INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Figures 3300-DR and 3300-UR
Drawing A-1037
2” to 16” Pilot-Operated Double-Acting Altitude Valves for Water

GA INDUSTRIES
A VAG-Group Brand

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Manual O&M-3300-2-16 042325

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

Section 1

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

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TABLE OF CONTENTS

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INSTALLATION, OPERATION and MAINTENANCE

Figures 3300-DR and 3300-UR Double-Acting Altitude Valves

INTRODUCTION
This manual provides information to install, operate and maintain GA single acting altitude valves to ensure a long service life. 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
Double acting altitude valves are used when a single line is used for both supply to and discharge from an elevated tank, standpipe, or reservoir. The valve closes tight when the water level reaches maximum to to prevent overflow. The valve opens when supply pressure falls below tank head to permit flow from the tank to distribution. See Figure 1.

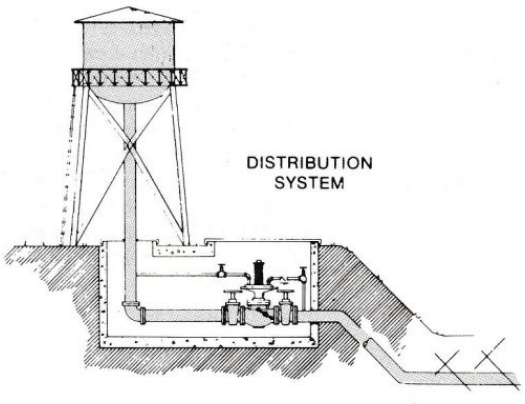

Figure 1

The valve consists of a differential piston main valve and an altitude pilot system, pre-piped and factory installed on the main valve. See Figure 5 on Page 6 for component identification and location. The main valve consists of just one moving part – the piston – with the top of the piston being larger than the bottom. GA Industries double acting altitude valves are installed such that tank head is applied to the bottom of the piston to provide an opening force. When inlet pressure tank head is simultaneously applied to the larger area on top of the piston, a greater closing force produced. Thus, applying system pressure to the top of the piston closes the valve while exhausting it from the top allows tank head to lift the piston and open the valve.

The pilot system consists of an altitude pilot, closing speed needle valve, wye strainer and pilot isolating valves. The altitude pilot contains a 3-way internal pilot valve that automatically applies inlet pressure to the top of the piston to close the main valve when the water level reaches maximum and exhausts the pressure from on top the piston when the supply pressure falls below tank head to open the main valve and allow flow from the tank to the supply system. The action of the internal pilot valve is illustrated in Figures 2 and 3.

The maximum water level is determined by the adjustment of a compression spring. The spring exerts an upward force which is opposed by tank head conveyed to the top of a diaphragm exerting a downward force. The tank is full when force of the tank head overcomes the spring force, thereby seating the upper pilot valve and unseating the lower allowing inlet pressure to flow through the pilot to the top of the piston closing the main valve to prevent overflow. The main valve's closing speed is determined by the rate at which water flows onto the piston through the needle valve. See Figure 2.

Tank head is applied to the pilot diaphragm through the restriction in an "orifice nipple." When supply pressure is greater than tank head the external check valve is closed allowing tank head to build on top of the diaphragm as the tank fills. The main valve closes when the water level reaches maximum, but supply pressure can rise above tank head without tank overflow. See Figure 2.

When consumption causes the supply pressure to fall below tank head, the external check valve opens exhausting the pressure on top of the diaphragm faster than it can be applied through the restriction in the orifice nipple. This allows the spring force to overcome the decreased head acting on the diaphragm thereby seating the lower pilot valve to

block the inlet pressure and simultaneously opening the upper pilot valve allowing the pressure on top of the piston to be exhausted through Port N opening the main valve to allow water to flow from the tank to the supply side. See Figure 3.

The tank will "ride on the system" until the tank fills, the altitude valve closes, and supply pressure is higher than tank head.

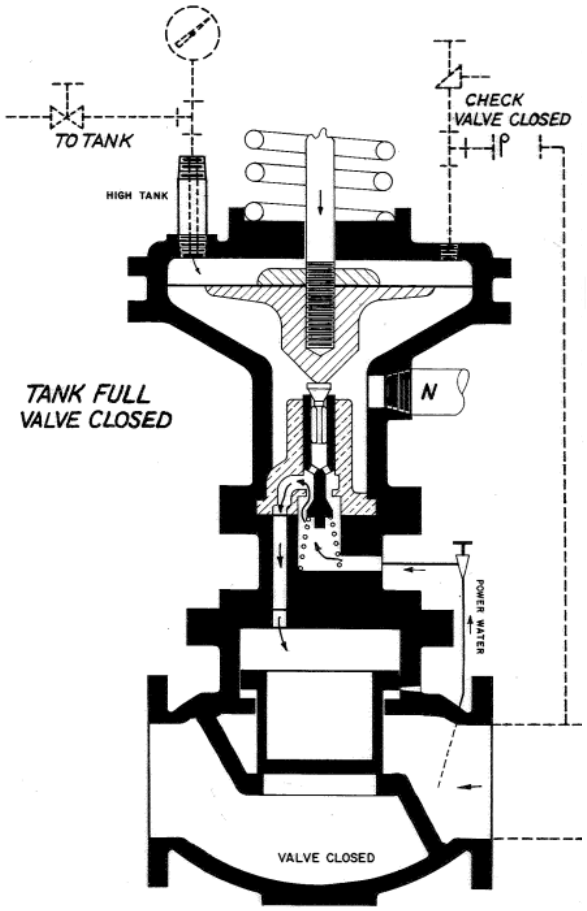

Figure 2

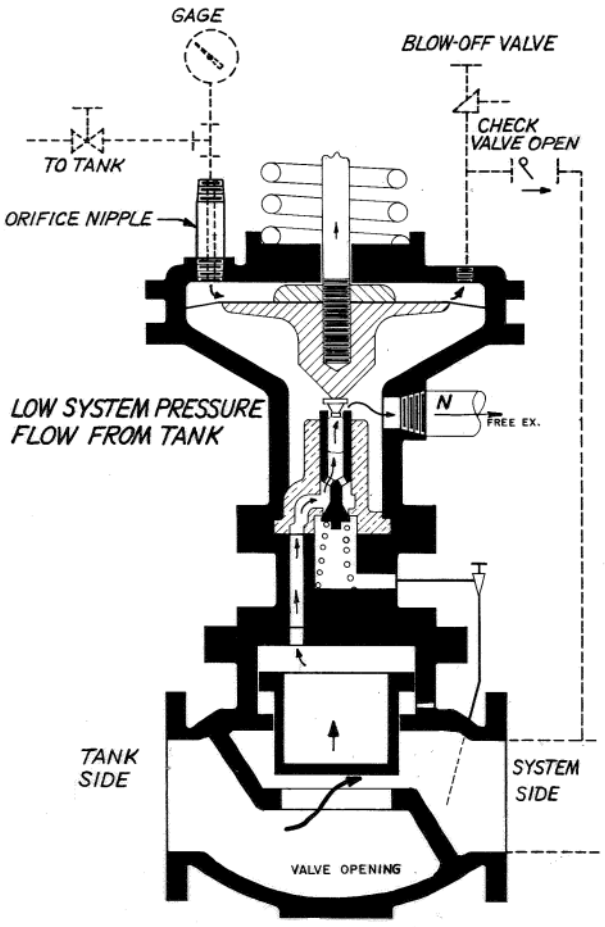

Figure 3

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 (indicated by an "A", e.g., 3300-DRA) main valves have the inlet and outlet connections 90 degrees apart.

Install the valve in the proper flow direction noting the "PUMP SIDE" and "TANK SIDE" tags on the valve.

The valve is normally configured for installation in a horizonal pipe with the altitude pilot in a vertical orientation although other installation configurations may be 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 all 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.

For accurate operation, the tank sensing line must sense the "static" head in the tank. It should be ½" hard pipe or ¾" copper and be connected through an isolating valve directly into the tank riser pipe (providing the riser pipe does not extend above the water surface), the bottom of the tank or as close to the standpipe or reservoir as possible to eliminate the effect of line friction between the tank and altitude valve.

Double-acting altitude valves require the port on the opposite side of the orifice nipple/tank sensing line connection to be connected to the inlet side pipe with a ½" rubber seated swing check that allows flow off the diaphragm.

It is recommended that a pressure gauge and "blow off" valve be installed. See Figure 4.

Pilot exhaust Port N must be open to atmosphere. Proper drainage must be provided to accommodate the momentary discharge of water from Port N that occurs every time the valve opens. See Table 1 for the volume of water discharged.

Table 1 Volume Discharged

SIZE	2"-3"	4"	6"	8"	10"	12"	14"	16"
US GAL	.08	.164	.503	1.12	2.08	3.73	6.29	10.54

START-UP

The valve generally does not require any calibration or adjustment prior to start-up. The water level at which the valve closes is factory set at the height specified by the engineer and indicated on the tag affixed to the pilot.

Refer to Page 5 for the location of components.

The closing speed needle valve should be initially opened approximately 1/4 turn from closed. Close the needle valve completely then turn the handwheel 1/4 turn counterclockwise.

