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CLS VACUUM CONDENSATE UNIT

INSTALLATION, OPERATION, & MAINTENANCE MANUAL

PLEASE LEAVE THIS MANUAL FOR OWNER'S USE

SAFETY INSTRUCTIONS

Read this manual carefully to learn how to safely install and operate your system. Throughout this manual there are a number of SAFETY HAZARDS that must be read and adhered to in order to prevent possible personal injury and/or damage to the equipment. Three keywords, "DANGER" ,"WARNING", and "CAUTION", are used to indicate the potential severity of the hazard, and are preceded by a SAFETY ALERT SYMBOL. Failure to follow the safety-related instructions may result in a safety hazard.

INTRODUCTION

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for each specific application. Therefore, it is the responsibility and the duty of all personnel involved in the installation, operation and maintenance of the equipment to ensure that applications not addressed in this manual are performed only after establishing that neither operator safety nor pump integrity are compromised by the installation.

PRE-INSTALLATION CHECK

Open all cartons and inspect for shipping damage. Report any damage to your shipping carrier or NES Company sales representative immediately. Always verify that the pump nameplate Voltage, Phase, and Horsepower ratings as well as Amps rating on motor match your control panel and power supply. Warranty does not cover damage caused by connecting pumps and controls to an incorrect power source (i.e., voltage and phase).

Site Inspection: The pump should be of the proper size and capacity for the proposed installation. Refer to nameplate for rated capacities. Check motor voltage against available power supply.

INSTALLATION

Electrical connections are to be made by a qualified electrician in accordance with the National Electrical Code (NEC) or the Canadian Electrical Code, as well all national, state and local codes. Code questions should be directed to your local electrical inspector. Failure to follow electrical codes and OSHA safety standards may result in personal injury or equipment damage. Failure to follow manufacturer's installation instructions may result in electrical shock, fire hazard, personal injury or death, damaged equipment, provide unsatisfactory performance, and may void the manufacturer's warranty.

Motor must have a properly sized starter with a properly sized heater to provide overload and under voltage protection unless motor meets following two conditions: single phase and motor horsepower is 1 HP or less. Motors that satisfy these two conditions have built-in thermal overload protection.

Operating personnel should be trained in the operation of the pump and any associated system.

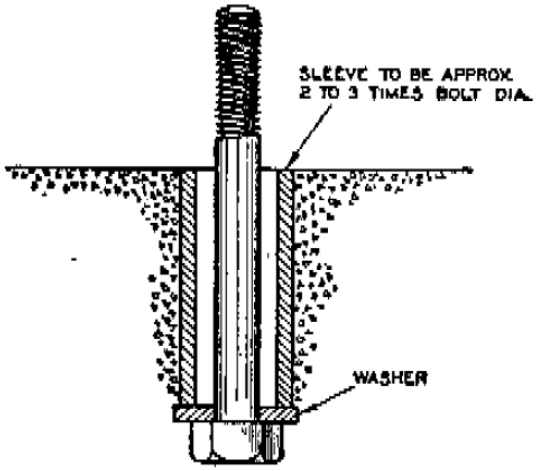
Unit and/or Pump Location: Place the unit at a point most central for the return lines and as near the boiler as possible. An auxiliary tank should be used if returns do not flow by gravity to the pump inlet. If the auxiliary tank is located more than 10 feet below the pump inlet, then the pump must be lowered into a pup pit. The pump inlet should not be more than 10 feet, horizontally, away from the auxiliary tank. If pump and motor are operating at extremely high or low temperatures, insulate and ventilate as required. Units are furnished with motors classified as either Open Drip Proof (ODP) or Totally

Enclosed Fan Cooled (TEFC) motors. Controls can be NEMA 1 or NEMA 4. Other classifications, such as explosion proof, are available upon request. Locate unit only in areas of the proper classification based on motor data and NEMA classifications of the equipment purchased. The unit should be located to allow for removal of pumps for replacement of seals. If a housekeeping pad is used, do not extend foundation under pump and motor assemblies.

