

INSTALLATION & OPERATION MANUAL

Coyote®

LIQUID RING COMPRESSOR SYSTEMS

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1.0 INTRODUCTION

The Travaini **Coyote[®]** Liquid Ring Compressor system will give you years of trouble-free service provided some of the basic maintenance guidelines, as set out in this manual, are followed. Our systems have been designed to provide safe and reliable service. However, because a vacuum pump is a rotating piece of equipment, the operator must exercise good judgment and proper safety procedures to avoid damage to the equipment or personal injury. A system drawing is enclosed. Please review and follow instructions in this manual before attempting to install or start equipment.

1.1 General Instructions

This manual is intended to provide reference to:

- application and operating safety
- installation and maintenance for pump or system
- starting, operating and stopping procedures for pump or system

NOTE:

- 1. All references made to <u>pumps or compressors</u> are also applicable to <u>systems</u> that employ these pumps or compressors, unless otherwise specified.
- 2. All references made to <u>motors</u> on **Coyote®** systems are also applicable to <u>natural gas driven engines</u>, unless otherwise specified.

The manual should then be **read carefully** and kept in a safe file for future reference. It should always be available to the qualified operating and maintenance personnel responsible for the safe operation of the pump or system.

(Qualified personnel should be experienced and knowledgeable of Safety Standards, should be recognized by the safety department manager as being capable to effectively act on safety issues, should the need arise. A knowledge of first aid should also be required.)

The pump is to be used only for the applications specified on the confirming order for which **PREMIER FLUID SYSTEMS INC. or the authorized representative** has selected the design, materials of construction and tested the pump to meet the order specifications.

Therefore, the pump or system **CANNOT** be used for applications other than those specified on the order confirmation.

In the event the pump is to be used for different applications, please consult the sales office or representative of the manufacturer. Premier Fluid Systems declines to assume any responsibility if the pump is used for different applications without prior written consent.

The user is responsible for the verification of the ambient conditions where the pump will be stored or installed. Extreme low or high temperatures may severely damage the pump or system unless proper precautions are taken.

Premier Fluid Systems does not guarantee repairs or alterations done by user or other unauthorized personnel. Special designs and constructions may vary from the information given in this manual. Please contact Premier Fluid Systems **or the authorized representative** should you have any difficulty or doubt.

N.B.: Drawings appearing in this manual are only schematics. These drawings are not for construction. For construction drawings contact Premier Fluid Systems Inc. or the authorized local representative

1.2 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 hazards which can arise from the presence of electrical power, hot liquids, toxic gases, and rotating equipment. <u>Proper installation and care of protective devices is essential</u>. Safety procedures are to be used in conjunction with the instructions contained in this manual.

1.3 Safety Instructions

CAUTION: CAREFULLY READ FOLLOWING INSTRUCTIONS.

Strictly adhere to the instructions listed below to prevent personal injuries and/or equipment damage.

ALWAYS apply the pump for the conditions outlined on the confirming order.

- Electrical connections on the motor or accessories must **ALWAYS** be carried out by authorized personnel and in accordance to the local codes.
- Any work on the pump should be carried out by at least 2 people.
- When approaching the pump **ALWAYS** be properly dressed (avoid use of clothes with wide sleeves, neckties, necklaces, etc.) and/or wear safety equipment (hard hat, safety glasses, safety shoes, etc.) adequate for the work to be done.
- ALWAYS stop the pump prior to touching it, for whatever the reason.
- ALWAYS disconnect the power to the motor prior to working or removing the pump from the installation.
- **NEVER** work on the pump when it is hot.
- After completion of the work **ALWAYS** re-install the safety guards previously removed.
- ALWAYS be careful when handling pumps that convey acids or hazardous fluids.
- **ALWAYS** have a fire extinguisher in the vicinity of the pump installation.
- **DO NOT** operate the pump in the wrong direction of rotation.
- **NEVER** put hands or fingers in the pump or system openings or cavities.
- **NEVER** step on pump and/or piping connected to the pump.
- Pump or piping (connected to the pump) must **NEVER** be under pressure or vacuum when maintenance or repair is carried out.

