Installation, Operation & Maintenance Instructions for Liquid Ring Compressor Systems
MANUFACTURER:

TRAVAINI PUMPS USA
200 Newsome Drive
Yorktown, VA  23692
Toll Free:  (800) 535-4243
Telephone:  (757) 988-3930
Fax:  (757) 988-3975
Website: www.travaini.com

WARRANTY:
All products manufactured by TRAVAINI PUMPS USA are guaranteed to meet the conditions listed on the general terms & conditions of sales and/or conditions listed on the order confirmations. Failure to strictly adhere to the instructions and recommendations listed in this manual, will void the manufacturer’s warranty.

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In preparing this manual, every possible effort has been made to help the customer and operator with the proper assembly and disassembly of the pump and/or system. Should you find errors, misunderstandings or discrepancies please do not hesitate to bring them to our attention.
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1.0 INTRODUCTION

This manual contains instructions for the installation, operation and maintenance of your Travaini liquid ring compressor system. It has been designed to provide safe and reliable service. However, since the compressor is a piece of rotating equipment, the operator must exercise good judgment and proper safety practices to avoid damage to the equipment or personal injury. The instructions in this manual are intended for personnel with a general training in operation and maintenance of rotating equipment.

The Travaini compressor system is a factory assembled system including all components required for operation. We have taken great care to use high quality components for long trouble-free operation.

SAFETY

It is assumed that your safety department has established a program based upon a thorough analysis of industrial hazards.

It is important that due consideration be given to these hazards which arise from the presence of electrical power and rotating parts. Proper installation and care of protective devices is essential.

In the following safety procedures you will encounter the words WARNING, CAUTION AND NOTE. They are intended to emphasize certain areas in the interest of personal safety and satisfactory compressor operation and maintenance. The definitions of these words are as follows:

<table>
<thead>
<tr>
<th>WARNING:</th>
<th>An operating procedure, practice, etc. which, if not correctly followed, could result in personal injury or loss of life.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAUTION:</td>
<td>An operating procedure, practice, etc., which, if not strictly observed, could result in damage to or destruction of equipment.</td>
</tr>
<tr>
<td>NOTE:</td>
<td>An operating procedure, condition, etc., which is essential to highlight.</td>
</tr>
</tbody>
</table>

These safety procedures are to be used in conjunction with the installation, operation and maintenance instructions contained in the compressor manual.
2.0 INSTALLATION

The design of plant piping systems, foundations, and other areas of system design is the responsibility of others, not Travaini Pumps, USA or its representatives. Data and comments are offered as an aid, but Travaini Pumps, USA cannot assume responsibility for the design and operation. We recommend that the customer consult a specialist skilled in the design of foundation, piping, and equipment location so as to supplement and interpret this information to ensure a successful installation.

WARNING: Install, ground and maintain equipment in accordance with local and national electrical codes.

2.1 CHECK UPON ARRIVAL
Shipment of systems ordered with control panels suitable for wall mounting will consist of two packages, one containing the control panel and one the compressor system. Remove each component from the respective crate and check thoroughly for possible shipping damage. If systems are ordered with control panels pre-wired, follow the above procedure.

LIFTING: Lift the unit to the required location by supporting from at least four points on the saddle or by slings under each end of the tank.

NEVER LIFT OR MOVE THE UNIT BY DECK MOUNTED COMPONENTS.

2.2 STORAGE (STORE UNIT IN ACCORDANCE WITH THIS AND COMPRESSOR O & M MANUAL PROVIDED.)

a) In instances where the unit is to be stored for a lengthy period prior to installation and operation, it should be located in a clean, cool, dry area protected from the elements. Special care should be taken with the control panel to ensure it is protected from dust and moisture.

b) When shipped from the factory, the pump unit is filled with a water soluble rust preventative solution. Should the unit be installed and tested on site, it should be placed in service immediately, since the rust preventative solution will be removed on running. When this is not possible, the pump and water trap must be filled with a similar solution to ensure that they remain operable.

NOTE: When putting the unit into service, do not connect the building air distribution system to the package until the unit has been tested for air quality.

2.3 PREPARATION

Read this manual and other literature provided. If questions arise, consult the distributor or the factory.