The condensate receiver is either black steel or cast iron Unit is designed for atmospheric operation. ***DO NOT pressurize receiver.***

The ambient conditions should be checked with the motor data. A thermal overload protection to shut off the pump. To facilitate maintenance, place unit for easy access to all parts. Allow adequate space for servicing.

Foundation Requirements: The pump base itself is made of heavy construction; however the foundation must provide rigid support and allow the unit to set level. Locate foundation bolts according to the prints furnished and set these (as shown in figure) with pipe sleeves two or three diameters larger than the bolt, permitting the bolts to be moved to conform with bed plate after the concrete is poured. If the unit is to be mounted on steelwork or on the floor it should be set directly over or near to the supports and walls to firmly support the base.



Setting The Unit on the foundation: Carefully level up the pump assembly on the foundation. After the base is level on its foundation pour grout under it. Do not tighten the foundation bolts until the cement has set. The pump assembly is inherently in line but forcing it down on an uneven foundation with bolts ,ay distorts the base and tank and could cause damage. When connecting the unit to the heating system do not force piping cut to the wrong length to meet the unit. The whole assembly can be sprung out of line in this manner. If the piping does not properly connect with the pump, cut it over.

Seal Flush Line (or Bleed Line): NES pumps are manufactured with provisions for a seal flush line. This line helps prevent the pump from vapor binding and allows the pump to operate against a dead shut-off for periods of time without burning the seals. The bleed line must remain open.

Vent Connection: Install a full sized vent to atmosphere from the receiver. DO NOT install any shut-off valves or other type of valves in the vent line. Do not plug vent to test system for leaks. Receiver is not made to be pressurized. The vent line should be installed as shown in our typical piping diagram. A priming tee is required for start-up.

Overflow: Install overflow piping from the vacuum receiver to the drain (See piping diagram).

Return Piping: Connect condensate return lines to the condensate receiver through a full-ported gate valve and an inlet strainer. The return lines should be pitched toward the receiver to insure gravity flow. An inlet strainer should be installed to remove foreign material and prolong the pump life.

Avoid piping restrictions immediately ahead of the condensate receiver such as elbows, tees, etc. Locate these at least 10 times the inlet diameter ahead of the inlet strainer (e.g., for 3" inlet, locate 30" ahead of strainer).

Suction Piping: An isolation valve may be installed in the suction piping between the receiver and pump suction for servicing the pump. The valve will be sized to allow an adequate flow of water to meet the Net Positive Suction Head (NPSH) requirement of the pump. Pump should not be subjected to more than 50 psig pressure.

Discharge Piping: If the pump does not have a flanged discharge, install a union immediately beyond the pump discharge. A spring-loaded check valve should be installed in the discharge piping near to the pump to prevent backflow into the unit. Next, a **manual flow control valve** (e.g., ball valve, globe valve, or steam cock) must be installed after the spring-loaded check valve and near to the pump discharge flange or union (see Figure 2) to “balance the pump” (i.e., adjusting discharge flow of the pump to keep it running at the design operating conditions for flow rate and discharge

pressure). A gate valve should not be used as a manual flow control valve. Note that some people refer to the term “balancing the pump” as either “throttling the pump” or “choking the pump”.

Notes on Piping:
1.When installing the pump, if the discharge flange of the pump does not include a tapping for a discharge pressure gauge port, a gauge port should be installed in the discharge piping.
2.The piping should include isolation valves on both the suction and discharge sides of the pump and have a drain valve in the suction line.

When installing the suction and discharge connections to a threaded pump housing, a Teflon tape sealer or a high quality thread sealant is recommended. For specific instructions on installation, operation and maintenance of pump/motor assemblies fitted to receiver, refer to IOM Manual for condensate pumps.

Product life and product efficiency are greatly affected by system maintenance. A tight (leak-free) system with properly functioning traps is essential for efficient operation.

