



VACUUM AND CONDENSATE PUMPS TYPE LRV & LRV-S

Caution: This Unit is designed for atmospheric operation. DO NOT Pressurize Receiver.

IOM MANUAL

INSTALLATION, OPERATION AND MAINTENANCE (IOM) INFORMATION

PLEASE LEAVE THIS MANUAL FOR OWNER'S USE

SAFETY INSTRUCTIONS

Read this manual carefully to learn how to safely install and operate your pump. 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.

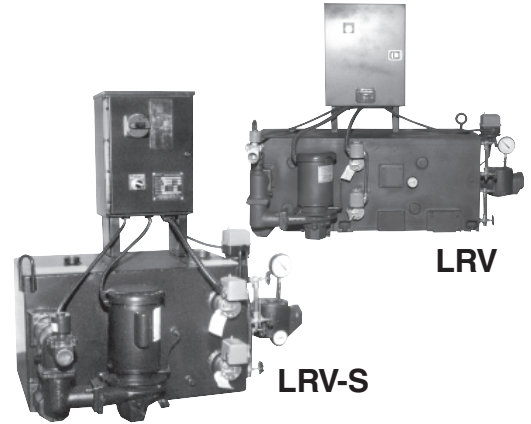
Three keywords, "DANGER", "WARNING", and "CAUTION", are used to indicate the potential severity of the hazard, and are preceded by a SAFETY ALERT SYMBOL. Failure to follow the safety-related instructions may result in a safety hazard.

DANGER Indicates an imminently hazardous situation which, if not avoided, WILL result in serious injury or death.

WARNING Indicates a potentially hazardous situation which, if not avoided, COULD result in serious injury or death.

CAUTION Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.



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 SHIPCO® 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.



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:



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 (LRV-S) black steel or cast iron (LRV).

Unit is designed for atmospheric operation. **DO NOT pressurize receiver!**

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

Seal Flush Line (or Bleed Line):



SHIPCO® 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 Model D 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					
1/3	1	1 1/2	1 1/2	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	7 1/2	7 1/2	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

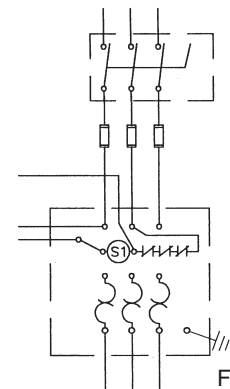
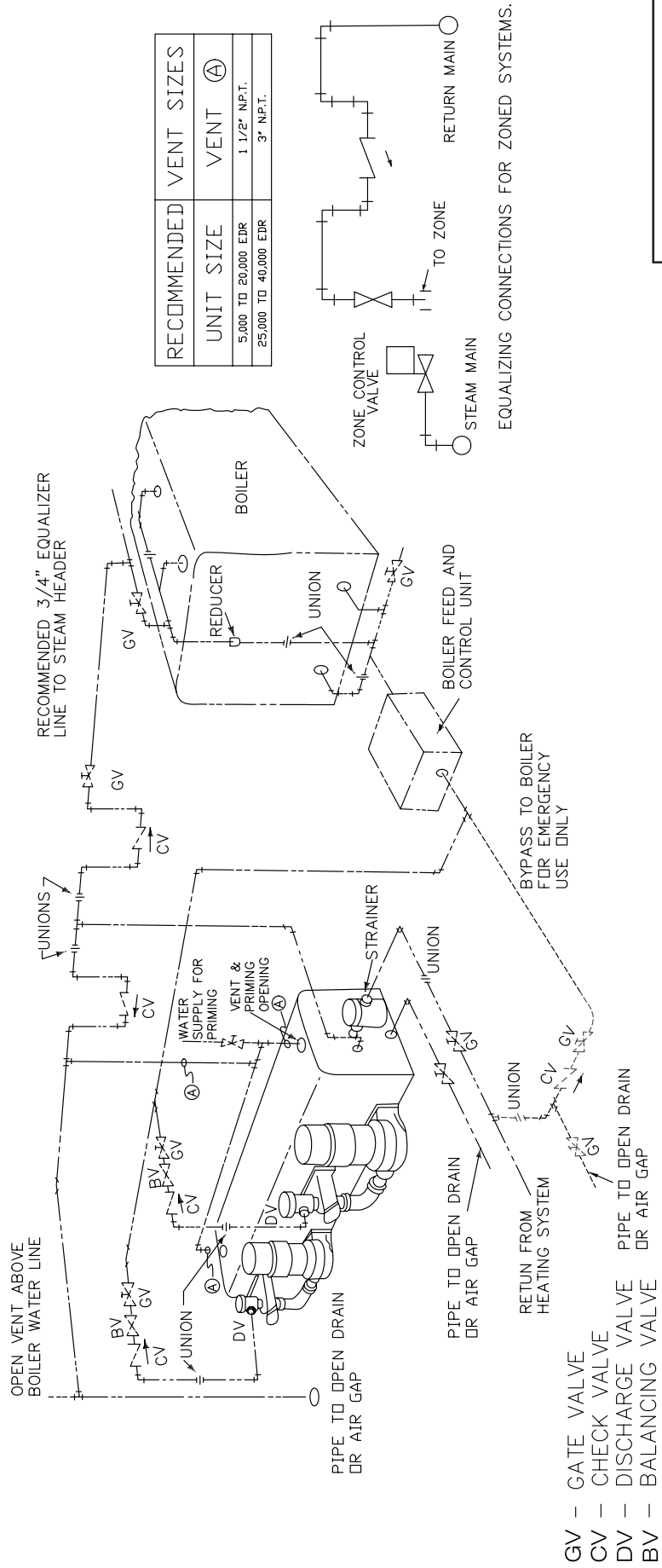


