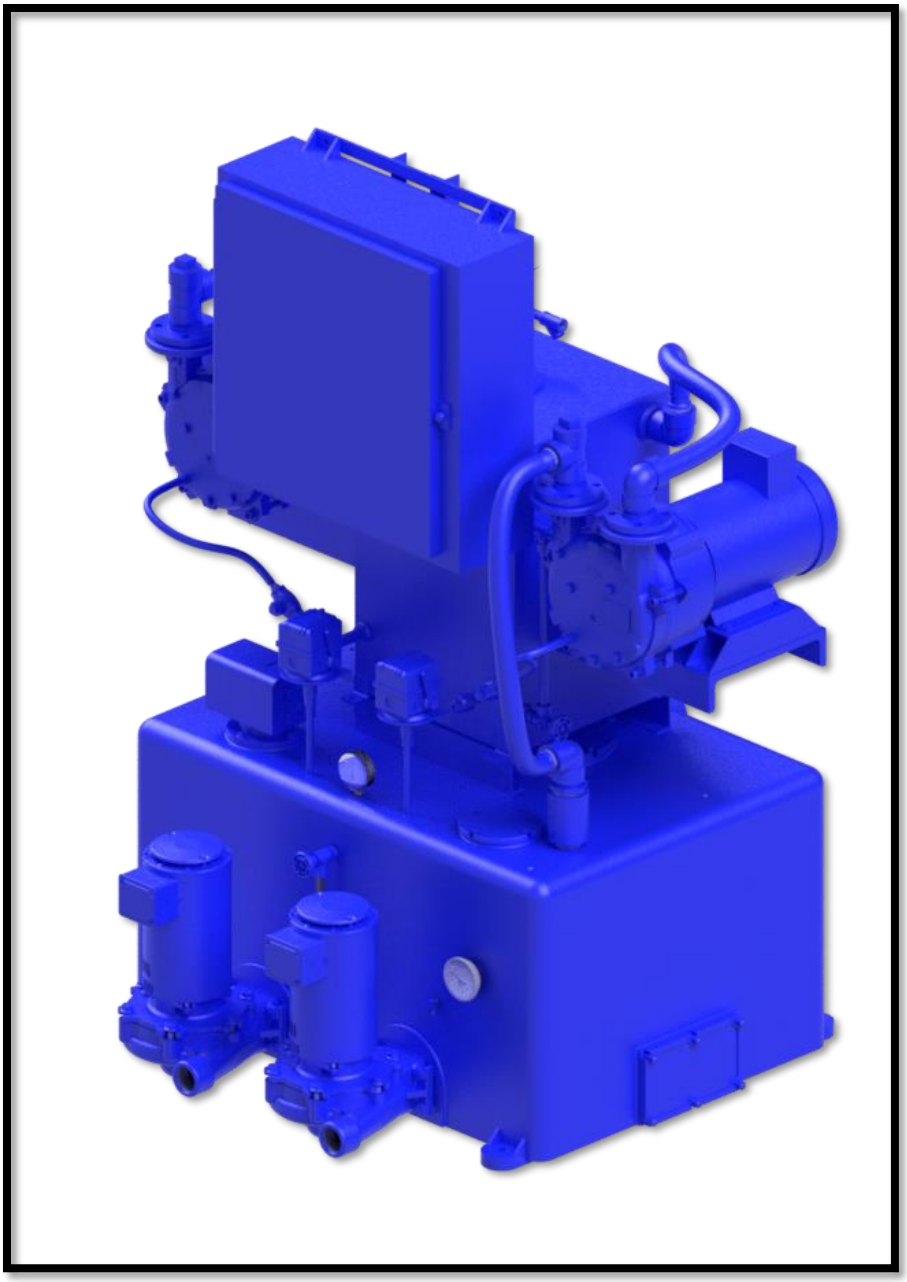
Vent-Rite®
A Swan Group Company

July 2021
Bulletin VMSM8JPD

Model E3 Liquid-Ring Vacuum Pumps

Installation, Operation & Maintenance Manual



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INTRODUCTION

The Vent-Rite® model E3 vacuum pumps are designed to promote circulation, sustain system vacuum, minimize warm up periods, and provide lower operating temperatures for system components, by exhausting the air and other non-condensable gases from the heating system. It also provides a positive means of returning the condensate to the boiler or boiler feed unit, and through its lower system temperature provides lower maintenance and operating costs for the system components.

