LeROI Gas Compressors

By Rotary Compression Technologies, Inc.

ISO 9001-2000

Installation – Operations

Maintenance and Service Guide

Rotary Screw Compressor

Models:

HG10
HGF10
HG12
HGF12
HGS17
HGSF17
HG17
HG24
LG30
LGL30

ROTARY COMPRESSION TECHNOLOGIES, INC. THANKS YOU FOR PURCHASING LEROI GAS COMPRESSORS

Table of Contents

Safety Information and Warnings

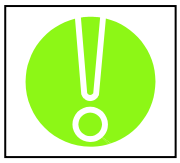
LeROI gas compressors are designed with safety in mind. However, there is no substitute for safe operating procedures. Throughout this manual, there will be additional "Notes", "Cautions" and "Warnings" intended to protect the operator and the equipment. These additions are not all inclusive. Extreme care must be exercised when operating or servicing this equipment.

A Careful Operator is the Best Insurance against an Accident

The operator and or serviceperson should:

- Be knowledgeable of one's equipment.
- Develop safe work habits.
- Never operate a unit without guards and shields in place.
- Never operate a unit that is not properly electrically grounded.
- Never service a unit with the pressure in the receiver-oil reservoir unless following specific operation manual instructions.
- Never service a unit without disconnecting and locking out the electrical power supply unless following specific operation manual instructions.
- Take all necessary precautions, when adjusting controls, etc., to prevent electrical shock.
- Take all necessary precautions when working with flammable gases to prevent fire or explosion.

Protecting Your Compressor Before Service

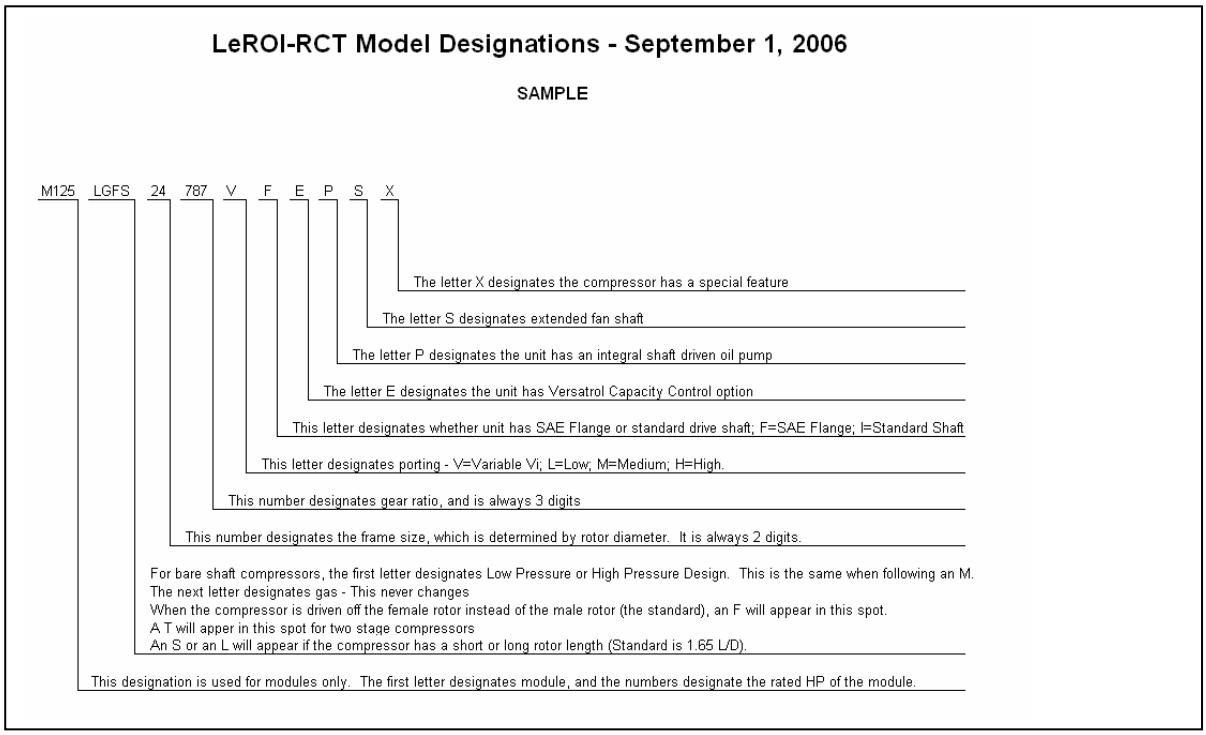


THIS COMPRESSOR IS SHIPPED WITHOUT OIL. ALTHOUGH RESIDUAL OIL FROM THE FACTORY TEST IS SUFFICIENT TO PREVENT RUST DURING SHIPPING, IT DOES NOT PROVIDE ADEQUATE PROTECTION FOR STORAGE.

IF THE COMPRESSOR WILL NOT ENTER SERVICE WITHIN ONE WEEK OF BEING RECEIVED, **COMPRESSOR OIL MUST BE ADDED** THROUGH THE GAS INLET SO THAT ITS LEVEL IS AT LEAST AS HIGH AS THE BOTTOM OF THE INLET CAVITY. ALLOW A FEW MINUTES FOR THE OIL TO FILL INTERNAL CLEARANCES THEN ADD TO BRING LEVEL BACK UP. **REINSTALL THE INLET COVER PLATE AND BOLT IT DOWN SECURELY.** THE **DRIVE SHAFT MUST BE ROTATED ½ TURN MONTHLY** TO INSURE THAT ALL MOVING PARTS HAVE AN OIL COATING.

Identifying Your Compressor

LeROI gas compressors have a nameplate that provides valuable information on your compressor. This information is needed for ordering parts and conversion kits, as well as for accessing warranty information and understanding the design of the compressor. Below is a Model Designation chart to help you identify your compressor.



Understanding Your Compressor

Your compressor is either a LG (Low Pressure) or HG (High Pressure) single stage, positive displacement, oil-flooded screw compressor. There are two basic general configurations; geared (Figure 1) and non-geared (Figure 2).

