

Model ZW221

One-Way Altitude Control Valve

Globe and Angle Valves

1 1/4", 1 1/2", 2", 2-1/2", 3", 4", 6", 8", 10", 12", 14" & 16"



☐ Installation ☐ Troubleshooting ☐ Maintenance Instructions

This valve controls the water level in an elevated reservoir by measuring the level change through a user installed sensing line. The main valve closes when water level reaches the high level set point. When the water level in the reservoir drops approximately 18-36", the valve reopens to fill the reservoir. The valve will not prevent reverse flow unless the check option is installed.

Installation / Start-up

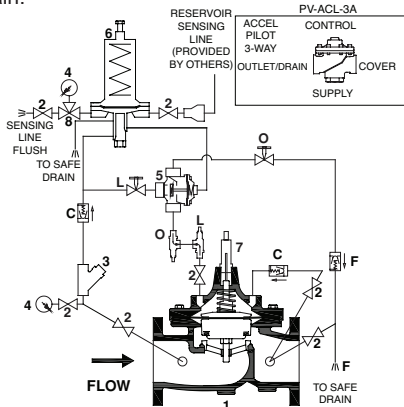
NOTE: Flushing of all pipe lines is to be performed to remove all debris prior to installing valve.

CAUTION: The recommended installation orientation for ACVs is horizontal, with the valve cover up. 6" and larger valves should only be installed horizontally, with the valve cover up, due to the difficulty of properly bleeding air out of the cover on valves installed in the vertical orientation. In addition, the horizontal positioning of the larger valves avoids premature wear due to the mass of plunger assemblies as well as allows for greater accessibility during annual inspections, and maintenance.

1. Allow for adequate space around the valve for making adjustments and servicing before installing valve.
2. When installing a ZW221, shutoff valves installed on both inlet and outlet are recommended for maintenance allowing for isolation of valve.
3. Position the valve in line matching the direction of flow as indicated on the valve model tag with the proper direction of flow in the system. The flow arrow should point toward the reservoir. Once attached to line, double check all fasteners/bolts in the pilot system and on main valve are tight and there is no damage prior to pressurizing system.
4. Install a remote sensing line between the reservoir and the pilot sensing port reducer. The sensing line should be a minimum of 3/4" size and should not be connected the piping between the reservoir and valve as this may cause incorrect level readings. The sensing line should be copper, PVC pipe, or other corrosion resistant material. The line should slope up toward the reservoir to allow trapped or dissolved air to naturally vent and prevent inaccurate readings.
5. The pilot drain line should be connected to safe drain location. If option F is ordered, then the accelerator pilot drain should also be connected to a safe drain.

Start-Up

1. Open the pilot ball valves (2) in the pilot system (see ZW221 Schematic).
2. Then slowly open the upstream supply shutoff valve only enough to fill main valve assembly and pilot system.
3. As the valve is filling with water, it is necessary to bleed the main valve and pilot system of air. To vent air, partially open or loosen the highest plugs or fittings in the system. Use caution when loosening plugs. Slightly open the test cock at the top of the ZPI valve position indicator with a screwdriver to vent air. It may be necessary to bleed system more than once. After removal of air in the system tighten all loose fittings. **NOTE:** If valve is installed vertically, it will be necessary to loosen some upper cover bolts until you have vented all the air from the cover chamber.
4. Vent the pilot sensing chamber by opening the sensing line isolation test cock, gauge isolation valve, and sensing chamber flush test cock. Once all air is removed, close the flush test cock.
5. Before setting pilot valve, open the closing speed control fully (L on ZW221 schematic). If valve is equipped with opening speed controls (O on ZW221 schematic) it is necessary to back out the adjusting screw or handle a minimum of 3 turns from closed position. On larger valves the opening speed control is on the downstream line and the closing speed control is on the upstream supply side. Adjust speed controls as needed after testing operation.
6. The sensing line isolation test cock and purge test cock can be used to check the pilot setting before opening downstream isolation valve. Check the reservoir level on the pilot sensing chamber gauge (reservoir isolation test cock and three way gauge isolation valve should still be open.) Close main valve cover pilot isolation valve. Loosen hose connection at cover isolation valve. Pressurized water will flow from this connection if the reservoir is above the pilot high setting. If no water flows, then the pilot is trying to fill the reservoir. To adjust the pilot, loosen jam nut on adjustment screw and either turn adjustment screw in to raise reservoir level or out to decrease reservoir level. See chart below. If pilot is set below reservoir level, slowly open sensing line isolation valve. As level rises on gauge, note high water reading on gauge when pilot drain discharges water. Adjust pilot to desired high level. After a few cycles of reservoir, verify pilot set point during reservoir filling, it can change slightly with reservoir fill rate and as air dissipates from system.