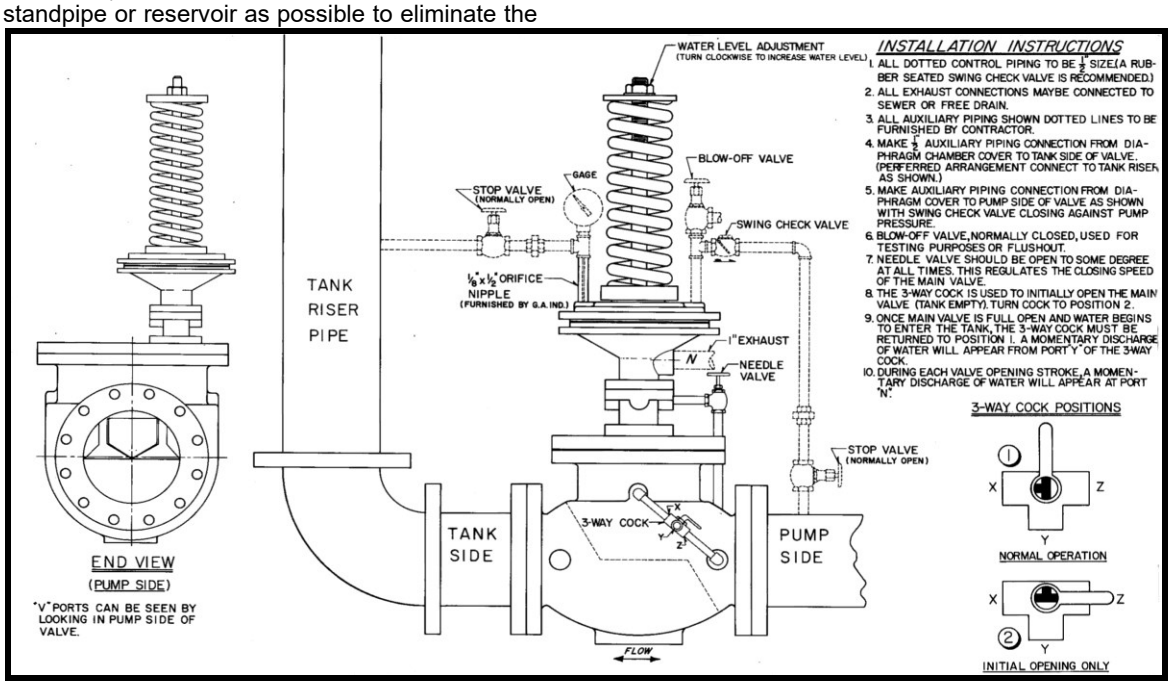

Figure 4

NOTE: If the valve is being installed in an orientation that the main valve's bolted cover is not parallel to the floor, it's recommended the main valve's piston be filled with water before installation. This can be done by removing an unused pipe plug from the valve's cover and filling the valve through a funnel. Replace the pipe plug before installing the valve.

Since tank head is used to lift the piston, if there is no water in the tank the valve will not open. GA Industries double acting altitude valves are supplied with a 3-way cock piping assembly that is used to open the valve when the tank is empty. See Notes 8 & 9 on Figure 4 for its operation.

After the installation is complete, with the downstream isolating valve closed, slowly open the inlet isolating valve to introduce pressure to the altitude valve. If the tank is empty, move the 3-way cock to Position 2 to lift the piston.

Open the downstream isolating valve to allow water to flow through the valve into the tank. Open the tank sensing line isolating valve and the blow off valve to vent air from the sensing line and diaphragm chamber. Close the blow off valve when the air had been purged.

Once water begins to flow into the tank, move the 3-way cock to Position 1. A small and/or intermittent discharge of water from the side vent tube is normal and has no effect on the valve's operation.

Verify the altitude valve closes at the desired maximum water level. Refer to below if adjustment is required and repeat the above steps to confirm.

If supplied with optional limit switch (indicated by an "L" (e.g., 3300-DRL), adjust the switch so that the contacts transfer just prior to the main valve closure.

ADJUSTING THE WATER LEVEL SETTING

The water level at which the valve closes can be field adjusted within the range of the pilot's installed spring.

If the required water level is higher than the installed spring's maximum setting, the spring must be changed.

Turning the large nut at the top of the spring clockwise raises the height at which the valve closes, turning it counterclockwise lowers the opening pressure.

Standard GA Industries Figures 3300-DR/-UR in sizes 2" to 16" are supplied with one of the following springs.

Table 2. Valve Sizes 2" to 16"

SPRING COLOR	MAX SETTING	WIRE DIAMETER	CHANGE PER FULL TURN
Yellow	25 ft.	0.500"	0.43 ft.
Orange	40 ft.	0.625"	1.0 ft.
Gray	110 ft.	0.750"	2.9 ft.
Green	160 ft.	0.875"	5.8 ft.
Red	250 ft.	1.000"	10.8 ft.

To return the spring to the proper setting after maintenance or mis-adjustment, if not present a gauge and blow off valve should be installed in the tank sensing line per Figure 4. Ideally, the gauge should be calibrated in feet of water.

If the altitude valve is closed but the tank water level is below the desired maximum setting the main valve may be opened to raise the water level by closing the isolating valve in the tank sensing line and opening the blow off valve. Observe the water level in the tank and when it approaches the desired maximum level close the blow off valve and open the sensing line isolating valve. If the main valve does not close, slowly turn the adjusting nut (#33) counterclockwise being careful not to exert a sideways force on the spindle (#30) until the valve closes. One can detect when the main valve starts to close by placing a finger at the base of the indicator rod.

PREVENTATIVE MAINTENANCE

No routine lubrication or adjustments are needed. The valve should be visually inspected once a month for the first 3 to 6 months after initial start-up to check for leaks and the wye-strainer should be flushed of collected debris.

Flushing the wye-strainer can be facilitated by installing a small ball or gate valve in place of the pipe plug in the bottom of the wye-strainer. Opening the valve while there is pressure in the system will "blow off" collected debris.

After the initial period, once every three (3) months the strainer should be flushed of collected debris as described above. Visually inspect for leaks around the indicator rod, side vent tube or pilot vent hole. If leakage is detected, see **TROUBLESHOOTING** to resolve.

WARNING

Personal injury may occur if the valve is disassembled while pressurized. Before attempting disassembly, follow appropriate lockout/tag out procedures to prevent accidental pressurization.

Once a year the valve should be isolated, depressurized and the wye-strainer screen removed and cleaned. At the same time the closing speed needle valve should be inspected. First, note the number of turns required to close it fully. Remove the needle valve bonnet and needle and inspect the needle for wear. Replace if needed. Clear needle

valve seat of collected debris and reinstall the bonnet and needle. Open to the noted position.

TROUBLESHOOTING

SYMPTOM or PROBLEM	SOLUTION
Tank Overflow	
• Improper spring adjustment	Follow “Adjusting the Water Level” instructions
• Wye-strainer clogged with debris	Clean
• Sensing line isolating valve closed	Open
• Restriction in orifice nipple plugged	Clean/replace
• Strainer cap clogged, internal pilot valves damaged and/or not seating	Clean strainer cap, replace internal pilot assembly or regrind pilot valve seats.
• Dirt, rust, or sediment collected in diaphragm chamber	Open blow off valve to flush chamber, inspect and replace pilot components as needed
• Main valve piston sticking, piston seals extremely worn or debris preventing proper closing	See Main Valve Repair Instructions in Section 2
Altitude Valve Closing Before Tank is Full	
• Improper spring adjustment	Follow “Adjusting the Water Level” instructions
Main Valve Cycling Up and Down	
• Sensing line connected too far from tank and not sensing “static” tank head	Connect sensing line directly into tank riser pipe or into bottom of tank
Continuous Flow from Pilot Exhaust Port	
• Main diaphragm worn	See Altitude Pilot Repair Instructions in Section 3
• Internal pilot high pressure valve not seating	See Altitude Pilot Repair Instructions in Section 3
Leakage from Base of Spring	
• Auxiliary diaphragm worn	See Altitude Pilot Repair Instructions in Section 3

REPAIR INSTRUCTIONS

Instructions for the inspection, troubleshooting and repair of the main valves utilized in the GA Industries Figure 3300-D/R-UR double acting altitude valves are provided in the following publications:

2” to 10” – IOM-DPMV2-10 (Latest Rev)
12” to 20” – IOM-DPMV12-20 (Latest Rev)

Instructions for the inspection, troubleshooting and repair of the double-acting altitude pilot utilized in the GA Industries Figure 3300-DR/-UR double acting altitude valves are provided in the following publication:

IOM-A1032 (Latest Rev)

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.

WARRANTY:

The Warranty for GA Industries valves is included in our Terms and Conditions which can be found here: https://gaindustries.com/terms