FIGURE 1

TYPICAL PIPING DIAGRAM
FIGURE 2



NOTE: Bleed line shut-off valve MUST remain open unless pump is being serviced.

WARNING: The manufacturer will not be liable for any malfunction, damage, or destruction of the equipment if the equipment is not installed properly or is not installed by professionals, licensed and registered as required. Failure to follow and install the equipment according to job specific drawings, made by professionals, who are licensed and registered as required and are familiar with the equipment, and failure to have the equipment installed by professionals, who are licensed and registered as required, in accordance with local, state, and federal codes will void all warranties and will void any liability upon the manufacturer. In addition, all warranties, including warranties of merchantability and fitness for a particular purpose are null and void for failure to follow job specific drawings made by professionals, who are licensed and registered as required, in accordance with local, state, and federal codes. failure to have the equipment installed by professionals, who are licensed and registered as required, in accordance with local, state, and federal codes.

Vacuum Switches and Adjustments:

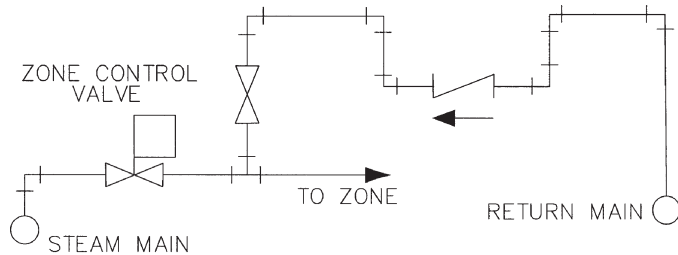
The vacuum switch(es) are factory preset for proper operation. Should field adjustments be required, the vacuum switch on a single unit and the lead vacuum switch on a duplex unit are typically set to close at 3" Hg and open at 8" Hg. The lag switch on a duplex unit is set to close at 2" Hg and open 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 3. 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.

