LACO TECHNOLOGIES

USER MANUAL

DURAVANE HIGH VACUUM ROTARY VANE PUMPS

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1. SCOPE

DuraVane^{HV} lubricated high vacuum rotary vane pumps have been designed to give you safe, reliable and trouble-free service, provided some of the basic maintenance guidelines as set out in this manual are followed. A vacuum pump is a rotating piece of equipment and operators must exercise good judgment and follow proper safety procedures to avoid damage to the equipment or personal injury. Please review and follow all instructions in this manual before attempting to install, start or operate equipment.

2. SAFETY

All products offered by LACO Technologies Inc. have been designed and manufactured for safe operation. However, the responsibility for safe operation rests with those who use and maintain these products. Your safety department should establish a safety program based on OSHA, federal, state and local codes. It is important that due consideration be given to hazards which arise from the presence of electrical power, hot liquids, toxic gases and rotating equipment. Proper installation and care of protective devices is essential to safe pump and system operation. These safety procedures are to be used in conjunction with the instructions contained in this manual.

DANGER Don't pump oxygen or oxygen mixtures with these pumps: Explosive hazards.

3. PREPARATION & INSTALLATION

3.1 STORAGE

Keep the pump in a cool, dry environment and plug all open ports to keep out dirt and foreign objects.

3.2 INSTALLATION

The design of the suction piping system is the responsibility of the purchaser. LACO Technologies, Inc. and its representatives may offer advice but cannot assume responsibility for operation and installation design. The installer should carefully read this manual before installing the equipment. LACO or your local dealer can provide start-up assistance in most instances at reasonable cost.

3.2.1 UNPACKING

Upon receipt of pump, immediately inspect for signs of damage. Carefully remove the packing or crating from around the pump. Be sure to keep equipment in the upright position. LACO products are shipped F.O.B. Factory, which means that any damage is the responsibility of the carrier and should be reported to them.

3.2.2 LIFTING

Lift the equipment carefully and with weight evenly distributed. LACO is not responsible for equipment that has been damaged through mishandling or dropping.

3.2.3 LOCATION

Install the unit in a well ventilated and dust free area. The pump should be a minimum distance of 3 feet from surrounding walls to allow for checking fluid level, temperatures, pressures and general servicing.

Whenever the pump is transported, be sure to drain the oil to avoid damage to the vanes when the pump is restarted. Do not tip pump over if filled with oil.

3.2.4 MOUNTING

The pump must be installed on a level surface in a horizontal position.

3.2.5 VENTILATION

Locate the pump in an area with sufficient airflow and accessibility. To prevent excessive ambient temperature rise, it is imperative to provide adequate ventilation. Cooling is an important aspect of reliable equipment operation and it is therefore important to install the unit in a reasonably cool area, where temperatures do not exceed 100 °F (38 °C). For higher ambient temperatures, contact the factory.

3.2.6 ELECTRICAL PREPARATION

Check area classification to ensure all electrical enclosures comply to code. Required customer wiring is minimal, but should be done by a qualified electrician in compliance with OSHA, National Electric Code and applicable local electric code concerning isolation switches.

After the electrical wiring connections are completed, check the incoming voltage to make sure that the incoming voltage is the same as the pump motor voltage. A motor wiring diagram is supplied inside the terminal box cover. Line voltage should be within the voltage tolerance as specified on the motor. Check the unit for proper motor rotation. The direction of rotation is marked by an arrow on the motor or pump housing.

WARNING Install, ground and maintain equipment in accordance with the National Electric Code and all applicable federal, state and local codes.

3.2.7 PIPE CONNECTIONS AND SIZING

Before installation, remove all protective inserts in pipe connections. Piping connected to the unit must be installed without imposing any strain on the unit components. Improperly installed piping can result in general operating problems and pump failure. Use flexible connectors where necessary. Piping must be cleaned of debris before installation.

The piping system has to be designed to ensure that no liquids such as condensate or liquid carried over from the process can reach the pump. If this possibility exists, a knock-out liquid separator should be installed. Consult the factory for recommendation.

3.2.8 INLET PIPING

Inlet piping should be at least the size of the pump inlet. Install the unit as close as possible to the process to minimize losses due to the length of the suction line. If the unit has to be installed further away from the process, be sure that the inlet piping is oversized accordingly to minimize the overall line pressure drop. For more information consult your dealer or call the factory.

