

OPERATION AND MAINTENANCE MANUAL

12” to 20” Differential Piston Main Valves

Drawings D-1027, D-1036, G-1031, G-1052, G-1054, G-1064

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WARNING: Cancer and Reproductive Harm – www.Prop65Warnings.ca.gov

INSTALLATION, OPERATION and MAINTENANCE

12" to 20" Differential Piston Main Valve

INTRODUCTION

This manual provides information about the operation and proper maintenance of standard GA Industries differential piston main valves. The main valve is an integral part of all GA Industries differential piston pilot-operated control valve. The valve is ruggedly constructed to provide many decades of dependable service with minimal maintenance.

CAUTION

The valve is NOT recommended for use with toxic, corrosive, or flammable fluids.

The Shop Order (SO) Number, Figure Number, size and pressure rating are stamped on a nameplate attached to the valve. Please refer to the SO number when ordering parts.

DESCRIPTION OF OPERATION

The operation of the main valve is controlled by the pilot system which automatically closes, opens or throttles the main valve. The main valve consists on one moving part, the piston. Applying inlet pressure to the underside of the piston creates an opening force but simultaneously applying it to the larger area on top of the piston creates a greater closing force. Thus, applying inlet pressure to the top of the piston closes the main valve (Figure 1) while exhausting it from the top opens the main valve (Figure 2).

A regulating pilot controls the pressure applied to the top of the piston so that the opening and closing forces are balanced and the main valve is in a partially open, "throttled" position to control pressure level or flow (Figure 3).

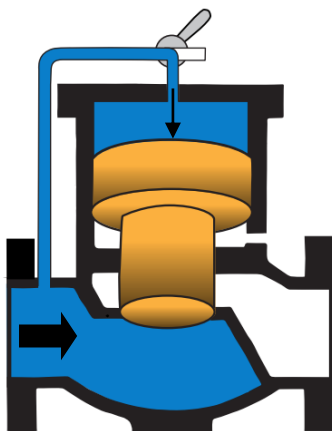


Figure 1. Valve Closed

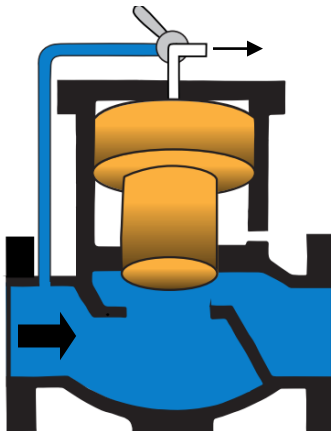


Figure 2. Valve Open

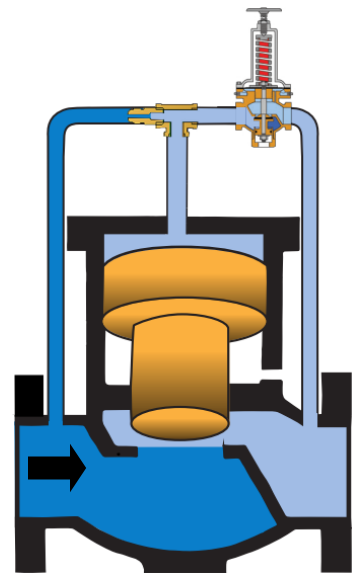


Figure 3. Valve Throttling

TYPES OF DIFFERENTIAL PISTON MAIN VALVES

There are two basic types of differential piston main valves: Water Service and Reducing Service. While there are exceptions, water service main valves are typically used in GA Industries pilot-operated control valves that perform an "open/close" (non-throttling) function (e.g., pump control, altitude, surge relief, solenoid) and reducing service main valves are typically used in GA Industries pilot-operated control

valves that regulate or throttle (e.g., pressure reducing, pressure sustaining, flow control). The parts for water service main valves are different than for reducing service so it's important to know the type of main valve.