NOTE: There are materials in the pump that may be hazardous to people suffering from allergies. Maintenance and operating personnel should consult the tab. 1 for such materials.

MATERIAL	USE	POSSIBLE DANGER
Oil and Grease	General lubrication, ball or roller bearings	Skin and eye irritation
Plastic and elastomer components	O-Ring, V-Ring, Splash ring, Oil seals	Release of fumes and vapours when overheated
Teflon & Kevlar fibers	Packing rings	Release of dangerous powders, release of fumes when overheated
Varnishes	Exterior pump surface	Release of powder and fumes in case of rework, flammable
Liquid compound	Gasket between flat surfaces	Skin, eye and breathing organs irritation

1.4 In case of Emergency

Tab 1

Should the pump break down leak gas and/or service liquid, immediately disconnect the electrical power following the instructions given elsewhere in this manual. Alert the maintenance personnel, at least two people should intervene using precautions as it is required for the specific installation: pump may be handling dangerous and/or hazardous fluids.

After correction of all the problems that created the emergency situation, it is necessary to carry out all the recommended starting procedures.

1.5 Basic First Aid

In the event dangerous substances have been inhaled and/or have come in contact with the human body, immediately contact the medical staff and follow the instructions given by the company's internal medical safety procedures.

2.0 INSTALLATION

The design of the foundation, piping system and the areas of plant systems design are the purchasers' responsibility. *Premier Fluid Systems Inc.* will offer advice but cannot assume responsibility for operation and installation design.

We recommend that the purchaser consult a specialist skilled in the design of foundation, piping and equipment location to supplement and interpret the information given in this manual to ensure a successful installation. Your representative can provide start up assistance in most instances at a reasonable cost.

<u>*WARNING*</u>: Install, ground and maintain equipment in accordance with the national electrical code and all applicable provincial, federal and local codes.

2.1 Unpacking

Inspect the unit immediately upon arrival for any sign of damage. All *Premier Fluid Systems Inc.* products are shipped F.O.B. factory, unless otherwise agreed upon in writing, which means that any damage is the responsibility of the carrier and should be reported to them.

2.2 Location

Install the unit in a well ventilated and dust free area. Cooling is an important aspect of the vacuum system operation, it is therefore important to install the system in a reasonably cool area where the temperature does not exceed $104^{\circ}F$ ($40^{\circ}C$), unless otherwise agreed upon.

For air cooled systems allow a minimum of 12 inches between the heat exchanger and the near wall. In addition, allow sufficient space around the unit for checking fluid level, temperature and for general servicing.

2.3 Foundation

The pump system must be installed in a horizontal position on a level surface. The foundation must be designed to support the total system weight and be rigid and substantial enough to absorb any system vibration and to permanently support the base plate at all points. We recommend the installation of standard neoprene mounting pads between the base frames and floor. Level the base frame using a machinists' level to determine the levelness

2.4 Electrical

Coyote[®] systems that include an electrical control panel have the main motor and control instruments wired to the panel at the factory. An electrical wiring diagram is included in this manual, if the panel is supplied. 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 (for electric driven systems) unless one is already included in the electrical panel. The full load current rating stamped on the motor nameplate should be used in selecting protective ratings.

After the electrical work is completed jog the motor to check direction of rotation. An arrow on the pump housing marks the direction of rotation. If the direction is wrong, switch any two of the three main leads at the power connection.

FOR GAS ENGINE DRIVEN UNITS, PLEASE CONSULT THE ENGINE SUPPLIER MANUAL FOR SAFE OPERATION AND MAINTENANCE GUIDELINES.

2.5 Pipe Connections and Sizing

Before installation, remove all protective inserts in the gas and liquid connections. Piping connected to the system must be installed without imposing any strain on the system components. Improperly installed piping

can result in misalignment, pump failure, and general operating problems. Use flexible connectors where necessary. Piping should be cleaned properly before installation.