Schematic Diagram

- | Item | Description of Standard Features |
|------|--|
| 1 | Main Valve |
| 2 | 850XL Isolation Valve |
| 3 | SXL "Wye" Type Strainer |
| 4 | Pressure Gauge |
| 5 | PV-ACL-3A Accelerator Pilot |
| 6 | PV-ALT Altitude Control Pilot |
| 7 | ZPI Position Indicator |
| 8 | 3-Way Gauge Isolation/Sensing Line Flush Valve |

PILOT	APPROXIMATE FEET PER TURN OF ADJUSTMENT BOLT
PV-ALT-33-55	1.25
PV-ALT-33-85	2.75
PV-ALT-33-230	5.0

7. Next it is advisable to flow water through the valve to ensure all air has escaped from system. High flow may be needed to flush all air. Fully open the upstream supply shutoff valve. Slowly open the downstream system shut off valve. Flow will begin to occur if the reservoir is not at the high level set by the pilot.

⚠ **WARNING:** Cancer and Reproductive Harm - www.P65Warnings.ca.gov
 ⚠ **ADVERTENCIA:** Cáncer y daño reproductivo - www.P65Warnings.ca.gov
 ⚠ **AVERTISSEMENT:** Cancer et néfastes sur la reproduction - www.P65Warnings.ca.gov

8. After pilot system has been adjusted and the valve is performing properly, the main valve opening and closing speed controls (O or L) can be adjusted as needed. Start with the speed controls three turns from fully closed. Unscrew stem to speed up the valve opening or closing.

9. Close three way gauge isolation valve and inlet pressure gauge isolation valve to prevent gauge damage. Leave sensing isolation valve (between pilot and sensing line reducer connection) open.

Troubleshooting

When the pilot valve senses the high water level has been reached, the diaphragm moves up allowing the plunger to close the supply pressure port and the main stem to vent the accelerator pilot cover to atmosphere through the drain port. The accelerator pilot then allows supply pressure to flow into the control valve cover to close the main valve. When water level drops in the reservoir, the drain port is closed by the main stem moving down and then the supply port is opened to allow water into the accelerator cover. The accelerator then vents the main valve cover to the downstream piping or to atmosphere, option F.

Table 1.

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION
1. Reservoir level too high	1. Pilot isolation valves closed 2. Sensing line has trapped air 3. Closing speed control shut or plugged 4. Pilot set too high 5. Sensing line plugged	1. Verify the inlet, outlet, cover, and sensing line isolation valves are open 2. (a) Purge sensing line of all air and sediment (b) Verify sensing line is sloped to prevent air being trapped at pilot 3. Verify speed control in correct position, exercise stem to remove any water deposits or debris 4. Lower setting by unscrewing adjustment bolt 5. (a) Check pilot valve for sediment build up under diaphragm (b) Verify sensing line isolation valves are open
2. Reservoir level too low	1. Supply pressure too low 2. Pilot isolation valves closed 3. Opening speed control shut or plugged 4. Pilot set too low 5. Sensing line plugged	1. Check valve inlet pressure gauge (and gauge isolation valve) to verify adequate supply pressure 2. Verify the inlet, outlet, cover, and sensing line isolation valves are open 3. Verify speed control in correct position, exercise stem to remove any water deposits or debris 4. Raise setting by screwing adjustment bolt in 5. (a) Check pilot valve for sediment build up under diaphragm (b) Verify sensing line isolation valves are open
3. Discharge from pilot bell weep hole	1. Leak in pilot diaphragm 2. Pilot diaphragm center bolt loose	1. Open and inspect diaphragm and bolt o-ring 2. Open and check that bolt is tight
4. Discharge from pilot drain	1. Normal operation 2. Worn o-rings 3. Corrosion/water deposits	1. (a) Drain tube drips and discharges water as reservoir reaches high level set point (b) Drain tube should be connected to a safe location where water can drain during valve operation 2. Disassemble pilot and check main stem o-rings 3. (a) Disassemble pilot and check small end of main stem, center chamfer should be smooth with no nicks or debris (b) Remove pilot main cap and plunger, inspect tip of plunger for corrosion or debris (c) Clean or replace parts as necessary

DIAGNOSIS CHECKS

CAUTION: Do not service valve while under pressure. When performing diagnosis checks on the ZW221 when the valve is fully open, high flow rates and high downstream pressures can occur. In order to prevent harm to personnel, equipment, and downstream piping be sure a downstream valve is closed before performing checks.

