piston – hence, extremely rapid closure of the Control Valve Disc (#10). The time period of disc closure is achieved by setting the distance between the Timing Valve Cam and the Timing Valve Roller closer or further apart from points of contact. Turning the cam clockwise will increase the distance and hence the time period of contact between the cam roller and the cam, thus permitting the disc to close at a very fast rate from its full open position toward the direction of closure. Conversely, turning the cam counter-clockwise will decrease the time period and distances between contact points of the cam and cam roller, thus permitting the disc to close slower from the open position toward closure. Alternately, if the cam and cam follower are adjusted so as not to make contact with each other, the secondary control which is the Flow Control Valve will control the disc movement from full open to 90% closed.

Slip Gear

The gap between the contact surfaces of the wormwheel and the gear segment is the Slip Gear (see figure 7). This Slip Gear feature allows the valve to operate as a check valve within this gap. Operating as a check valve, the dashpot cylinder system fully controls disc movement during either the opening or closing cycle. The dashpot cylinder system has 3 control stages:

1. Primary Control – Timing Valve (#96) controls the first stage of disc travel.

2. Secondary Control – Flow Control Valve (#64) controls the second stage.

3. Third Control – Built into the bottom cylinder cap, provides the final stage closure of the disc to shut-off.

The top Flow Control Valve (#64) controls rate of opening of main valve while the bottom control valve (#64) controls the rate of closing.

The dashpot cylinder system is self-contained. Oil is the controlling media to create a closed system preventing problems or corrosion, electrolysis and mineral deposits, as results with water operated dashpots.

All Telling Indicator

The top half of the indicator shows various disc positions. The lower half shows various control positions (actual position of wormwheel). The two pointers move independently of each other. The longer arrow points to the disc position, is directly connected to the shaft. The shorter arrow is mounted on the wormwheel, which rotates freely on the shaft. See Figure 8.

Referring to the control position indicator (lower half), the distance from “check” to “C” is the power close travel, meaning the valve will control flow in the normal direction, but has the ability to freely close, if there is a reversal flow. The distance from “check” to “O” is the power open travel, meaning the wormwheel will force the disc to open, thereby controlling flow in the reverse direction.

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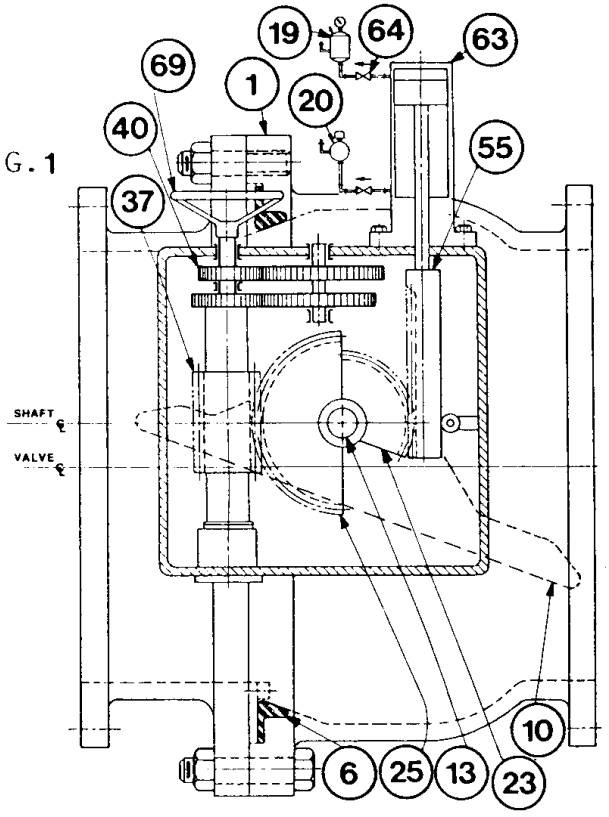
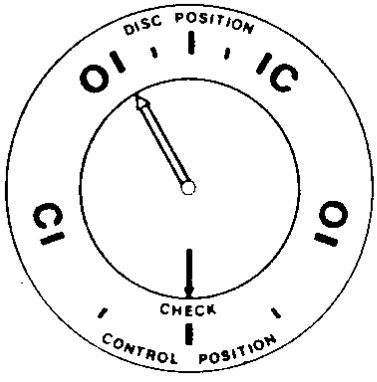
55	RACK
63	DASHPOT CYLINDER
64	FLOW CONTROL VALVES (2)
69	HANDWHEEL OR MOTOR OPERATOR

FIG. 1



SECTION THRU SLIP GEAR OPERATOR

Figure 7: Slip Gear Illustration



GRADUATED INDICATOR

Figure 8: All Telling Indicator

Adjustment of Flow Control Valves

The Flow Control Valve has a micrometer type adjustment which incorporates a color coded reference scale to simplify setting, resetting and adjusting. See Figure 9.