<u>Install a temporary screen at the pump inlet flange at first start up to protect the unit</u> against carry over of pipe debris and welding slag. The screen must be removed after the initial run period.

Piping Sizing

Inlet and discharge piping should be at least the size of the pump inlet and separator discharge. It is recommended to install the system as close as possible to the process (well bore or optimal gathering point when pulling on multiple wells) to minimize the length of the suction line. If the system has to be installed further away from the process (well), be sure that the inlet piping is oversized accordingly to minimize overall line pressure drop. If not sure, consult a specialist or call the factory. Pump systems operating in parallel on a common manifold must each have a manual or automatic shut-off valve or a suitable check valve installed in the suction line close to the pump suction flange.

NEVER RUN A PUMP WITH CLOSED SUCTION!

Discharge Piping

It is recommended to install the exhaust piping according to the sketch below. Install a drain valve at the lowest point to prevent condensation from draining back into the separator reservoir. Pump systems operating in parallel on a common discharge manifold must each have a suitable check valve installed close to the pump discharge flange. When discharging more that one pump in a common discharge line and/or over a long distance, oversize piping accordingly.



installations.

3.1 General Description

At the heart of the **Coyote**[®] system there is the reliable Travaini liquid ring compressor. The compressor design and principle of operation provides ample clearance between the impeller and casing elements. Grease lubricated bearings are mounted external from the pumping chamber, isolated by mechanical shaft seal. This means that the pump requires no internal lubrication. The function of the seal fluid in the system is to create a liquid piston action and to remove the heat of compression. The seal fluid in the system circulates in a closed loop. The heat exchanger can be either air or water-cooled. It removes the heat of compression from the seal fluid. The discharge separator/reservoir holds the seal fluid and incorporates a highly efficient separator arrangement to separate the seal fluid from the air or gases discharged by the pump system.

3.2 Compressor Seal Fluid

The system is shipped with a factory recommended seal fluid although any light viscosity oil can be used. We recommend the use of our TR1001 fluid for obtaining ultimate performance from your **Coyote**[®] system, providing low viscosity, excellent water separating qualities, anti-foaming and low oxidation.

If the recommended fluid is not at hand, contact the factory for recommended substitute. When the air-cooled system includes a temperature control valve this is provided to maintain operating temperatures at all time between 150°F and 180°F.

<u>Note</u>: The temperature control valve may also be omitted in some special systems, where greater cooling of the oil is necessary. Check system drawing for verification.

	TR1001 Fluid
SUPPLIER	PRODUCT
Petro-Canada	Harmony 22
Mobil	Vacuum Pump Oil 22
Shell	Tellus 22
Esso	Nuto A22

Mineral Oil Specifications for Coyote[®] Compressor Systems TR1001 Fluid

Recommendations:

Our compressor systems are shipped with Petro-Canada Harmony 22 oil. When choosing a different oil supplier, it is recommended to make a full oil change to prevent product mix.

3.3 Alignment

3.3.1 Direct Drives

Pump and motor are factory connected and correctly aligned. However, due to shipping and handling, alignment may change. Fig. 13 and fig. 14 indicates a method of checking for correct alignment.

(Not required on Monoblock pumps)



Check parallel alignment by placing a straight edge across the two coupling flanges and measure the offset at various points around the periphery of the coupling. DO NOT rotate the coupling. Maximum offset values are listed below and on the next page.

Check angular alignment with a micrometer or caliper. Measure from the outside of one flange to the outside of the other at intervals around the periphery of the coupling. Determine the maximum and minimum dimensions.

	Maximum Offset 'X'	
Motor		
HP	Inch	mm
7 ½ - 10	0.015	0.4
15 - 30	0.020	0.5
40-50	0.025	0.64

DO NOT rotate the coupling. The difference between the maximum and minimum must not exceed the value given below. If a correction is necessary, be sure to recheck the parallel alignment.

NOTE: For maximum life, keep misalignment values as near to zero as possible.