OPERATION – CONDENSATE RETURN

1. Condensate is returned to the vacuum receiver thru the “return” inlet.
2. When the receiver water level reaches the lead pump set point, the float switch starts the return pump(s), pumping the water from the receiver to the boiler feed system.
3. When the vacuum in the lower receiver reaches a low level, the vacuum switch turns on the vacuum pump(s) (via the required motor controllers) which circulates the water in the seal water tank. Part of this liquid ring seal water is discharged along with air and vapor from the pump into the seal water tank. Therefore, a regulated supply of water (from the seal water tank) must continuously replace the discharged water to maintain an adequate seal water level within the pump.
4. When water in the seal tank reaches a low level, a float switch operated make-up valve will be activated to replace lost water. A temperature sensitive switch is also wired in parallel to this circuit which gives the E3 the added benefit of adding cooling water to the existing seal water supply.

OPERATION – BOILER FEED

1. Condensate is returned to the vacuum receiver thru a return inlet.
2. When water level switch in boiler reaches set low level, the receiver pump is turned on, pumping water from the receiver to the boiler(s).
3. On duplex or semi-duplex units, the water level switch may control an electric alternator in the motor control circuit.
4. When water level in the receiver reaches a set low level, the reverse acting float switch in receiver opens the solenoid valve, allowing water to feed from the hurling tank to the receiver.
5. Vacuum in reservoir and water level in hurling tank are maintained as per 3 & 4 in above condensate return system.

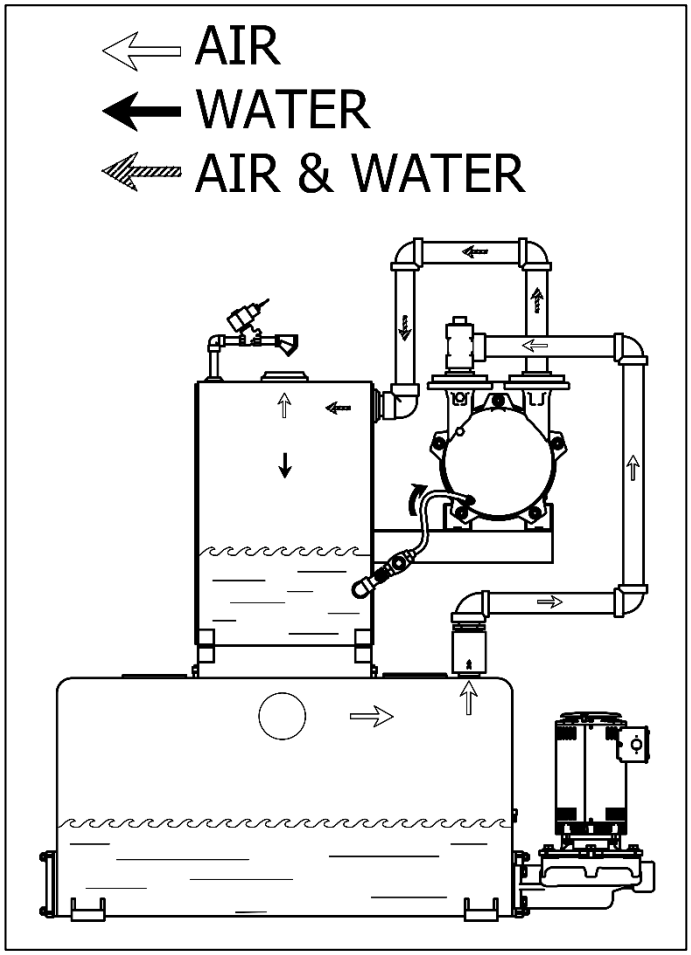


Figure 1, Boiler feed flow diagram. Note: System layout is exaggerated to better show plumbing arrangement.

