Vent-Rite

DUNHAM LLC
THE STEAM HEATING PROFESSIONALS

Form SM3659
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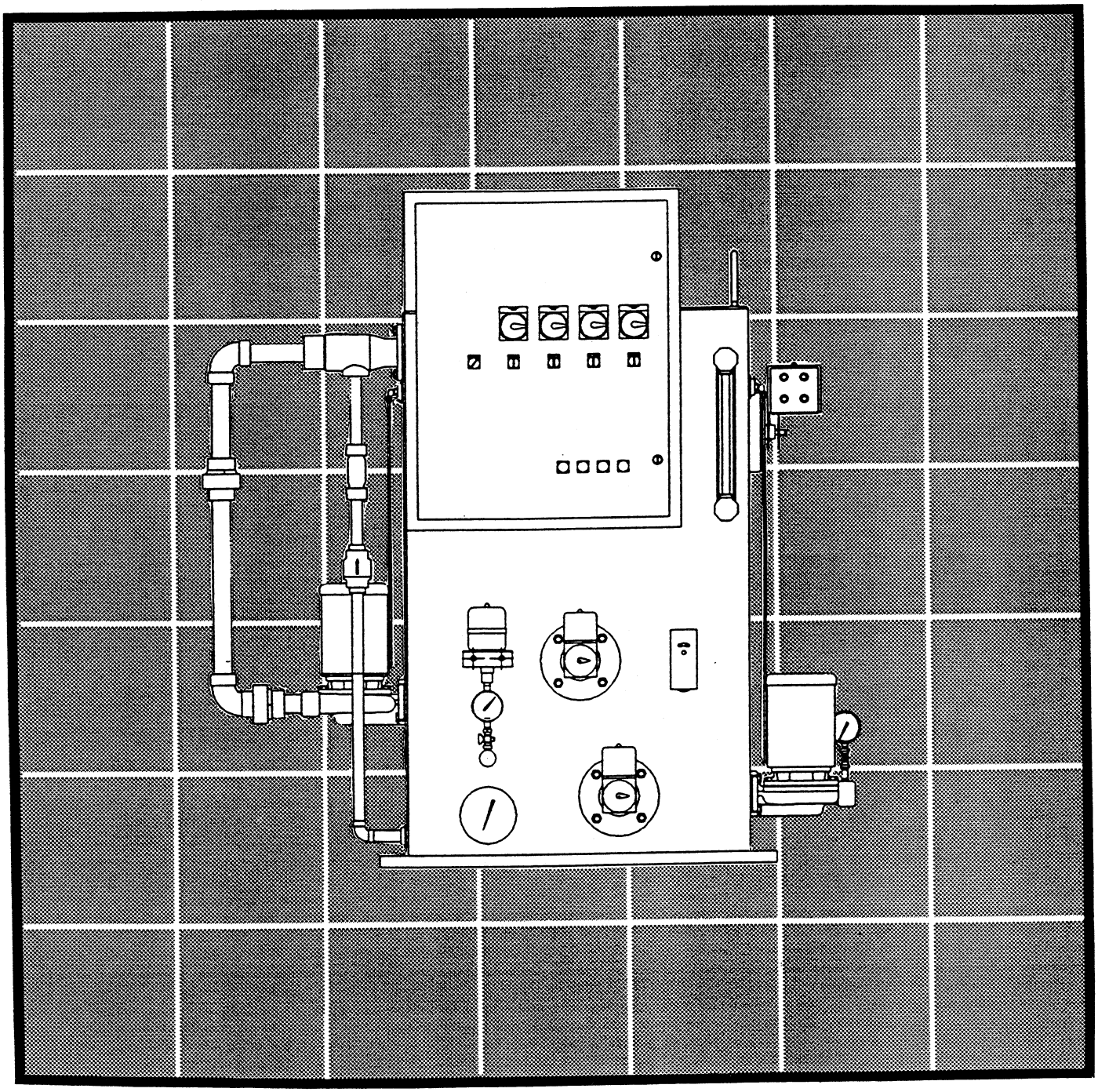
STANDARD - VRD and DVD, Duplex, Model C-5 Vacuum Pumps



Installation, Operation & Maintenance Manual

INTRODUCTION

The Vent-Rite Model C5 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 noncondensible 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. The vacuum pumps are comete assemblies which include motor driven centrifugal pumps, kinetic exhausters, tanks and controls. Type VRD are pumping systems for use on vacuum return line systems. Type DVD pumps are similar with the exception that they are designed for use with Vent-Rite Vari-Vac Differential Heating Systems, and they employ a differential controller to provide and sustain the vacuum and maintain the desired pressure differential between the supply and return mains which ensures continuous circulation.