To aid in identifying, Table 1 lists the diameter of the top of the piston or the factory can identify which type by the valve's serial (SO) number

Table 1 Top of Piston Diameter

SIZE	Water Service	Reducing Service
12"	15"	12.75"
14"	19"	15"
16"	21.75"	17"
18"	24.75"	21.25"
20"	24.75"	21.25"

Most GA Industries differential piston main valves incorporate a 1-piece piston. Some main valves are supplied with optional 2-piece "stop-check" piston (Figure 4). If the valve is open and there is a pressure reversal, the bottom part of the piston (the "baffle") drops and checks to prevent back flow through the valve.

The "stop-check" piston can be supplied in both water service and reducing service main valves.

Repair procedures and parts (except for the piston, baffle, and indicator rod) are the same whether a 1-piece or 2-piece piston.



Figure 4

RECEIVING AND STORAGE

Inspect the valve upon receipt for damage during shipment. Carefully unload all valves to the ground without dropping.

Valves should remain in a clean, dry, and weather protected area until installed. After completion of shop testing the valve is drained of the test water but a small residual amount could remain so the valve should be protected from freezing during storage.

INSTALLATION

Figure Numbers suffixed with "D" indicate the valve has ANSI Class 125 flanged connections, Figure Numbers suffixed with "U" indicate the valve has ANSI Class 250 flanged connections.

GA Industries differential piston globe body main valves have the inlet and outlet connections in line while angle body main valves have the inlet and outlet connections 90 degrees apart.

Install the valve in the proper flow direction noting the "INLET" tag on the valve.

The valve is configured to be installed in the orientation specified by the engineer. Consult the drawings of record to verify the valve is installed in the proper orientation.

Prior to installation ensure all debris, packing material or other foreign material has been removed from both ports.

If installed outdoors, below ground in a vault or in an unheated area, adequate freeze protection must be provided.

Adequate isolating valves should be installed between the valve and the pipeline or system to facilitate maintenance.

The valve should be installed with sufficient clearance to permit maintenance and removal of internal components.

The valve is not designed to support adjacent equipment, piping loads should not be imposed on the valve and large valves should be properly supported. Ensure mating flanges are square and parallel to the valve flanges before tightening flange bolts.

Flat-faced flanged valves should be mated with flat-faced flanges and full-face gaskets. If ring gaskets are used the bolt material shall be ASTM A307 Grade B (or equivalent). Higher strength bolting should only be used with full-face gaskets.

Lower heavy valves using slings or chains around the valve body and/or the lifting eyes. DO NOT LIFT BY THE EXTERNAL PILOT PIPING. Lubricate the bolts or studs and insert around flange. Lightly tighten bolts until gaps are eliminated. Torque bolts in an alternating pattern in graduated steps. If leakage occurs wait 24 hours and re-torque the bolts but do not compress the gasket more than 50% or exceed bolt maximum torque rating.

MAIN VALVE CONSTRUCTION

The standard valve has a flanged cast iron body with a bolted cover. The piston and liner are made from bronze. The piston has a replaceable rubber seat, held in place by a brass or stainless steel follower ring and stainless steel screws. A brass or stainless steel visual position indicator is attached to the piston and extends through the valve cover through a packing gland. A brass or stainless steel vent tube protrudes from the side of the main valve.

Refer to Pages 5 to 7 for parts identification and location for each type of main valve.

START-UP

Refer to the Installation, Operation and Maintenance Manual for the start-up procedure applicable to the pilot-operated control valve being installed.

PREVENTATIVE MAINTENANCE

The differential piston main valve does not require routine lubrication or adjustments. After the initial start-up, periodic visual inspection is recommended.

Perform any additional preventative maintenance procedures as recommended in the Installation, Operation and Maintenance Manual for the pilot-operated control valve being installed.