A lock nut is provided for locking the valve setting. Turning the valve clockwise closes the valve and turning counter-clockwise opens the valve and increases rate of closure of the check valve.

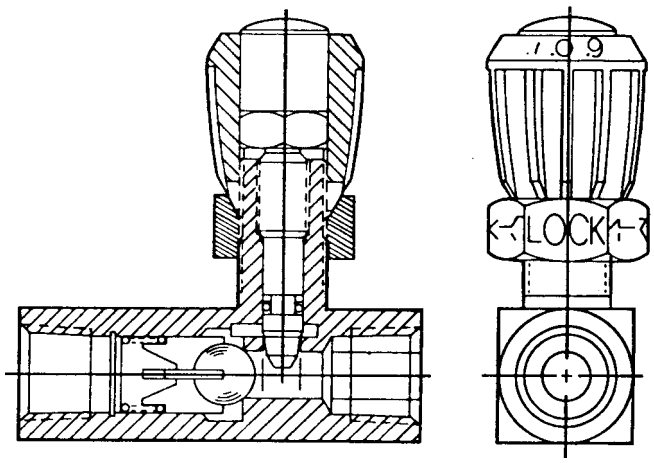


Figure 9: Flow Control Valve

Operation of Internal Cushions

The cushioning of a hydraulic cylinder stroke is obtained by trapping the exhaust fluid as the piston assembly nears the end of its stroke. In Figure 10: As the Cushion Plunger (1) enters cushion cavity (2) the exhaust fluid is almost completely trapped by the Ball Check (3) and the Adjusting Screw (4), creating a back pressure against Piston Assembly. The back pressure cushions and slows the final part of the piston stroke, thus, reducing the high impact hammering of the Piston Assembly against the cylinder cap. Turning the Adjusting Screw (4) to allow more or less fluid to escape regulates the degree of cushioning as desired.

In Figure 11: When pressurized fluid enters the Cylinder Cap End to stroke the Piston Assembly in the opposite direction, the pressure fluid moves the ball check (3) off its seat, opening the passage for more fluid to act against the piston, thus speeding its start-up movement as the Cushion Plunger (1) is immediately forced out of its cavity (2).

Operation of Internal Cushions (Continued)

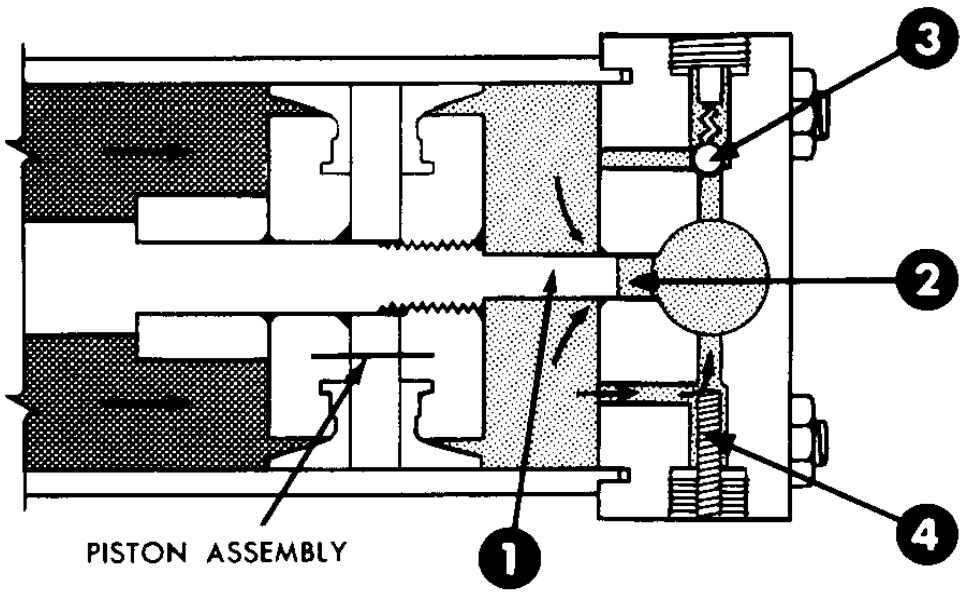


Figure 10: Cushion "IN"