DIAPHRAGM CHECK

- Slowly close upstream shut off valve and relieve all pressure downstream.
- With all pressure relieved in the main valve, close both upstream and downstream pilot ball valves. Remove side plug

on cover and leave off.

- Then open upstream shut off valve partially, allowing water to flow through the valve. While flowing water monitor the opening on the cover. Water will flow from the cover as the plunger assembly rises, if water continues to flow once fully open then there is most likely damage to the diaphragm or fluid is leaking past the diaphragm assembly due to loose assembly. It is recommended that the valve cover be removed to investigate the leakage (To remove cover see "Maintenance" section for procedures). If water stops flowing out of cover then the diaphragm is good and you may proceed to the diaphragm movement check.

DIAPHRAGM MOVEMENT CHECK

1. The diaphragm movement check can be determined during the diaphragm check by removing the top center plug or it can also be performed with the use of a valve position indicator model ZPI.
2. Replace cover plugs and open pilot ball valves on upstream and cover.
3. Closing the downstream pilot ball valves will direct the flow to the cover causing it to close. **NOTE: Slow or delayed closing of main valve is normal and is due to the time requirements to fill and pressurize cover, pushing the diaphragm into the closed position. This normal delay is not mechanical binding of the valve assembly.**
4. Using the valve position indicator, make note of the closed position on the indicator. Compare distance of the open mark to the close mark and compare to Table 3. (Or by measuring to the top of the stem under center plug before and after diaphragm check)
5. Verify that the main valve is closed, by opening a downstream source. If water continuously flows, then the main valve is not sealing properly. Double check the valve movement matches the values in Table 3 and refer to the disassembly procedures section if it does not. This is an indication that the main valve is not sealing due to an obstruction between the seat and the seal, stem or a damaged seal. If water does stop flowing and the measured valve movement does not match Table 3, then there is possible damage under the cover. Remove cover to identify obstruction and replace parts as necessary.

TABLE 3. VALVE STEM TRAVEL

VALVE SIZE (in)	VALVE SIZE (mm)	STEM TRAVEL (in)	STEM TRAVEL (mm)
1-1/4" - 1-1/2"	38	0.4	10.2
2"	50	0.7	18.0
2-1/2"	65	0.8	21.3
3"	80	0.9	23.4
4"	100	1.1	28.8
6"	150	1.7	43.4
8"	200	2.4	59.7
10"	250	2.8	71.1
12"	300	3.4	86.4
14"	390	3.8	96.5
16"	400	4.3	109.2

6. For smaller valves (6" and below) diaphragm checks can be performed by hand with the use of a valve stem tool. The valve stem tool can be made using Table 4 to create a "T" bar handle with the appropriate threads on the opposite end of the "T" handle.

TABLE 4. VALVE STEM THREAD SIZE

VALVE SIZE (in)	THREAD SIZE UNF INTERNAL
1-1/4" - 1-1/2"	10-32
2"	10 - 32
2-1/2"	10 - 32
3"	1/4 - 20
4"	1/4 - 20
6"	1/4 - 20
8"	3/8 -16
10"	3/8-16
12"	3/8-16
14"	3/8-16
16"	3/8-16

7. To perform the diaphragm check using the valve stem tool, first remove all pressure in the system and vent the cover. Then remove the center plug on the cover and insert tool into the top of the stem threads. Once the tool is inserted, the valve can be lifted up and the valve movement can be measured by creating marks on the tool in the opened and closed positions. The distance between marks is the valve stem travel. Replace or repair any parts as necessary. **Caution:** water will squirt from center hole or can be vented from extra plug on cover when lifting.

SEAL RING CHECK

1. To check the seal of the valve disc, an additional pressure gauge will be needed downstream of main valve. Also isolate low flow bypass line if equipped.
2. With the valve flowing, slowly, close downstream pilot ball valves to apply pressure to cover and allow to close.
3. Open downstream source to relieve all downstream pressure and then completely close downstream shutoff valve or downstream source to close downstream system. Monitor the pressure on the inlet and installed outlet gauge, for one min. The pressure on the outlet side should remain zero. If the pressure matches inlet pressure or increases, the main valve is leaking or the outlet ball valve on the pilot system is allowing pressure to creep by. Either way it is recommended that the valve be disassembled and inspected (refer to "Disassembly" section).