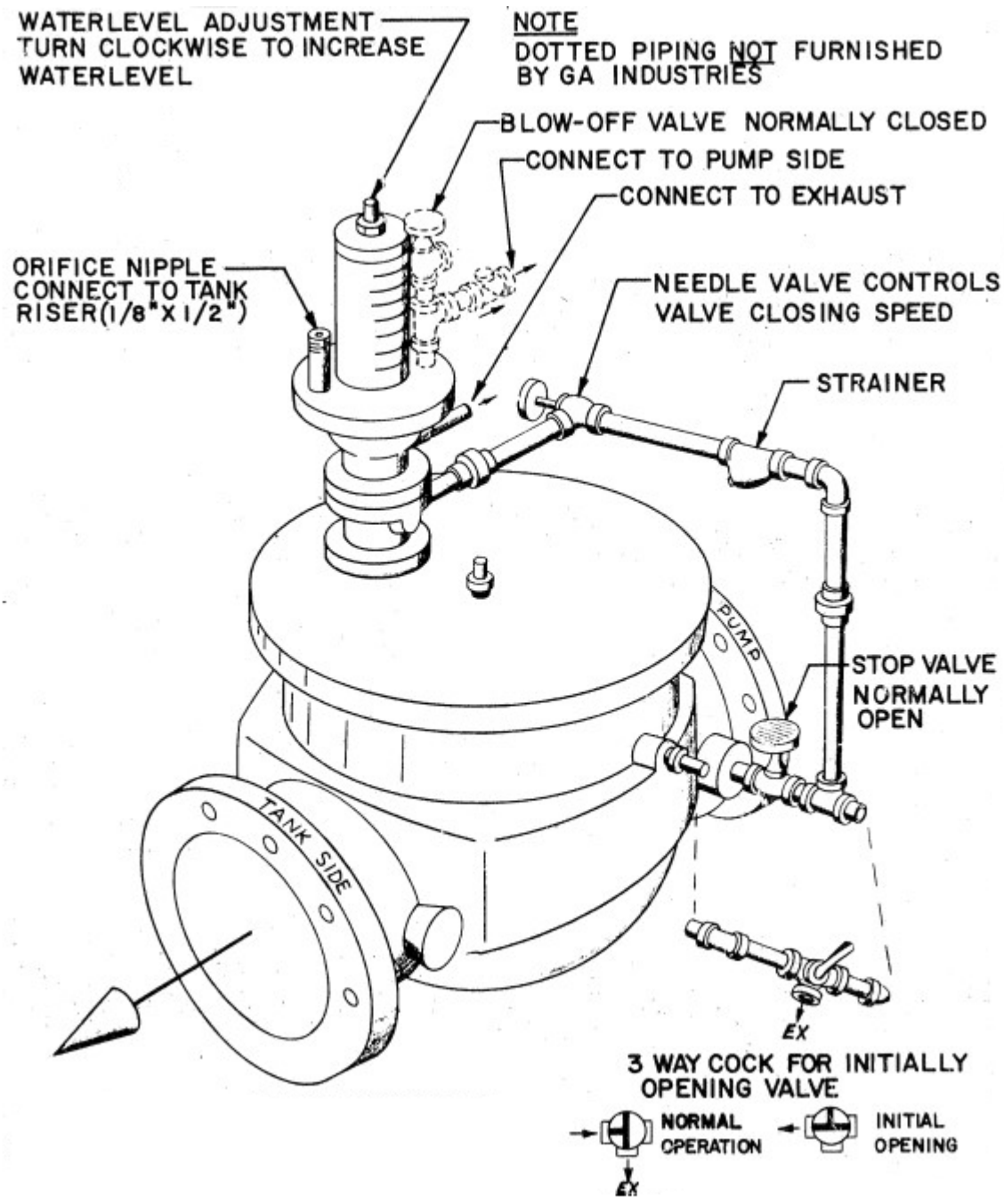

Figure 5

Figure 3300-DR (Class 125 Flanges) and Figure 3300-UR (Class 250 Flanges) with Globe Body

Section 2

OPERATION AND MAINTENANCE MANUAL

2” to 10” Differential Piston Main Valves

Drawings G-1035, G-1036, G-1037, G-1041, G-1047, G-1051, D-1028 and D-1161

TABLE OF CONTENTS

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Manual Number IOM-DPMV-2-10inch 041621R1

INSTALLATION, OPERATION and MAINTENANCE

2” to 10” 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 of 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).

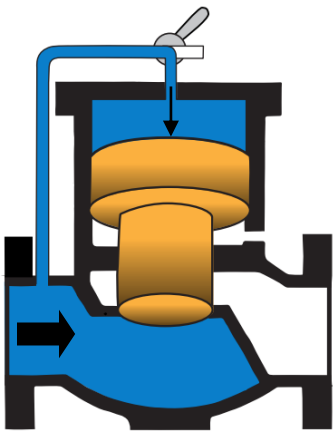

Figure 1. Valve Closed

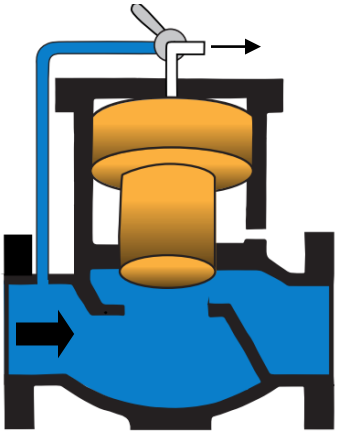

Figure 2. Valve Open

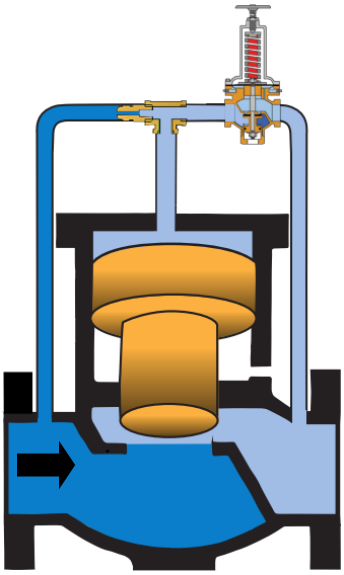

Figure 3. Valve Throttling

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
2½"	4.25"	3.50"
3"	4.25"	3.50"
4"	5.63"	4.63"
6"	8.00"	6.75"
8"	10.50"	8.75"
10"	13.00"	10.75"

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.

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PREVENTATIVE MAINTENANCE

Thew 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	
• Water cannot exhaust from top of piston	Check status of manual valves and electrical connection to solenoids (if any) in external pilot piping
• 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.
• Vent tube blocked	Ensure vent tube (22) is open to atmosphere
• Indicator rod packing too tight	Turn indicator gland (17) counterclockwise in quarter turn increments
Main valve will not close	
• 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
• Wye-strainer clogged	Clean strainer
Leakage through main valve when closed	
• Debris in valve	Remove debris, inspect for damage
• Worn or damaged seat ring (10)	Inspect, replace
Excessive leakage through vent tube (slight or intermittent leakage is normal)	
• Worn piston cup (4) and/or liner cup (7)	Replace
• 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)	
• 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 de-pressurize the valve before commencing work.

INSTALLING A 2" to 10" REPAIR KIT

1. Remove indicator gland (17) and indicator packing (18)
2. 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
3. Remove cover bolts/nuts (14)
4. Remove cover (13) lifting straight up to avoid damaging or bending the indicator rod (16)
5. Remove cover O-ring (32)
6. Loosen indicator rod lock nut (20) and remove indicator rod 16).
7. 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.
8. Remove the piston U-cup (4A)
9. Remove the seat ring (10) by removing the follower screws (12) and follower (12).
10. Reach inside the liner and remove the liner U-cup (7A)
11. 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.

12. Install new liner U-cup ensuring the lips are pointing into the valve. Apply a very light coating of lightweight lubricant such as petroleum jelly.
13. Replace 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.
14. Install the new piston U-cup (4A) ensuring the lips are pointed toward the large diameter end of the piston. Apply a very light coating of lightweight lubricant such as petroleum jelly.
15. Apply a thin coating of lubricant to the large ID of the liner and the small OD of the piston.
16. Install the piston being careful not to damage the cups.
17. 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.
18. Install cover new O-ring (32).
19. 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.
20. Install new indicator packing (18) by wrapping it around the indicator rod and tamping until 2 or 3 threads are exposed. Cut off excess.
21. 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.
22. If desired, remove vent tube gland (23) and vent tube packing (24). DO NOT LOOSEN OR REMOVE vent tube (22). Replace packing as in step 20 above. Install vent tube gland (23) and tighten to compress packing.
23. Replace pilot piping, slowly introduce pressure to the valve and check for leaks. Tighten indicator rod gland only as much as needed to stop leakage.

LINER REMOVAL & INSTALLATION

1. Mark a line across top of liner and the top of the valve body to ensure the liner is properly aligned when installed.
2. Remove the vent tube gland (23), packing (24) and unscrew the vent tube (22). DO NOT DAMAGE THE VENT TUBE SEALING SURFACE.
3. Reach inside the liner (3) 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, follow steps 3a through 3h. Otherwise, proceed to step 4.
    a. Refer to Figure 5.
    b. The “lower bar” is a steel bar approximately 1” x ½” 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.
    c. 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.
    d. Support the upper bar on wooden blocks positioned just outside the OD of the liner.
    e. 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.
    f. Install two 5/8”-11 hex nuts on the all thread and turn both nuts clockwise until resistance is felt.
    g. 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.
    h. Note the liner in some 8” and 10” valves is in two pieces, a liner (3) and seat crown (21). Both pieces will be extracted using this method.

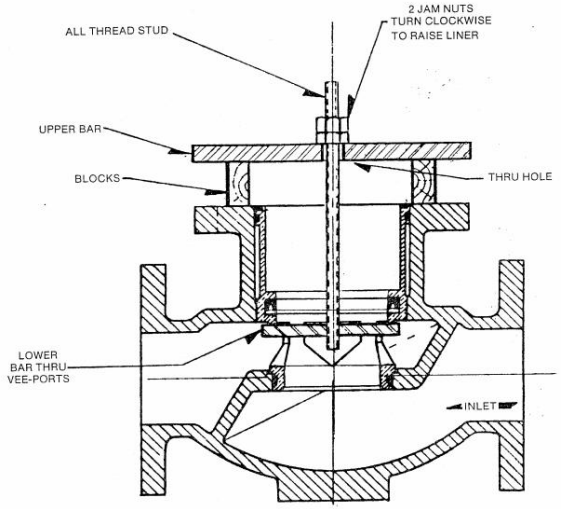

Figure 5

4. Once liner is extracted, remove top (33) and lower (35) liner O-rings.
5. Using very fine wet or dry emery cloth, sand the liner ID to shiny metal. Inspect for deep scoring or gouges that cannot be polished out. Consult factory for evaluation if unsure. Should a new liner be required, see **INSTALLING A NEW LINER**
6. Before installing the liner (and seat crown), lubricate the O-ring grooves and the top (33) and lower (35) O-rings and install in the appropriate grooves.
7. Clean and lubricate the areas of the valve body where the O-rings will seal.
8. Install the liner (3) so that it aligns with the mark, being careful not to damage the O-rings. If 2-piece liner, first install seat crown (21) then the liner (3).
9. The top of the liner should be flush with the top of the valve body. A mallet or wooden block can be used to bump the liner into position.
10. Apply pipe sealant or tape to the threads on one end of the vent tube (22) and thread into the liner. Tighten to a leak tight joint.