TROUBLESHOOTING

SYMPTOM or PROBLEM	SOLUTION
Main valve will not open	
<ul style="list-style-type: none"> Water cannot exhaust from top of piston 	Check status of manual valves and electrical connection to solenoids (if any) in external pilot piping
<ul style="list-style-type: none"> Insufficient inlet pressure 	Ensure inlet isolating valve is open and there is at least 5 to 10 PSI inlet pressure present. Small sizes require 10 PSI, minimum decreases with size.
<ul style="list-style-type: none"> Vent tube blocked 	Ensure vent tube (22) is open to atmosphere
<ul style="list-style-type: none"> Indicator rod packing too tight 	Turn indicator gland (17) counterclockwise in quarter turn increments
Main valve will not close	
<ul style="list-style-type: none"> Inlet pressure cannot be applied to top of piston 	Check status of manual valves and electrical connection to solenoids (if any) in external pilot piping
<ul style="list-style-type: none"> Wye-strainer clogged 	Clean strainer
Leakage through main valve when closed	
<ul style="list-style-type: none"> Debris in valve 	Remove debris, inspect for damage
<ul style="list-style-type: none"> Worn or damaged seat ring (10) 	Inspect, replace
Excessive leakage through vent tube (slight or intermittent leakage is normal)	
<ul style="list-style-type: none"> Worn piston cup (4) and/or liner cup (7) 	Replace
<ul style="list-style-type: none"> Vent tube (22) loose or its threaded connection to liner (3) not sealed 	Connection into liner (3) must be leak tight. Tighten and/or apply thread sealant.
Excessive leakage past indicator rod (slight or intermittent leakage is normal)	
<ul style="list-style-type: none"> Indicator packing (18) worn or not sufficiently compressed 	Turn indicator gland (17) clockwise one quarter to one half turn. DO NOT OVERTIGHTEN. If leakage does not stop, replace indicator packing.

REPAIR PROCEDURES

GA Industries differential piston main valves are fully serviceable and repairable while the body remains bolted in the line. No special tools are required for normal repair. Due to the weight of the internal components, servicing large valves requires overhead lifting equipment.

Special care must be utilized when servicing differential piston main valves when installed such that the piston is in a horizontal position. Service can be more easily performed if large valves installed in this manner are first removed from the line.

Repair kits are available (see REPAIR KITS) and should be on hand before starting any repairs.

The valve should be disassembled only to the point necessary to perform the repair.

These repair procedures apply only to the main valve. External pilot piping should be removed prior to undertaking disassembly of the main valve. Adequate unions are provided in the control piping to facilitate removal.

CAUTION

Repairs should be conducted by skilled technicians who have read all instructions and are familiar with the equipment and associated drawings. Follow all safety procedures.

WARNING

Before starting repairs, ensure valve is isolated from the system and properly locked out and tagged to prevent accidental pressurization. Completely depressurize the valve before commencing work.

INSTALLING A 12" to 20" REPAIR KIT

- Remove indicator gland (17) and indicator packing (18)
- Scribe or mark an alignment line on the OD of the cover and the top flange of the valve body to ensure cover is properly aligned during assembly
- Remove cover bolts/nuts (14)
- Remove cover (13) lifting straight up to avoid damaging or bending the indicator rod (16)
- Remove cover gasket (15)
- Loosen indicator rod lock nut (20) and remove indicator rod (16).
- Make a mark across the top of the liner and body to permit alignment when the liner is replaced.
- Remove the vent tube gland (23), vent tube packing (24) and unscrew the vent tube (22)
- Remove piston (2). DO NOT use indicator rod to pull out the piston. If necessary, remove indicator rod bushing (19) and install 5/8-11 eyebolt to lift piston out of the valve (18" & 20" is 1"-14).
- Remove the piston cup follower screws (6), piston cup follower (5) and piston cup (4).
- Remove the seat ring (10) by removing the follower screws (12) and follower (11).
- Remove the liner (3), liner cup follower screws (9), liner cup follower (9) and liner cup (7).
- Using very fine wet or dry emery cloth, sand the large ID of the liner and the small OD of the piston

to shiny metal. Inspect for deep scoring or gouges on those surfaces that cannot be polished out. Consult factory for evaluation if unsure. See next section if new liner is needed.