Verify that the proper utility services required to operate the equipment are available. Among these are the electrical supply, voltage, current, number of phases, the water supply temperature, pressure, flow capability and quality, drain size and capacity.
a) **LOCATION**
Install the compressor in an accessible place, as close as possible to the compressed air use area. Allow adequate space for operation as well as for scheduled maintenance operations involving dismantling and inspection of parts. Consideration must be given to the environment. Proper ventilation is necessary and extremes of dampness or temperature should be avoided.

b) **SEALING LIQUID SUPPLY**
Proper operation of the liquid ring compressor is dependent upon a continuous supply of cool, clean sealing liquid, normally water, which enters the pump through the sealing liquid inlet connection on the suction side of the pump and is discharged together with the compressed gas. The sealing liquid entering and leaving the pump also serves to carry away the heat of compression imparted to the liquid ring during the working cycle.

Service liquid supply to each compressor is fixed and set at the factory for the correct amount by a flexible flow orifice.

Compressor performance data as published is based on the use of 60˚ Fahrenheit (15˚C) water as the sealing liquid. When operating with water of higher temperature, a drop in capacity may be expected.

An adequate supply of good quality water must be available to meet the system requirement. The following data serves as a guideline for the water supply:

- Water Hardness: maximum 200 ppm
- Dissolved Solids: maximum 200 ppm
- Chlorides: maximum 10 ppm
- pH: minimum 7

**NOTE:** Mineral deposits on pump internals can cause operating problems and are not covered under warrantee.

### 2.4 FOUNDATION
Mount and bolt the unit onto a concrete pad adequate to support the weight as shown on the attached drawing. Mounting holes are located in each tank foot (or on baseplates) and locations are shown on the overall dimension drawing supplied with system O&M manual.
2.5 V-BELT ALIGNMENT

For the pumps utilizing V-belt drives, make sure the sheaves are properly installed and aligned before attempting to tension the drive. The V-belts should be placed over the sheaves and in the grooves without forcing them over the sides of the grooves. The tensioning steps 1, 2, and 3 are listed below.

1) With all belts in their grooves, adjust centers to take up the slack until they are fairly taut.

2) Start the drive and continue to adjust until the belts have only a slight bow on the slack side while operating with load conditions.

3) After several hours of operation, the belts will seat themselves in the sheave grooves. Further tensioning may be necessary, such that the drive shows a slight bow in the slack side. Insufficient tension is often evidenced by slipping (squealing) at start-up. If the unit is idle for an extended period of time, the tension on belts should be removed. Excessive heat (140˚ F and higher) should be avoided, as belt life is shortened since the rubber is over cured. Belts should never be mixed or switched from one groove to another on the sheaves and dressing should never be used. Belts should be replaced with a matched set. Sheaves should remain free of oil and grease. Consult the drive manufacturer for more specific information.

CAUTION: Do not attempt to free a compressor shaft from a binding or bound condition by applying power to the motor. Severe damage may result. To free up a compressor, put an adjustable wrench on the shaft, using the key from the keyway as a stop for the wrench. Apply leverage to the wrench in the direction of normal rotation. If you are not able to free up the pump, contact your area representative or call the factory before trying any other method.
2.6 PIPING

Prior to installation, check to make sure that all protective inserts fitted in the gas and service liquid connections of the pump are removed.

Piping connected to the compressor system components must be installed without imposing any strain on the components. Improperly installed piping can result in misalignment, rubbing of internal parts, etc. Use flexible connectors when necessary.

Piping should be cleaned properly before installation and must be, at a minimum, the same as the corresponding pump connections.

The discharge piping from the system must be sized and installed properly.

2.7 MECHANICAL CONNECTIONS

a) Connect main to service liquid supply line.

b) Connect both water traps and the auxiliary trap to the drain. Use lines as short as possible and pipe size the same as the drain connections.

| NOTE: Drain should be gravity flow with no restriction or back pressure. |

c) Connect the intake filter silencers to a clean air source. The minimum pipe size should correspond to the silencer intake size.

2.8 ELECTRICAL CONNECTIONS

Our compressor systems include an electrical control panel as standard. The main motor and control instruments are wired to the panel at the factory. An electrical wiring diagram is included with this manual. The system must be connected according to the local electrical codes. A disconnect switch should be installed between the system control panel and plant power. The full load current rating is stamped on the motor nameplate and should be used in selecting protective ratings.

After the electrical work is completed jog the motor to check direction of rotation. The direction of rotation is marked by an arrow on the pump housing. If the direction is wrong, switch any of the three main leads on the contractor in the control panel.