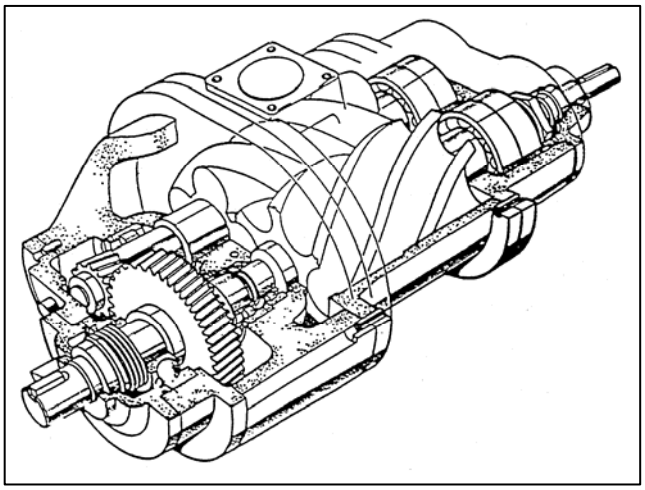


Figure 1 - geared compressor

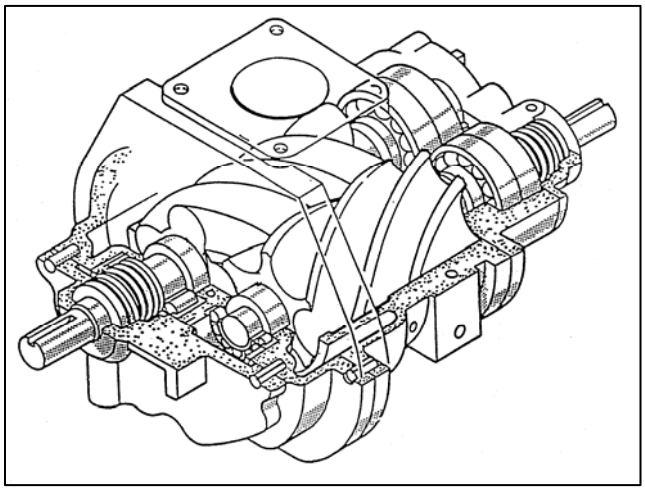


Figure 2 -Typical non-geared compressor

Oil-flooding provides cooling, lubrication and sealing in the compressor. The oil must be cooled using either water or air in a heat exchanger that is properly sized for all operating conditions.

Geared units (Figure 1) come standard with integral gearing to increase or decrease the speed internally, allowing for direct connection with standard drivers. The drive (input) shaft is an integral extension of the male rotor. Compressors with gears use an independent input shaft, commonly referred to as a jackshaft, mounted on roller and/or special deep groove ball bearings. The gear mounted on the jackshaft drives the gear mounted on the male rotor and the male rotor meshes with and drives the female rotor.

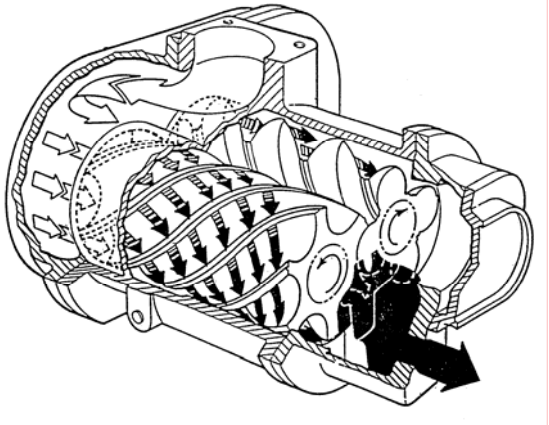


Figure 3 - Oil/Gas Flow-Typical

Figure 3 shows the direction of the rotor rotation and the gas/oil flow through the compressor. Note that this flow is between the rotors and the inside diameter (bore of the cylinder).

The uncompressed gas enters the compressor at the inlet flange, passes into the front bearing retainer, and enters the cylinder bore at the front (inlet) end. (Figure 3). As the gas passes a predetermined inlet cut-off point in the cylinder, compression takes place due to decreasing rotor to cylinder volume as the rotors turn. Gas at the desired pressure is discharged at the rear (discharge) end. Oil is injected into the compressor at specific locations for cooling.

The Compressor System

The LeROI gas compressor is one part of the compressor system. The compressor combined with the driver forms the heart of the system. However, the other vital elements are essential to ensure the heart of your system continues to operate.

Suction Scrubber (with filtration, if necessary)

This is required to prevent the carry over of liquids into the compressor. Filtration is often necessary, especially in vacuum installations, to prevent debris (e.g. iron sulfides) from getting into the compressor.

Gas/Oil Separator

The gas/oil separator is a key component of the compressor system. The separator should be designed to handle the maximum capacity at the lowest discharge pressure and the highest discharge temperature. It is important that the vessel and coalescing filter are sized properly to insure optimum gas and oil separation. The separator also acts as the oil reservoir (oil sump), with the oil collecting in the bottom.

Oil Cooler

The oil cooler is an air-cooled or water-cooled heat exchanger that is sized to suit the size (capacity) of the compressor being cooled. The cooler should be designed to handle the worst operating condition, which is usually based on the lowest suction pressure and the highest discharge pressure. However, the oil flow plays a critical role in determining the heat rejection of the oil cooler.

Minimum Pressure Valve

The minimum pressure valve is recommended to maintain a minimum pressure in the gas/oil seperator. It is especially important to use this device when the possibility exists that the system pressure may not be sufficient to maintain pressure in the seperator to achieve adequate gas/oil seperation.

Thermal By-Pass Valve

The injection temperature of the oil used to cool, seal, and lubricate the compressor is controlled by the thermal by-pass valve. As the name implies, this valve allows part or all of the oil flow to by-pass the oil cooler, depending on the temperature of the oil leaving the compressor. This valve can be controlled thermostatically or with more sophisticated temperature control valve where more precise control of oil temperature is required.

The Compressor System (Continued)

Oil Filter

It is extremely important that the oil injected into the compressor be as clean as possible. The oil filter should be generously sized to handle full oil flow, and should have a filter element that will remove particles down to 10 micron. If the compressor is in an application where continuous operation is important or where the filter will get dirty in a short period of time, it is recommended that a dual filter arrangement be used.

Instrumentation and Controls

The compressor has operating limitations that must be monitored. Protective devices are required to the protect the compressor from experiencing a catastrophic failure. These include, but are not limited to high temperature and pressure, as well as liquid level switches in the suction scrubber where there is a potential for large amounts of liquid in the gas stream.

