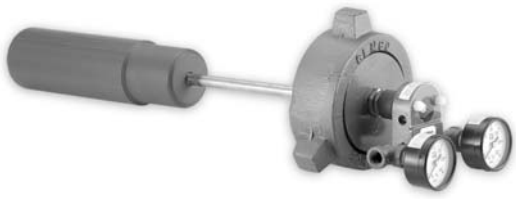
Installation, Operation & Maintenance Instructions for Series 6900 Cantilever Liquid Level Control



Note: *This document is to be used in conjunction with WellMark Catalog Document, Section No. 3.5, "Series 6900 Cantilever Liquid Level Control".*

WARNING!

Over-pressure of this control or installation of the control in applications which may see pressure levels beyond those for which the control is designed may result in leakage and/or catastrophic failure. This failure could result in leaking gas, or produced liquid, damage to surrounding equipment and/or environment, personal injury or death.

Suitable pressure-relieving devices, as recommended by appropriate codes or standards, should be installed in your system to assure that maximum rated pressures are not exceeded.

Specifications

Connections

Process _____ 2" MNPT Std.
3", 4", 5", 6" Flanges, Yale and Hammer Union Configurations also available

Pilot _____ 1/4" FNPT

Output

Throttle (Proportional) _____ 3-15 psig

Snap-Acting _____ 0 to Full Supply (Pilot rated to 75 psi)

General

Maximum Working Pressure (CWP) _____ 1500 psi

Pilot Operating Pressure _ Normal: 20 psi minimum-30 psi Max.
Overpressure Protection: Gauges are the limiting factor.

Temp. Limits _____ -40°F to +200°F
(Higher temperatures available - Consult factory)

Materials

Displacer _____ PVC (165°F max.)
Delrin (200°F max.)
Phenolic Screw-on (275°F max.)
Phenolic Slip-on (400°F max.)

Sight Glass _____ Polycarbonate (Pyrex® available)

Seals _____ Buna-N standard (others available)

Application

The Series 6900 Cantilever Level Control is designed for use in liquid level and interface liquid control applications. They are commonly used in oil and gas processing, manufacturing plants, hazardous waste disposal, food processing, water treatment, petrochemical facilities or wherever fluid levels need to be controlled. The unit is available in either Snap-Acting or Throttling configuration, controlling pneumatic pressure for various control devices. The standard displacer is 2" x 10" Delrin and is mounted in a horizontal configuration. Displacers of other materials and dimensions, as well as Vertical Displacers are optionally available.

Principle of Operation

This liquid level control operates based on two physical laws:

- *"A solid, heavier than a fluid [such as a displacer] will descend to the bottom of the fluid, and the solid will, when weighed in the fluid, be lighter than its true weight by the weight of the fluid displaced."* - Archimedes' Principle

- A Cantilever beam (sensing rod) projecting outward, anchored at one end, will flex in proportion ot the weight applied, or removed, at the free end.

Therefore, following Archimedes Principle, a body (displacer or float) immersed in a fluid experiences a bouyant, or lift force equal to the weight of the displaced fluid. This static lift force acts vertically through the center of gravity of the displaced volume (Figure 1).

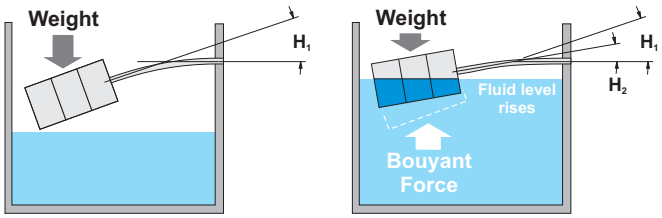


Figure 1
(Deflection exaggerated for clarification)

Applying the above fundamentals to this liquid level control, we can sense and regulate levels of most gas-to-fluid interface applications as well as many fluid- to-fluid interfaces.