11. Install vent tube packing (24) and gland (23) and tighten to compress packing.

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-Piece Liner

1. Locate the raised boss on the OD of the liner, compare to old liner
2. Install liner (3) without any O-rings in the valve body ensuring it is flush with the top of the valve body. Center the liner's boss on the vent tube hole in the side of the valve body.
3. 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.
4. Make an alignment mark across the liner and the top flange of the valve body
5. Remove the vent tube (22), gland (23) and liner (3).
6. Tap drill the liner 11/32" centered on the punch mark and tap 1/8" 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.

2-Piece Liner

1. There is no raised boss on the 2-piece liner
2. Install seat crown (21) and liner (3) without any O-rings in the valve body ensuring the liner is flush with the top of the valve body.
3. 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.
4. Make an alignment mark across the liner and the top flange of the valve body
5. Remove the vent tube (22), gland (23) and liner (3).
6. Tap drill the liner 11/32" centered on the punch mark and tap 1/8" 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.

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 2½" to 10" GA Industries differential piston main valves with a serial number 800000 or higher. The kits contain part numbers 4A, 7A, 10, 18, 24, 32, 33 and 35.

Reducing Service Kits

Size	Kit Number	Part Number
2" - 3"	GA3R	2-80-23000-007
4"	GA4R	2-80-23000-009
6"	GA6R	2-80-23000-012
8"	GA8R	2-80-23000-015
10"	GA10R	2-80-23000-004

Water Service Kits

Size	Kit Number	Part Number
2" - 3"	GA3W	2-80-23000-008
4"	GA4W	2-80-23000-010
6"	GA6W	2-80-23000-014
8"	GA8W	2-80-23000-016
10"	GA10W	2-80-23000-005

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
4a	Piston U-Cup
7a	Liner U-Cup
10	Seat Ring
12	Sear Ring Follower Screws
14	Cover Bolts/Nuts
16	Indicator Rod
17	Indicator Gland
18	Indicator Packing
19	Indicator Bushing
20	Indicator Lock Nut
22	Vent Tube
23	Vent Tube Gland
24	Vent Packing
32	Cover O-Ring
33	Top Liner O-Ring
35	Lower Liner 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