3.0 START UP

3.1 INITIAL START UP PROCEDURE

a) Verify that the electrical power to the equipment is off.

b) Check the drive coupling alignment or belt drive tension as described in section 2.5 of this manual.
c) Rotate the pump by hand to ensure that it turns freely. During the time between manufacture and start-up, a slight film of rust may form on the port plates, causing the pump to be hard to turn. If this is the case, fill the pump with a water soluble rust inhibitor and wait until it can be turned by hand.

d) Fill the pump with clean sealing liquid up to the shaft level. Do not start the pump when the liquid level is above the shaft level, as the increased starting torque can cause damage to the pump internals and/or the drive.

e) Re-install any safety guards or covers that may have been removed.

f) Verify that all valves required for operation are open (sealing liquid, cooling water, etc.)

g) Turn on the electrical power to the equipment. Verify that all phases are energized and the voltage is correct.

### 3.2 PUMP ROTATION

With H-O-A switch to hand position, bump start pumps to check direction of rotation, as indicated on pumps by an arrow. All compressors run clockwise facing the drive shaft from motor side. Turn hand-off-auto switch to hand position momentarily and check operation of solenoid valve to ensure water is getting to the unit. Check each compressor in this way.

![CAUTION:](image)

**CAUTION:** Check rotation to see that it is correct. Improper rotation can cause damage to the pump.

### 3.3 SERVICE WATER ADJUSTMENT

Minimum service water-pressure in service liquid line is 5 psig.

**(OPTIONAL)**

The low water pressure switches are factory set to be activated at these pressures. To turn off the alarm for low water pressures conditions, correct the problem first, turn circuit breaker handle to “RESET” position and then to “ON” position.

a) Isolate the compressor package from the compressed air distribution system by closing an upstream isolation valve.

b) Open tank isolation valves between compressor and receiver to full open position.

c) Set H-O-A switch to hand position, pumps should start.

d) The liquid ring compressor will produce 100% oil free air. However, prior to shipment, they are filled with an oil base rust inhibitor to prevent rust from forming on the internal parts of the compressor.
NOTE: The rust inhibitor used is water soluble and will require flushing of the compressor by operating compressor isolated from the compressed air distributor network.

CAUTION: Should oil contamination be detected, run unit while testing quality for air periodically. Only after the oil free air specification is met should the unit be connected to the compressed air network.

4.0 OPERATIONAL TESTING

The switch(s) are factory set, however, the settings may alter due to atmospheric pressure changes and handling during shipping and installation. Do not readjust the pressure switches unless factory settings have varied significantly or changed settings are desired.

NOTE: Clockwise rotation will increase the pressure setting, counter clockwise rotation will decrease the setting. The pressure switch scale may not be accurate and should be used for guidance only. Adjustment should made with the reference to the pressure gauge only.

4.1 DUPLEX SYSTEMS

a) Start compressors by setting H-O-A switch(es) to auto position. The pumps should start and pressure should increase. The pressure switches are set at the factory. However, the settings may alter due to atmospheric pressure changes or handling during shipping and installation. Do not re-adjust pressure switches without making a note of current settings by watching pressure gauge on receiver.

When the maximum pressure has been reached, the pumps will stop. Bleed air out of receiver until lead compressor starts again. If both pumps start at the same time, the setting of switch 2 is too high. Allow the pumps to run until shut off then turn the upper slotted adjustment on switch No.2 counter clockwise one (1) turn and again bleed air out of the tank; if only one pump starts proceed further if not, repeat the above procedure.

NOTE: If the unit has frequent start/stop protection, pumps will run for an additional ten minutes and load and unload via the unloading solenoid valves.

Record the shut-off pressure of the single pump as indicated on the pressure gauge and note which pump was operating. Should this setting be too high or too low, it may be adjusted accordingly by rotating the upper slotted adjustment on pressure switch No.1 in the control panel.

b) While checking this gauge again bleed air out of the tank until a single pump starts.
Record the pressure indicated on the pressure gauge and note again which pump is operating. Should the same pump restart, allow the pressure to increase to the shut-off point and repeat the above procedure. In the event the same pump restarts repeatedly consult your distributor or the factory for assistance.

c) Check that the pressure differential between the start and stop values recorded above are as shown below. Should the differential be exceeded, it may be adjusted by turning the lower slotted adjustment on switch No.1. Several attempts may be required to accurately adjust the switch settings.