INSTALLATION INSTRUCTIONS

The LR vacuum pump is factory mounted with interconnecting piping and wiring. Refer to Figure 2 for schematic arrangement of vacuum pump and accessories mounting on the hurling separator tank. Field connections required are as follows:

1. Both receiver drain tappings plus the overflow tap should be plumbed to the main floor drain area. This will prevent a potential room flooding problem, should excessive make-up be required because of high return temperature condensate.
2. The cold water make-up supply line must also be plumbed into the hurling separator tank. This ensures an adequate water supply level to the LR vacuum unit through the standard float switch assembly.
3. The final step involves bringing the properly sized electrical power service to the unit's main control panel.

Once the previously mentioned steps have been completed, we are then ready to process to the Start-Up Instructions.

INITIAL START-UP INSTRUCTIONS

The following steps must be taken prior to putting the vacuum pump(s) into the automatic operation mode.

1. Fill the hurling separator tank until water begins to drain from the overflow line. A visible means of ensuring a proper water level, would be to fill the receiver to approximately 1" from the top of the gauge glass.
2. To fill the vacuum pump with seal water, open the control valve(s), remove pump priming inlet plug, and allow pump cavity to fill with water, water should not fill above the shaft centerline. Replace plug and proceed with step 3.
   (Do not allow the vacuum pump(s) to run without the required seal water at any time. Failure to abide by this can cause premature mechanical seal failure.)
3. Switch the motor "on" briefly to make sure it rotates in the proper direction. (Refer to arrow on the pump unit) If the unit runs in the wrong direction, swap two electrical phases.