If the possibility exist that the gas pumped contains dust or foreign particles, a suitable (5 micron or finer) inlet filter should be installed at the inlet port. It is good practice to install this accessory at all times, as it will increase the life of the pump.

3.2.9 INLET GASES

The pump was designed to operate with clean air or inert gasses at an inlet temperature from 0 - 100 °F.

DANGER The pump must not be used for corrosive gasses or vapor and not for pumping oxygen. Explosive hazard.

3.2.10 DISCHARGE

Do not discharge the exhaust gasses from the pump into the workplace. If condensable vapors are pumped, the discharge line from the pump should be pointed downwards to prevent condensate from flowing back into the pump.

When operation at high pressures (above 10 Torr) for long periods of time, the pump may smoke at the discharge. Under those conditions we recommend installing an exhaust filter.

3.2.11 FILLING WITH OIL

All pumps are shipped from the factory without oil, which is supplied in a separate container. Undo filler plug. Fill oil tank with supplied oil to mid-level of the oil sight glass. Never exceed maximum allowed level. Replace filler plug and wipe off any spilled oil.

4. BASIC OPERATION

4.1 OPERATION

DuraVane^{HV} lubricated high vacuum rotary vane pumps are single- or two-stage pumps with an integrated closed loop oil circulation system. The construction is heavy-duty and compact, resulting in a small footprint. The high-tech vane material provides a long vane life. All pumps are quipped with a gas ballast. Single-stage pumps have an external inlet check valve. Two-stage pumps have a relief device that puts the pump back at atmospheric pressure when rotation stops. Pumps are direct driven with a flange-mounted motor. An exhaust filter is an optional accessory.

NOTE Pump can operate with closed suction without overheating.

4.1.1 GAS BALLAST VALVE

All DuraVane^{HV} pumps are equipped with a gas ballast valve. Its main function is to prevent water vapor from condensing in the pump, which would cause emulsification of the lubricating oil, resulting in possible pump seizure.

4.1.2 PUMP LUBRICANT

All pumps are shipped without oil. A charge of LACO 19 grade oil is shipped in a separate container with each pump. Before filling the pump with oil, check that the pump is installed level. Fill the pump with the recommended lubricant through the oil fill plug until it reaches the 1/2 way mark of the sight glass.

WARNING Do not overfill the pump.

WARNING Do not add or fill oil when the pump is running.

WARNING Do not fill oil through the inlet or exhaust port.

If the pump does not reach the ultimate vacuum it indicates that the oil might be contaminated with process vapors or water. Check oil. Clean or change oil if necessary.

4.2 START-UP PROCEDURES

1. DuraVane^{HV} rotary vane vacuum pumps and systems are shipped from the factory dry. They do not contain oil. A container of 19 grade oil is shipped with the unit. Before operating add the supplied oil to the pump(s). Fill the pump(s) to the middle of the sight glass before start-up.
2. Completely close the inlet suction valve before starting the unit.
3. Jog the motor briefly (press START then STOP) and check direction of rotation which is marked by an arrow on the end of the motor or pump housing. If the direction is backwards, switch any two of the three leads at the power connection. A loud grinding noise and absence of vacuum is an indication of improper motor direction.

   WARNING Operating the pump backward can cause vane failure.

4. Start and run the unit for approximately five (5) minutes, then stop.
5. With the unit shut off, check the oil level again. The oil level should be visible in the middle of the bulls-eye gauge. Add oil if necessary.

   WARNING Never remove the oil fill plug while the vacuum pump is running.

6. Voltage and motor current should be checked by a qualified electrician and should be within the motor specifications.

   NOTE This test should also be performed under normal system operating conditions.

5. MAINTENANCE

5.1 COMPONENTS

- Gas Ballast
  To check and clean gas ballast, fully unscrew and clean it thoroughly with compressed air. Change gasket if damaged.
- Pump Oil Level (check Daily)
  Under normal circumstances it should not be necessary to add oil between recommended oil changes. A significant drop in oil levels means there is an oil leak or a leaking inlet check valve.
  It is normal for the oil to be slightly foamy and lightly colored. If the oil shows signs of emulsifying, contamination or is dark colored, pump must be purged or oil needs to be changed.