**STANDARD SYSTEM PRESSURE SWITCH SETTINGS**

<table>
<thead>
<tr>
<th>Switch No.1</th>
<th>85-105 PS1G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch No.2</td>
<td>80-105 PSIG</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Differential pressure switch No.1</th>
<th>20 PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low pressure setting switch No.2</td>
<td>80 PS1G</td>
</tr>
</tbody>
</table>

d) Allow the pump to run until the high pressure set point is reached and the pump stops. While checking pressure gauge bleed air out of the tank until both pumps come on. Record the start point of the second pump. The low pressure setting for lag pump may be adjusted by turning the upper slotted adjustment on pressure switch No.2. Clockwise rotation will increase the pressure setting, counter clockwise rotation will decrease the setting.

e) Check to ensure that resetting the upper adjust point of switch No.2 has not interfered with proper alternation. Should the pumps cease to alternate; back off the upper adjustment on pressure switch No.2.

f) Check the temperature of areas such as the bearing housing, pump and motor casings, and discharge piping for unusually hot spots.

g) Check that the motor current draw is within specification.

**NOTE:** If current draw is more than 10% into service factor, (motor nameplate), see trouble shooting section. If correction cannot be made, consult factory.

4.2 TRIPLEX SYSTEMS-SINGLE PUMP OPERATION

a) Set the HAND-OFF-AUTO switches to the “AUTO” position. Pumps should start and run until the maximum pressure setting is reached. When the maximum pressure is obtained, the pumps will stop. Bleed air from the tank until one pump restarts. Record the start pressure.

b) Pump should run to the high pressure setting and then stop. Record the high pressure setting and note which pump was running.

c) Compare the start and stop pressures with those given as standard switch settings below.
d) Again, bleed air from the tank until one pump starts. Note which pump is operating and allow the unit run to shut off.

e) Repeat this procedure several times. In each case, one pump should start and after each cycle a different pump should start. (Lead pump should alternate).

NOTE: If more than one unit starts simultaneously, switches are set incorrectly.

4.3 TRIPLEX SYSTEMS -TWO PUMPS OPERATING. ONE STAND-BY (FACTORY STD.)

a) Bleed air from the tank until a pump starts. Continue bleeding air from tank until a second pump starts. Record the start point of the second pump. Start pressure should be approximately 5 psi below the start of the first pump.

b) Repeat the procedure several times and note that the lead pump and the standby pumps alternate on each cycle.

c) Bleed air from the tank until one pump starts. Continue bleeding until a second and finally the third pump starts. Start of the third pump should be approximately 5 psi below the start of the second pump. Lag alarms will be initiated on the start of the third pump. If included, an audible horn will sound in the panel. This may be silenced by pushing the local horn knowledge button in the panel cover.

Once alarms have been initiated, they will be held in until the alarm reset is pushed or the circuit breakers are reset.

STANDARD SWITCH SETTINGS

Switch #1 85 -105 PSIG
Switch #2 80 -105 PSIG
Switch #3 75 -100 PSIG

NOTE: The above pressure switch settings are standard switch settings and do not apply to all compressor systems. For the pressure switch settings on your unit consult your distributor or the factory.

4.4 FLOW SWITCH TESTING

Units fitted with low water pressure switches include a visual light in the panel to indicate failure due to low water flow. To turn off the alarm for water flow conditions correct the problem first, turn circuit breaker handle to the “reset” position and then return circuit breaker to the “ON” position.
4.5 LEVEL SWITCH TESTING

Tank mounted condensate level switches should be checked regularly for proper operation.

a) Place system in the “AUTO” mode.
b) Isolate level switch assembly by closing the isolating valves.
c) Open vent plug on switch assembly and fill the pipe with water and observe that 1st and 2nd alarms come on as the water rises in the tube.
d) Once alarms have been checked, drain the water from the tube through the drain plug.
e) Replace top and bottom plugs, open the isolating valves to the air tank

4.6 PRESSURE SWITCH SETTING

CAUTION: Do not reset switches if unit operates according to factory setting.

NOTE: Some switches may have different adjustments.

a) Preliminary

i) Isolate the compressor system from the distribution line.

ii) Set circuit breakers and selector switches to the “OFF” position. Open control panel door. Control panels are equipped with a control voltage circuit breaker; set control circuit breaker to the “OFF” position.