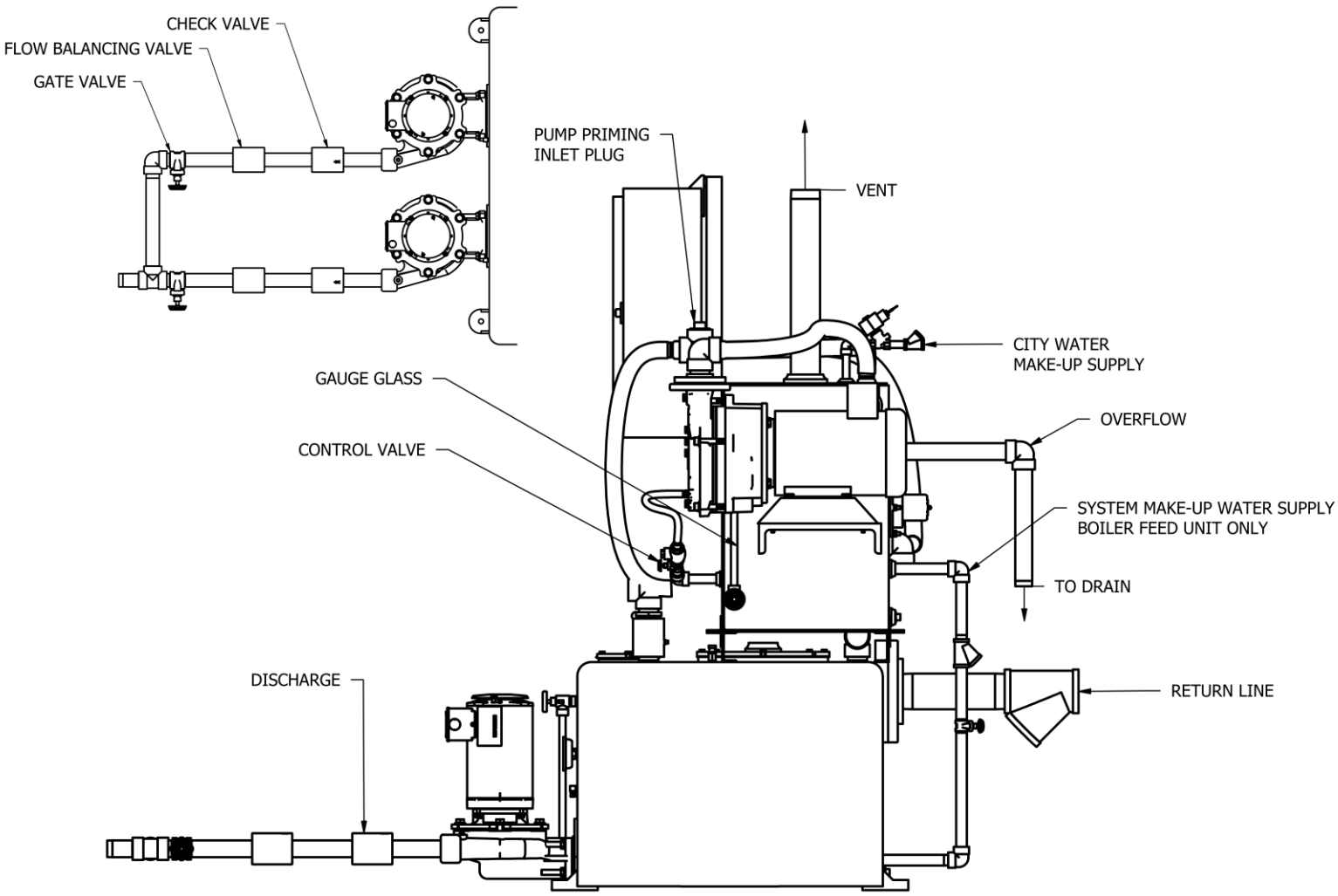
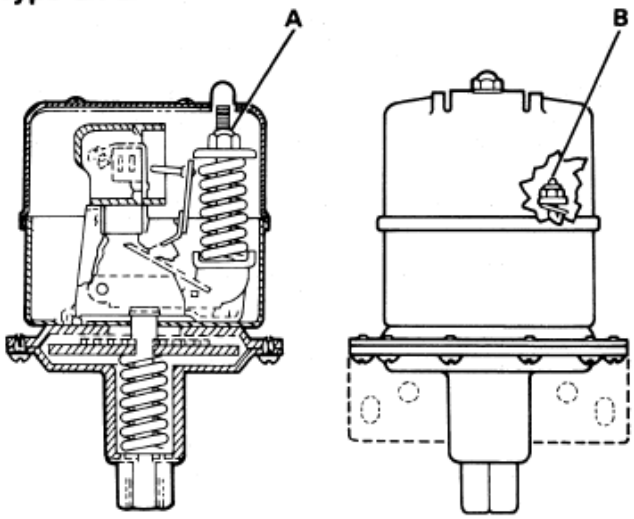


Figure 2, Typical piping diagram.