Maintenance Instructions

PREVENTATIVE MAINTENANCE

The Zurn Wilkins ZW200 models require minimal maintenance. However, it is highly recommended to schedule annual inspections and to have a repair kit on hand before work begins. Valves used often may be inspected on an annual basis, but at least every five years. Valves that rarely open, should be inspected every six months to one year for water deposits, debris, or corrosion.

DISASSEMBLY

Warning: Because of the ability to perform inspections and maintenance without removal from the system, it is very important that all shut off valves be closed and all pressure relieved in the valve before beginning disassembly. Failure to do so can result in personnel injury or equipment damage.

1. Verify that all pressure sources are closed up and downstream of valve.
2. Remove pressure in pilot system by loosening the tube fittings to the valve body and cover. When all pressure has been vented, continue to disassemble the pilot control valve and cover tubing. **NOTE:** Taking a picture before tear down can help with re-assembly of pilot system.
3. Next remove the cover by loosening and removing the cover bolts. If the cover does not come off easily it may be necessary to loosen the cover using a brass chisel and rubber mallet. Apply the chisel under the cover pointing upward away from valve body and tap bottom of cover with the chisel and mallet to loosen the cover. Once the cover is loose, pull cover straight up to avoid damaging the stem and stem bearing in the cover. On larger valves 8" and up, eye bolts and a hoist are recommended due to the weight of these larger covers.

4. With the cover removed the diaphragm assembly can be removed. To avoid damaging the seat bushing, grab the stem and lift straight up. For larger valves 8" and up it is recommended that an eye bolt with the proper stem threads be used with a hoist to lift the assembly out of the valve (see Table 4 for appropriate stem threads).
5. Next it is recommended that the diaphragm assembly be placed in a vise with the bottom hex secured. Once secured remove the spring and stem nut.
6. After inspecting the stem and removing the nut the diaphragm assembly can be dismantled. If the valve has not been serviced in awhile it is possible that the assembly will require the use of a rubber mallet or pry bars to dismantle the assembly. If this is the case gently tap or pry the components until the components are free to move. When disassembling be sure to clean, inspect, and save all components. Replace any damaged components as necessary.
7. The last component to inspect is the seat which is in the body of the main valve. During inspection of the seat, clean and polish as necessary with fine grit wet/dry sandpaper (400 grit or higher). Typically, if after cleaning there is no visual damage or excessive wear the seat should not require removal. If damage is present or the seat is excessively worn the seat should be replaced.
8. To remove the seat, on valves 6" and smaller the seat is threaded into the body and will require a seat removal tool. Care should be taken when removing the seat to avoid damaging. On 8" and larger valves, the seat is held in place with flat head hex screws. For larger valves a seat puller may be required to remove the seat from the body. A seat tool may be made by grinding three notches for the spokes in the end of a pipe. Turn with a pipe wrench.

INSPECTION OF COMPONENTS

Cleaning of components is required for proper inspection. Lime deposits are common in systems that use water. To remove deposits, fine grit wet/dry sandpaper (400 grit or higher) can be used. If deposits cannot be removed, off the shelf lime deposit remover can be used. Prepare a solution following the lime deposit remover instructions and soak components (excluding rubber components) until lime deposits are removed.

CAUTION: When handling chemicals (acids) be sure to use proper safety equipment (gloves and eye protection) and practices. After soaking components, be sure to thoroughly rinse all components before handling and re-assembling valve.