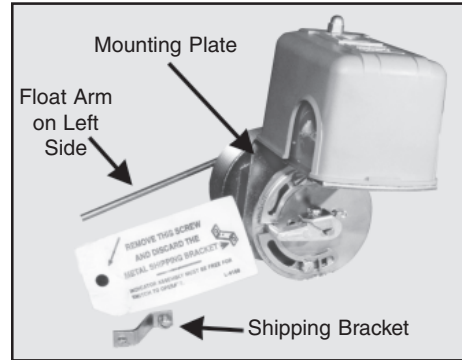


EQUALIZING CONNECTIONS FOR ZONED SYSTEMS.

PUTTING THE PUMPS INTO SERVICE

- Check system piping with the Typical Piping Diagram (See Figure 2).
- Make sure total system is free from debris.
- 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.
- 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. If needed, reference Technical Articles section on the SHIPCO® website (www.shipcopumps.com) for detailed instructions on how to adjust a float switch.
Adjusting a Nema 1 Square-D, 9037 Series Float Switch
- 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 start-up, 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.

- 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.
- 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.
- 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 Model D and Model V pump for additional information.
- 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.

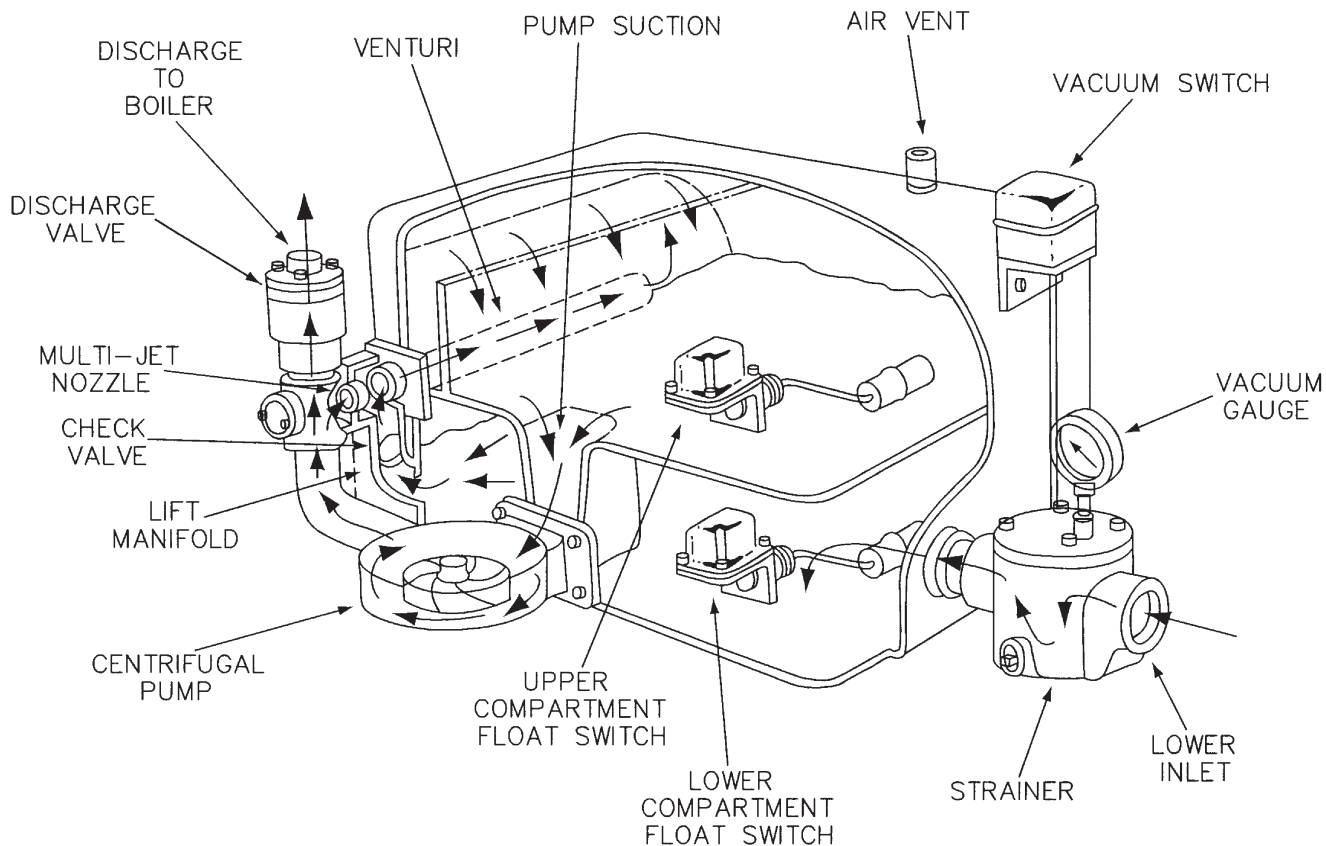
FIGURE 3—Float Switch

DESCRIPTION OF OPERATION

The unit is designed to produce a vacuum on the system with a multi-jet nozzle, venturi arrangement as shown in the typical cut away drawing below. The centrifugal pump forces water through the multi-jet nozzle. The streams of water, passing across the air gap between the nozzle and venturi. Air from the bottom compartment is entrained with the streams of water. The mixture of air and water is forced into the venturi, producing a vacuum in the lower compartment. Water is transferred from the lower compartment to the upper compartment of the receiver by means of the vacuum lift that is created.

As condensate returns into the bottom compartment, the water level rises in the bottom compartment. At the high water setting, the float switch in the lower compartment starts the pump; the pump runs until the condensate level drops to the float switch's preset, shut-off point. The water level in the top compartment begins to rise as the condensate is transferred from the lower compartment to the upper compartment. When the water level reaches the preset, high water setting, the float switch in the upper compartment actuates the discharge valve, causing the valve to open and the pump to run until the water level in the upper compartment drops to a preset, shut-off point.

The vacuum switch can also cause the pump to run. The vacuum switch senses the vacuum in the system. When the vacuum drops to the preset level, the vacuum sends a signal to turn on the pump. The pump runs, producing a vacuum, until the preset vacuum level is obtained.