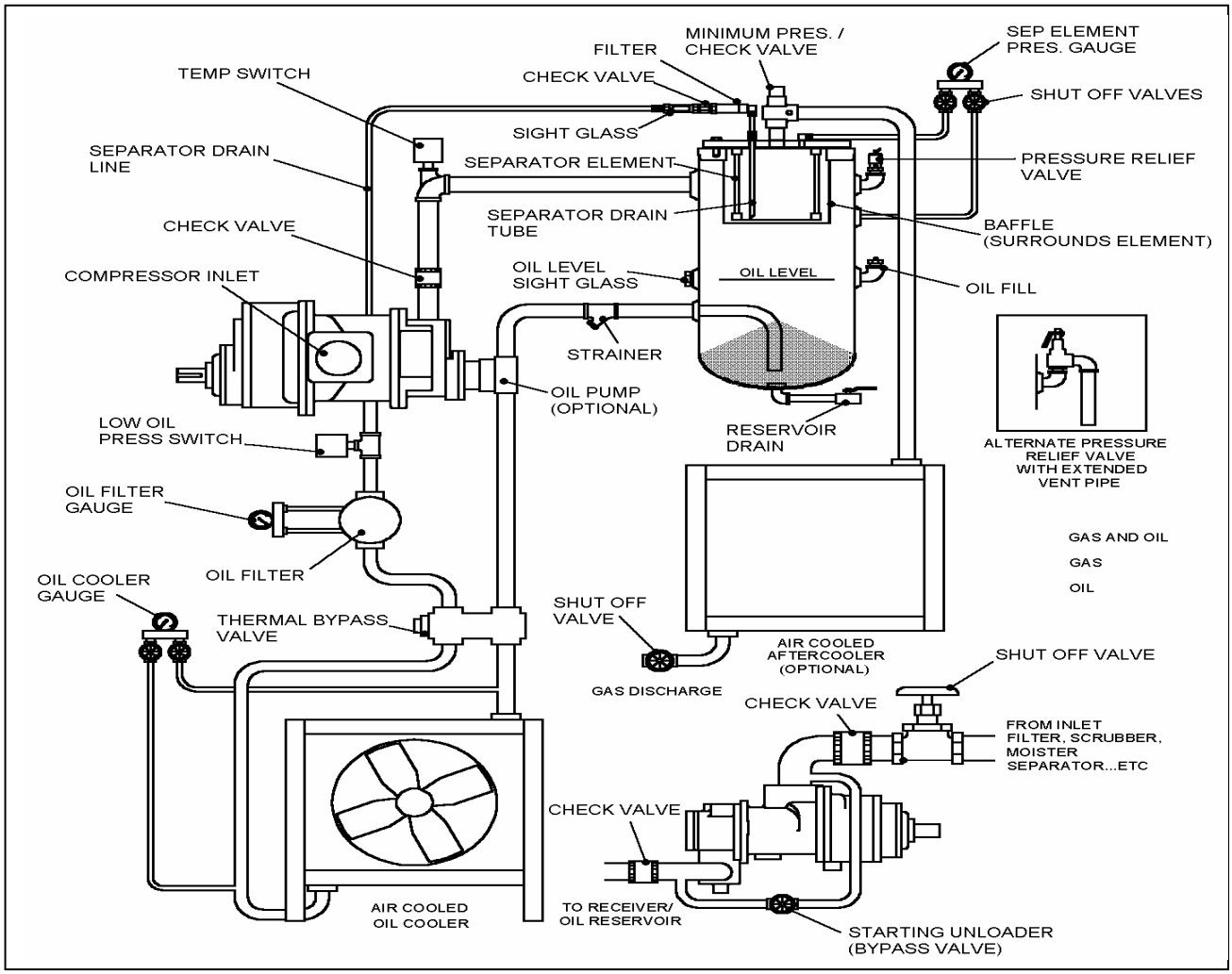


Figure 4 – Typical Basic Piping Diagram

Oil Flow and Orifice Sizing

As mentioned previously in this manual, rotary screw compressors require oil lubrication of the bearings, cylinder and rotors. Bearing lubrication is necessary for long life. Cylinder and rotor lubrication does three things:

1. Reduces friction between the rotors
2. Provides a seal between the cylinder and rotors to reduce gas slippage.
3. Cools the gas.

In certain applications the pressure differential (discharge-suction) is such that an oil pump is not required. However, if the application has a lower pressure differential than an oil pump will be required. It is important for the application to be reviewed especially if the unit will be moved from one site to another resulting in different conditions.

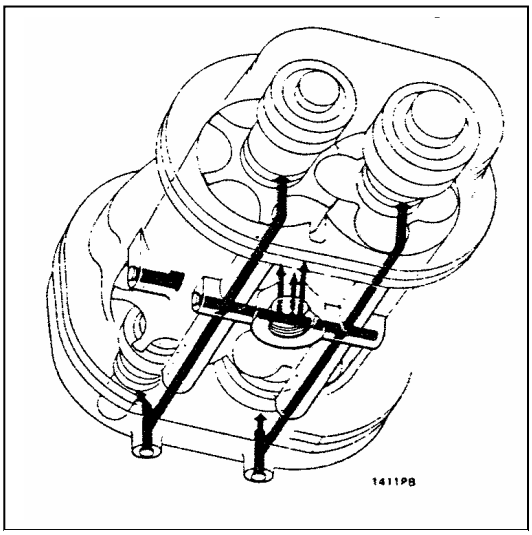


Figure 5 – Typical Oil Flow

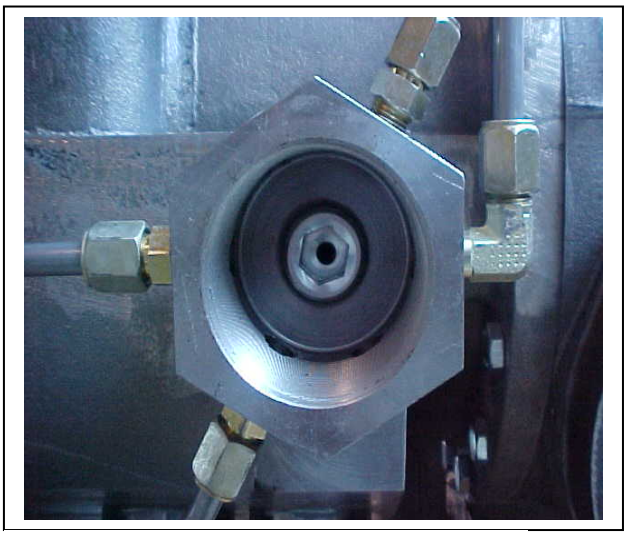


Figure 6 – Orifice Installation

LeROI gas compressors have an oil injection manifold that distributes oil supplied by the pump or pressure differential. The orifice creates a restriction. A smaller orifice results in a greater restriction, which forces more oil to the bearing and less oil to the rotors. The goal is to create a proper balance in the compressor for reliable operation.

Oil Flow and Orifice Sizing

Pumps are installed at the factory based on packager instructions or specified operating conditions. Every LeROI compressor is tested at the factory to ensure reliable operation. After testing, the standard orifice or an orifice specified by the customer is installed in the unit.

IT IS ALWAYS GOOD PRACTICE TO VERIFY THAT THE PUMP AND ORIFICE SELCTION ARE CORRECT FOR THE FIELD OPERATING CONDITIONS DURING COMMISSIONING OF THE COMPRESSOR PACKAGE.