GENERAL

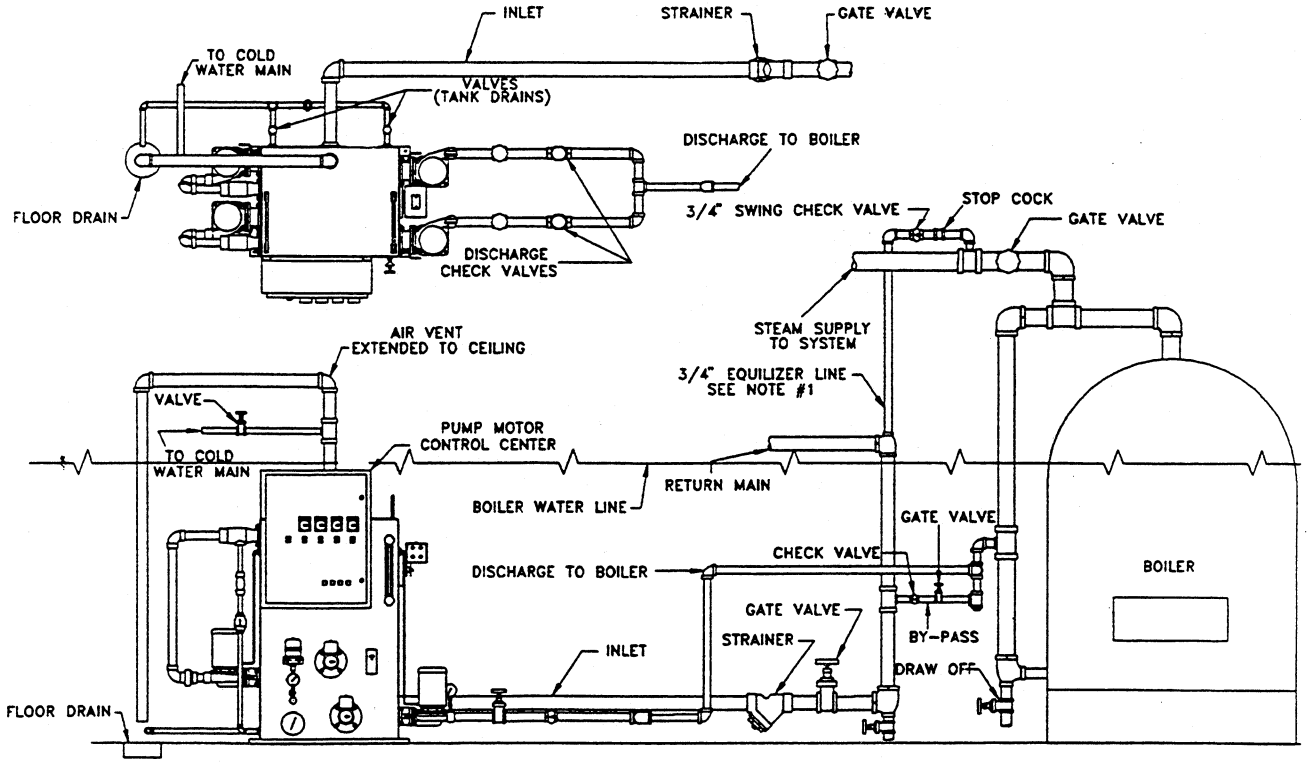
This equipment is a factory built and tested vacuum pump designed for the purpose of sustaining a vacuum in a heating system. To assure satisfactory operation and to avoid costly damage to the unit, the following procedures should be observed. It is not the intent of these instructions to give complete design procedures for a heating system, but only to guard against some of the common mis-applications. These instructions are general in nature and are for standard cataloged units. Non-standard units may vary in some respects from these instructions.

Note: Vent-Rite *reserves the right to make changes in specifications and design without notice*

INSTALLATION

A. RECEIVING INSPECTION - When the unit is delivered, an immediate visual inspection of the unit and its accessories should be made in the presence of the carrier's representative. If there is any evidence of rough handling or damage, a notation should be made on the delivery receipt. Shipping damages are the responsibility of the carrier and it is the obligation of the customer to file a claim. If requested, Vent-Rite will assist in the filing of the claim.