Check the oil level only wen the pump is shut off. The best time to check is before start-up. Replenish oil if the level drops below the Min line next to the sight glass. Oil must be added through the fill port only.

CAUTION Do not add oil while pump is running, since hot oil can escape from the fill opening. Be careful when draining hot oil, personal injury could result.

- Pump Purging
  If the pump does not reach the ultimate vacuum it indicates that the oil might be contaminated with process vapors or water. Check oil appearance through the sight glass. If oil is light in color and shows no sign of emulsification it is clean. If oil is contaminated or emulsified, pump needs purging or oil needs changing. To purge the pump, close the inlet valve completely, open gas ballast valve and operate the pump for at least 1 hour in order to purge any condensables from the oil. If after 1 hour oil appearance is not back to normal or the pump still does not reach the ultimate vacuum, stop pump and change oil.

- Oil Change
  Use only factory recommended specially formulated LACO oils. Change oil every 6 months or 500 hours of operation, whichever comes first. Run pump for about 15 minutes to get oil to operating temperature. Drain oil by removing drain plug. Close drain plug and fill with fresh oil through the filler plug up to mid-range in oil sight glass. Run pump with closed inlet for a few minutes and top off oil if necessary.

CAUTION A more frequent oil change might be required if the oil becomes contaminated or shows signs of emulsifying. A dark color is a sign of oxidation and varnishing which would reduce the life of the internal parts of the pump.

- Devarnishing or Flushing
  The operating life of the pump is greatly enhanced based on the oil quality. Oxidized or darkened oil is a sign of trouble. Periodic maintenance will offer protection for your equipment. LACO offers a flushing fluid for cleaning the pump between oil changes.

  NOTE Varnished pumps are not covered under warranty.

- Inlet Filter (if installed)
  Check after first 8 hours or operation. Clean or replace inlet filter element every 1,000 hours depending on application or if excessive pressure drop is noticed.

  NOTE In some applications it may be required to clean inlet filter more often.

CAUTION Be careful not to allow accumulated foreign material to fall in the pump suction opening when removing the filter cartridge. Horizontal filter installation is recommended to prevent this. Filters must be disposed of properly as they might contain toxic substances carried over from the process.

- Exhaust Filter (if installed)
  Required only if operation at high pressures (above 10 Torr) for long periods of time. At these vacuum levels the exhaust gases of high vacuum rotary vane vacuum pumps contain oil mist. These filters have been designed to solve this problem and they are equipped with a built-in overpressure valve that prevents the rise of pressure inside the pump when the filter element gets clogged. In case of saturation of the filter element, replace.

CAUTION Over filling pump with oil may result in misting and if filter element is oil-soaked, it must be replaced.

CAUTION Do not clean or re-use these filter elements. Elements must be disposed of properly, as they might contain toxic substances carried over from the process. Always replace O-rings on filter when changing.

- Bearing and Seals
  Internal pump components do not require preventative maintenance. Bearings are self-lubricating type.

- Bearing Lubrication — Motor (where required)
  The motors are shipped from the factory with the bearings properly packed with grease.

NOTE Motors use sealed bearings and do not require lubrication. Consult factory with any questions.

5.2 MAINTENANCE SCHEDULE

To help ensure trouble-free equipment operation a basic maintenance schedule consisting of the following system checks is recommended.

TIME	CHECK
First 8 hours operation	Check oil level and inlet filter element (if installed))
Daily	Check oil level daily, sight glass should be half full when pump is stopped. Check inlet filter (if installed).
Weekly	Inspect inlet filter (if installed) and replace if necessary. Inspect exhaust filter (if installed) for signs of oil bypass, replace if necessary.

TIME	CHECK
500 hours operations (or once every 6 months).	Change oil. Drain oil when hot, using caution and properly dispose of oil.
1,000 hours operation	Remove debris from pump body, motor fan guard, check and clean gas ballast valve. Clean or replace inlet filter (if installed).
10,000 hours operation	Replace pump vanes.

6. TROUBLE-SHOOTING

These tables are intended as a basic troubleshooting guide.
We recommend you consult your local dealer for service. Each DuraVane ^{HV} high vacuum rotary vane pump unit is tested and checked at the factory. Always indicate unit model and serial number when calling.