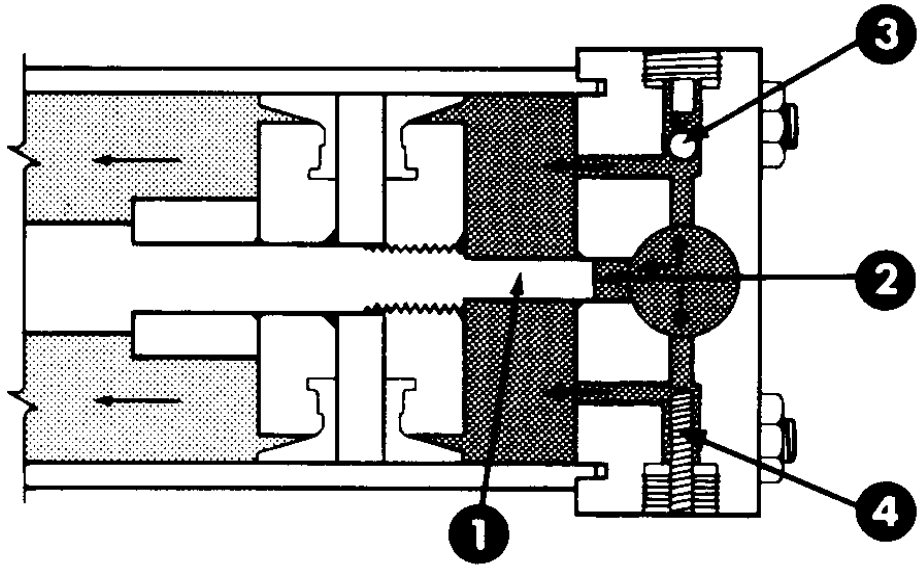


Figure 11: Cushion "Out"

Guarantee

Products, auxiliaries and parts thereof of DeZURIK, Inc. manufacture are warranted to the original purchaser for a period of twenty-four (24) months from date of shipment from factory, against defective workmanship and material, but only if properly installed, operated and serviced in accordance with DeZURIK, Inc. recommendations. Repair or replacement, at our option, for items of DeZURIK, Inc. manufacture will be made free of charge, (FOB) our facility with removal, transportation and installation at your cost, if proved to be defective within such time, and this is your sole remedy with respect to such products. Equipment or parts manufactured by others but furnished by DeZURIK, Inc. will be repaired or replaced, but only to the extent provided in and honored by the original manufacturers warranty to DeZURIK, Inc., in each case subject to the limitations contained therein. No claim for transportation, labor or special or consequential damages or any other loss, cost or damage shall be allowed. You shall be solely responsible for determining suitability for use and in no event shall DeZURIK, Inc. be liable in this respect. DeZURIK, Inc. does not guarantee resistance to corrosion, erosion, abrasion or other sources of failure, nor does DeZURIK, Inc. guarantee a minimum length of service. Your failure to give written notice to us of any alleged defect under this warranty within twenty (20) days of its discovery, or attempts by someone other than DeZURIK, Inc. or its authorized representatives to remedy the alleged defects therein, or failure to return product or parts for repair or replacement as herein provided, or failure to install and operate said products and parts according to instructions furnished by DeZURIK, Inc., or misuse, modification, abuse or alteration of such product, accident, fire, flood or other Act of God, or failure to pay entire contract price when due shall be a waiver by you of all rights under this warranty.

The foregoing guarantee shall be null and void if, after shipment from our factory, the item is modified in any way or a component of another manufacturer, such as but not limited to, an actuator is attached to the item by anyone other than DeZURIK, Inc. Factory Service personnel. All orders accepted shall be deemed accepted subject to this limited warranty, which shall be exclusive of any other or previous Warranty, and this shall be the only effective guarantee or warranty binding on DeZURIK, Inc., despite anything to the contrary contained in the purchase order or represented by any agent or employee of DeZURIK, Inc., in writing or otherwise, notwithstanding, including but not limited to implied warranties.

Metric fasteners should not be used with ASME Class 150/300 bolt holes and flange bolt patterns. If you use metric fasteners with ASME Class 150/300 bolt holes and flange bolt patterns, it may lead to product failure, injury, and loss of life. DeZURIK Inc. disclaims all liability associated with the use of metric fasteners with ASME Class 150/300 bolt holes and flange patterns, including but not limited to personal injury, loss of life, loss of product, production time, equipment, property damage, lost profits, consequential damages of any kind and environment damage and/or cleanup. Use of metric fasteners with ASME Class 150/300 bolt holes and flange bolt patterns is a misuse that voids all warranties and contractual assurances. If you use metric fasteners with ASME Class 150/300 bolt holes and flange bolt patterns, you do so at your sole risk and any liability associated with such use shall not be the responsibility of DeZURIK, Inc. In addition to the foregoing, DeZURIK's Manufacturer's Conditions apply.

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Limitation of liability

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Sales and Service

For information about our worldwide locations, approvals, certifications and local representative:

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Printed in U.S.A.