B. UNCRATING - When uncrating the pump be sure that all temporary plugs remain in their tappings until



NOTES: (1) EQUILIZER CONNECTION NOT NECESSARY ON DVD

you are ready to connect it to the system, and all instructional tags are attached.

C. RIGGING - Each unit has been carefully tested and inspected at the factory where every precaution was taken to assure that it reaches its destination in perfect condition. It is very important that the installer, movers, and riggers use the same care in handling of the unit. Chains, cables, or other moving equipment should be placed to avoid damage to any part of the unit. Lift rings are permanently mounted to the tank for this purpose.

D. PLACEMENT - The foundation for the vacuum pump must be of solid concrete which rises from three (3) to six (6) inches above the floor. It must also be level for proper operation and functioning of controls. Three and one-half (3-1/2) inch bolts should be embedded in the foundation with one and one-half (1-1/2) inches protruding from it to mount the pump. The pump should then be mounted and shimmed level (if necessary) and grouted with cement. When the cement has hardened, tighten down the hold-down bolts.

E. PIPING CONNECTIONS - All units are provided with heavy steel threaded fittings on the water inlet. Installation of valves with pipe flanges or unions, rather than couplings, is recommended to permit ease of installation and removal. All piping should be properly supported by hangers, not by its connections to the units. Typical piping systems are shown in Fig. 1. There are points however, that cannot properly be shown in the drawing. They are listed (1-7): 1. Return Mains; **CAUTION:** DO NOT connect steam returns from equipment or common returns which carry high pressure steam directly to vacuum return mains or to the vacuum pump. High pressure steam returns MUST be piped through a properly sized flash tank or economizer, prior to connecting them to the vacuum return mains. Return mains should be sloped downward toward the vacuum pump accumulator tank VRD, DVD.

2. DISCHARGE TO BOILER: When connecting the vacuum pump discharge to the boiler, the pipe size should be no smaller than the size of the fittings of the pump. If noise from the flow of water is a problem the pipe size should be increased to reduce the amount of friction. When the discharge line from the vacuum pump to the boiler is of considerable length or is above the boiler water line, a second check valve should be installed at the boiler return header in addition to the check valve at the pump discharge, to prevent noisy operation of the check valve caused by sudden variations in pressure. Hartford connections must be used on all systems to prevent backward flow into the return main or vacuum pump. A bypass connection is recommended on systems where the end of the return main is two (2) feet or more above the boiler water line, to permit condensate to return to the boiler if there is a current failure.

3. VENT CONNECTIONS: a. A vent should be installed extending from the internal accumulator tank of the vacuum pump to a point near the ceiling, but NO LESS than twelve (12) inches above the boiler water line and should terminate in an air check. Units with an auxiliary condensate accumulator tank require a vent for the auxiliary tank that should also terminate in an air check. b. The hurling tank also requires a vent. It should rise to a point near the ceiling, but NO LESS than twelve (12) inches above the boiler water line. This vent must terminate over a floor drain or into a waste system. The plumbing of the vents should not be reduced and should match the tapping size found on the tank.

4. EQUALIZER CONNECTIONS: A three-quarter (3/4) inch equalizing line should be installed between the steam main and return main through a swing check valve and hand valve as depicted in Fig. 1. It is not necessary to install an equalizer connection on systems using DVD and DVDA units as it is incorporated in the differential controller installation.

5. WATER CONNECTIONS: A water connection should be plumbed into a three-fourth (3/4) or one (1) inch reducing tee in the vent line.

6. TIGHTNESS: Prior to filling any tanks or opening any valves to the system, be sure that all connections are tight and that all drain plugs have been installed.

7. Remove shipping constraints from both discharge valve floats and the mechanical alternator.

F. ELECTRICAL WIRING - The only wiring required for vacuum return line system pumps, DVD or VRD, is a power connection. All other pumps require additional external wiring. *Prior to start up of the unit the following checks and observations should be made:

1. Connections to the unit should match the unit nameplate in volts, phase and hertz with a maximum variation of 10% of nameplate.

2. All field wiring is to be in accordance with the National Electric Code and must comply with federal, state and local codes.