By attaching a Displacer to the free end of the Sensing Rod, vertical movement is achieved. The rising and lowering of the fluid gives the static lift force - either up or down - which is transferred along the rod to an Actuator Pad (seat) extending out past the anchored end (See Figure 2). As the Actuator Pad moves to the Nozzle, supply pressure is diverted to output, opening a diaphragm-operated motor valve. As fluid is drained away through the motor valve and fluid level declines, the Actuator Pad moves up and away from the Nozzle and supply pressure is exhausted from the valve, thereby allowing it to close. This cycle then repeats as necessary.

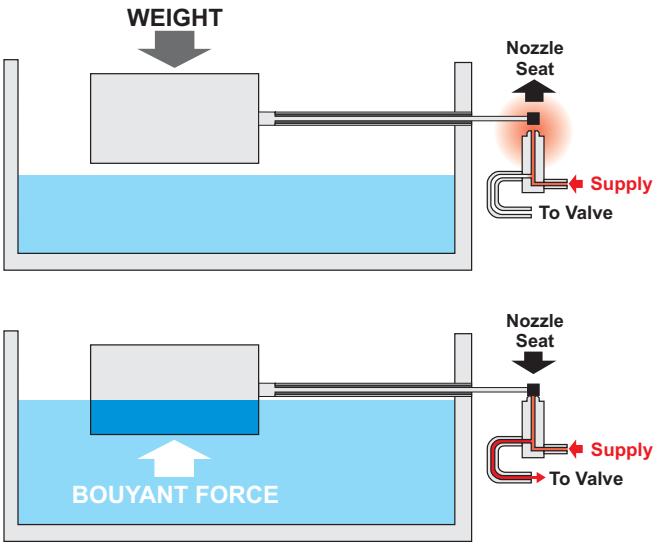


Figure 2

Modes:
In **throttling mode**, this control will continually throttle the valve to maintain the fluid level at a desired set point.

In **snap-acting mode**, a Shuttle Pilot is attached to the throttling head, converting the throttling output pressure to pilot signal pressure, tripping the shuttle pilot to either full supply pressure, opening the valve quickly, or to zero supply pressure, allowing the valve to close.

Installation

WARNING!

Prior to installation of the 6900 Cantilever Level Control system must be isolated from pressure. Failure to do so may result in personal injury, environmental spill concerns and/or damage to equipment.

If supply gas is flammable or noxious, this product must be located in a well ventilated, non-hazardous area or sealed and vented to a non-hazardous area.

Insure that threaded connections on both the Series 6900 Cantilever Level Control and the vessel are clean, free of debris and undamaged prior to installing. Visually inspect the unit, observing that the Nozzle Seat and rod-end are centered in the Sensing Rod connector. If not, the unit has been distorted and should be returned to center before placing the control in service (See "Centering Sensing Rod" in the following **Maintenance** section).

Install the control into appropriately-sized mating female threaded connections or flanges. For threaded connections utilize a suitable thread sealant to assure leak-tight makeup and to avoid thread galling. For flanged connections, utilize proper gaskets or seal rings as required for the specific flange configuration. After installation in the vessel, check for mechanical clearance of Displacer, assuring free movement by flicking the actuator pad and observing that Displacer travel is unobstructed.

Connect instrument supply line to supply port marked "**IN**" on side of the unit. Connect control valve signal line to "**OUT**" port on the opposite side. Use a suitable thread sealant to assure leak-tight make up and to avoid thread galling. Do not over-tighten.

NOTE: 20-30 psi is recommended for proper operation. Supply gas should be clean (filtered) and dry to assure longer maintenance-free operation.

Start-Up

Remove the clear Cover Plate and visually check to determine that the Sensing Rod/Nozzle Seat is properly centered in the Cantilever Tube. If not, the Cantilever Rod assembly has become misaligned and must be adjusted before placing the control in service (See "Centering Sensing Rod" in the following **Maintenance** section).

Assure that the vessel liquid levels are below the Displacer, and that proper system shut-off valves are open or closed as required.

Energize the control by opening the supply gas to the pilot head (20-30 psi recommended). Supply gas should flow freely from the Nozzle orifice.