There are several size options for each compressor. In the event that an orifice is needed and one is not readily available one can easily be created. Simply drilling a hole in a solid plug will provide the orifice. It is also important to note that you may need to create an orifice in the event your desired size is in between manufacturer available sizes.

Temperature/Viscosity/Pressure

Refer to Figure 7 for temperature and pressure methods and locations.

Gas discharge temperature range: 175-210 °F

(Temperature must be high enough to reduce condensation in separator tank.)

High temperature shut down: 230 °F

(Switch must be located between compressor discharge flange and separator tank inlet.)

WARNING! NEVER EXCEED 230°F DISCHARGE

Temperature/Viscosity/Pressure (Continued)

For Most Situations:

Temperature rise - From oil injection to gas discharge: 30 – 40° F

For heavy gas streams, a 30-40 °F temperature difference may not be possible

Temperature rise – From oil injection to discharge bearing oil drain: 15 °F

WARNING! NEVER EXCEED 20°F BEARING RISE

Oil pressure difference – gas inlet versus oil injection: 60-100 psi

(When gas discharge pressures are 50 psig or less, it may not be possible to achieve 60 psig oil pressure. That is acceptable if all other specifications are met.)

Oil viscosity at injection temperature: 13-40 cSt

(Refer to oil supplier data for viscosity at actual injection temperature.)

Field Evaluation of Pump & Oil Injection Orifice Size

Equipment & Measurement Location

Although other permanent instrumentation is necessary for monitoring overall package performance, the following are specifically for the purpose of evaluating the pump and orifice size.

Table 2 Instruments & Measurement Locations

Instrument	Data	Location
Infrared (IR) temperature gun	a. oil injection temperature b. gas discharge temperature c. discharge bearing oil drain temperature	(A) pipe (B) pipe (C) tube (goes down on some models)
Pressure gage or transducer 1	d. gas inlet pressure	(D) inlet pipe
Pressure gage or transducer 2	e. oil injection pressure	(E) injection manifold

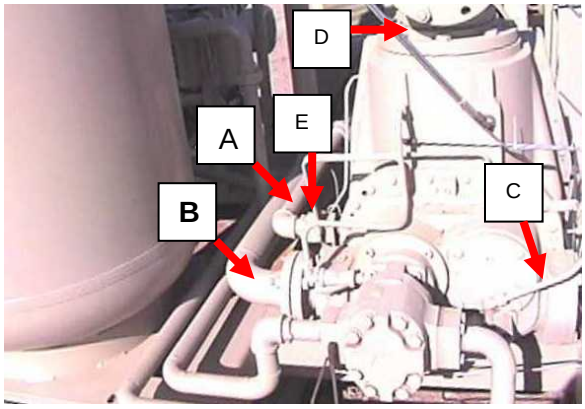


Figure 7 -Temperature / Pressure Measurement Locations

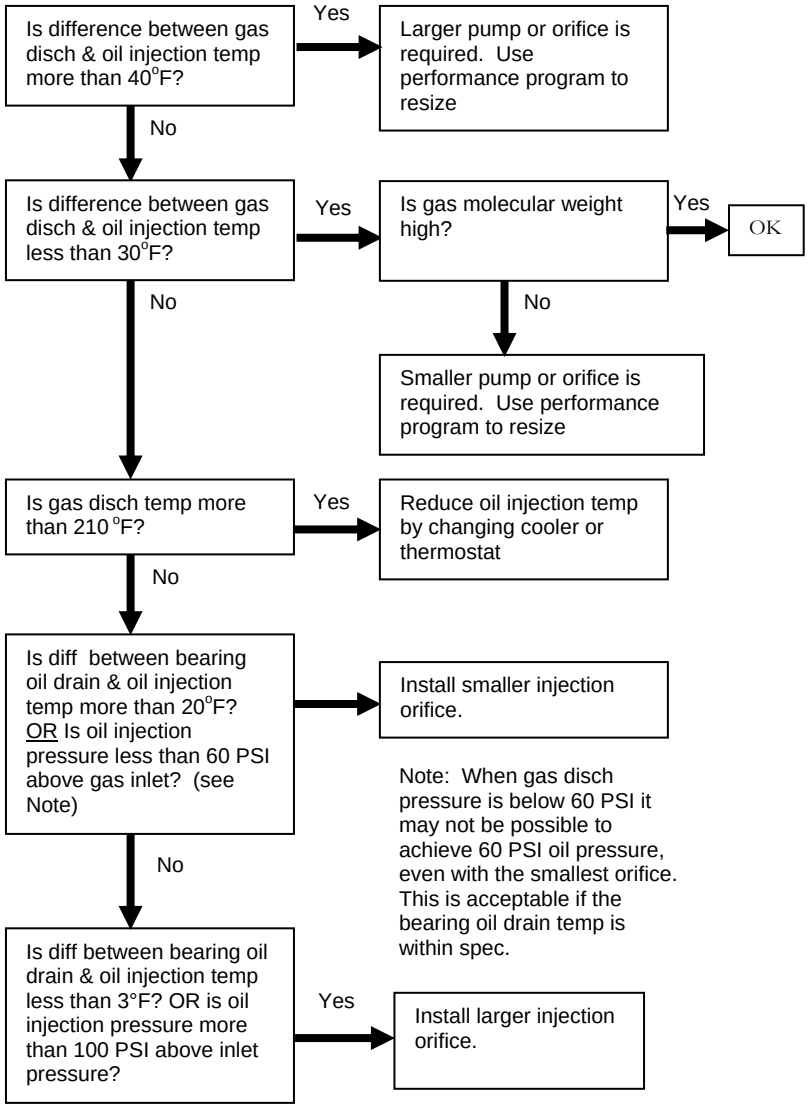
Although probes inserted directly in the gas or oil stream will give more accurate results, an **infrared (IR) temperature gun is recommended** for this procedure. Since a probe cannot be readily used on the discharge bearing drain, the IR gun will allow a better comparison.

For best results when using an IR gun, slowly moving the IR gun over the item to obtain the highest temperature. **Be careful not to pick up temperatures from background objects.**

Temperature measurements at points A, B, and C should be made on sections of pipe or tube (not fittings) as close to the compressor as possible.

Pressures at points D and E should be as close to the compressor as possible. There is typically an unused port on the oil injection manifold for E. Point D is located in the package inlet piping. If pressures are not taken at these specific locations, they should at least be located on the compressor side of any major restrictions such as a filter.