SELECTOR SWITCH SETTINGS

Selector switches are normally set on the **Float & Vacuum position**. This position allows the pumps to operate on a signal from the float switch, in the lower compartment, 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. This position allows pumps to be turned "off" during short shut-down periods.

The **Float Only position** allows the pump to operate on a signal from the float switch in the lower compartment for high water. This position is used when the unit is only operating as a condensate transfer unit.

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

TROUBLESHOOTING

PUMP WILL NOT START

1. Inadequate condensate has returned from the system to activate float switch.
2. Vacuum on the system is not low enough to activate the vacuum switch.
3. The power supply has been interrupted, disconnect switch is open or a selector switch is not in the proper position.
4. Wiring to the control panel is incorrect or connection requires tightening.

5. Voltage supplied to unit is wrong. Check voltage and wiring with motor and panel specifications.
6. Starter coil wrong for power supplied.
7. Overload relays in the starter have tripped and require resetting. Ambient temperature may be too high.

PUMP DOES NOT OPERATE ADEQUATELY (SYSTEM FLOODS)

1. Pump may be running backwards. Rotation of 3 phase motors can be corrected by interchanging any 2 of the 3 wires. **Pump should run clockwise.**
2. Steam traps are failing, causing condensate to return at excessive temperatures. If 160°F is exceeded, the capacity of the pump may be reduced 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.
6. The eye of the impeller is clogged. Unclog the impeller.
7. Pump is too small for the system.
8. 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.
9. The discharge solenoid valve fails to open. This may be caused by the solenoid valve failing in the closed position.

PUMP IS NOISY

1. Balancing valve not installed or not adjusted, causing pump to operate too far out on the pump curve. Install balancing valve per I.O.M. and adjust to the rated discharge pressure of the pump.
2. Excessive condensate temperature. Correct system condition.
3. Starters chatter. Trouble is caused by low line voltage, poor connection, defective starter coil, or burned contacts.
4. Hum or bearing noise in motor. Consult motor manufacturer's authorized service station nearest pump location.
5. Pump is running backwards.