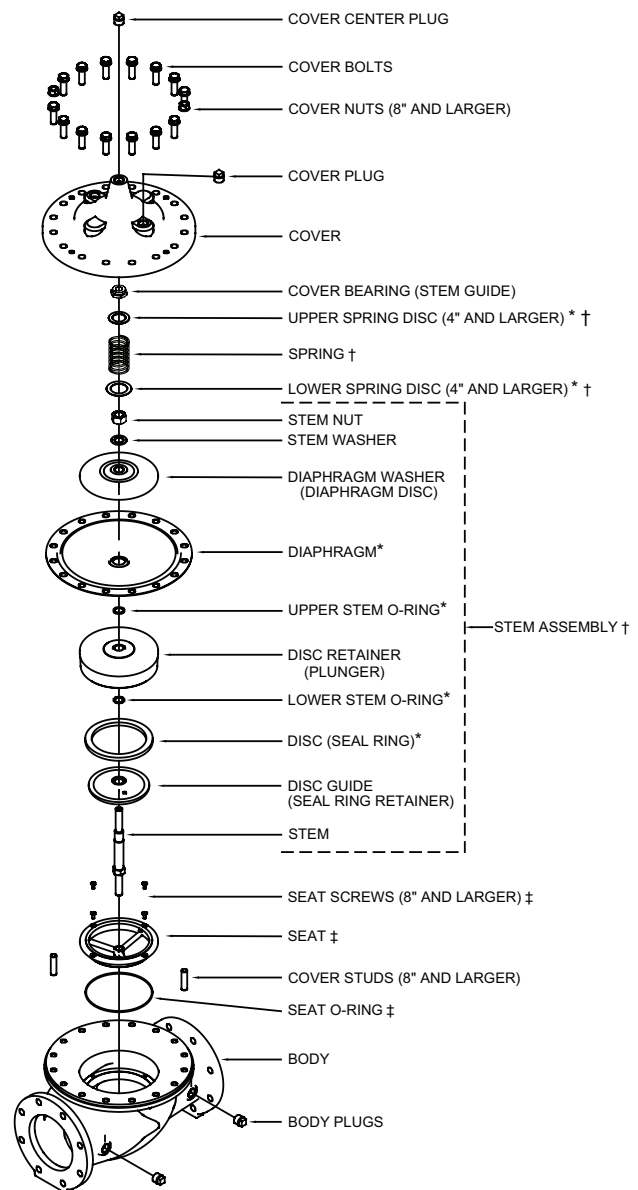
Once all valve components have been cleaned, inspect each component looking for damage, abnormal wear & corrosion, and replace all components that look questionable. Replace all rubber components including the diaphragm, o-rings and disc each time the valve is serviced or inspected (rubber components are standard in ZW200 repair kits).

REASSEMBLY

1. First reinstall seat into body. Be sure to use lube around seat o-ring before tightening. Tighten seat according to torque values in Table 5 using seat tool.
2. Next place valve stem in a vise clamping on the hex portion of the stem. Then assemble the diaphragm assembly as shown in Figure. When assembling be sure that the diaphragm is centered on the raised step of the disc retainer. It is also recommended to apply lube to stem threads and o-rings before tightening. Then tighten the stem nut according to Table 5 for torque values.
3. Lower diaphragm assembly carefully into the seat bushing. Be careful not to damage the seat or stem while installing assembly. Rotate the assembly as needed until the bolt holes on the diaphragm line up with the body bolt holes.
4. Place lower spring disc on the diaphragm disc and place spring on top of the assembly. Then install cover, aligning the bolt holes and insuring that the cover is not pinching the diaphragm between the bolt holes. Position cover so plug holes and pilot connection are in original position.
5. Install cover bolts and tighten in a star pattern to the torque values in Table 5.
6. Before installing center cover plug manually check that assembly has full operating travel before installing the pilot assembly (refer to "Diaphragm Movement" in the diagnosis checks section).
7. Once full operation range of the main valve is verified, begin reinstalling pilot system.
8. After installing pilot system double check that all plugs, bolts, and fittings are sealed and tight before applying pressure.
9. Slowly open upstream supply isolation valve to pressurize the system and check for any leaks.
10. Stop leaks as needed and proceed to "Start-Up" and "Diagnosis Check" sections for returning valve to proper system operations.

TABLE 5. VALVE TORQUE SETTINGS

VALVE SIZE (in)	COVER (ft-lbs)	DIAPHRAGM ASSEMBLY (ft-lbs)	THREADED SEAT (ft-lbs)	SEAT BOLTS (ft-lbs)
1-1/4"	3.5	7.5	11	N/A
1-1/2"	3.5	7.5	11	N/A
2"	15	20-25	30	N/A
2-1/2"	25	25-35	60	N/A
3"	25	35-45	70	N/A
4"	55	40-50	85	N/A
6"	110	50-60	95	N/A
8"	120	60-70	N/A	7.4
10"	184	70-75	N/A	7.4
12"	200	110-115	N/A	7.4
14"	275	170-175	N/A	7.4
16"	360	230-240	N/A	7.4



* RUBBER REPAIR KIT ITEMS
† COMPLETE REPAIR KIT ITEMS
‡ SEAT REPAIR KIT

Flow Characteristics

BODY MINIMUM FRICTION LOSS