Square the Nozzle Seat and Nozzle orifice. Manually hold the Nozzle Seat against the Nozzle. Observe the Outlet Pressure Gauge (left-hand gauge). The outlet pressure should equal the inlet pressure within 1 psi. If not, inspect the supply system piping for leaks or malfunctions. Release the Nozzle Seat, again allowing free flow of supply pressure from the orifice. Outlet Pressure Gauge should again read zero. Reinstall the clear Cover Plate.

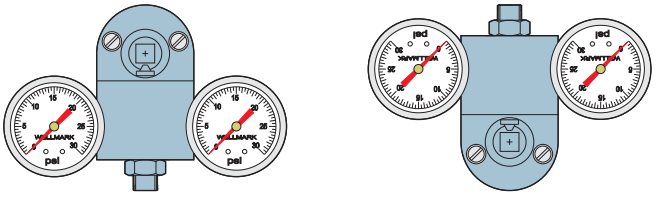
Adjust the Adjusting Screw/Nozzle upward toward the Nozzle Seat, by loosening Jam Nut and turning Adjustment Screw clockwise (when looking at the bottom of the unit) until Output Pressure Gauge starts to indicate a reading (1-3 psi).

Open the vessel inlet and observe the rising liquid level. Once the liquid reaches the Displacer fine adjustment of the control can be made within the diameter range of the Displacer by adjusting the Adjusting Screw up or down to actuate the diaphragm-operated motor valve. Once the desired adjustments are complete, tighten the Jam Nut, being very careful not to inadvertently disturb the Adjusting Screw setting.

To INCREASE Liquid Level - Turn Adjusting Screw counter-clockwise (moves Nozzle orifice away from actuator pad).

To DECREASE Liquid Level - Turn Adjusting Screw clockwise (moves Nozzle orifice toward actuator pad).

Normal pilot installation is **direct-acting** (rise in liquid level resulting from an increase of output). For **indirect-acting** (rise in liquid level resulting in a decrease of output), simply loosen 3/4-16 Jam Nut behind Pilot Head, and rotate Pilot Head 180° and re-tighten Jam Nut (See Figure 3).



Direct-Acting Indirect-Acting

Figure 3

Maintenance

The Series 6900 Cantilever Liquid Level Control requires very little maintenance. As with any instrumentation, the most important factors for long life and consistent operation is that supply pressure be clean and dry.

From time to time the entire pilot head may come loose on the Cantilever Rod. Check to assure that this connection is sound and that the jam nut is properly tightened.

Clearing a Clogged Orifice

The flow of gas in the supply line will draw any foreign material or particles as the gas moves to and through the control and valve. Occasionally, this may result in a particle of sand, weld slag, etc. becoming lodged in an orifice in the Adjusting Screw or Nozzle.

Shut off supply pressure to the control. Loosen the Jam Nut on the bottom of the unit and unscrew the Adjusting Screw/Nozzle from the Pilot Housing. Pull the Adjusting Screw/Nozzle completely free of the Pilot Housing.

Remove O-Rings from Adjusting Screw. Clean Adjusting Screw/Nozzle with solvent. Inspect for debris in orifices on side and end of Nozzle, removing as necessary with thin gage wire. Care should be exercised not to deform the orifice openings.

Inspect O-Rings for wear and replace if necessary. Lubricate O-Rings with a light coating of general-purpose grease and reinstall on the Nozzle. Take care that no grease clogs the orifices.

Gently re-insert the Adjusting Screw/Nozzle with O-Rings back into the Pilot Housing, taking care not to damage the O-Rings in the process. Readjust the Nozzle as directed on Page 2 under “Start Up”. Once proper adjustment is made re-tighten the Jam Nut.

Centering Sensing Rod

Occasionally, the Sensing Rod/Nozzle Seat will become misaligned in the Sensing Rod Housing and must be re-alinged prior to installation and use. This is a relatively easy procedure.