VACUUM SWITCHES
Type GVG



Class 9016 Type GVG-1 Series C Vacuum Switch

INSTRUCTIONS FOR ADJUSTMENT

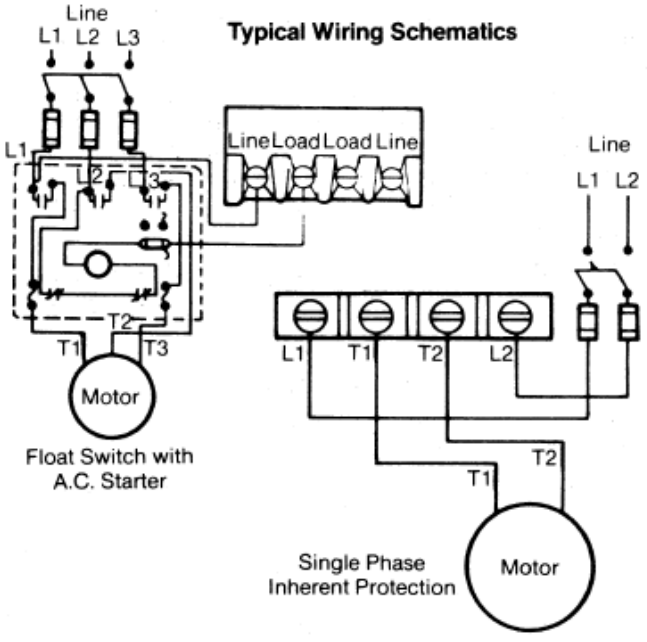
RANGE — Always adjust the range spring nut (A) first until the desired higher vacuum operating point is obtained. Keep in mind this adjustment changes both the high and low operating points but should always be used to set the higher vacuum operating point. Turning the nut (A) clockwise will decrease (lower vacuum) both operating points.

DIFFERENTIAL — Then set the lower vacuum operating point by adjusting the differential nut (B). Turning the nut (B) clockwise increases the vacuum difference between the high and low operating points by decreasing the lower vacuum point only.

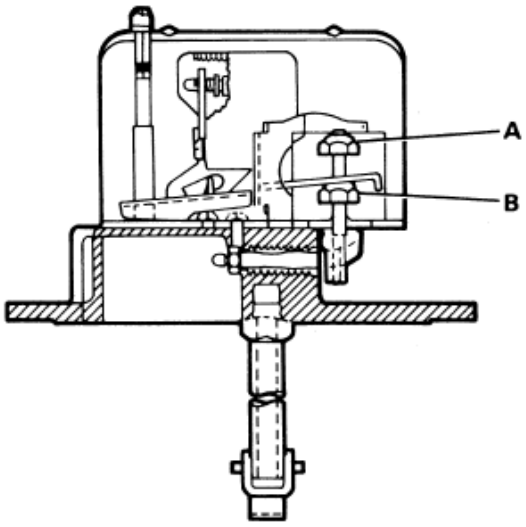
MOUNTING — The Class 9016 Type GVG vacuum switch may be mounted in any position directly on a ¼" I.P.S. pipe, or by the convenient mounting bracket supplied with Form F switches.

MOTOR PROTECTION — A float switch of this type does not afford motor protection, however it is quite frequently used as a pilot to operate a starter providing these desirable features.

Typical Wiring Schematics



TANK FLOAT SWITCH
Class 9037, Type EG



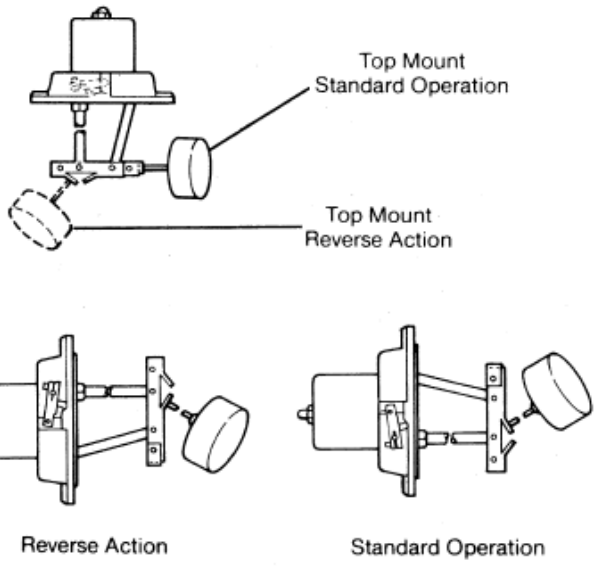
INSTRUCTIONS

ADJUSTMENT — Switches are shipped from the factory set for a specified float travel with a given length of rod. Reasonable adjustment of float travel can be made in the field. A guard is provided to prevent entanglement of operating lever with load and line wires. Remove guard by loosening, not removing, holding screws. By turning adjusting nuts A downward and B upward, float travel will be decreased. The reverse of this operation will increase float travel.