14. Clean the top of the body (1) and liner (3) and the mating surfaces of the cover (13) of any gasket residue.
15. Install new liner cup (7) ensuring the lips are pointing into the valve. Install the liner cup follower (8) and screws (7) and tighten uniformly in an alternating pattern. Do not tighten so much as to deform the follower. Apply a very light coating of lightweight lubricant such as petroleum jelly.
16. Install assembled liner in valve body and align marks. Apply thread sealant to one end of the vent tube (23), install in threaded hole in liner and tighten. Install vent tube packing (24) by wrapping it around the vent tube and tamping it into the cavity until 2 or 3 internal threads are exposed. Cut off the excess. Install vent tube gland (23) and lightly tighten.
17. Install a new seat ring (10), follower ring (11) and screws (12) and tighten. Do not over-tighten to the point where the seat ring or the follower ring deforms.
 - a. Reducing service pistons: trim any rubber that extrudes beyond the small OD of the piston with a sharp utility type razor knife.
18. Install the new piston cup (4) ensuring the lips are pointed toward the large diameter end of the piston. Install the follower ring (5) and screws (6) and tighten uniformly in an alternating pattern. Do not tighten so much as to deform the follower. Apply a very light coating of lightweight lubricant such as petroleum jelly.
19. Apply a thin coating of lubricant to the large ID of the liner and the small OD of the piston.
20. Run a finger under the liner cup to flare its lip inward to facilitate an initial seal. Install the piston being careful not to damage the cups.
21. Install the indicator rod bushing (19). Clean and polish the indicator rod (16) with very fine emery cloth and install with indicator rod lock nut (20). Tighten lock nut.
22. Place new cover gasket (15) on top of valve aligning bolt holes.
23. Align cover (13) and lower over indicator rod (16) *being careful not to bend the rod*. Install cover bolt/nuts (14) and tighten in alternating pattern.
24. Install new indicator packing (18) by wrapping it around the indicator rod and tamping until 2 or 3 threads are exposed. Cut off excess.
25. Install indicator gland (17) and tighten to compress packing only until resistance is felt. **DO NOT OVERTIGHTEN**. Packing compression can be adjusted once pressure has been introduced.
26. Replace pilot piping, slowly introduce pressure to the valve and check for leaks. Tighten indicator rod gland (17) and vent tube gland (23) only as much as needed to stop leakage.

INSTALLING A NEW LINER

New liners are not drilled and tapped to accept the vent tube. Follow these instructions to ensure the liner is properly aligned before drilling/tapping.

1. Make a mark on the top flange of the new liner centered on the location of one of the two bosses on the side of the liner.
2. Make a mark on the top flange of the body centered on the location of the vent tube
3. Install liner in the valve body ensuring the liner is flush with the top of the valve body and the two marks are aligned.
4. Loosely install the vent tube gland (23) and slide in the vent tube (22). Insert a center punch through the vent tube and punch a mark in the liner.
5. Remove the vent tube (22), gland (23) and liner (3).
6. Tap drill the liner to accept the vent tube:
 - a. 12" and 14" – tap drill 37/64" and tap 3/8" NPT
 - b. 16" to 20" – tap drill 23/32" and tap 1/2" NPT
7. Install liner in body and loosely screw in the vent tube and gland. If everything fits, remove gland, vent tube and liner and proceed with reassembly Step 15 in previous section.

REMOVING & INSTALLING A NEW SEAT CROWN

Note: The seat crown (21) in reducing service valves (see Table 1) is threaded in and bonded and is not easily removed. If damaged, it may have to be "cut out."