Once the unit is removed from service, remove the entire Rod Assembly from the Pilot Head, detaching the Displacer as well. Remove the Nozzle Seat by loosening the Hex Nut and pulling the Nozzle Seat off the Sensing Rod. Peer into the end of the Rod Assembly and note in which direction the Sensing Rod is off center.

Rotate the Rod Assembly such that the Sensing Rod offset is now in the uppermost or 12-o’clock position (See Figure 4).

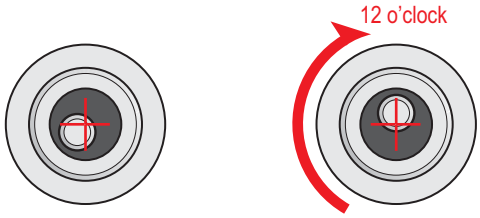


Figure 4

Grasp the Rod Assembly by this end and lightly tap the opposite end (the Displacer end) on a bench or block of wood. The Sensing Rod will begin to move back into the center of the Sensing Rod Housing. Continue with light taps until the Sensing Rod is properly centered (Figure 5).

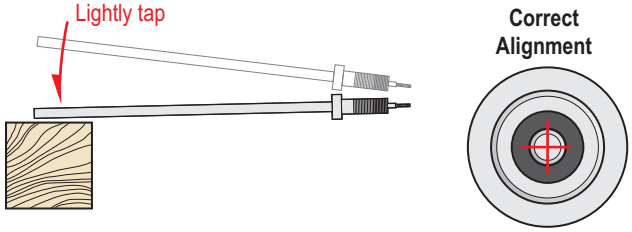
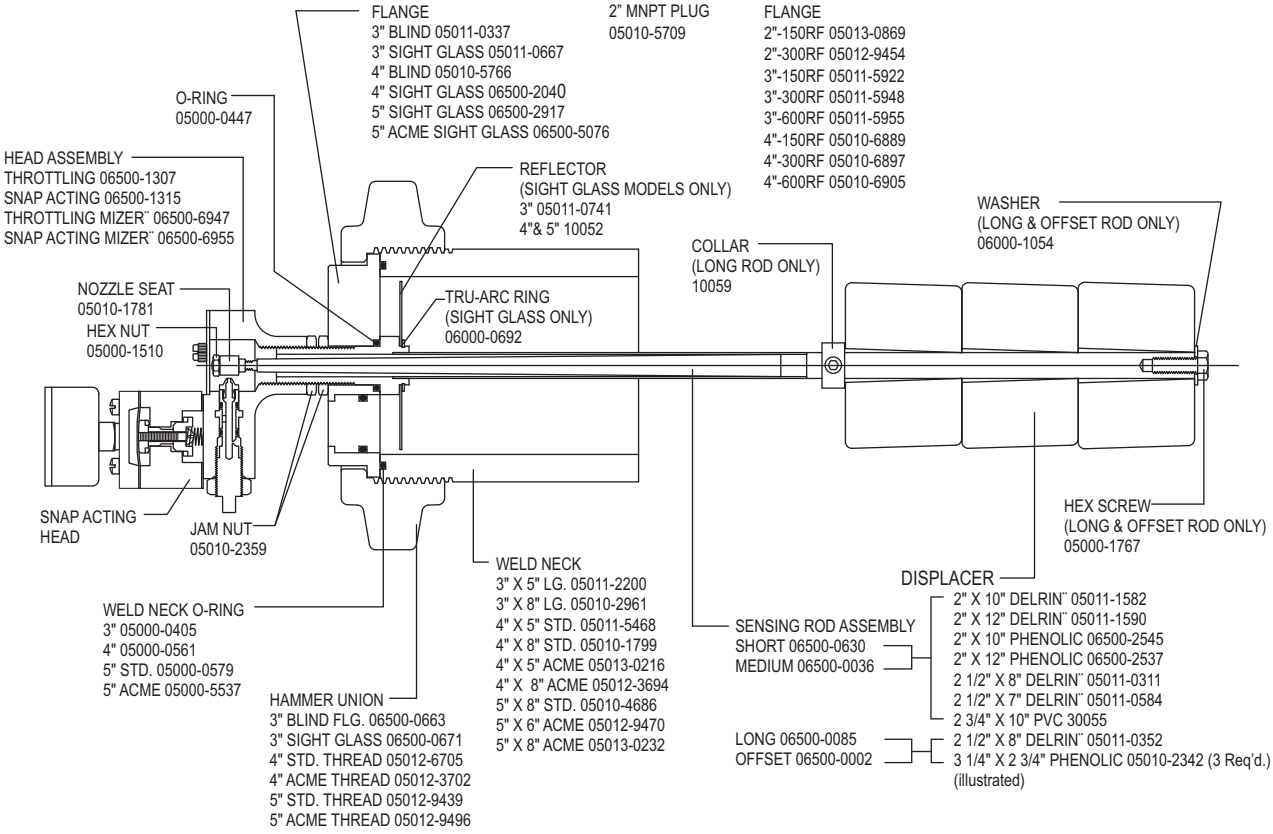
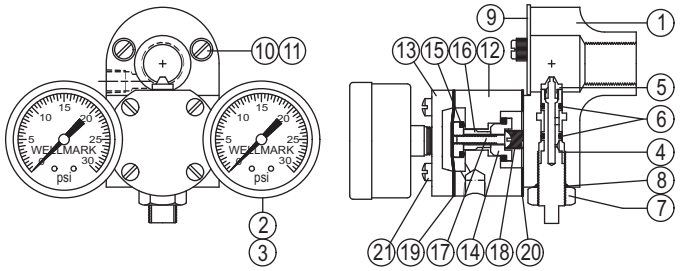