WHEN TO CHANGE A PUMP OR ORIFICE



Variable VI Adjustment

Variable Vi is used to minimize the power required by the compressor. It does not change flow directly, but can allow an increase in flow through more efficient use of power. Vi is the *volume compression ratio* of a compressor: V1 / V2. The internal Vi of the compressor is determined by the size of the discharge port. A small port causes gas to be released later in the compression cycle resulting in a higher internal Vi, while a larger port allows the gas to be released earlier in the cycle resulting in a lower internal Vi. The ideal Vi for an application can be calculated if the inlet and discharge pressures and k (C_p/C_v) of the gas are known.

The compressor makes the most efficient use of power when the internal Vi equals the ideal Vi. For example, if the internal Vi is high but the ideal Vi is low, the gas is compressed to a pressure greater than the external pressure prior to being released. On the other hand, if the internal Vi is low but the ideal Vi is high, gas momentarily flows backward into the compressor and is re-compressed. Both of these scenarios result in wasted energy.

The standard discharge housings of the HG17, HG24, LG30, and LGL30 compressors have a 4.4 Vi port, but are fitted with four valves that can be opened to increase the total size of the discharge port, so that the following internal Vi's can be achieved.

Vi = 4.4 (HIGH) All valves closed
Vi = 3.0 (MEDIUM) Two inner valves opened (two outer valves closed)
Vi = 1.9 (LOW) All valves opened

Instructions

THE COMPRESSOR CAN BE VERY HOT!
PROTECT YOUR SKIN WHEN ADJUSTING A RUNNING OR HOT COMPRESSOR.

DO NOT TIGHTEN VALVES.
Valves are not intended to be closed or opened by tightening. Doing so may damage the valve and/or compressor rotors. The valve should only be turned until it "touches" the end of its stroke and then backed off about 1/16 of a turn.

The first item to be performed is to determine the ideal Vi of the application.

There are three ways to do this:
(1) Trial and error – adjust the valves while monitoring horsepower draw.
(2) Use the LeROI Screw Compressor Performance Program by alternatively selecting High, Medium, and Low Vi on the Compressor tab, and see which results in the lowest horsepower.
(3) Calculate the ideal Vi mathematically (or from a spreadsheet calculator available from www.leroigas.com):

$$Vi = (P_2/P_1)^{1/k}$$

P_1 and P_2 must be in PSIA, and be at the compressor inlet and discharge flanges. Be sure to account for package pressure drops, which decrease the inlet pressure and increase the discharge pressure at the compressor flanges. As a quick reference, for a typical natural gas with k = 1.26, the pressure ratios that correspond to available internal Vi's are:

Vi	**P2 / P1**
4.4	6.5
3.0	4.0
1.9	2.2

Since there are three available internal Vi settings, each must cover a range of ideal application Vi's:

Ideal Vi	Select Internal Vi
Greater than 3.5	HIGH (All valves closed)
Greater than 2.5, but not greater than 3.5	MEDIUM (Inner valves open, Outer valves closed)
Less than or equal to 2.5	LOW (All valves opened)

After Determining the appropriate Vi ratio perform the following steps to adjust the internal Vi ratio:

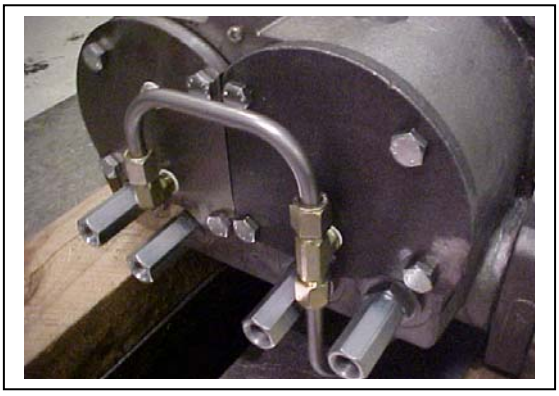


Figure 8:
Compressor discharge end showing four closed Vi valves fitted with special locknut-thread protectors.

Compressor models may also have an oil pump mounted above the two valves on the left.

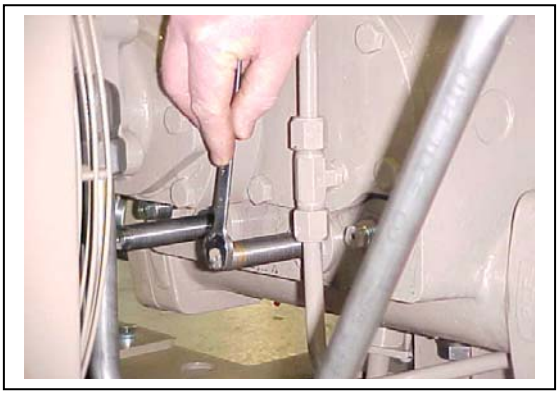


Figure 9:
Remove locknuts with wrench before making adjustments.

It is not necessary to remove the outer locknuts if only the inner valves are being adjusted.

The model represented in the figure has a pump and is part of a package.

Figure 10: For MEDIUM Vi, turn the inner valves counterclockwise until they are fully out.

DO NOT FORCE THE VALVES. Once they "touch" the end of their stroke reverse them by 1/16 of a turn. *This also applies when closing valves.*

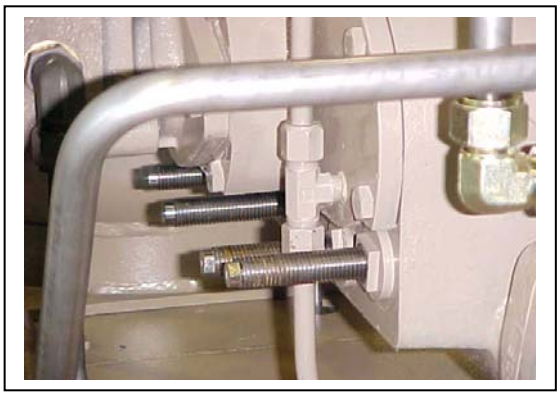


Figure 11: For LOW Vi, in addition to turning the valves for MEDIUM, turn the outer valves counterclockwise until they are fully out.