3. All wiring checked for damage and all terminal connections are checked for tightness.

G. PRELIMINARY OPERATION - Prior to placing the vacuum pump into service, close the gate valve before the return main strainer and open the draw-off valve. Operate the heating system for a period of time, preferably two weeks, to flush the system of dirt, grease, scale and other foreign matter. When wasting the condensate to the sewer, be sure to supply make-up water to the boiler to maintain the proper water line. Once placed in service the Model C5 vacuum pump will require a minimum amount of attention by the operating

engineer. With a properly equipped, designed and tight piping system, the pump should furnish full and complete satisfaction.

1. **FINAL CHECK OF THE UNIT:** Prior to starting the unit Preliminary Operation, recheck the following:
a) **PLUMBING**: 1. All connections are tight. 2. All drain plugs are installed. 3. Disks for air check(s) are clean and properly installed. 4. Hand valves for the condensate return main and discharge main are closed. Hurling tank should have enough water to cover all pump suctions sufficiently to maintain their prime—about half full on gauge glass.

b) **ELECTRICAL**: 1. All connections match the nameplate in volts, phase and hertz with a maximumvariation of 10% nameplate. 2. All field wiring is in accordance with the National Electric Code and it complies with federal, state and local codes. 3. All wiring has been checked for damage and all terminal connections checked for tightness. 4. Circuit protection is properly sized in accordance with amp requirement.

c) **MOTOR ROTATION**: Start unit to check correct rotation of motors.

d) **RUN TEST**: Place selector switch in automatic position. Check vacuum gauge. At seven to eight inches (7 - 8") pumps will shut off. With return main valve and discharge valves closed, unit will hold seven (7) to eight (8) inches of vacuum. If no leaks occur, open valves to system for pumps to run properly.

PRINCIPLE OF OPERATION

Water in the hurling air separating tank primes the centrifugal pump which in operation delivers water under a steady pressure to the exhauster. As the water leaves the nozzles of the exhauster at high velocity, it envelopes air, water vapor and condensate and discharges them into the air separating tank. Vapor which often is a greater load than either air or water is condensed as it becomes entrained in the flow, and assists in inducing the vacuum. The rapid removal of air, water and vapor creates a high vacuum on the return lines of the heating system.

The return piping is installed so that the condensate gravitates into the accumulator tank which is equipped with a float switch. The accumulator tank of the VRD and DVD pump is a sealed chamber in the lower portion of the tank. As the accumulator tank fills with condensate, the float within the tank rises and causes the float switch, wired to the motor, to start the pump. Through the operation of the exhauster, the water is drawn from the accumulator tank and into the air separating tank. Air leaves the air separating tank through a vent to the atmosphere. Water passing through the exhauster is directed downward into the hurling tank. As the water level rises the mechanical alternator trips and causes the condensate pumps to discharge the condensate to the low pressure boiler, surge tank or feed water heater. As the water level in the tank lowers the mechanical alternator trips causing the centrifugal condensate pumps to shut off. Where the returns are at a level below pump inlet, the VRDA, DVDA assembly is used, utilizing a separate horizontal accumulator tank installed ahead of the vacuum pump.

AUTOMATIC OPERATION OF PUMP

When the selector switch is set on "Auto" for full automatic operation, the vacuum switch, connected by piping to the accumulator tank, is normally set to start the pump at 3" of vacuum and stop the pump when 8" of vacuum is obtained on the return piping. The pump then stands idle until started again by float switch or vacuum switch. The "range" and "differential" settings of the vacuum switch are adjustable. By changing the "range", the point at which the vacuum switch starts the pump may be raised or lowered by turning the adjusting screw. Adjusting the "differential" by turning the screw, the "spread" between the lower and higher limits at which the pump is started and stopped by the vacuum switch may be varied.

MAINTENANCE

A. PERIODIC CHECKS - Maintenance of the vacuum pump is minimal and most problems can be eliminated through periodic checks of the unit.

1. Monthly periodic checks and maintenance should be accomplished to be sure that all sight glasses are kept clean and that the pressure and vacuum gauges and the thermometers are operating properly.
2. Every year the following checks and maintenance should be completed.