	Maximum Offs	et 'Y1 & Y2'
Motor HP	Inch	mm
7 ½ - 10	0.070	1.8
15 - 30	0.094	2.4
40 - 50	0.128	3.3

3.3.2 V-Belt Coupled Units

For 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 stretching them over the grooves. The tensioning steps a, b, and c can be used for all types of V-belts, all cross sections and numbers of belts, and all types of construction.

- a. With all belts in their grooves, adjust centers to take up the slack until they are fairly taut.
- b. Start the drive and continue to adjust until the belts have only a slight bow on the slack side while operating with load conditions.
- c. After several hours of operations, 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 slippage (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 <u>belt dressing should never be used</u>. 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 pump shaft from a binding or bound condition by applying power to the motor. Severe damage may result. To free up a pump, 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.

3.4 Oil Circulating Pump Option (where applicable)

The oil circulating pump is provided to guarantee a positive oil flow to the vacuum pump even when the operating pressure is very low, or where a higher pressure drop in the oil piping due to deposit build-up, dirty and/or viscous oils is anticipated.

It is important to provide the compressor with the correct oil flow to prevent flooding or starving the pump or high horsepower draw. To regulate the oil flow proceed as follows:

- 1. After the compressor has been started and the working pressure has been set, adjust the oil flow-regulating valve while reading the pressure on the compound gauge.
- 2. The correct flow is achieved when the oil pressure on the pressure gauge is approximately:
 - Min 5 PSIG above compressor inlet pressure for compressors type TRS-TRV-TRH
 - Min 35 PSIG oil pressure for compressors type SAO
 - 0–3 PSIG when compressor suction is 600 mbar or higher (higher than 12" Hg vacuum).
 - 0–5"Hg vacuum, when compressor suction is below 600 mbar(higher than 12" Hg vacuum).

Above instructions should be used for general guidelines. The setting may vary with pump sizes and ultimately the compressor motor should not be overloading. The compressor should run smoothly without vibration or abnormal noises and the oil temperature remain constant.

3.5 Start Up Procedure

The following provides a basic step-by-step procedure to start a standard **Coyote[®]** system. Where necessary, separate instructions are given for gas engine driven systems.

For gas engine systems:

Please refer to the engine manufacturer manual for start-up procedures. Use the 3-way valve on the engine to supply fuel. The valve should be used to switch fuel supply from 'liquid propane' to natural gas off the well. The compressor can be engaged and disengaged using the P.T.O. (Power take Off) assembly.

Connect the inlet and discharge of the **Coyote**[®] system as required. DO NOT open the system inlet valve. <u>Gas Engine Driven Compressors</u>: Start the engine per instructions in the engine start-up manual and the note above given. DO NOT engage the P.T.O.

1	Ensure seal fluid isolation valve is open.	
2	Jog the motor briefly and check direction of rotation. An arrow on the pump housing marks the correct direction of rotation. If direction is backward switch any two of the three leads at the power connection. Usually the correct direction or rotation is clock-wise facing the pump from the motor skid.	ROTATION
3	Check drive-coupling alignment, both angular and parallel alignment, adjust to manufacturer specifications Mono-block units do not require any field adjustments (motors are C-face mounted). See Section 3.3	Correct Parallel Shaft Angular Alignment
4	Check fluid level in separator reservoir. The fluid level should be halfway in the sight glass.	
5	If installed set the inlet valve about 3/4 closed and start the pump. Gas Engine Driven Systems: Engage P.T.O.	
6	Check the voltage and motor current, they should be within the specifications for the motor. Standard motors have a 1.15 S.F. (Service Factor). NOTE: This test should be performed under normal operating conditions	DANGER: High voltage and lethal shock hazards are present. Use extreme caution.
7	Run pump for a few minutes at operating pressure and then stop.	START

8	With the pump shut off, check the fluid level again, the fluid level should be visible in the sight gauge between the ¹ / ₂ and ³ / ₄ mark. Add fluid if necessary.	
9	Gas Engine Driven Systems: Use the 3 way valve, switch fuel supply from 'liquid propane' to produced natural gas or methane, After 10 minutes of operation check compressor operating temperature, it should be in the $150^{\circ} - 180^{\circ}$ F range.	СО 40 40 40 40 40 40 40 40 40 40

3.6 Shut Down Procedure

To stop the compressor system, disengage the P.T.O. (for gas engine driven system), switch to off position, or push stop button. The inlet check valve will prevent fluid from system being pushed back into the suction piping.