VACUUM PUMP RUNS CONTINUOUSLY OR FAILS TO PRODUCE SUFFICIENT VACUUM

1. Selector switch is set on "continuous."
2. A vacuum breaker is set too low. It should not allow air at a vacuum within the range of the vacuum switch settings.
3. The temperature of the condensate is too high. Normal operating condensate temperature should not exceed 160°F for rated capacities. Correct the cause for the high temperature condensate.
4. There are excessive leaks in the system piping preventing the pump from achieving sufficient vacuum to satisfy the vacuum switch setting. To confirm this, isolate the unit from the system and observe the vacuum pump, achieving required vacuum to satisfy vacuum switches.
5. The vacuum or float switch electrical contacts remain in closed position. Adjust controls.
6. Check valve in equalizing line or air vent line from receiver or the accumulator tanks leak, or is installed backwards.
7. One nozzle body check valve, on a duplex pump arrangement, remains open permitting air to recirculate.
8. Pump is too small for the system.
9. Lower float switch does not turn off. Float resting on the bottom of the receiver and should be raised.

PUMP STARTS AND STOPS IN RAPID SUCCESSION

1. A check valve is in the return line. Remove the check valve.
2. The inlet valve is partially closed. The inlet valve should be a gate valve rather than a globe valve.
3. Inlet strainer is clogged with dirt. Clean strainer.
4. Equalizing line improperly connected.
5. A lift in return line at or near the pump. Low return lines will fill with condensate between pump operations. The inertia of the collected water may be great, and before the vacuum suddenly produced by starting of the pump can set the water in motion, the vacuum at the pump may reach the cut-off point of the vacuum switch, thus stopping the pump.

The vacuum quickly recedes as the condensate moves into the receiver and the pump "cuts in" on vacuum control again, thus repeating this "hunting action." Following are two solutions to this difficulty:

- a. If the vacuum sensing line can be drained away from the vacuum switch(es), connect this sensing line into the nearest "Dry" point in the return main so that the operation of the unit may be governed by the vacuum in the system.
 - b. If the nearest "Dry" point on the return main is more than 2 ft. above the vacuum switch, relocate and reconnect the switches to sense the vacuum at this point.
6. Elbow in return line too close to unit inlet. Correct as described in No. 5 above, or if there is no lift in the return line at or near the pump, extend the equalizing line to top of "Dry" point on return main.

MECHANICAL SEAL REPLACEMENT INSTRUCTIONS FOR WATER AND VACUUM PUMPS ON MODEL LRV

When it is necessary to replace a mechanical seal refer to the procedures in the Installation, Operation, and Maintenance Manual (IOM) for Model D and Model V Pumps. **Note: Seals will be damaged if operated dry.**

REPRESENTATIVE SERVICING

If trouble occurs that cannot be rectified, contact your local SHIPCO® representative who will need the following information in order to give you assistance:

1. Provide all information on water pump, vacuum pump, and motor from SHIPCO® nameplate (see examples below).
2. Suction and discharge pipe pressure gauge readings.
3. Ampere draw of the motor.
4. A sketch of the pump hook-up and piping.

UNIT MODEL		[REDACTED]	
MANUFACTURED BY	P.O. BOX 279, SHIPPENSBURG, PA 17257		
SHIPCO® PUMPS	PHONE: (717) 532-7321 • FAX: (717) 532-7704		
WWW.SHIPCOPUMPS.COM			
RATED	[REDACTED]	GPM @	[REDACTED] PSIG
MOTOR HP	[REDACTED]	VOLTAGE	[REDACTED]
UNIT SERIAL NO.		[REDACTED]	
PUMP TYPE		[REDACTED]	

Notes / Comments

TERMS AND CONDITIONS OF SALE

AGREEMENT

By entering your order or requesting a quote, you confirm that the following terms and conditions of sale are the legal agreement governing your purchase, and that no changes or additional or different terms will apply unless you have previously established a different written contract for these purchases with Shippensburg Pump Company, Inc., hereafter referred to as the Seller.