Electrical Wiring: Units are furnished with single-phase or three-phase motors. Single phase motors are usually furnished as dual 115/230/1/60. Three-phase motors are usually furnished as tri-voltage 208/230/460/3/60. Motors should be connected according to manufacturer’s instructions for correct voltage.

If control panel is furnished, confirm that the nameplate data on the control panel[s] matches the supply current. If the nameplate data does not match the power source, consult factory.

Verify controls, starter coils, etc., match the control voltages before installing. The secondary side of transformer is the control circuit. Wire in accordance with the National Electrical Code, state and local codes where applicable. See typical wiring diagrams (Figure 1)

Short Circuit Protection: According to the National Electrical Code, branch circuit over-current protection must be provided for each contactor or starter. The following table is provided as a guide. DO NOT EXCEED MAXIMUM PROTECTIVE DEVICE RATINGS.

Maximum HP Maximum Volts					NEMA Size	Maximum Voltage	Class K5 or R Fuse (Ampere)	Class K1 or J Fuse (Ampere)	Inverse–Time Circuit Breaker (Ampere)
Single Phase		Three Phase							
115v	230v	208v	250v	600v					
⅓	1	1½	1½	2	00	600	10	15	15
						250	12	15	15
1	2	3	3	5	0	600	20	30	20
						250	25	30	35
2	3	7½	7½	10	1	600	30	60	40
						250	40	60	60
–	–	10	15	25	2	600	60	100	80
						250	60	100	90
–	–	25	30	50	3	600	100	200	125
						250	125	200	150

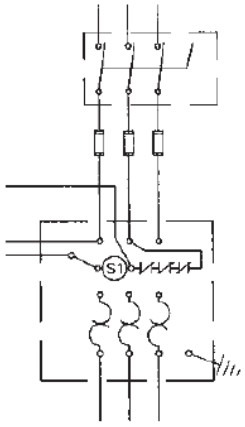


FIGURE 1

Vacuum Switches and Adjustments: The vacuum switch(es) are factory preset for proper operation. Should field adjustments be required, the vacuum switch on a single unit and the lead vacuum switch on a duplex unit are typically set to close at 3" Hg and open at 8" Hg. The lag switch on a duplex unit is set to close at 2" Hg and open at 8" Hg. Refer to vacuum switch manufacturer’s instructions for specific details.

Float Switch(es): Per instructions on tag attached to float switch, remove shipping bracket (See Figure 3) from each float switch or mechanical alternator as per manufacturer’s instructions. The float switch has been factory set for maximum capacity of the receiver. Should an alternate setting be required, refer to the float switch manufacturer’s instructions.

Equalizing Line: A vacuum may be formed on the radiation side of the system when the steam stops flowing in the steam mains. In some cases, this vacuum may be greater than the vacuum in the return line preventing the condensate from flowing into the receiver. To correct this in an unzoned system, an equalizing line is installed as shown in Figure 2. In a zoned system, an equalizing line must be installed after the zone valve in each zone. A vacuum breaker may be installed after the zone valve on the radiation side in lieu of an equalizing line.