Figure 5



Parts List for Snap-Acting Pilot Head

Item	Description	Qty.	Part Number
1	PILOT HOUSING, ALUM. ALLOY 383	1	05010-3472
2	STREET-L, MALLEABLE	2	06000-0684
3	PRESSURE GAUGE	2	06000-0700
4	ADJUSTING SCREW, 303 SS	1	05010-1674
5	NOZZLE, 303 SS	1	05010-1682
6	O-RING, NITRILE	2	05000-0033
7	JAM NUT, 18-8 SS	1	05010-2334
8	O-RING, NITRILE	1	05000-0074
9	COVER PLATE, POLYCARBONATE	1	05010-3720
10	COVER SCREW, NYLON	2	05010-3761
11	O-RING, NITRILE	2	05000-0009
12	BOOSTER BODY, ALUMINUM	1	05010-3456
13	COVER, ALUMINUM	1	05010-3464
14	LOWER SEAT, ALUMINUM	1	05010-3423
15	UPPER SEAT, ALUMINUM	1	05010-3431
16	CONNECTOR, ALUMINUM	1	05010-3449
17	SCREW, PLATED STEEL	1	05000-2591
18	SPRING, ASTM A-313	1	05010-3704
19	DIAPHRAGM, FAIRPRENE	1	05010-3712
20	GASKET, FAIRPRENE	1	05010-3696
21	FILSTER HEAD SCREW, STEEL	4	06000-1601
22	DAMPENER, SS	1	05010-3829



Parts List for Throttling Pilot Head

Item	Description	Qty.	Part Number
1	PILOT HOUSING, ALUM. ALLOY 383	1	05010-1617
2	STREET-T, MALLEABLE	2	06000-0676
3	PRESSURE GAUGE	2	06000-0700
4	ADJUSTING SCREW, 303 SS	1	05010-1674
5	NOZZLE, 303 SS	1	05010-1682
6	O-RING, NITRILE	2	05000-0033
7	JAM NUT, 18-8 SS	1	05010-2334
8	O-RING, NITRILE	1	05000-0074
9	COVER PLATE, POLYCARBONATE	1	05010-3720
10	COVER SCREW, NYLON	2	05010-3761
11	O-RING, NITRILE	2	05000-0009