Removing a water service seat crown:

1. After the piston and liner have been removed, reach inside the seat crown (21) through the V-ports and pull up while slightly rotating. In the unlikely event the liner cannot be extracted from the valve body in this manner, refer to Figure 5 and follow these steps.
 - a. The "lower bar" is a steel bar approximately 1" x 1/2" x long enough to be inserted through opposite V-ports and engage the liner. It should be drilled and tapped 5/8"-11 at its center.
 - b. The "upper bar" is a steel bar the same size as the lower bar but with a length equal to the OD of the valve's top flange. It should be drilled through 11/32" at its center.
 - c. Support the upper bar on wooden blocks positioned just outside the OD of the liner.
 - d. Insert a piece of 5/8"-11 all-thread through the upper bar and thread into the lower bar. It should be long enough to extend 1 to 2 inches beyond the upper bar.
 - e. Install two 5/8"-11 hex nuts on the all thread and turn both nuts clockwise until resistance is felt.
 - f. Continue to slowly turn the nuts to "jack" the liner outward. After a few turns the liner should "pop" at which time it can be removed.

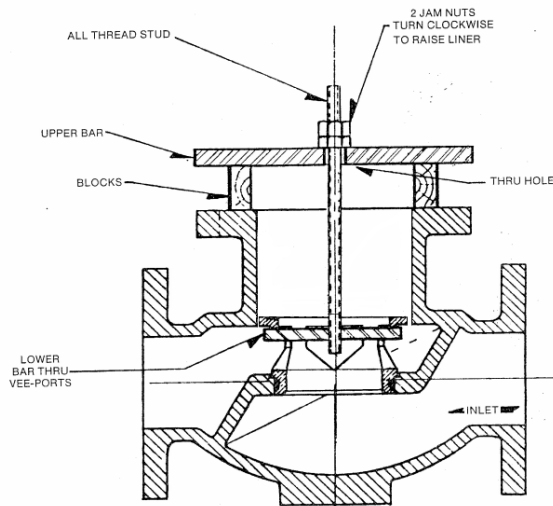


Figure 5

Installing a new water service seat crown:

1. Lubricate and install a new seat crown O-ring (35) in seat crown (21)
2. Clean the surface in the body where the seat crown (21) will sit
3. Lubricate the inside of the bore in the body where the seat crown is inserted
4. Carefully lower the seat crown (21) with O-ring (35) through the top of the body (large valves will require overhead lifting equipment) until it is inserted into the body bore being careful not
5. Ensure it is fully inserted and seated before continuing with reassembly step 14 on page 4.

REPLACEMENT PARTS

Genuine replacement parts are available from your local GA Industries representative or from the factory:

VAG USA, LLC
 234 Clay Avenue
 Mars, PA 16046 USA
 Telephone: 724-776-1020
 Fax: 724-776-1254
 E-mail: quotes-ga@vag-group.com

Please have the nameplate data available when ordering parts.

REPAIR KITS

The below Soft Goods Repair Kits are applicable to 12" to 20" GA Industries differential piston main valves with a serial number 800000 or higher. The water service kits contain part numbers 4, 7, 10, 15, 18, 24 and 35. Part number 35 is not included in the reducing service kits.

Water Service Kits

Size	Kit Number	Part Number
12"	WS12	2-80-23000-008
14"	WS14	2-80-23000-008
16"	WS16	2-80-23000-010
18" & 20"	WS18/20	2-80-23000-014

Reducing Service Kits

Size	Kit Number	Part Number
12"	R12	2-80-23000-007
14"	R14	2-80-23000-007
16"	R16	2-80-23000-009
18" & 20"	R18/20	2-80-23000-012

All other parts are ordered separately.

Consult factory for valves with lower serial numbers.

PARTS LIST

Refer to Figures 6, 7, 8 and 9 for parts location.