ORDER ACCEPTANCE

All orders are subject to acceptance by Seller at its general office in Shippensburg, Pennsylvania. Acceptance will be evidenced by Seller issuing its Sales Acknowledgement Form. The Sales Acknowledgement Form, together with any documents incorporated therein, shall constitute the entire agreement and may not be changed except in writing signed by Seller and Buyer. Publication and circulation of current price lists, catalogues and related literature by Seller shall not be deemed an offer to sell, but rather an invitation for offers to buy. Acceptance by Seller of the Buyer's order is expressly limited to the Terms and Conditions stated herein; any additional, inconsistent or different terms and conditions contained in the Buyer's purchase order or other documents supplied by Buyer are expressly rejected.

PAYMENT TERMS—PRICES

Payment terms are as follows: If the Buyer is a Credit Card Customer, the Buyer agrees to pay at the time of purchase the price, shipping and handling charges, taxes and duties quoted by the Seller. If the Buyer is an Account Holder, the Buyer agrees to pay invoices with payment terms of net thirty (30) days after date of invoice unless otherwise specifically agreed to in writing. If the Seller believes that the Buyer's financial condition requires it, the Seller reserves the right to require full or partial payment prior to manufacture or shipment. If the Buyer fails to make any payment when due, (1) the seller reserves the right to suspend performance and the Buyer agrees that any charges incurred prior to the suspension will be assessed to the Buyer and payable to the Seller; (2) the Buyer further agrees to pay a charge on the amount past due at the rate of 1½% per month (18% per year) or the maximum lawful rate, whichever is less. In the event of non-payment, the Buyer agrees to pay the Seller reasonable attorney's fees and court costs, if any incurred by the Seller to collect payment and interest charges. These terms shall apply to partial, as well as complete shipments of Product. Published prices are subject to change without notice and the right is reserved to invoice at prevailing prices at time of shipment unless otherwise specifically agreed to in writing. All quotations are conditional on 30 days acceptance unless stipulated otherwise in writing and to approved credit rating or reference, otherwise payment terms are cash with order or C.O.D.

DELIVERY—DELAYS

Shipping dates represent estimates only and are based on projected production schedules and commitments by suppliers. Seller shall not be liable for failure or delay in manufacturing or shipping Products, nor shall such failure or delay constitute grounds for cancellation if such failure or delay is directly or indirectly due to shortages of fuel or energy; acts of omissions of the Buyer; acts of God; war, riot, civil disturbances; labor difficulties; accident; inability to reasonably obtain materials; acts of transportation companies; or other causes of any kind whatever beyond the control of Seller. In the event of such delays, Seller reserves the right to make adjustments in price and delivery schedules.

FREIGHT TERMS

Prices are f.o.b. factory unless otherwise stated. Seller's responsibility ceases upon delivery to the transportation company at shipping point. It is the Buyer's responsibility to examine shipment upon arrival to ascertain if in good order. Any shortage or damage claims must be pursued by the Buyer. All weights shown on price sheets and literature are approximate. All packaging is standard domestic boxing, slat and wire crating and/or skidding. An additional charge will be made for full wooden crating or special packaging when specified on the order.

Seller will make every effort to consolidate orders and backorders wherever possible. Seller will not be responsible for excess charges due to their inability to consolidate shipments.

When requested by Buyer, shipments may be routed using premium carriers such as express or airfreight or the Buyer may specify the method or route of shipment. In such cases the shipment will be made on a "collect" basis and where applicable the freight allowance will appear as a separate line item on the product invoice, Seller reserves the right to select the transportation company where freight is allowed.