DO NOT FORCE THE VALVES. Once they "touch" the end of their stroke reverse them by 1/16 of a turn. *This also applies when closing valves.*

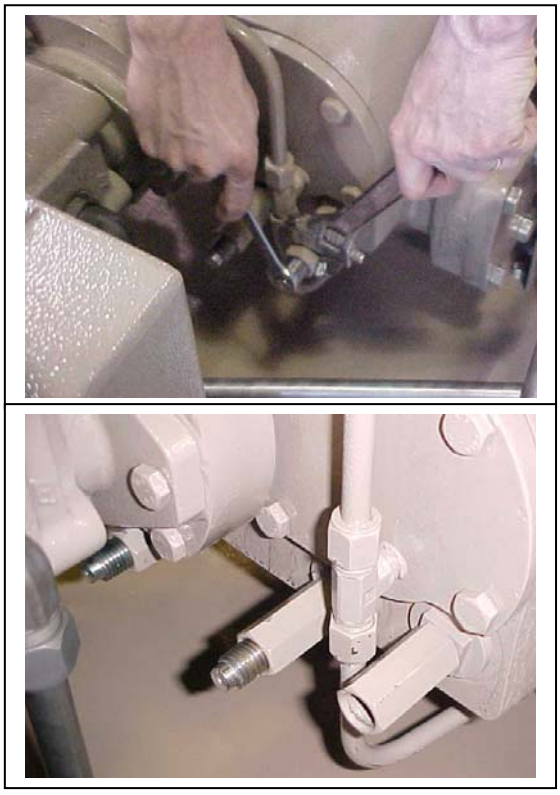


Figure 12: Reinstall and tighten locknuts just snugly while holding valves so they do not turn. The valve positions in this figure are low Vi. Note that all of the valves are out. **PERIODICALLY LUBRICATE THE VALVE STEM THREADS WITH GREASE TO PREVENT RUST AND ALLOW FOR FUTURE ADJUSTMENT.**

Figure 13: The valves in this figure are in a MEDIUM Vi position (inner valves out, outer valves in). It is not possible to hold the outer valve while tightening the locknut – just tighten the locknut lightly to prevent jamming the valve.

Versatrol Capacity Control

Versatrol capacity control is used to regulate compressor flow and reduce power requirements. Versatrol consists of a set of pressure actuated valve assemblies mounted on the side of the compressor. When opened, these valves allow gas to leave the compression cycle and return to the compressor inlet prior to compression and delivery, thus reducing flow and horsepower. A valve is closed by applying actuating pressure and opened by releasing actuating pressure. This can be used to ramp up the compressor during start up. Start the compressor with all the ports open then close them.

The by-pass valve assemblies are sometimes referred to as unloaders or pockets.

Versatrol is available on the HG12 and larger models. Due to the small cylinder size, the HG12 has two valves and an external by-pass (Figure 14). All larger models have four valves with an internal by-pass (Figures 15 and 16).

Figure 14 - HG12 showing one of two Versatrol pockets. Second identical pocket is on the opposite side

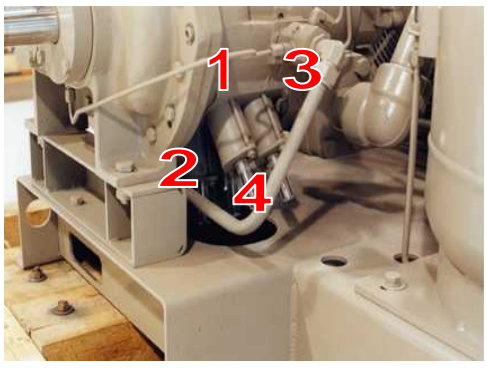


Figure 15 – HG17 showing four Versatrol pockets. HG24 arrangement is the same (Pockets 2 and 4 are under the compressor)

Figure 16 – LG30 showing four Versatrol pockets. (Pockets on HG17 and HG 24 are on the other side)

Depending on actual operating conditions, Versatrol can reduce flow by approximately 50% and power by 25%. Versatrol can be operated in steps or stepless.

Step Control - each valve is fully opened of closed. For each valve opened in sequence, capacity and power will be reduced by approximately 13% and 6% respectively.

Stepless Control - each valve is positioned anywhere between fully opened and fully closed, thus throttling the by-pass and allowing infinitely variable flow control. Stepless control is achieved through the use of electronic controls, which monitors flow and power, and adjusts valve position. LeROI-RCT does not supply control systems, but they are commercially available.

Versatrol Capacity Control Continued

Actuation:

The Versatrol valves can be operated with *pressurized* air, gas or lubricating fluid depending on whether it is step or stepless control. The actuation pressure should be the same or nearly the same as the compressor discharge pressure. The valves should be opened in the 1-2-3-4 sequence and closed in the 4-3-2-1 sequence, except the HG12. The HG12 can be opened or closed in any sequence.

Oil may be used for either step or stepless control. Oil taken from the gas/ oil separator or after the oil pump should have adequate pressure to allow Versatrol actuation. Oil should always be filtered prior to entering the control system.

Air or gas can be used for step control systems only. Air and gas are compressible and will not allow accurate or quick control responses. Air can be used for stepless control systems without a problem.

As mentioned previously, the valve is unloaded or opened by reducing the control pressure. When the control pressure is reduced the higher pressure inside of the compressor opens the valve. Therefore, it is important for the actuation pressure during the unloading stage to be lower than the cylinder pressure. To ensure this occurs, the Versatrol valve assembly should be vented to the cylinder inlet if actuated by gas or oil. If the air is used in the control system then it will have to be vented to the atmosphere.

NEVER UNDER ANY CIRCUMSTANCES VENT GAS OR OIL TO THE ATMOSPHERE

NEVER UNDER ANY CICUMSTANCES VENT AIR INTO A GAS COMPRESSOR

An oversight that occasionally occurs is the testing of a compressor on air with a vacuum inlet. If the Versatrol valve is vented to atmospheric pressure, the valve frequently does not open because the pressure in the cylinder is less than atmospheric pressure.

Plumbing:

Steel or **stainless steel** tubing and fittings should be used. Copper tubing is not recommended. Copper and gas can react and reduce the reliability of your system.

Tubing runs should not be any longer than necessary in order to avoid reduced response times between controls and the Versatrol valves. Tubing should be **3/8"**. Tubing size increases in importance in cold environments or when tubing runs exceed 4 feet.

Control Valve Selection:

Since actuating pressure is applied and released through the same port in the Versatrol assembly, it is necessary to use a valve that can be turned between the pressure source and a vent (cylinder for oil and gas, atmosphere for air). Generally, a three or a four-way valve is required. Three-way valves are a good choice for manually operated Versatrol. Four-way valves are best for automatic, stepless control systems.

Oil and Related Items

The lubrication system is vital for reliable operation of LeROI gas compressors. Following these guidelines about oil and related items will ensure years of reliable service.

Start-Up: Prior to start-up the compressor should be pre-lubed.

Oil Filter: Check after first 100 hours. Change once a month if continuously operated or every 1000 hours otherwise. Filter must be changed with every oil change.
At the minimum a differential pressure is recommended for the oil filter. A differential gauge with an alarm is advised.

Viscosity: The packager/user is responsible for selecting oil that is compatible with the gas, and can maintain minimum viscosity at the operating conditions. The recommended viscosity is 15 centistokes regardless of the operating conditions. The minimum viscosity is 13 centistokes regardless of the operating conditions.

Oil viscosity greater than 15 centistokes can affect performance, especially horsepower.