4.1 Seal Fluid

After the first 50 hours of operation, clean the filter/strainer in the seal fluid line to remove any debris carried over into the system.

Check seal fluid level in the reservoir. A high fluid level could mean a build up of water in the reservoir, which should be drained.

Repeat the above procedure every 1000 hours.

It is recommended that the seal fluid be changed every 6000 hours of operation or once a year, whichever is sooner. <u>Extreme operating condition with contaminants may require more frequent changes.</u> More frequent fluid changes should also be made in areas where there are contaminants such as water, coal dust, etc.

To change the fluid, make sure the pump is off, and then drain the reservoir, vacuum pump and heat exchanger. We recommend that the fluid be changed when the system is at operating temperature.

Clean the seal fluid filter/strainer. If the strainer shows a considerable amount of deposit, consider flushing the system with Thermalsolve or similar cleaning fluid to remove varnish or sludge.

When changing the system with new fluid, make sure that the pump is filled up to shaft level, and that the reservoir is up to the level in the sight gauge. Open the air bleed valve on the heat exchanger to remove all air from the oil loop. Run the pump for a few minutes, stop and check fluid level again. If required, add fluid up to the correct level given by the sight glass gauge.

4.2 Bearing Lubrication

The larger units of 10 HP and above require re-greasing every 3000 hours. <u>Extreme operating conditions might</u> require more frequent re-greasing. Grease fittings are located on each bearing housing.

WARNING: DO NOT over grease bearings

4.3 Shaft Seals

All Travaini compressors are fitted with mechanical shaft seals. Mechanical seals usually do not require maintenance unless there is visible leakage. Some leakage is normal or will accumulate over time. Seal replacement is addressed in the assembly and disassembly instruction for the specific pump model used.

4.3 Exhaust Filter

The exhaust filter element (coalescent filter) is located in the separator/reservoir. Generally we recommend the replacement of the element once a year. Earlier replacement might be necessary when the pressure across the filter is higher than 4 PSI (the compressor is creating 4 PSI higher pressure than the downstream line pressure). If excessive smoking or oil mist is present, check oil return line and orifice sight glass while the pump is running. A small amount of oil should be visible in the return line sight glass orifice.

4.4 Inlet Scrubber (if installed)

Check level gauge for fluid level in the inlet scrubber. To drain the scrubber:

- Open the equalizing valve between the inlet scrubber and the discharge separator tank
- Open the drain valve at the bottom of the inlet scrubber
- Close the drain valve after draining
- Close the equalizing valve

WARNING: while draining, do not let any air inside the inlet scrubber through the draining valve

4.5 Maintenance Schedule

We recommend that you set up a basic maintenance schedule as follows to ensure trouble free operation.

*<u>50 hours operation</u>: check oil level, clean strainers, remove temporary inlet screen if installed. Check for water in sight gauge. Drain off water, if necessary. Check piping for any signs of oil leakage, tighten, if necessary.

*Every 1000 hours of normal operation: repeat above procedure.

*<u>1000 – 3000 hours of operation (on pumps 10 HP and larger)</u>: Grease bearings No.2 quality lithium grease. There are grease fittings located on each bearing housing. DO NOT OVERGREASE! 3–4 pumps with a normal grease gun is sufficient under normal conditions.

*<u>Once a year:</u> change seal fluid. Use recommended seal fluid. Change separator element if backpressure exceeds 4 psig. Check coupling element or belts for wear, replace if worn.

*<u>Every 3 years or 25,000 hours</u>: it is recommended to have the mechanical seals and bearings replaced as preventative maintenance. Only an authorized distributor or properly trained individual should do this.