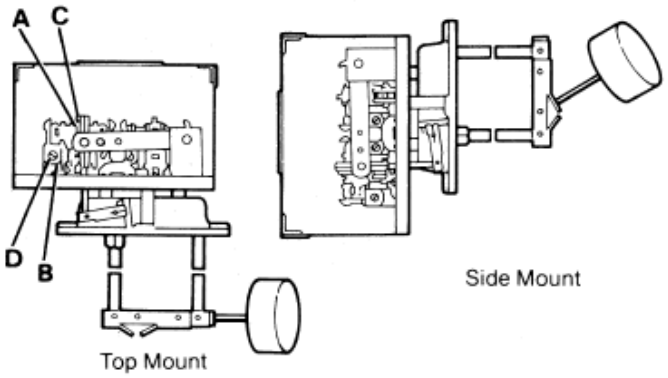
STANDARD OPERATION — The standard setting for the Class 9037 float switch is so arranged as to close the circuit at high liquid level and open the circuit at low liquid level.

REVERSE ACTION — (Energizing Solenoid Low Water Condition). The reverse action (Form "R") assembly can be obtained simply by changing the float ball and rod positioning as shown below.

SIDE MOUNT ASSEMBLIES can be changed from the reverse action mode to the standard operation mode simply by rotating the float switch assembly 180°



MECHANICAL ALTERNATOR
Class 9038, Types DG, DW, DR



INSTRUCTIONS

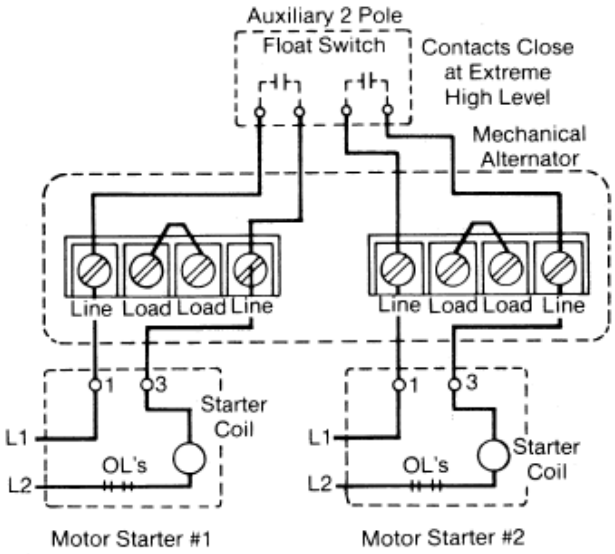
ADJUSTMENT — These alternators are pre-set at the factory for proper operation. Reasonable adjustment of float travel can be made by loosening lock nuts (A) and (B) and adjusting the nuts (C) and (D). Nut (C) controls the upper limit of float travel, at which the switch is actuated and Nut (D) the lower limit. Extreme caution should be exercised in making this adjustment. For maximum vertical float travel, ultimately limited by internal stops, the adjusting nuts should be spaced so that both switch units have been actuated at the point of full float travel. For minimum float travel do not bind Nuts (C) and (D) on pin of operating lever. Retighten Nuts (A) and (B).

STANDARD OPERATION — Contacts are arranged for sump action. In this form the contacts will close on increase in liquid level.

MANUAL TRANSFER (LEAD-LAG) SELECTOR — Form N3 switches have a manually engaged selector which voids alternation. The pump selected to lead always comes on first. With selector disengaged, the unit reverts to normal alternation.

NON-ALTERNATING MECHANISM — On Form N4 switches, the pump wired to lead always comes on first, with the second pump operating only under peak demand conditions, or when first pump fails.