Analysis: Oil should be analyzed on a regular basis. Oil should be checked once a week for the first month, with at least two of those samples being analyzed. If the first month of samples is okay then the analysis can be reduced to once a month. Increases in water content and metals should be watched closely. All reputable oil suppliers and manufacturers will analyze oil samples at no charge.

Recirculation: It is important that the oil recirculates at least two times per minute, especially with heavier hydrocarbon and water saturated gases. This keeps the oil temperature higher, thereby reducing the possibility of hydrocarbons condensing and affecting the viscosity of the oil, or having water condense and cause lubrication problems.

Strainer: When there is an oil pump, it is recommended that a Y-strainer be installed between the separator and the suction to the pump

It is recommended that a Y-strainer be installed downstream of where the oil leaves the discharge bearing retainer, and where it is injected in the casing. This will reduce the possibility of a catastrophic failure if a bearing fails on the discharge end.

Coalescing: The coalescing element in the gas oil separator should be monitored with a differential pressure gauge. This element should be changed as required. It should be checked at least once a year. It is important that the filter element have enough surface area to remove oil from the gas stream.

Gas Filtration: Gas filtration is recommended. Particulate in the gas stream can contaminate the oil and cause premature failure.

Temperature: Oil temperature in and out of the rear-bearing retainer should be checked regularly. If differential is greater than 30°F, there may not be sufficient lubrication for that are. This could also be an indication of worn bearings.

Installation

The compressor and prime mover must be mounted on a rigid frame so that the drive, piping, etc. are not subject to strain and/or misalignment. Mounting holes are provided to securely attach the compressor.

The mounting surface must be a smooth, level surface that will support the weight of the compressor and handle the associated vibration. Shims must be installed between the frame and the mounting surface to eliminate strain on the frame.

Adequate airflow for cooling must be provided. Uncontrolled recirculation (from unit to other source) of hot air must be prevented. Refer to figure 17 for a typical installation.

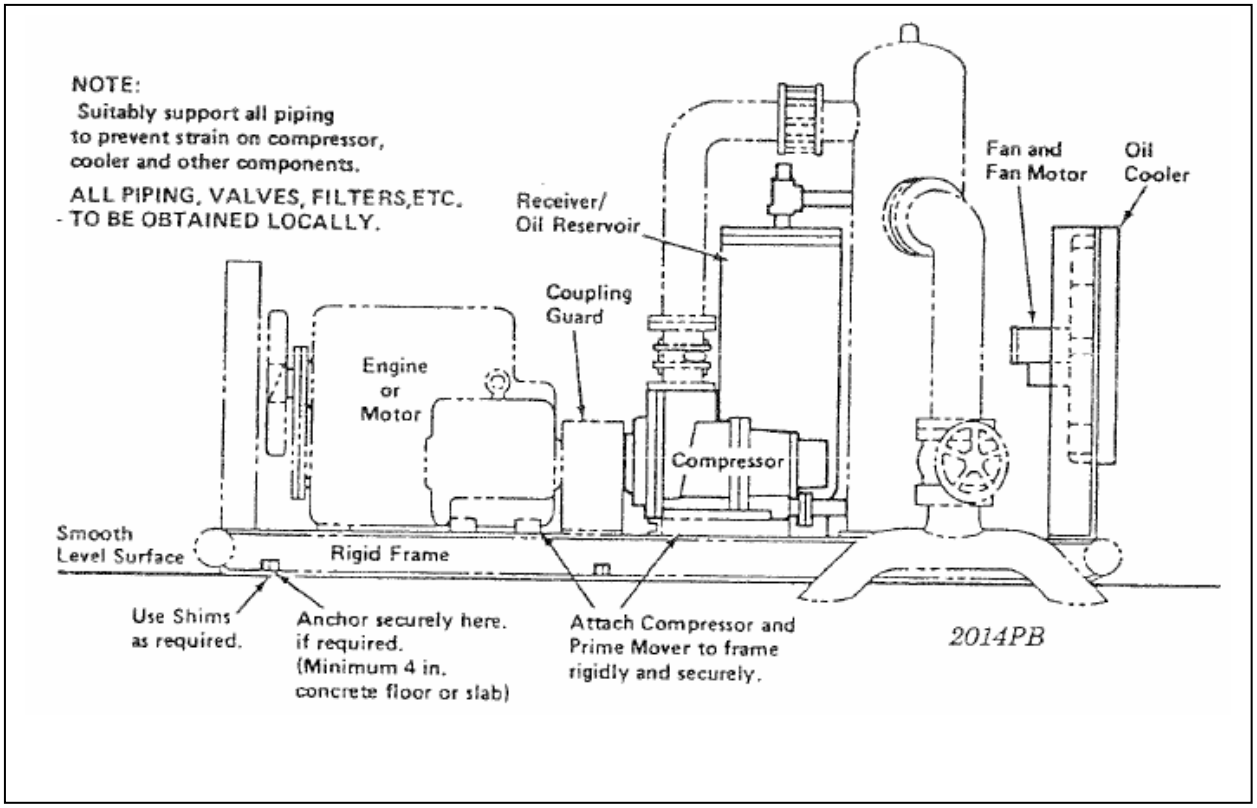


Figure 17 – Typical Installation

Installation (Continued)

Drive:
Several types of drive couplings may be used. However, direct flexible and universal joint types are recommended. When using a direct flexible coupling follow the coupling manufacturer's instructions. As a general rule, for this type of coupling, the alignment should be as near "in line" as possible. In any case, coupling misalignment may not exceed 1/32" parallel and/or 2° angular misalignment. Refer to figure 18.

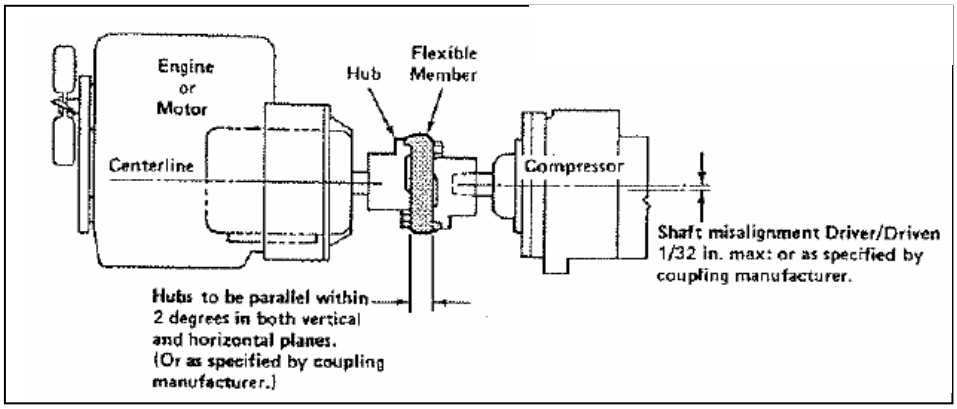


Figure 18

THE DRIVE COUPLING (COUPLING, SHAFT, BELTS) MUST BE COVERED BY A SUITABLE GUARD OR SHIELD. ALL GUARDS AND SHIELDS MUST BE IN PLACE WHEN OPERATING THE UNIT

Depending on the size of the compressor, it may be possible to belt drive the compressor.