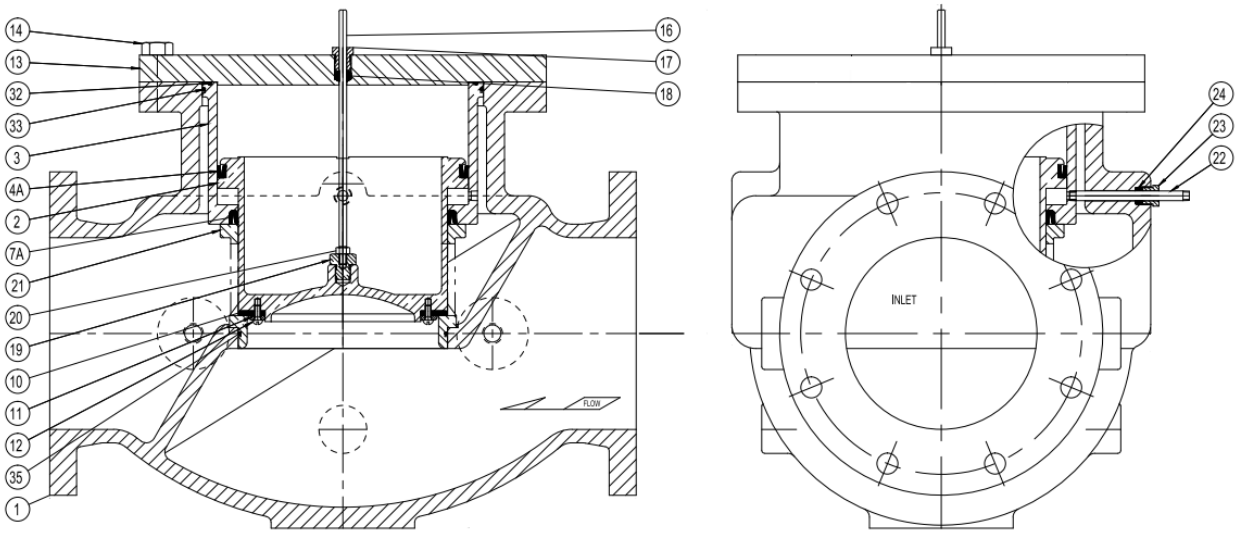

Figure 6 Globe Body

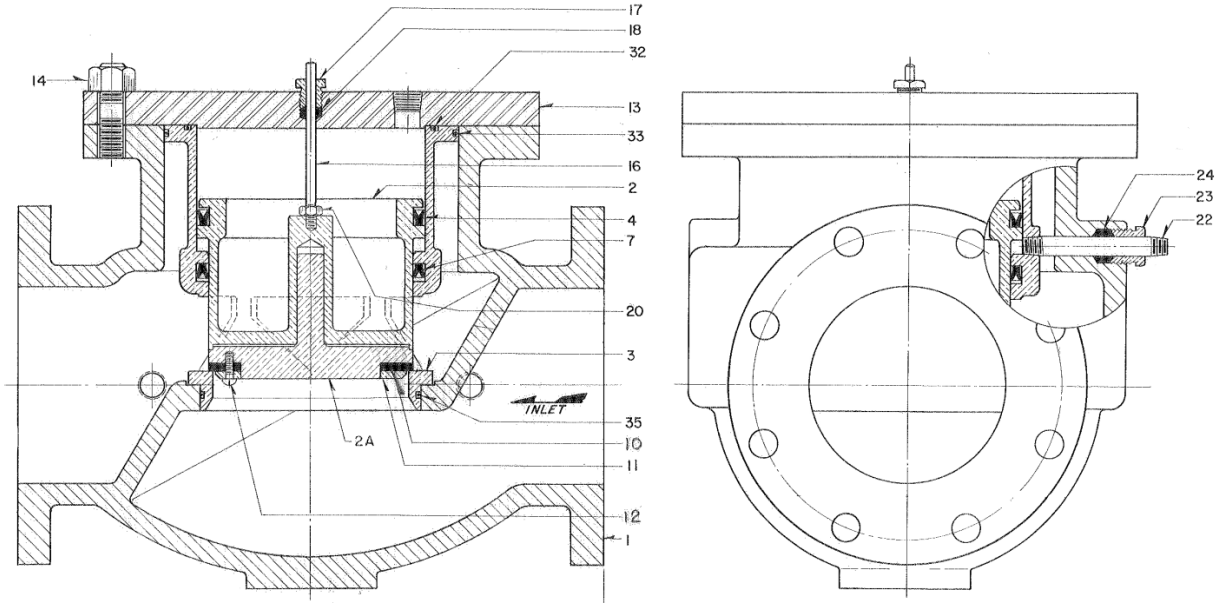

Figure 7 Globe Body, Stop Check

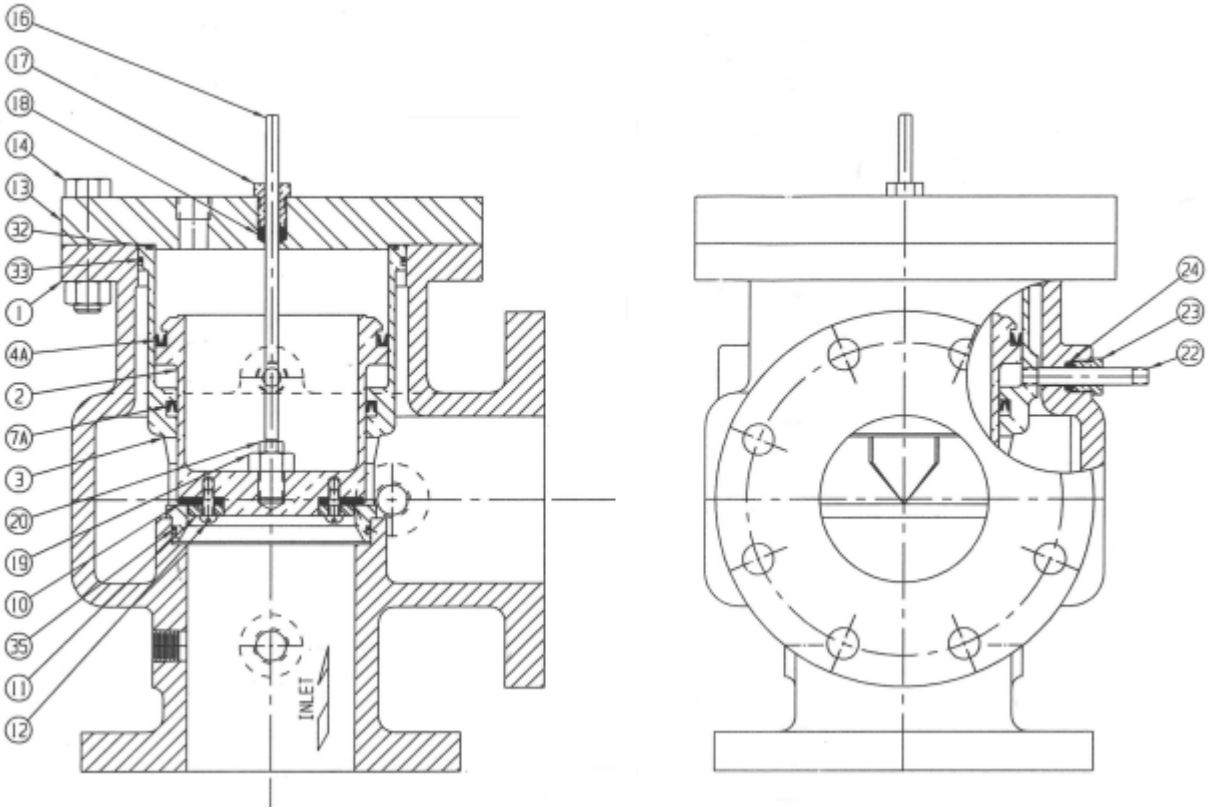

Figure 8 Angle Body

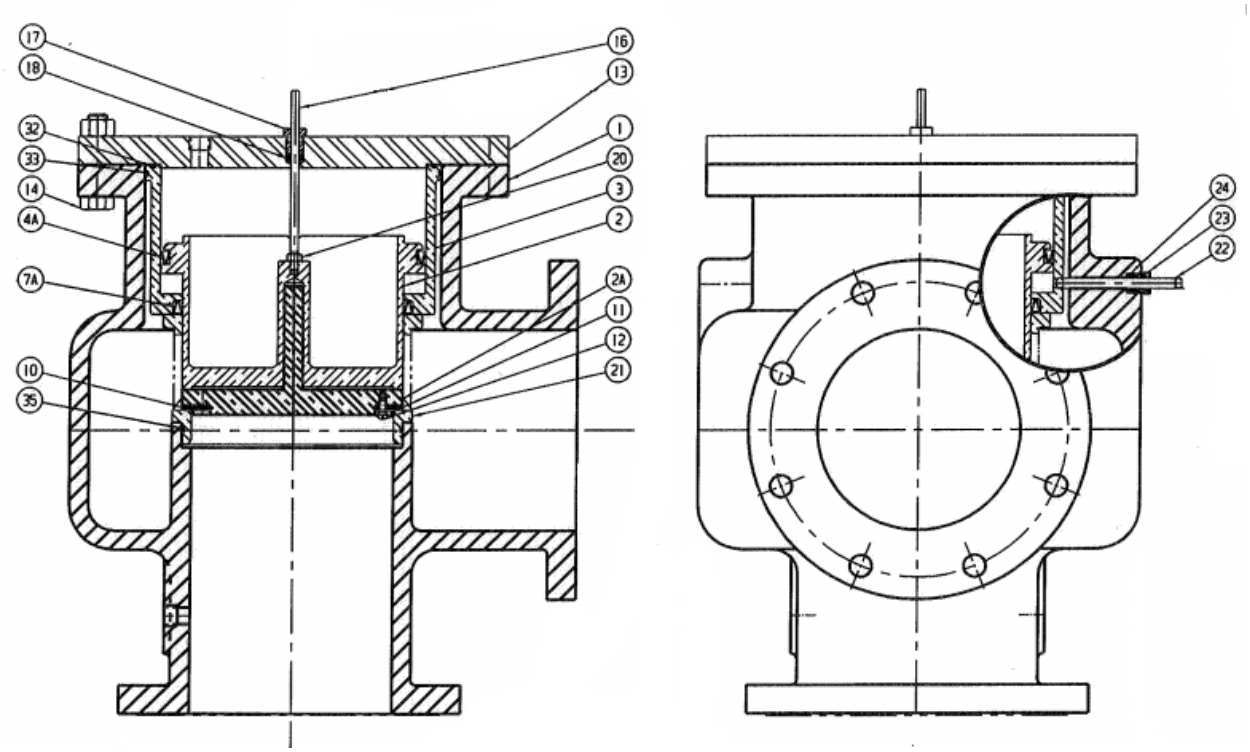

Figure 9 Angle Body, Stop Check

Section 3

OPERATION AND MAINTENANCE MANUAL

12” to 20” Differential Piston Main Valves

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

TABLE OF CONTENTS

GA INDUSTRIES
A VAG-Group Brand

234 Clay Avenue • Mars, PA 16046 USA
Telephone (724) 776-1020 • Fax (724) 776-1254
E-mail: info-ga@vag-group.com

Manual Number IOM-DPMV-12-20inch 073121 (Rev 1)

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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).

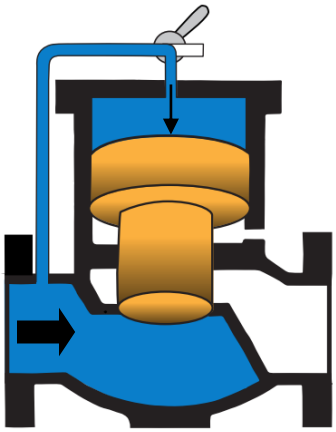

Figure 1. Valve Closed

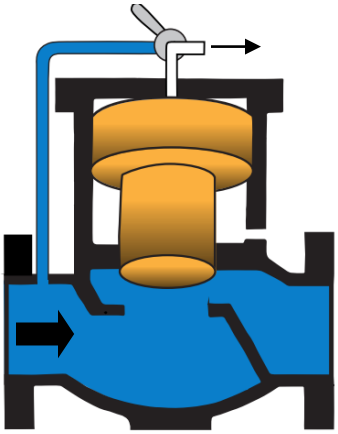

Figure 2. Valve Open

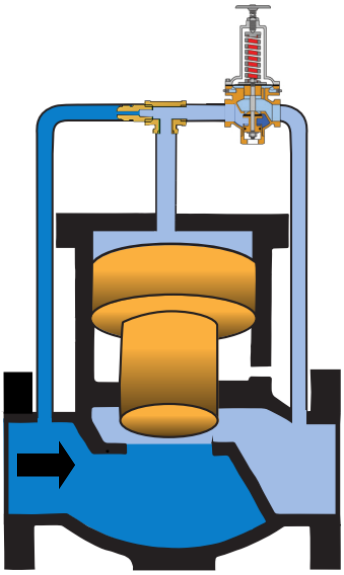

Figure 3. Valve Throttling

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.

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PREVENTATIVE MAINTENANCE

Thew 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	
• Water cannot exhaust from top of piston	Check status of manual valves and electrical connection to solenoids (if any) in external pilot piping
• 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.
• Vent tube blocked	Ensure vent tube (22) is open to atmosphere
• Indicator rod packing too tight	Turn indicator gland (17) counterclockwise in quarter turn increments
Main valve will not close	
• 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
• Wye-strainer clogged	Clean strainer
Leakage through main valve when closed	
• Debris in valve	Remove debris, inspect for damage
• Worn or damaged seat ring (10)	Inspect, replace
Excessive leakage through vent tube (slight or intermittent leakage is normal)	
• Worn piston cup (4) and/or liner cup (7)	Replace
• 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)	
• 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 de-pressurize the valve before commencing work.

INSTALLING A 12" to 20" REPAIR KIT

1. Remove indicator gland (17) and indicator packing (18)
2. 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
3. Remove cover bolts/nuts (14)
4. Remove cover (13) lifting straight up to avoid damaging or bending the indicator rod (16)
5. Remove cover gasket (15)
6. Loosen indicator rod lock nut (20) and remove indicator rod (16).
7. Make a mark across the top of the liner and body to permit alignment when the liner is replaced.
8. Remove the vent tube gland (23), vent tube packing (24) and unscrew the vent tube (22)
9. 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).
10. Remove the piston cup follower screws (6), piston cup follower (5) and piston cup (4).
11. Remove the seat ring (10) by removing the follower screws (12) and follower (11).
12. Remove the liner (3), liner cup follower screws (9), liner cup follower (9) and liner cup (7).
13. 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 ⅜" NPT
   b. 16" to 20" – tap drill 23/32" and tap ½" 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 ½" 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.

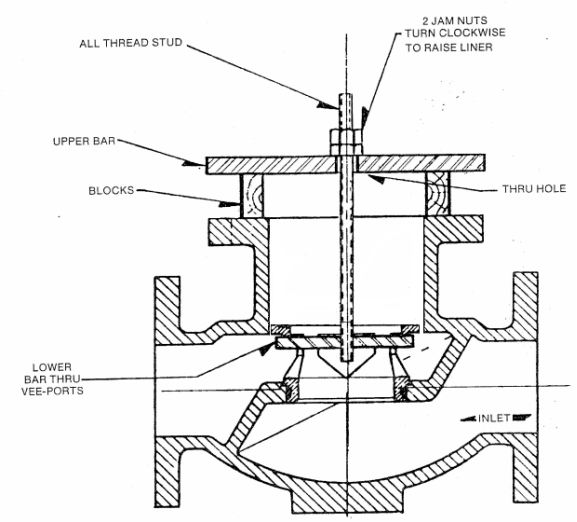

Figure 5

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. Prior to 2014 the first two digits of the SO number are the year (660217 = 1966, 800907, 80 = 1980, 020100, 02 = 2002), followed by a sequential number. Beginning in 2014 the SO numbers start with 432 (43203718) followed by a sequential number and do not indicate the year.