WARNING Before attempting any repairs, disconnect all power from the unit by switching off the main breaker or disconnect the switch. This will prevent the unit from starting accidentally.

SYMPTOM	CHECK
Until will not start	A - C - F - G - H - I - J
Unit/motor will not turn	J
Unit is not drawing vacuum	D - K - L - N - O - P - U - V
Unit is overheating.	L - N - R - S
Unit is not reaching ultimate vacuum level	N - P - R - T - U - V - W - X - Y - Z
Unit starts, but labors and draws a very high current	G - K - AA - BB - DD
Unit smokes at the exhaust side	N - R - S - T - EE - MM
Unit is running noisy	R - JJ - KK
Unit is high oil consumption	L - N - R - S - U - X - MM

LETTER	INSTRUCTION
A	Check reset button on pump motor, overloads may have been triggered.
C	Check power. Make sure that supply voltage matches motor voltage.
D	Check if gas ballast valve is open, it should be closed.
F	Check fuses. Fuses may be blown.

LETTER	INSTRUCTION
G	Check motor wires. Motor wires may be wired incorrectly. Look at motor wiring diagram on conduit box of motor for correct wiring configurations. Make sure connections are secure.
H	Check wire size and length. Incorrectly sized wires can cause a voltage drop at the pump. If temperature of wire is high, use larger wire size.
I	Check to see if motor turns.
J	Pump or motor may be seized. Contact the factory.
K	Check if motor rotation is correct by comparing it to the arrow on the motor or pump housing. If incorrect, change leads.
L	Check oil. If oil is varnished, replace at once. Oil should be replaced as specified in the Maintenance Schedule.
N	Check oil level. Oil level should be maintained at the middle of the sight glass on the side of the pump reservoir. (Check when pump is off and is stationary).
O	Check to see if the inlet to the pump is wide ope or if there is a leak in the piping.
P	If an inlet filter is installed, check to see if filter element needs to be replaced.
R	Check oil for excessive foaming. If foaming, replace.
S	Make sure that the pump is being cooled correctly.. Check that pump is located in a well-ventilated area. Maximum ambient temperature for the rotary vane vacuum pumps is 104 °F. All standard pumps are air-cooled. Clean motor and pump air grills if needed.
T	Check to see if the oil is contaminated. If the oil has been used longer than the recommended life expectancy, the pump will not draw ultimate vacuum. Allow pump to cool before changing oil..
U	Oil is contaminated with process vapors. Close inlet valve, open gas ballast valve and run pump for a minimum of 1 hour. If not resolved, replace oil.
V	Inlet filter (if installed) clogged. Clean or replace.
W	Check to see if inlet check valve assembly (if installed) is stuck in closed position due to contamination. Disassemble and clean inlet check valve.
X	Check around pump for oil leaks. Replace and/or tighten fittings as needed.
Y	Internal parts may be worn or damaged. Contact factory.
Z	Check pump model and specifications. Consult authorized dealer.
AA	Check power supply. Excessively high or low voltage or phase imbalance will damage motor.
BB	Check to see if pump is overfilled with oil. Oil level should be in the middle of the sight glass on the side of the pump reservoir. (Check when pump is off and is stationary.)
DD	Foreign particles may have carried over into pump causing damage to the vanes or other internal parts. Contact factory.

LETTER	INSTRUCTION
EE	Check operating temperature.. Excessive heat will cause smoking.
JJ	Check bearings. If bearings are noisy, contact the factory for replacement instructions.
KK	One of the vanes in the motor may be stuck. Contact the factory for instructions.
LL	Plugged discharge. Clean and unplug.
MM	Pump is operating too close to atmospheric pressure. Check oil level frequently.

7. ACCESSORIES

The following accessories are available for DuraVane^{HV} lubricated high vacuum rotary vane pumps.

- Flexible Pipe Connections
  Used to eliminate pipe strain on pump body.
- Inlet Filter
  An inlet filter is optional, but highly recommended and needs to be installed in the inlet piping.
- Inlet Check Valve
  An inlet check valve is option, but highly recommended and needs to be installed in the inlet piping.
- Exhaust filter
  An exhaust filter is required only if operation at low vacuum levels (above 10 Torr) for long periods of time.