WARNING: With circuit breakers in the “OFF” position, there is no power on the control panel side of the circuit breakers. However, the power line side of the circuit breakers is energized.

iii) Remove pressure switch housing (if installed) and carefully lift off plastic contact cover at the top of each switch, (between the two terminal screws).

iv) Rotate the lower slotted screw clockwise. You will note this causes the cam mounted on the upper screw to turn. Continue rotating the lower screw until the cam bottoms our against the cam stop. Repeat for the remaining two switches if applicable.

v) Adjust the range adjustment (upper slotted screw) for all pressure switches until the range indicator, which is located on the left side of the pressure switch is indicating the stop pressure points.
b) **Switch setting notes**

It is not necessary for switches to be precisely set, however it is necessary for start pressure levels to be progressively lower from switch 1 to switch 3 (i.e. start pressure of switch 1 must be higher than switch 2 which in turn must be higher that switch 3.) If this is not the case, alternation will not occur.

c) **Setting Switch No.1 – Stop Pressure**

| NOTE: Stop pressure is controlled by the upper slotted adjusting screw. |

i) With panel door open, set circuit breakers to “ON” and HAND-OFF-AUTO switch for pump 1 to “AUTO”. Leave all other HAND-OFF-AUTO switches in “OFF”. This will disable alternation and allow only one pump to start. Pump 1 should start and run to the shut off point.

ii) Bleed air from tank and observe the pressure at which the pump stops. Compare this value with the factory setting and reset as necessary. Turn the upper screw clockwise to increase the stop pressure level, counter-clockwise to decrease the stop pressure level. Repeat as necessary until the start point is correct.

d) **Setting Switch No.1 – Start Pressure**

| NOTE: Start pressure is controlled by the lower slotted adjusting screw. |

i) Rotate the lower slotted screw counterclockwise and observe the cam movement. Stop at approximately the mid-point of cam rotation.

ii) Bleed air from the tank until a pump starts. Compare the start pressure to the factory setting value. Adjust the lower adjusting screw and retest as necessary. Clockwise rotation will decrease the start pressure level, counter clockwise rotation will increase the start pressure level.

e) **Setting Switch No.2 – Start & Stop Pressure Levels**

i) Ensure pressure level is above the pump start point and pump is not operating.

ii) Carefully insert a small piece of paper or light cardboard between the open side of the contacts of switch No.1. This will disable switch 1 (Alternatively disable switch No.1 by removing the wire on the front terminal at the top of the switch.)
WARNING: Wire will be energized at 120 volts.

iii) Proceed to set the start and stop vacuums per steps c) and d).

f) Setting Switch No. 3 Start & Slop Pressure Levels

i) Similar to step e. Disable switch No.2 (keeping switch No.1 disabled) and set switch No.3 to the values in accordance with the procedures in step c) and step d)

g) Checking Switch Settings

i) With panel door open, remove paper isolators from all switches and/or reconnect wires to the proper terminals.

ii) Return all circuit breakers to “ON” and selector switches to “AUTO”.

iii) Perform operational checks as applicable. If varied settings are required, correct per above steps.

iv) Set circuit breakers to “OFF”. Close panel door and reset breakers to “ON”.

v) Open system isolating valves and return system to operation.

5.0 OPERATION AND MAINTENANCE

Travaini liquid ring pumps require very little attention or maintenance provided the units are installed properly. However, it is necessary to follow the maintenance schedule below.

5.1 MAINTENANCE SCHEDULE

a) AT FIRST 24 HOURS OF OPERATION:

i) Tighten V-Belts and/or Check Alignment.

b) AT FIRST 50 HOURS OF OPERATION:

i) Clean strainers associated with the system to remove any foreign assembly material, pipe scale, etc.

ii) Check alternation sequence.

iii) Check lag alarm is operational.

iv) Check condensate level switches alarms.

v) Blow down water from air receiver, if water has accumulated.
c) **EVERY 500 HOURS:**
   i) Clean strainers.
   ii) Check alternation sequence.
   iii) Check lag alarm is operational.
   iv) Check condensate level switches alarms.
   v) Blow down water from air receiver, if water has accumulated.
   vi) Clean water traps, if necessary.

d) **EVERY 3000 HOURS:**
   i) On those pumps with grease fittings, grease the bearings. Use a moisture resistant lithium based grease of number 2 consistency. Typical products are Texaco Premium RB, Chevron SRI #2, and Esso Ronex MP. DO NOT OVER GREASE.
   ii) Check conditions of drive coupling or V-belt drive. Service if necessary.