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 older 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 Cup
8	Liner Cup Follower
9	Liner Cup Follower Screw
10	Seat Ring
11	Seat Ring Follower
12	Sear 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

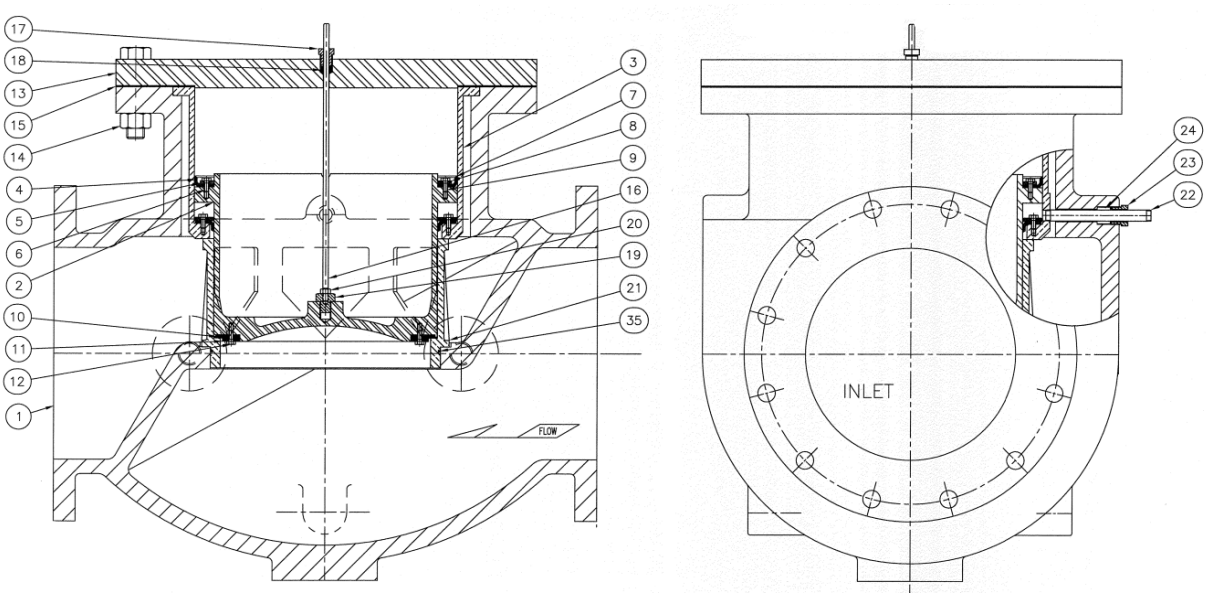

Figure 6 Globe Body, Reducing Service

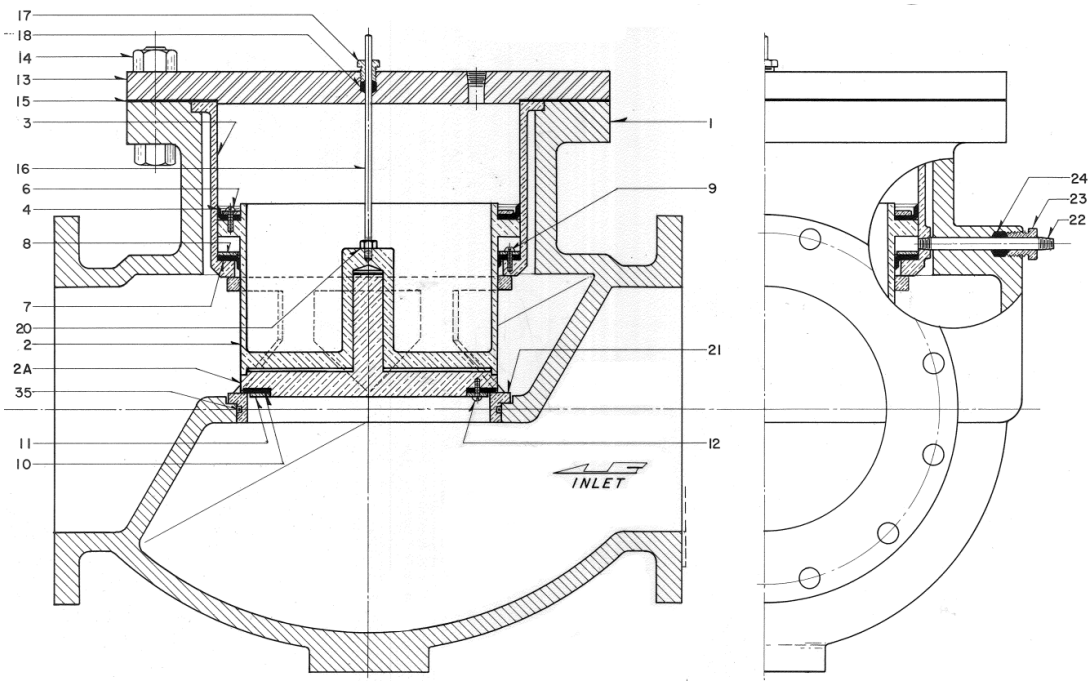

Figure 7 Globe Body Stop Check Piston, Water Service

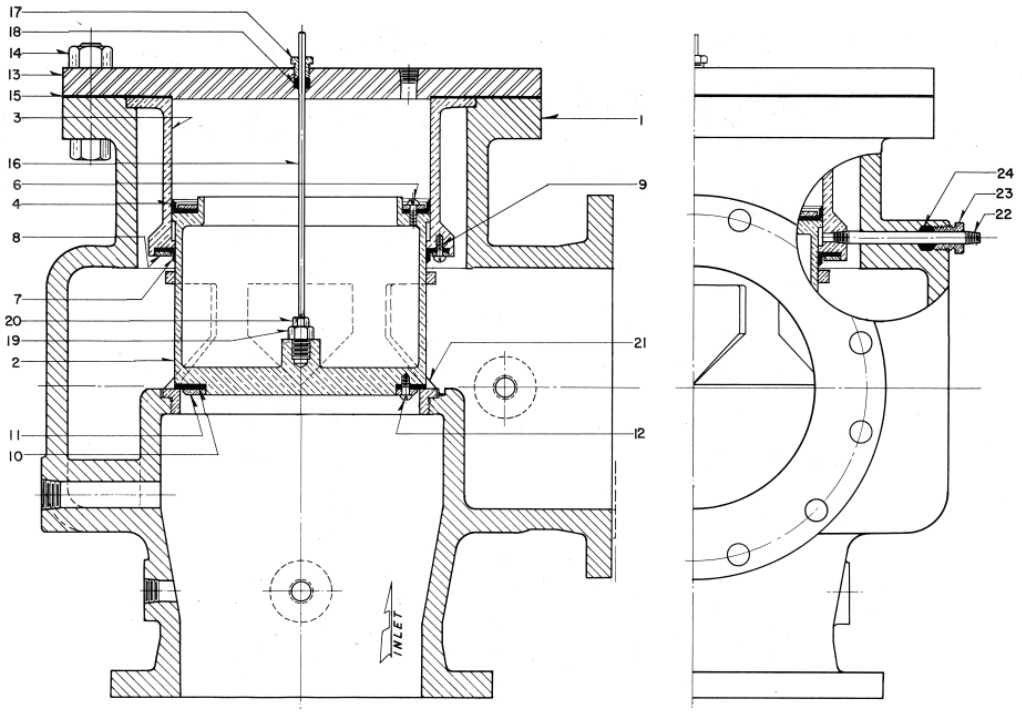

Figure 8 Angle Body, Reducing Service

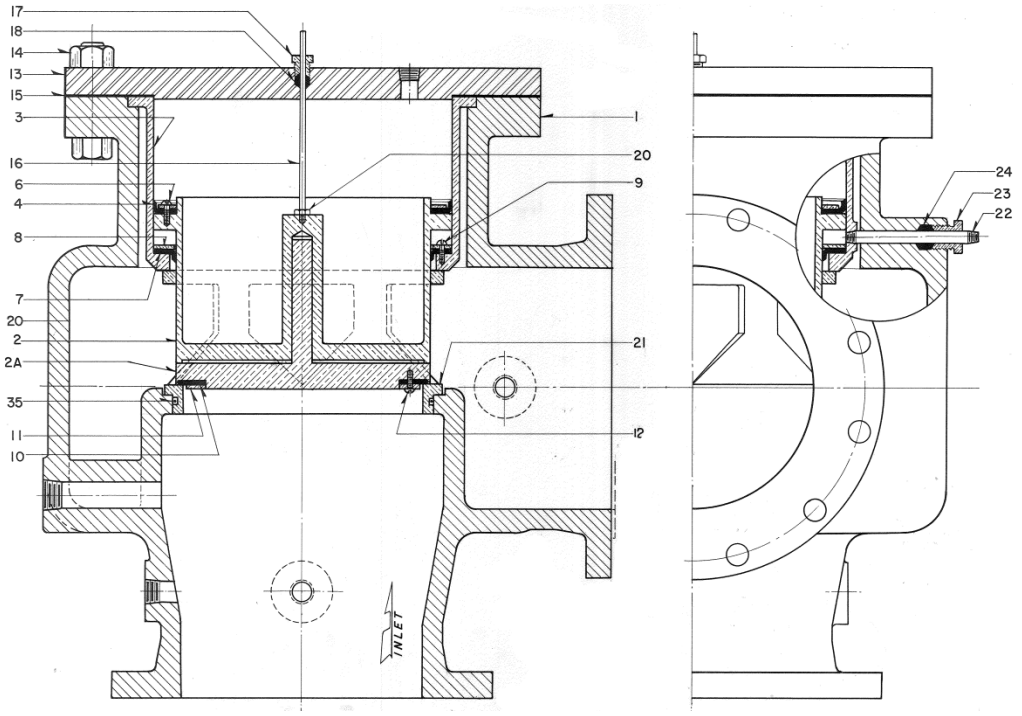

Figure 9 Angle Body, Stop Check, Water Service

Section 4

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

13-Inch Double Acting Altitude Pilot Assembly without Differential Level Control Drawing A1032

TABLE OF CONTENTS

GA INDUSTRIES
A VAG-Group Brand

234 Clay Avenue • Mars, PA 16046 USA
Telephone (724) 776-1020 • Fax (724) 776-1254
E-mail: info-ga@vag-group.com

Manual Number IOM-A1032-042325

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

INSTALLATION, OPERATION and MAINTENANCE

13-Inch Double Acting Altitude Pilot (Without Differential Level Control)

INTRODUCTION

This manual provides information to install, operate and maintain GA altitude valve pilots to ensure a long service life. The pilot is ruggedly constructed to provide many decades of dependable service with minimal maintenance.