Item	Part Name
1	Body
2	Piston
2a	Baffle
3	Liner
4	Piston Cup
5	Piston Cup Follower
6	Piston Cup Follower Screw
7	Liner U-Cup
8	Liner Cup Follower
9	Liner Cup Follower Screw
10	Seat Ring
11	Seat Ring Follower
12	Seat Ring Follower Screws
13	Cover
14	Cover Bolts/Nuts
15	Cover Gasket
16	Indicator Rod
17	Indicator Gland
18	Indicator Packing
19	Indicator Bushing
20	Indicator Lock Nut
21	Seat Crown
22	Vent Tube
23	Vent Tube Gland
24	Vent Packing
35	Seat Crown O-Ring

WARRANTY:

The Warranty for GA Industries valves is included in our Terms and Conditions which can be found here:

<https://gaindustries.com/terms>

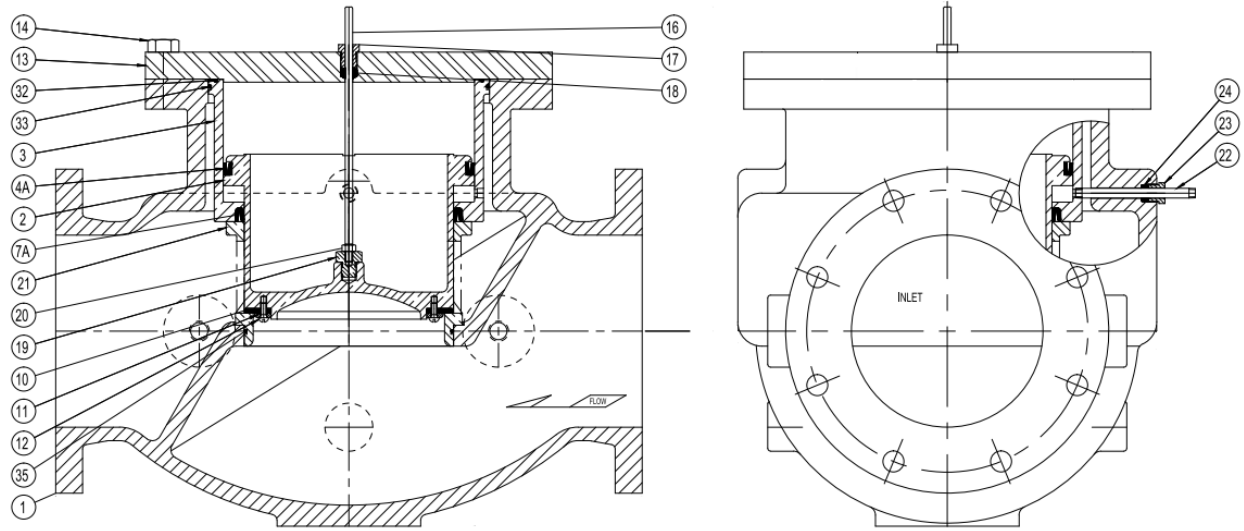


Figure 6 Globe Body

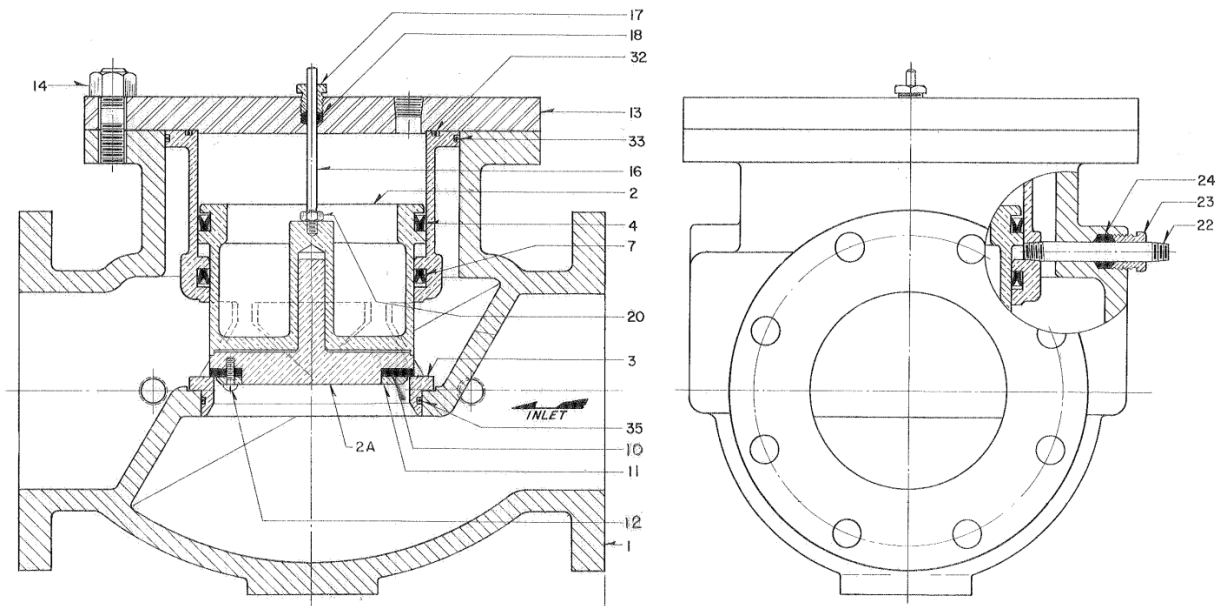


Figure 7 Globe Body Stop Check Piston\

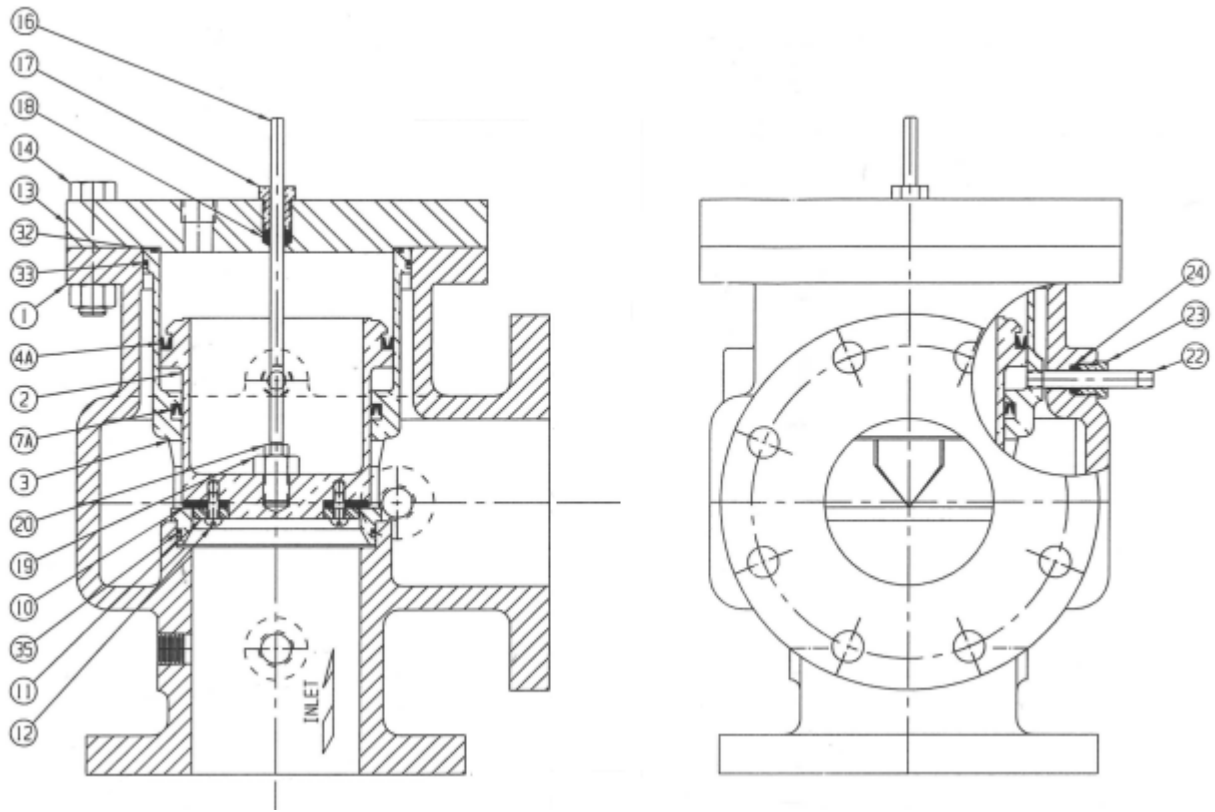


Figure 8 Angle Body

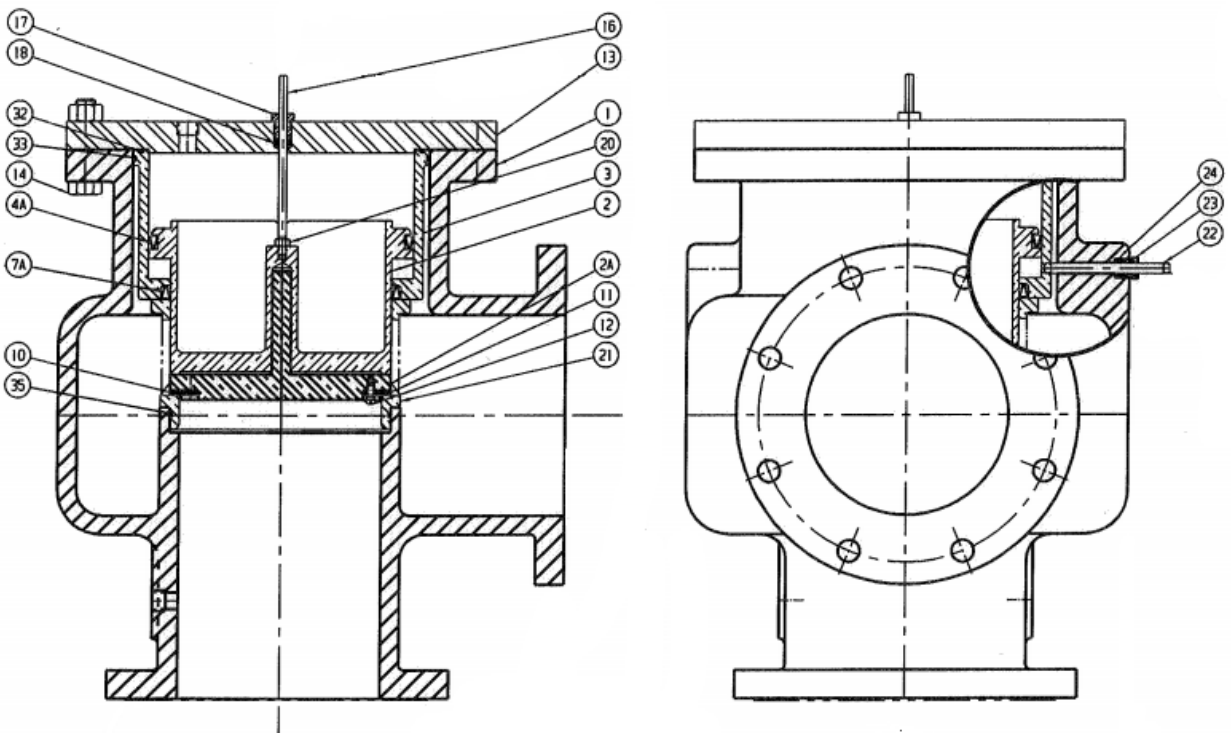


Figure 9 Angle Body, Stop Check