5.2 **OPERATION**

| WARNING: The unit must not be operated unless the drive guard is in place. Failure to observe this warning could result in personal injury to operating personnel. |
| WARNING: Do not attempt any maintenance, inspection, repair or cleaning in the vicinity of rotating equipment. Such action could result in personal injury. |

6.0 **TROUBLE SHOOTING**

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>POSSIBLE CAUSE</th>
</tr>
</thead>
</table>
| **Compressor does not start** | Compressor seized  
Power supply failure  
Faulty fuse or breaker  
Loose wires  
Faulty electrical connections  
Faulty step-down transformer  
Pressure setting too high |
| **Compressor does not stop** | Pressure setting too high  
Air leakage  
Selector switch faulty |
| **Compressors do not alternate** | Selector switch faulty or not set correctly  
Pressure setting too high |
Frequent start-stop
Pressure switch or its contacts may be damaged
Excessive air leakage
Pressure switch differential
Pressure setting too close

Overheating of compressor
Bearing failure
Coupling misalignment
Insufficient service water supply
Water temperature too high
Water leaking at compressor
Mechanical seal failure

Low capacity
Low compressor speed
Incorrect voltage
Insufficient service liquid
Service water pressure (flow) too high
Faulty drive coupling

Air pressure too low
Low compressor speed
Pressure setting too low
Excessive air leakage
Insufficient service water
Faulty couplings
Crossed wires to water solenoid valves

High power consumption
Bearing failure
Too high air pressure
Scale build-up in compressor
Coupling misalignment
Too much service water
Intake Filter Contaminated

Slow running motor
Damaged motor
Faulty power supply
Incorrect voltage
Faulty fuse or breaker

Vibration
Compressor damaged
Coupling misalignment
Too much service water flow

Excessive noise
Compressor damaged
Bearing failure
Coupling misalignment
Intake silencer faulty
Too much service water

Leaking check valve
Check valve sticking
Broken pin
Broken or worn seat
| Solenoid valve failure | Scale build-up  
|                       | Loose contact  
|                       | Corroded wire  
|                       | Burned coil  
|                       | Broken or Worn Seat  |
| Water build-up in tank | Faulty tank water trap  
|                        | Plugged drain line  
|                        | Leaking water solenoid valve  
|                        | Faulty separator  
|                        | Damaged trap balance line  
|                        | Too much service water  |
| Moisture content too high | Service water temperature too high  
|                          | Faulty water trap  
|                          | Clogged separator  
|                          | Leaking water solenoid valve  
|                          | Too much service water  
|                          | Damaged trap balance line  
|                          | Faulty air dryer  
|                          | Incorrect located air dryer  |
| Water trap problems | Scale build-up  
|                      | Damaged balance line  
|                      | Clogged orifice  |
| Contaminated air | Compressor not properly flushed out  
|                   | Air intake improperly located  
|                   | Air intake contaminated  
|                   | Inoperative water trap  
|                   | Service water quality not suitable  
|                   | Intake filter contaminated  |
| Faulty pressure switch | Damaged membrane  
|                        | Burned contacts  
|                        | Corroded contacts  
|                        | Pressure setting too close  |
| Low water pressure | Low main water pressure  
|                      | Strainer screen plugged  
|                      | Isolating valves in water line closed  
|                      | Water pressure switch set incorrectly  
|                      | Time delay relay set too short  
|                      | Plugged line to pressure switch  |
OUR PRODUCTS

LIQUID RING VACUUM PUMPS
LIQUID RING COMPRESSORS
ROTARY VANE VACUUM PUMPS
PACKAGE VACUUM SYSTEMS WITH PARTIAL OR TOTAL SERVICE RECIRCULATION
CUSTOM ENGINEERED VACUUM SOLUTIONS
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REGIONAL SALES LOCATIONS

NORTH EAST
Travaini Pumps USA
14 Rob Rider Road
Redding, CT 06896
Phone: 203-938-0108
Fax: 203-938-0109
E-mail: northeast@travaini.com

SOUTH EAST
Travaini Pumps USA
565 Underwood Drive
Jefferson, GA 30549
Phone: 706-367-7133
Fax: 706-367-2770
E-mail: southeast@travaini.com

MIDWEST
Travaini Pumps USA
509 Livingston
McHenry, IL 60050
Phone: 847-973-1916
Fax: 847-973-1974
E-mail: midwest@travaini.com

MIDAMERICA
Travaini Pumps USA
6662 W. Johnson Road
LaPorte, IN 46350
Phone: 219-879-9514
Fax: 219-879-5005
E-mail: lefcocps@netnitco.com

WEST
Travaini Pumps USA
PMB 485
835 W. Warner Road
Suite 101
Gilbert, AZ 85296
Phone: 480-632-7166
Fax: 480-545-0704
E-mail: west@travaini.com

Continuing research of TRAVAINI PUMPS USA results in product improvements; therefore any specifications may be subject to change without notice.

DATE 12/00