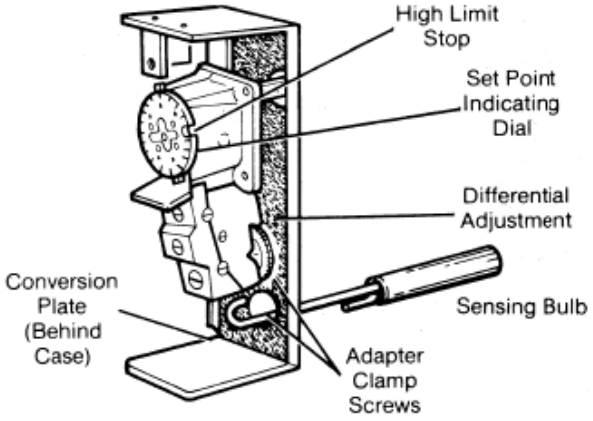
HIGH WATER ALARM — On Form N5 switches an additional snap switch mechanism is tripped initiating a high water alarm circuit if for any reason both pumps are unable to control the rising of liquid in the tank.



AUXILIARY FLOAT SWITCH — In certain applications an auxiliary float switch is required set at an extreme level beyond the limits of the alternator to provide emergency operation. Below is a wiring diagram showing use of an auxiliary float switch in an AC pilot application.

MOTOR PROTECTION — A control of this type does not afford motor protection. However, it is quite frequently used as a pilot to operate a starter providing this desirable feature.

L6006A1145 AQUASTAT CONTROLLER



ADJUSTING

DIFFERENTIAL

Set the differential to correspond with the old control. To adjust, rotate the wheel on the back of the snap switch until the differential adjustment desired reading is aligned with the "V" notch in the frame. The wheel provides an adjustment from 5 to 30 degrees F. Replace the Aquastat cover.

CONTROL POINT

Adjust the control point to correspond with the old control. To adjust, insert a screwdriver in the slotted screw-type head located beneath the window in the cover. Turn the scale to the desired control point.

HIGH LIMIT STOP

The high limit stop on these controllers is factory set at 240°F. Readjust to the stop setting specified by the boiler manufacturer, or to the same setting as the old control, as follows:

The stop lever is locked by means of posts on the back of the dial which engage with teeth on the hub of the lever plate. Insert a screwdriver between dial and plate, separate sufficiently to disengage the locking posts, and move stop lever to the desired setting. Be sure posts engage teeth when screwdriver is removed.

REMEMBER — Follow the boiler manufacturer's instructions for recommended settings or use the same settings as the old control.

CHECK OUT

IMPORTANT: Always check out entire system immediately following replacement or installation.

Check to make certain that the Aquastat control has been installed and adjusted properly. Put the system into operation and observe the action of the controller through several cycles to make certain that it provides proper high or low limit cut-out protection or circulator control. Further adjustments then can be made to meet more exact requirements.