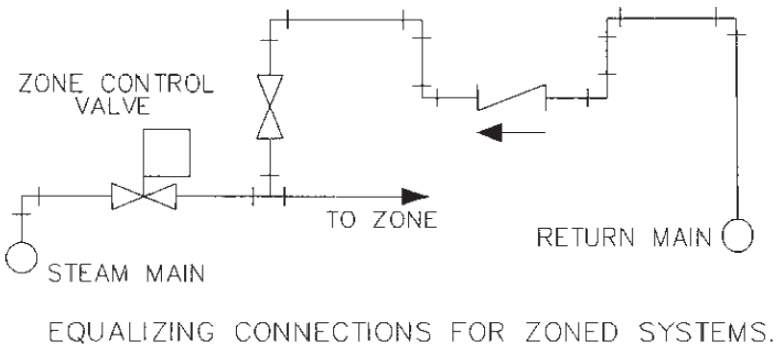


FIGURE 2

PUMP STARTUP

1. Check system piping with the Typical Piping Diagram (See Figure 2).
2. Make sure total system is free from debris.
3. Flush unit to drain to remove any debris from total system (i.e., pipes, radiators, receivers, etc.). Make sure all debris has been removed from inlet strainer after start-up of system. Reinstall drain plug.
4. Remove shipping brackets on float switches. Per instructions on tag attached to float switch, remove shipping bracket (See Figure 3) from each float switch or mechanical alternator as per manufacturer's instructions. The float switch has been factory set for maximum capacity of the receiver. Should an alternate setting be required, refer to the float switch manufacturer's instructions.
5. **Priming pump:** The receiver is divided into two compartments. The upper compartment is used to produce the vacuum by feeding water into the suction of the centrifugal pump. On initial startup, pour water into the priming opening (e.g., air vent) until the gauge glass, for the upper compartment, shows one-half (1/2) full. Do NOT pressure receiver. Do NOT run pump(s) dry. The mechanical seals will be damaged by running the pumps dry.
6. **On Three-Phase Units:** Energize the power circuits and immediately check the direction of rotation of each condensate and vacuum pump. If unit is furnished with test push buttons, these should be utilized to momentarily check the direction of shaft rotation. Pump should rotate clockwise when viewed from motor end. If rotation is backward, interchange any two of the three power wires to the particular pump.
7. **Throttle Pump:** With pump running, adjust the throttling valve (closed) installed in pump discharge to bring pump discharge pressure to design conditions. When proper conditions have been met, tighten valve and remove handle. If pump sounds noisy, it may not be operating at design conditions.
8. **Motor Lubrication:** The pump is a close-coupled centrifugal unit. The pump has no internal bearings. However, it does have patented water-lubricated bearings in the column. Refer to IOM Manual for condensate pumps for additional information.
9. Bleed line shut-off valve MUST REMAIN OPEN unless pump is being serviced.

WARNING!: Switch is shipped with a bracket attached to the mounting plate to prevent the float from moving in the tank during shipment. When installing the unit, this bracket, clearly marked with a tag, MUST be removed for float switch to operate.

FIGURE 3: Float Switch

DESCRIPTION OF OPERATION

Function of a vacuum condensate unit: The function of the CLS heating pump is to achieve the most economical operation of the steam heating system by providing free steam flow through the system. Two things hinder the movement of steam through the system and reduce the efficiency of the heating surfaces; air & water.

Air is always present in a steam heating system when it is cold. Therefore the steam must push the air out as it flows through the system piping. The removal of the air allows the steam to flow more quickly and evenly. The time required for warming up is thus reduced to a minimum. The vacuum heating pump induces the flow of condensate from the system lines and pumps it back to the boiler to replace the water which has been boiled off. The condensate is used over and over with only the occasional addition of makeup water. Proper installation and maintenance of the heating system cannot be over-emphasized.

The returns made up of condensate and air, flow into the main chamber of the receiving tank through the strainer. The water is drawn off through an opening in the side of the tank directly into the impeller of the centrifugal water pump. This pump discharges to the boiler through a check valve. The vent piping between the inner head and the receiving tank keeps the pump primed at all times by venting air from the inner head.

Air is drawn off the top of the main chamber into a pipe that leads to the suction side of the vacuum pumps. The seal water, used to seal the liquid ring vacuum pumps, is drawn from the lower part of the main chamber through the seal water orifice and into the vacuum pump through a check valve in the air suction line. The discharge of the vacuum pump, made up of air and entrained seal water, is discharged to the separator chamber. The chamber separates the seal water from the air. The seal water is returned through the separator float valve to the main chamber of the receiving tank. The air passes out through the external air discharge piping.

Vacuum Pump Operation: Type CLS duplex vacuum condensate return pumps are fitted with 2 vacuum switches, labeled VS#1 and VS#2. VS#1 is the primary switch. It is set to cycle on and off between 3” and 8” Hg. vacuum. The control circuit for VS#1 is wired through an electronic alternator so each time the contacts close on VS#1, the opposite vacuum pump will start.