Study these instructions and become familiar with the components before undertaking disassembly and/or service work.

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

The altitude pilot is a spring-loaded, diaphragm operated 3-way valve with a neutral position where all three ports are blocked.

The pilot controls the operation of the altitude valve's main valve differential piston. Refer to Sections 2 & 3 for more information on the differential piston operation.

The altitude pilot responds to changes in the water level in an elevated tank, standpipe, or reservoir. The altitude pilot contains a 3-way internal pilot valve that automatically applies inlet pressure to the top of the piston to close the main valve when the water level reaches maximum and exhausts the pressure from on top the piston when the water level falls about one foot below maximum to open the main valve and replenish the tank. In 18" and larger valves, the 3-way internal pilot valve applies/exhausts pressure from the top of the piston in an intermediate hydraulic pilot which in turn applies/exhausts pressure from the top of the main valve piston.

Figures 1 and 2 illustrate the altitude pilot. The same pilot operates all sizes and types of double acting altitude valves with 13" diameter pilot except those with differential level control, indicated by an "E" in the Figure Number (e.g., 3300-DRE).

OPERATION

The maximum water level is determined by the adjustment of a compression spring. Referring to Figure 2, turning the adjusting nut (33) compresses the spring (29) and exerts an exerts an upward force on the spindle (30). Tank head applied to the top of the main diaphragm (22) through either port "K" exerts a downward force. See Figure 2.

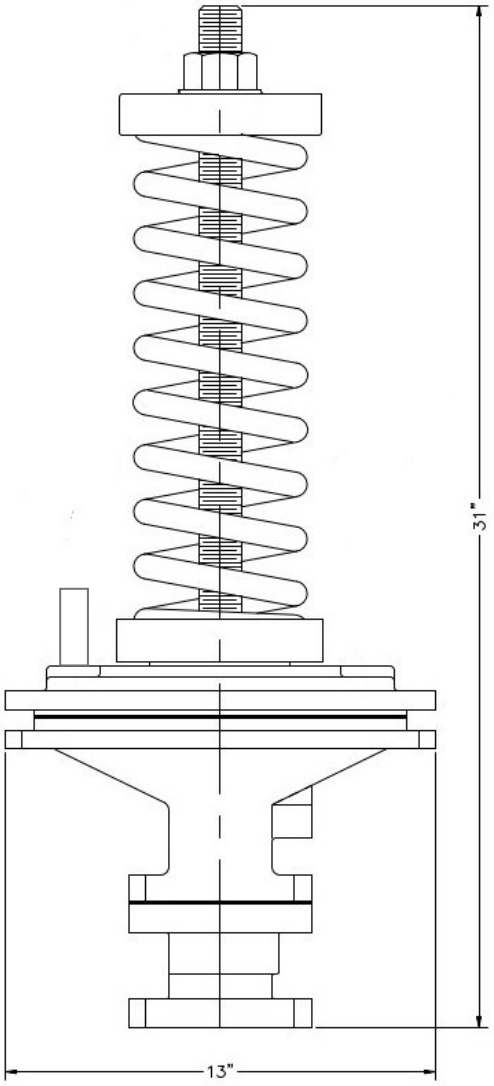

Figure 1

The tank is full when force of the tank head overcomes the spring force, thereby seating the pilot exhaust valve (16) and unseating the high-pressure valve (15) communicating the pressure port "J" through passageway "M" to the main valve cover port "L" allowing inlet pressure to be applied to the top of the main valve piston closing the valve.

When consumption causes the supply side pressure to fall below tank head, the pressure on top of the diaphragm is exhausted through the auxiliary check valve faster than it can be admitted through the orifice nipple's restriction. This allows the spring force to overcome the decreased head acting on the main diaphragm (22) thereby seating the high-pressure valve (15) and unseating the pilot exhaust valve (16) communicating the cover port "L" through passageway "M" to the exhaust port "N."

This allows the pressure that was holding the main valve piston closed to be exhausted through port "N" thereby opening the main valve allowing flow from the tank back into the supply side system.

The auxiliary check valve closes when supply side pressure rises above tank head allowing tank head to build on top of the main diaphragm (22) as the tank fills until it reaches maximum water level at which time the valve closes.

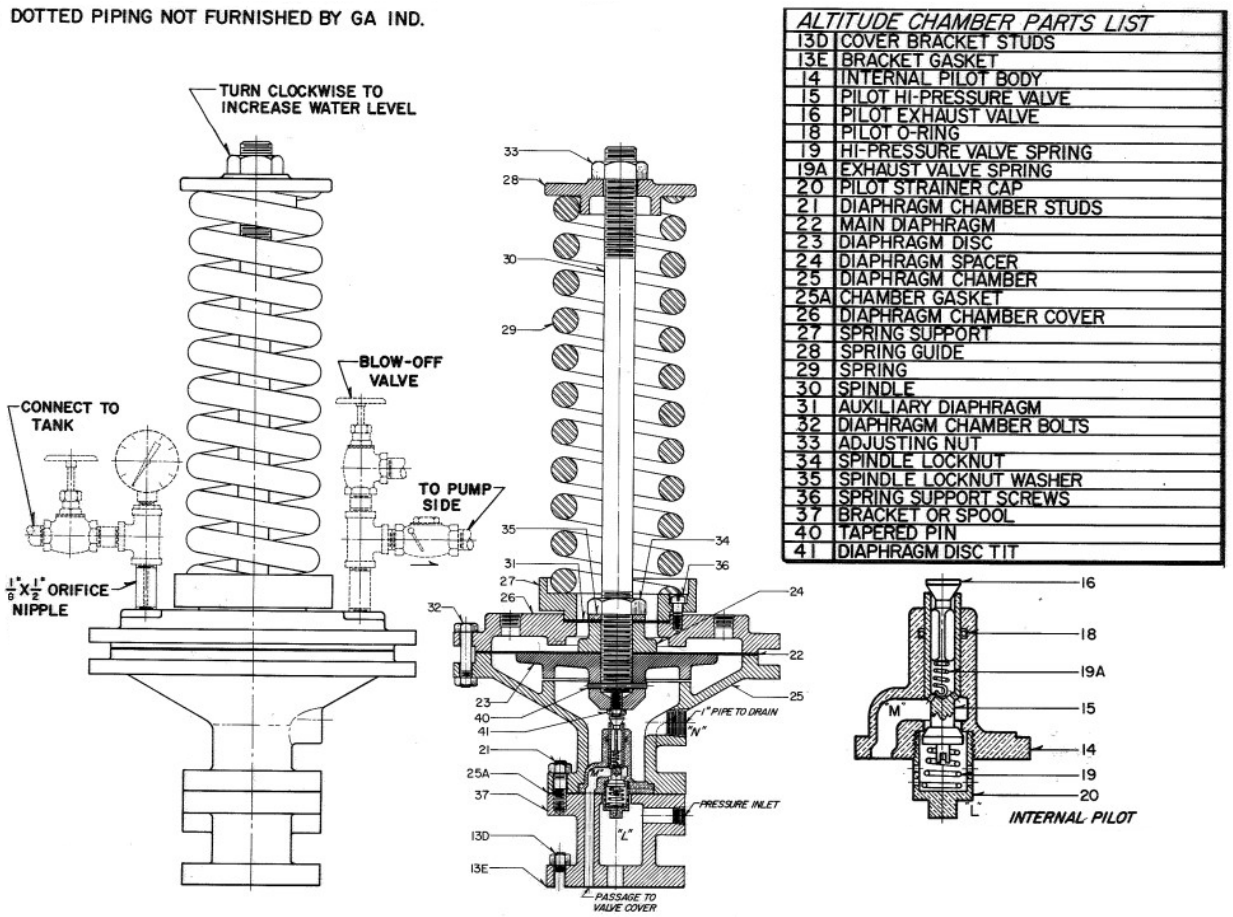

Figure 2

TROUBLESHOOTING THE INTERNAL PILOT

Water is discharged through exhaust port "N" as the main valve opens but should stop when the main valve is fully open. A continued discharge of water through port "N" usually implies the internal pilot valve needs servicing.

- A continuous leak from Port N only when the main valve is closed generally indicates the pilot exhaust valve (16) has a worn or scored seat.
- A continuous leak from Port N only when the main valve is fully open generally indicates the high-pressure pilot valve (15) has a worn or scored seat, or a weakened or broken high pressure spring (19) or a damaged gasket (25A).
- A continuous leak when the main valve is open and closed may indicate a damaged main diaphragm (22) or loose spindle locknut (34).
- A continuous high flow of water from exhaust port N with a by a wide-open altitude valve indicates a ruptured or compromised main diaphragm (22).
- Water leaking from below the spring indicates a ruptured or compromised auxiliary diaphragm (31).

WARNING

Personal injury may occur if the valve is disassembled while pressurized. Before attempting disassembly, follow appropriate lockout/tag out procedures to prevent accidental pressurization.

SERVICING THE INTERNAL PILOT

Most altitude pilot issues involve the internal pilot assembly which can be serviced or replaced without complete disassembly of the altitude pilot. Prior to removing the altitude pilot, close the system side and tank side main line isolating valves. Close the tank sensing line isolating valve and the closing speed needle valve supplying inlet pressure to port "J" noting how many turns it took to close. There is no need to loosen the adjusting nut (33).