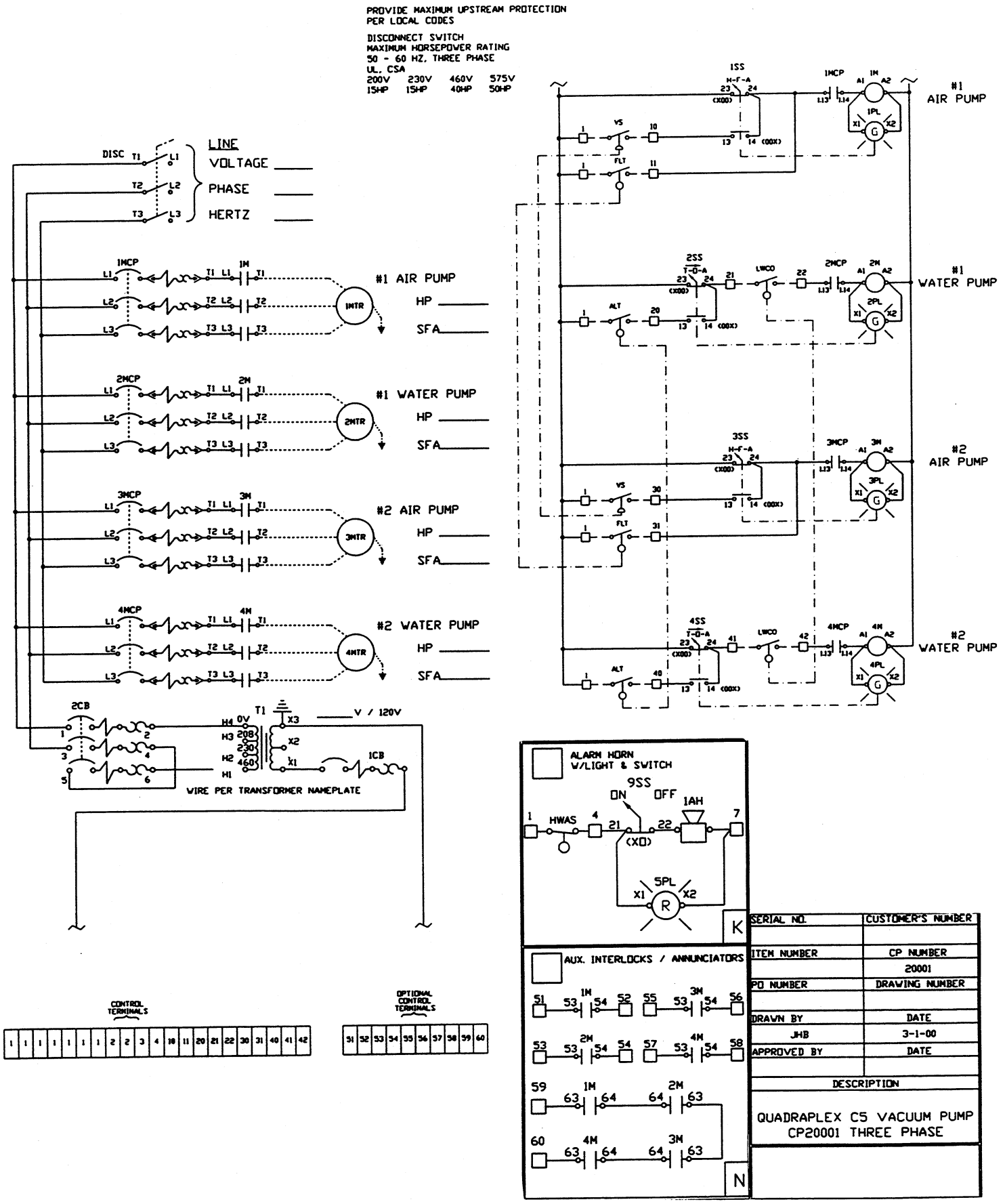
a) The tank should be flushed to prevent mineral build-up.

b) Float and/or alternating float switches and vacuum switches should be checked to assure proper operation.

c) The pump(s) and tank should be checked to determine if they are capable of producing and holding the required vacuum. d) The nozzle suction check valves should be taken apart; the valves and seats should be cleaned and then the valves should be reassembled.

B. CARE OF PUMP - Lubricate the motor bearings according to the motor manufacturer's recommendations.

Typical Wiring Schematic VRD Duplex Model C-5 Vacuum Pump



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	20001
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DESCRIPTION	
QUADRAPLEX C5 VACUUM PUMP CP20001 THREE PHASE	

TROUBLESHOOTING

Check the following in sequence listed, if sufficient vacuum is not produced:

1. The pressure developed by the condensate pumps as shown by pressure gauge should not be less than pressure indicated on pump nameplate. If sufficient pressure is not maintained, then check the following:
a. MOTOR ROTATION: If motor is running in the wrong direction on 3 phase current, interchange any 2 wires at the incoming line terminal block. The correct rotation is clockwise as viewed from the back of the motor.

b. MOTOR SPEED: If speed is less than that as shown on motor nameplate, check voltage and wiring instructions.

c. PUMP PRIME: Hurling tank should have enough water to cover all pump suctions sufficiently to maintain their prime—about half full on gauge glass or enough to trip the low water cutoff switch.