TAXES

In addition to the price stated, the amount of any present or future sales, use, excise or other similar tax applicable to the production, sale, use or transportation of the Products shall be paid by Buyer. In lieu of paying such taxes to Seller, Buyer may furnish Seller a Tax Exemption Certificate or Certificates acceptable to appropriate taxing authorities at any time prior to Seller's shipment of the Products.

CANCELLATIONS

Any order placed with Seller may be cancelled by the Buyer only upon payment of reasonable cancellation charges that shall include but not be limited to expenses already incurred, as well as material and labor commitments made by Seller.

SHIPMENT—TITLE—RISK OF LOSS

Shipment terms are f.o.b. Seller's facility, unless otherwise specifically agreed to in writing. Notwithstanding the granting of any allowances for shipping, title to and risk of loss for Products will pass to the Buyer when delivered to the Common carrier at the Seller's facility.

BACK CHARGES

All invoices shall be due and payable when submitted for payment in accordance with the provision entitled "Payment Terms—Prices." No withholding of funds, back charges, or credits against amounts otherwise due Seller will be permitted unless specifically agreed to in writing by Seller. Settlement of any amounts due Buyer will be negotiated as separate items and not as offsets against amounts otherwise due Seller from Buyer for Products sold hereunder.

RETURNED GOODS

Unused material of current manufacture can only be returned for credit with the written consent of Seller, under return goods policies existing at the date of the return. Products that are obsolete or made to special order are not returnable.

PATENT INDEMNITY

a. Patent Indemnity by Seller to Buyer

Seller agrees to indemnify and hold harmless the Buyer from and against all legal expenses which may be incurred, as well as all damages and costs (except all consequential and special damages and costs) which may be finally assessed against Buyer in any action for infringement of any United States Letters Patent by the Products delivered to Buyer hereunder; provided that the Buyer shall give Seller prompt written notice of any action, claim or threat of patent infringement suit, either oral or written, or of the commencement of any patent infringement suit against Buyer relating to Products sold by Seller to Buyer hereunder; and provided Buyer shall give Seller opportunity to elect to take over, settle, or defend any such claim, action or suit through counsel of Seller's own choice and under

its sole direction, and at its sole expense, and provided that in the event Seller elects to take over, defend or settle same. Buyer will make available to Seller all defenses against any such claim, action, suit or proceeding known to or available to Buyer; and provided further that Seller shall have the right to substitute for any such Product or any part thereof claiming to infringe the patent right of others, non-infringing Products which will give equally good service. If the use of any such Product or any part thereof should be enjoined, Seller shall have the right at its own expense, to take any of the following courses of action:

- i. To procure for Buyer the right to continue using such Product;
- ii. To replace said Product with a non-infringing Product;
- iii. To modify the Product so that it becomes non-infringing; or
- iv. To remove said Product and refund the purchase price, transportation costs and installation costs thereof.

b. Limitation

The foregoing provisions as to patent protection by Seller to Buyer shall not apply to any of the following:

- i. To any Product manufactured to the design or specification furnished by the Buyer;
- ii. To orders for special non-commercial Products which Seller has not sold or offered for sale to the public on the open commercial market;
- iii. To any infringement occasioned by modification by Buyer of any Product without Seller's written consent, or any infringement arising from the use of a Product with any adjunct or device added by the Buyer without Seller's written permission.

c. Patent Indemnity by Buyer to Seller

To the extent that Products delivered hereunder are manufactured pursuant to detailed designs furnished by Buyer, Buyer agrees to indemnify Seller and hold Seller harmless from all legal expenses which may be incurred, as well as all damages and costs, which may finally be assessed against Seller in any action for infringement of any United States Letters Patent by such Products delivered hereunder. Seller agrees to promptly inform the Buyer of any claim for liability made against Seller with respect to such Products and Seller agrees to cooperate with the Buyer in every way reasonably available to facilitate the defense against any such claim.

GOVERNING LAW

The validity, interpretation and performance of any order shall be governed by the Uniform Commercial Code ("UCC") as adopted by the state in which the Products are manufactured by Seller.