Disassembly:

1. Disconnect the tank sensing line (the main valve may open fully as a result and discharge water from Port N).
2. Remove the diaphragm chamber nuts (21)
3. Carefully lift the entire altitude pilot assembly at least 6 inches off the bracket or spool (37).
4. If the internal pilot remains on the spool/bracket (37), set the rest of the assembly on a clean surface.
   a. If the internal pilot remains in the diaphragm chamber (25) it can be removed by hand before setting the rest of the assembly on a clean surface.
5. Invert the internal pilot to remove the pilot exhaust valve (16) and exhaust valve spring (19A).
6. Unscrew the strainer cap (20) and remove the spring (19).
7. Using a screwdriver or similar object, push down on the top of the high-pressure valve (15) forcing it out of the pilot body (14).
8. Do not remove the O-ring (18) unless a replacement is on hand. A sharp tool is needed to remove the O-ring and damage is likely.

Clean Up:

1. Inspect the exhaust valve (16) for scoring or wire drawing on the seating surface. Light score marks can usually be removed by placing the exhaust valve into the high-pressure valve and while pressing on the exhaust valve twist it back and forth with fingers. Repeat until a shiny new seat edge can be seen all around.
2. Inspect the high-pressure valve (15) seating surface for score marks. Light score marks can be ground out by placing the high-pressure valve back into the pilot valve body (14) and using a screwdriver twist the high-pressure valve back and forth while applying some pressure. When a shiny new seat edge is seen all around the regrinding is done.
3. In neither case should the grinding be "over done." While severely scored parts may require lapping compound, do not grind the seat until it is too wide as it's then more difficult to make a watertight seal. The seating edge should be between 1/32" and 1/16" wide, the narrower the better.
4. After the seats have been re-ground, polish the outside of the high-pressure valve using very fine emery cloth being careful not to tough the seat.
5. Clean the strainer cap (20) of any build-up or debris.

Reassembly:

1. With the O-ring (18) in place, lubricate the outside of the high-pressure valve (15) and install in the pilot valve body (14).
2. Place the conical spring (19) into the strainer cap (20) and screw the cap into the pilot valve body (14) hand tight.
3. Insert the exhaust spring (19A) into the high-pressure valve (15) hook first.
4. Insert the exhaust valve (16) into the high-pressure valve.
5. If replacing the chamber gasket (25A) ensure that all the old gasket is removed and the sealing surfaces on the top of the spool/bracket and the underside of the diaphragm chamber (25) and internal pilot body (14) are clean.
   a. Apply a light film of gasket cement to avoid potential leak.
6. Place the assembled internal pilot on the spool/bracket, being careful to center it and that the passageway in the spool/bracket lines up with the passageway "M" in the pilot.
   a. Ensure the exhaust valve (16) and spring (19A) are still in place.
7. Carefully lower the rest of the altitude pilot over the internal pilot on to the spool/bracket as it was oriented prior to disassembly.
8. Install nuts (21) and tighten.
9. Re-install the sensing line.
10. Proceed to "Check Out and Calibration"

INSTALLING A NEW INTERNAL PILOT (ACP-13 or ACP-13S KIT)

To replace the entire internal pilot (parts 14 through 20) follow Disassembly steps 1 through 4 and Reassembly steps 5 through 10.

INSTALLING AN AC-13 ALTITUDE PILOT SOFT GOODS KIT

The soft goods kit includes parts 13E, 22, 25A and 31. These parts are also included in the ACP-13 and ACP-13A kits.

Soft goods replacement is easier if done while the altitude pilot is mounted on the spool/bracket (37) atop the main valve. If also servicing/replacing the internal pilot, do so before or after installing the soft goods kit when the altitude pilot is mounted on the spool/bracket.

Prior to removing the altitude pilot, close the system side and tank side main line isolating valves. Close the tank sensing line isolating valve and the closing speed needle valve supplying inlet pressure to port "J."

Disassembly:

1. Disconnect the tank sensing line and auxiliary line (the main valve may open fully as a result and discharge water from Port N).

2. Measure to within 1/32" and note the distance from the top of the spindle (30) to the top of the spring guide (28).
3. Loosen and remove the adjusting nut (33) by turning counterclockwise being careful not to exert a side load on the spindle (30).
4. Remove the spring guide (28) and spring (29).
5. Remove the diaphragm chamber bolts and nuts (32) and lift off the diaphragm cover (26) ad everything that's attached to it.
6. Knock out the disc pin (40) and unscrew the diaphragm disc (23).
7. Remove the spring support screws (36) and spring support (27).
8. Extract the spindle (30) and unscrew the diaphragm spacer (24) and remove the auxiliary diaphragm (31).
9. Inspect all parts for wear and corrosion. Clean or replace as needed.

Reassembly:

1. Ensure the surfaces of the diaphragm disc (23), diaphragm chamber (25), diaphragm chamber cover (26) and spring support (27) that seal on the main and auxiliary diaphragms (22 and 31) are clean.
2. Install the auxiliary diaphragm (31) on to the spindle (30) against the spindle lock nut washer (35).
3. Install the diaphragm spacer (24) and main diaphragm (22).
4. Screw the diaphragm disc (23) onto the spindle (30) and install the disc pin (40).
5. Tighten the spindle lock nut (34) clamping all the parts together.
6. Place the spindle and attached components into the diaphragm chamber and install diaphragm chamber bolts and nuts (32). Tighten in an alternating pattern clamping the main diaphragm (22)
7. Install the spring support (27) and spring support screws (36). Tighten in an alternating pattern clamping the auxiliary diaphragm (31).
8. Place spring (29) in the spring support (27) and the spring guide (28) on top of the spring.
9. Thread on the adjusting nut (33) and tighten to the distance as measured before disassembly.
10. Assembly is complete.

CHECKOUT and CALIBRATION

With the altitude pilot re-mounted on the spindle/bracket, install a pressure gauge (ideally calibrated in feet of water) and a blow off valve as shown in Figure 3 (if not already there).

Checkout:

1. Re-connect the auxiliary line with check valve.
2. Reconnect the tank sensing line and open the closing speed needle valve to the position it was when closed prior to servicing the altitude pilot. If not known, initially open ¼ turn from closed.
3. Open the supply side and tank side isolating valves to introduce pressure to the altitude valve and check for leaks.
4. Open the blow off valve and open the tank sensing line isolating valve about 1/8th turn. Slowly close the blow off valve when all the air has been purged. Fully open the tank sensing line isolating valve and watch the gauge reading increase.
5. If the current tank water level is at or above the level at which the adjusting spring (20) is set, the main valve will close.
   a. While watching the gauge with a finger placed at the base of the indicator rod, note the exact height or pressure (PSI x 2.31 = feet of water) at which the main valve starts to close. This is the present water level set point of the spring (20).
   b. If the level at which the main valve closes is below the desired level, proceed to "Calibration."
6. If the main valve does not close, make sure there are no leaks, especially from Port N. If so, refer to Troubleshooting and correct leak.
7. If no leaks and the main valve remains open but the tank is not overflowing, it indicates the tank is not yet full.
   a. Wait for the tank to fill and follow Step 4
8. If no leaks and the tank is overflowing, the water level is set too high. Proceed to "Calibration."

Calibration:

To test the assembled altitude valve and verify the water level settings the tank must be full and a gauge and blow off valve installed on the altitude pilot diaphragm chamber as shown in Figure 3.

Calibration is easier if the gauge indicates feet of water, and the gauge range is not significantly more than the height of the water in a full tank.

1. Close the sensing line isolating valve and re-open.
   a. If it's a gate or globe valve, open 1/8th turn.
   b. If it's a ball valve, open about 10 degrees.
2. Close the tank side main line isolating valve to avoid putting water into a full tank during calibration.
3. Very slowly open the blow off valve which will cause the pressure in the diaphragm chamber cover to fall simulating lowering the supply side water pressure.
4. With a finger placed at the base of the indicating rod note the gauge pressure at which the main valve starts to open. This is the opening water level.
5. Slowly close the blow off valve causing the pressure inside the diaphragm chamber to rise simulating a rising tank water level.
6. With a finger placed against the base of the indicating rod, note the pressure at which the main valve starts to close. This is the maximum tank water level set point.
   a. The main valve should close a foot or so below tank overflow.
   b. To lower the desired set point, turn the adjusting nut (33) counterclockwise. To raise the desired set point, turn the adjusting nut (33) clockwise.
   c. Refer to Table 1 for the approximate change in water level per full turn of the adjusting nut for each spring. Do not exceed the spring's maximum water level setting.

7. When the calibration is complete, fully open the sensing line isolating valve and the tank side isolating valve to put the valve into service.

PREVENTATIVE MAINTENANCE

No routine lubrication or adjustments are needed. The altitude valve pilot should be visually inspected once a month for the first 3 to 6 months after initial start-up to check for continuous leakage from Port N.

Table 1. Altitude Valve Springs

SPRING COLOR	MAX SETTING	WIRE DIAMETER	CHANGE PER FULL TURN
Yellow	25 ft.	0.500”	0.43 ft.
Orange	40 ft.	0.625”	1.0 ft.
Gray	110 ft.	0.750”	2.9 ft.
Green	160 ft.	0.875”	5.8 ft.
Red	250 ft.	1.000”	10.8 ft.

REPLACEMENT PARTS

- Altitude Pilot Soft Goods Kit AC-13 (Parts 13E, 22, 25A and 31) – Kit Part Number 2-80-23000-815
- Bronze Internal Pilot Altitude Chamber Repair Kit ACP-13 (Parts 13E, 14 to 20, 22, 25A and 31) – Kit Part Number 2-80-23001-215
- Stainless Steel Internal Pilot Altitude Chamber Repair Kit ACP-13S (Parts 13E, 14 to 20, 22, 25A and 31) – Kit Part Number 2-80-23001-256

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.

WARRANTY:

The Warranty for GA Industries valves is included in our Terms and Conditions which can be found here: https://gaindustries.com/terms