Water can be added to the hurling tank by slowly opening the valve which is plumbed into the vent line. The only time water should be needed is upon initial start up of the unit.

2. With air pumps running, close the valve in return main. With no air leakage around the pump, a vacuum on accumulator tank should be created rapidly as shown by vacuum gauge, and the vacuum switch will stop the pump. If this does not happen then check the following for tightness, after first proving that the vacuum gauge is functioning properly (suction connections). Also make certain that the air check(s) on accumulator tank vent(s) contain the small loose disc furnished as a part of the assembly. This disc must be in place and clean to prevent the re-entrance of air into the tank. Diaphragm of vacuum regulator could be ruptured and a source of air leakage.

3. If still unable to create a satisfactory vacuum then the nozzles in the exhauster assembly should be removed and cleaned of foreign matter. Be sure to reassemble all parts tightly, replacing any damaged gaskets. If pump operates satisfactorily with valve in return main closed, but is unable to produce sufficient vacuum on the system when return main valve is opened, check the following:

a. Clean the strainer in the return main.

b. Check for priming boiler. If boiler is dirty, large quantities of water will be carried into the system causing pump to handle excessive amounts of water. To handle for priming boiler, pull open the safety valve when the boiler is carrying a few pounds of steam pressure. If clean, "white" steam comes out, boiler water is satisfactory. If dirty water is discharged from the safety valve, the boiler should be blown off from top to remove the oil and sludge while steam pressure is maintained and city water added to maintain boiler water level for a period of three hours or more.

c. Check for air leaks into system. If pump is exhausting air from the system and discharging it at the vent, yet does not build up a vacuum, it indicates that there are air leaks in the system. The easier way to check for air leaks is to shut down the pump or operate it at short intervals on "test" control after removing disc from air check, and carry a few pounds of steam pressure consistently on the boiler, permitting no vacuum to be created in return lines. A leak, whether on steam or return side of system, will be shown by dripping water. Where piping is concealed, run the pump on "Auto", fill all the radiation with steam under pressure and then shut off boiler fire as quickly as possible, or if there is a valve in the outlet of boiler, close it. The condensing of steam in radiation together with air exhausted by pump will create a vacuum on the system. By listening, particularly in the basement, the leak of air can be heard.

d. Check for steam entering return lines through an open connection or through some steam traps not seating properly. The hottest return line usually indicates the source of the trouble. The source of such trouble is usually in drip traps on the ends of steam mains or risers where scale and rust collect. It is rather uncommon to find such trouble in radiator traps.

If steam is supplied to apparatus at higher pressures than is carried on the heating system, the return piping from this apparatus should not be carried directly into the heating system returns unless means are provided to dissipate the excess heat. Where this is not possible, other means for handling the condensate from medium or high pressure returns to boiler must be employed.

e. Should the water level rise in tank and overflow vent while the pump is in operation, the float may have come off the alternator as the alternator switch may have a malfunction. To check to see if the float has fallen off the alternator, simply move the float arm to check for the weight of the float.

f. If the water gauge glass shows water rising in the tank rapidly after vacuum pump stops automatically, the check valve in discharge line to boiler is leaking and should be repaired or replaced.

g. If vacuum falls very rapidly when pump stops automatically on the "Automatic" control, starting and stopping the pump at very frequent intervals, in all probability, the check valve in nozzle suction is leaking

and must be replaced, or the strainer in return main is clogged and needs to be cleaned.

h. If pump does not start, reset the circuit breaker switch of the starter. This is a means of providing protection for the motor against overload or phase failure. With main switch open, examine the contacts of the various switches and fuses to make certain there is a source of power to motor. If on 3-phase current, the pump motor will not run but merely hums, a fuse in the line has probably blown and needs to be replaced or a circuit breaker has tripped. If on a single phase, the commutator of motor is dirty or the brushes need to be adjusted.

i. If no pumps start, check incoming power. Make sure all circuit breakers are reset and fuses are not blown. If pumps still fail to start, check hurling tank to make sure there is a sufficient amount of water to trip the low water cutoff switch, if one is present.