4.6 Troubleshooting

We recommend that you consult your local representative for service. This chart is intended as a basic troubleshooting guide. Each **Coyote®** system is tested and checked at the factory. Always indicate system model and serial number when calling. A wiring diagram is supplied with each system if a control panel is supplied Always isolate the machine before attempting any repairs.

<u>*WARNING:*</u> Please observe caution, some machines can start automatically from remote switches or controls.

4.7.1 Troubleshooting Chart

PROBLEMS	ITEMS TO CHECK*
1. Pump operates, but there is no pressure	A-B-F-N-S
2. Pump shuts down while running	B-C-D-E-H-M-S
3. Pump overheats or operates above 200°F	B-F-G-P-Q
4. Motor kicks out or stops after several starts	E-H-K-M
5. Pump will not start in hand or auto position	B-D-H
6. Abnormal noises or sound from pump	B-L-M-Q-R
7. Pump does not achieve desired vacuum level	A-C-S-Q
8. Excessive oil usage or misting	J-K
9. Excessive vibration	L-M-O
10. Pump will not rotate	I
11. Gas engine starves for fuel	Т

Items to check for:

- **A.** Open the inlet valve, check inlet filter (if installed) for possible obstructions. Ensure that no lines are open to the atmosphere, causing loss of vacuum. Check suction line and system for leakage. Ensure that the equalizing valve between the separator tank and inlet scrubber (if installed) is closed.
- **B.** Ensure that the oil level is correct and that the pump is primed at start up.
- **C.** Check the inlet pressure cut-off switch setting, if installed. Set switch at lower pressure (deeper vacuum) level.
- **D.** Check low oil level switch (if installed), add oil if needed. A 15 second time delay should be installed for oil level switch.
- E. Check high temperature switch (if installed), which is set for 225°F
- F. Check if the oil isolation valve is open and the solenoid, if installed, is working properly.
- **G.** Check the oil cooler and fan. Clean cooler, ensure that 12" of space is available in front of the cooler and the ambient is below 110°F. Ensure that the fan motor is functional (if available).
- **H.** Check the overload setting on the starter and fuses. Ensure the proper voltage is supplied and that the wire size is correct. Check if the disconnect is switched on. Push reset button.
- I. Check if the pump has seized. If seized, consult the factory or dealer at once.

- **J.** Check the oil return line from the separator and ensure that the oil flows through the sight glass. Check for a plugged line or closed metering valve. Oil return line at bottom of oil separator should have 45° cut.
- K. Check for high discharge pressure. Check 'pressure cut-off' limit on pressure switch (if installed).
- L. Check the coupling and/or element. If worn or damaged, replace. Check belt drive, if available.
- **M.** Check if bearings are greased. Rotate the pump by hand. If a rubbing noise or binding is observed, consult factory. Pump should rotate freely by hand.
- N. Check if the pump rotation is correct!
- **O.** Check the pump mounting bolts, coupling, fan and cooler are not loose. Tighten as required.
- **P.** Check if the thermal valve (if installed) is working and if the oil is flowing through the cooler. *Caution, hot oil!!*
- Q. Check that oil is clean and not viscous. Change if necessary.
- **R.** Check if the inlet is closed. The pump cavitates due to closed inlet or plugged filters.
- S. Clean the strainer
- T. Check for contamination inside regulator in the fuel line. Clean up frozen condensate.

5.0

RECOMMENDED SPARE PARTS

- 5.1 System Parts:
- 1 Oil Demister Filter
- 1 Pressure Gauge
- 1 Vacuum Gauge
- 1 Temperature Gauge
- $1-20\ L$ Pail of Oil for top ups

5.1.2 Compressor Parts:

- 1 Set of Mechanical Seals 1 – Set of Bearings
 - 1 Set of Radial Seal Rings
 - 1 Set of Gaskets

5.1.3 Oil Pump, if installed: 1 – Mechanical Seal

NOTES:



TOTAL TECHNICAL ASSISTANCE AND SERVICE

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