WARRANTY AND LIMITATION OF LIABILITY

Seller warrants for a period of eighteen (18) months from date of shipment from its factory or one (1) year from date of installation, whichever occurs first, that all Products furnished by it are free from defects in materials and workmanship.

Seller's liability for any breach of this Warranty shall be limited solely to replacement or repair, at the sole option of Seller, of any part or parts found to be defective during the Warranty period providing the Product is properly installed and is being used as originally intended. Buyer must notify Seller of any breach of this Warranty within the aforementioned Warranty period; defective parts must be shipped by Buyer to Seller, transportation charges prepaid.

IT IS EXPRESSLY AGREED THAT THIS SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER. UNDER NO CIRCUMSTANCES SHALL SELLER BE LIABLE FOR ANY COSTS, LOSS, EXPENSE, DAMAGES, SPECIAL DAMAGES, INCIDENTAL DAMAGES OR CONSEQUENTIAL DAMAGES ARISING DIRECTLY OR INDIRECTLY FROM THE DESIGN, MANUFACTURE, SALE, USE OR REPAIR OF THE PRODUCT WHETHER BASED UPON WARRANTY, CONTRACT, NEGLIGENCE OR STRICT LIABILITY. IN NO EVENT WILL LIABILITY EXCEED THE PURCHASE PRICE OF THE PRODUCT.

THE WARRANTY AND LIMITS OF LIABILITY CONTAINED HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, EXPRESSED OR IMPLIED. ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED BY SELLER AND EXCLUDED FROM THIS WARRANTY.

Seller neither assumes, nor authorizes any person to assume for it, any other Warranty obligation in connection with the sale of the Product. This Warranty shall not apply to any Product or parts of Products which (a) have been repaired or altered outside of Seller's facilities; or (b) have been modified or damaged through misuse, abuse, accident, neglect or mishandling by Purchaser or Purchaser's customer, erroneous voltage, modification, acts of God, or any other act not specifically stated; or (c) have been used in a manner contrary to Seller's instructions.

Products covered by this warranty are for the intended uses as described in the corresponding seller's instructions. Before using for any other application, user shall determine the suitability of the product for its intended use and user assumes all risk and liability in connection therewith.

No oral statement made by the seller, its agents, employees, or other representatives, concerning the product, its value, description, condition, design, specifications, performance, capability, durability, adaptability, or accuracy, shall be relied upon by the purchaser and is specifically and expressly excluded and invalidated as the basis for any bargain or warranty.

In the case of Products not manufactured by Seller, there is no Warranty from Seller, but Seller will extend to the Buyer any Warranty of Seller's supplier of such Products.

FORCE MAJEURE

Seller shall have no liability in respect of failure to deliver or perform, or delay in delivering or performing any obligations due to causes such as acts of omissions of Buyer; acts of God, fire, flood, war and civil disturbances; riot, acts of governments, currency restrictions, labor shortages or disputes, unavailability of materials, fuel, power, energy or transportation facilities, failures of suppliers or subcontractors to deliver on time and every other circumstance outside the reasonable control of Seller.

MODIFICATIONS

Unless otherwise provided, Seller reserves the right to modify the specifications of Products ordered by the Buyer providing that the modification will not materially affect the performance.

STORAGE CHARGE

If Buyer is unable to accept products in accordance with the applicable shipping schedule then Seller may arrange to store ordered Products and the cost of storage will be charged to Buyer.

ENTIRE CONTRACT

These provisions constitute all the terms and conditions agreed upon by the parties and shall replace and supersede any provisions on the face and reverse side of Purchase Order and any attachment thereto, or any prior general agreement inconsistent with the provisions hereof except that orders by Representatives with whom Seller has an Agreement shall be subject to the provisions of the Agreement. No modification hereof shall be valid unless in writing and duly signed by a person authorized by Seller. The provisions hereof shall not be modified by any usage of trade, or any course of prior dealings or acquiescence in any course of performance.