VS#2 is the back-up vacuum switch. It is set to cycle between 2” and 8” Hg. vacuum. The control circuit for VS#2 by-passes the alternator and starts both vacuum pumps together. This arrangement will automatically bring both vacuum pumps into operation when the system vacuum drops below 2” Hg. It will also bring the backup pump into operation when one pump or VS#1 has been removed from service.

Condensate Pump Operation: The condensate pumps are controlled by mechanical alternating float switch. Under normal operation this switch alternately completes the control circuit for each condensate pump. Under peak load conditions, the float switch will bring both pumps into operation. It will also function as a single switch when only one is in service.

SELECTOR SWITCH SETTINGS

Selector switches are normally set on the **Auto position.** This position allows the pumps to operate on a signal from the float switches, in the lower chamber, for high water or on a signal from the vacuum switch when it senses a low vacuum condition in the system.

The **Off position** breaks the control circuit for putting the pump out of service. NOTE: Disconnects must be turned off for servicing pumps.

The **Hand** position allows the pump to run continuously.

TROUBLESHOOTING

Water Pump Will Not Start

1. In adequate condensate has returned from the system to activate the float switch.
2. The power supply has been interrupted, disconnect switch is open or a selector switch is not in proper position.
3. Wiring to the control panel is incorrect or connection requires tightening.
4. Voltage supplied to unit is wrong. Check voltage and wiring with motor and panel specs.
5. Starter coil wrong for power supplied.
6. Overload relays in the starter have tripped and require resetting. Ambient temperature may be too high.

Water Pump Does Not Operate Adequately (System Floods).

1. Pump may be running backwards. Rotation of 3 phase motors can be corrected by interchanging any two of the three wires. Pump should run clockwise.
2. Steam traps are failing, causing condensate to return at excessive temperatures. If 160F is exceeded, the capacity of the pump may be reduce below its rating. Traps should be repaired or replaced.
3. A valve in the discharge line between the vacuum pump and the boiler feed unit is closed or throttled too tightly. A check valve may be installed incorrectly.
4. The total back pressure at the pump discharge is greater than the rated discharge pressure of the pump. Check the total pressure including lift, pipe friction loss, and any system pressure.
5. The inlet strainer is dirty. Clean the strainer.

Pump is too small for the system.

1. Condensate is held up in the system periodically by induced vacuum in the boiler or radiation. After the pump starts, the condensate is released in a surge. Install an equalizing line.
2. The discharge solenoid valve fails to open. This may be caused by the solenoid valve failing in the closed position.
3. Water Pump is Noisy
4. Balancing valve not installed or not adjusted, causing pump to operate too far out on the pump curve. Install balancing valve and adjust to the rated discharge pressure of the pumps.
5. Excessive condensate temperature. Correct system condition.
6. Starters chatter. Trouble is caused by low line voltage, poor connection, defective starter coil, or burned contacts.
7. Hum or bearing noise in motor. Consult motor manufacturer's authorized service station nearest pump location.
8. Pump is running backwards.

Vacuum Pump Not Handling Air.

1. Air discharge blocked or improperly connected. Check air discharge and make sure it is open to atmosphere.
2. Suction check valve fails. Make sure the vacuum inlet check valve is properly installed and functioning.
3. Vacuum seal water is in adequately supplied. Verify that the vacuum pumps are receiving the proper amount of water through the seal water line and that the seal water orifice is not blocked.

Vacuum Pump Throwing Water Out of Air Discharge

1. Float valve stuck closed. The float valve is located inside the air discharge separator which is mounted on the backside of the tank. If the float valve gets stuck shut the seal water will fill up the air outlet pipe causing the air pump to blow water out the air vent.
2. Receiver tank is pressurized. If the receiver tank become pressurized it will prevent the flow of water from the separator tank back into the receiver. Such a pressure may be built up with very hot returns so the thermometer should be checked and inspection of the system should be made.