TROUBLESHOOTING GUIDE

SYMPTOMS	POSSIBLE CAUSE	REPAIR
1. Pump will not start	Reset button tripped or blown fuse.	Check line voltage to be sure it agrees with motor nameplate voltage. High peak power demand may cause low voltage condition. Turn pump shaft by hand. If it is tight refer to the operating guidelines section
	Float switch or vacuum switch may be stick in off position.	Check both switches and adjust according to control instructions.
2. Vacuum producer pump runs constantly or does not produce enough vacuum.	Hurling water above 170 °F causing hurling water to flash to vapor.	Check solenoid valve making sure it is in the open position adding cooling water to the hurling tank. Hurling water in excess of 170°F caused by leaking traps. Check all steam traps.
	Excess air leaking into system.	Close gate valve on main return line to pump inlet. If pump stops, check for leaks in traps, fittings or returns.
	Pump not primed.	Check water level in hurling tank. Level should be in accordance with the initial start-up instruction.
	Relief valve set too low.	This will admit air to system. Shut off gate valve at receiver inlet, note vacuum at which pump stops. Put vacuum switch lever on continuous and adjust relief valve at 1-2 in. Hg higher than the vacuum cut-off.
	Vacuum pump impeller worn.	Check to see if pump is primed, Close return line valve at receiver inlet. Put vacuum switch lever to “continuous,” block the relief valve inlet and start the pump. If the pump does not develop 15 in. Hg on the vacuum gauge in 2-3 minutes, disassemble the air handling portion of the unit and readjust the impeller. Refer to instructions for repair section.
	Motor operating in wrong direction.	Remove motor cover to make sure motor is running on a clockwise rotation. See starting instructions.
	Mild weather operation where traps remain cool and stay open.	Operate pump on float only unless there are lifts in the return line.
3. Condensate return pump runs constantly.	Float switch out of adjustment, not shutting off at low level.	Check float switch and refer to adjustment instructions.
4. System does not hold vacuum.	Condensate temperature over 170 °F	Check for faulty traps.
	Excessive air leaking to system.	See Section 2 of Trouble Shooting Guide.
	Suction check valve between receiver and the PDVC unit is leaking.	Check to see that seat is clean and disc in good condition – replace check valve if necessary.
	Relief valve not set high enough.	See relief valve setting as noted in Section 2 of Trouble Shooting Guide. If more then 2 in Hg above vacuum switch setting – readjust valve.
	Condensate held up in radiation due to vacuum on boiler.	Install equalizer line between the vacuum pump receiver and boiler.
	Pump has lost prime.	Check water level in hurling tank. Level must be in accordance with the initial start-up instructions noted on page 2. Re-check valve – see above
	Inlet strainer clogged	Remove strainer cover and clean basket – wash backet thoroughly before replacing.
	Motor not up to speed.	Check voltage and RP

TROUBLESHOOTING GUIDE (CONT.)

SYMPTOMS	POSSIBLE CAUSE	REPAIR
5. Pump starts and stops in rapid succession.	Clogged inlet strainer basket.	Remove strainer cover and clean screen.
	Partially closed valve in return line.	Check all return line valves.
	Water trap or low spot in return line.	Install pipe from top of receiver to a point beyond the low spot.
6. Excessive water discharges from hurling tank overflow.	Make-Up valve stuck in open position.	Check float switch and adjust. See instructions or check solenoid valve for malfunction or check aquastat for malfunction.
	System pressure higher than designs of boiler feed impeller.	Check pressure on discharge of pump. If higher than nameplate of pump, check for closed valves or other restrictions. It should also be noted that the vacuum pump will overload under these conditions, as it will begin to remove the excessive condensate (through the suction hose) from the condensate receiver.
	Excessive water discharges from hurling tank overflow	The overall condition of the condensate pump should be examined as the unit may need servicing (example: impeller replacement). The condensate motor/pump rotation should be checked as it may be running backwards.
	Make-up valve stuck in open position.	Check float switch and adjust. See instructions, page 5, check solenoid valve for malfunction, or check aquastat for malfunction. see adjustment, page 6.
	Vacuum pump overloads	Check for proper operating voltage and motor wiring. Check the back pressure on the unit, as it cannot exceed the maximum of 2.5 in. Hg absolute or 28.5 in Hg. Vacuum pump(s) may be pumping an excessive amount of condensate (from lower receiver)
7. Pump is cavitating. (Cavitation sounds like small pebbles in the pump)	Pump is oversized for the system	Proper assessment of the pump system curve will prevent cavitation. Induce back pressure on the system through the use of a gate valve on pump discharge.
	Condensate temperature over 170°F	See Section 2 of Trouble Shooting Guide.

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VARI-VAC®
MANUFACTURING AND DESIGN OF QUALITY HVAC SYSTEMS SINCE 1921