However, there is a limit to the power that each compressor can sustain. Refer below:

HG10; 30 HP
HGF10; 50 HP
HG12; 50 HP
HGF12; 50 HP
HGSF17; 50 HP

If the shaft horsepower exceeds these numbers then the compressor must have the pulley mounted on a "jack" or idler shaft. If the idler pulley has a ratio other than 1:1 you will need to ensure you have not exceeded the speed rating on the compressor

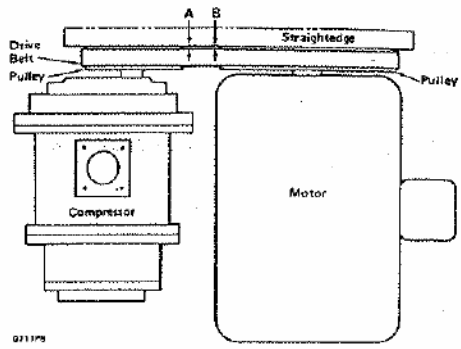


Figure 19

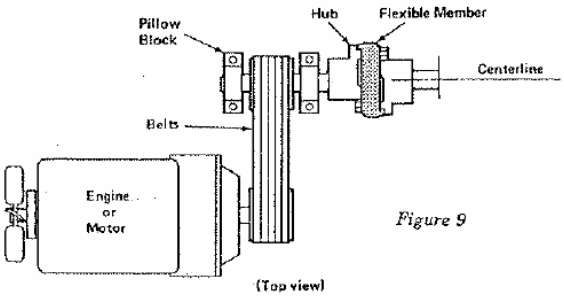


Figure 9

Figure 20

Installation - Component Location

The components (Figure 17) of a gas compressor system should be mounted on the frame to make servicing the unit as convenient as possible. Oil piping and hoses should be located and fastened to prevent accidental damage. All moving parts (coupling, belts, fans, etc) must have guards or shields installed.

Compressor Inlet: The inlet piping must be clean and fitted with suitable filters, (scrubber, moisture separator, etc.) to prevent foreign matter from entering the compressor. All piping and other components must be adequately supported. Provisions must also be made to install other components such as gages, valves, temperature measuring and pressure control devices.

Compressor Discharge: The discharge line between the compressor and the oil receiver must be as large as permitted by the size of the compressor discharge opening. The discharge line *must never* be reduced in size. The discharge line should be as short as possible with the minimum number of bends and fittings.

A high discharge temperature shut down switch, wired into the prime mover controls, must be installed in the discharge line. This trip switch should have a maximum trip setting of 230°F.

Provisions must also be made to install other components such as gauges, valves, temperature measuring and pressure control devices.

Separator out: The piping from the separator out (minimum pressure check valve) must be as large as permitted by the outlet port of the minimum pressure valve. The length must be as short as possible with the minimum number of bends and fittings.

The piping must be adequately supported and fastened securely.

Provisions must be made to mount and connect other components in this line such as aftercooler, valves, pressure and temperature sensing devices, etc.

Comp Instrumentation: Pressure gauges should be provided to monitor the pressure drop (restriction) across the oil filter element, separator element, and oil cooler.

A single gauge for each is recommended, with a manifold and shut off valves, to red both upstream and downstream (inlet and outlet) pressures. This limits the possibility of gauge error affecting pressure readings.

Operation and Preventive Maintenance

Satisfactory performance of a stationary screw compressor requires a good preventive maintenance program. The following information is provided as a guide for such a program.

Start Up:

1. Service all equipment (filters, moisture separators, prime mover, etc.) following the equipment manufacturer's instructions.
2. Drain condensate (water) from the oil reservoir. Close the drain valve securely when oil appears.
3. Check the compressor oil reservoir fluid level. Add oil as necessary to the correct level. Do not overfill.
4. Make certain adequate ventilation and cooling water, if required, is provided.
5. Start the unit by actuating the electrical controls or starting the engine following the equipment manufacturer's instructions.
6. Observe the unit for leaks, unusual noise, vibration, etc. (Shutdown the unit and correct as required.)
7. Observe all instrumentation for proper readings.

Shut Down:

1. Stop the prime mover following manufacturer's instructions.

Preventive Maintenance:

1. Ensure the oil is properly maintained per the "Oil and Related Items" section of this manual.
2. Visually inspect the entire unit for leaks, loose hardware, etc. as often as feasible. Correct as required.
3. Service all equipment (filters, moisture separators, etc.) following the manufacturer's instructions.
4. Drain water (condensate) from the oil reservoir. Close the drain valve securely when oil appears.
5. Check the compressor oil reservoir level. Add correct type of oil as required. Do not overfill.
6. With the unit running, observe the oil pressure gages and compare readings (filter in-filter out) A difference in pressure readings of 15 PSI or more indicates that the filter element must be renewed.
7. With the unit running observe the gas pressure gauges and compare readings. A pressure drop across the separator element of 15 PSI or more indicates the separator element is restricted. If the restriction is caused by dirt or other foreign matter, renew the separator element.

Oil saturation can cause excessive restriction across a separator element. Always check the separator drain tube and line for restriction, the check valve (installation and condition) and clean or renew the drain line filter before condemning a separator element.

8. Remove surface dirt and dust from the oil cooler and after cooler.

Service Procedures - Components

BEFORE REMOVING ANY COMPONENTS SHUT THE UNIT DOWN, CLOSE ALL INLET AND DISCHARGE SHUTOFF VALVES, RELIEVE ALL PRESSURE BY "PUMPING OUT". MAKE CERTAIN THE PRESSURE SYSTEM REMAINS VENTED TO ATMOSPHERE. DISABLE, LOCKOUT AND TAG THE PRIME MOVER.

Compressor Service:
The compressor for these units is serviced only as a complete assembly using a new or factory rebuilt compressor. Parts available for field service include the input shaft rotary oil seal and the seal retainer gasket or o-ring seal.

Input Shaft Seal Replacement:

The compressor input shaft rotary seal may be replaced as follows, Refer to Figure 21:

1. Make certain the unit cannot be started and system has all pressure removed.
2. Remove any coupling guards and/ or shields.
3. Clean the front of the compressor thoroughly to prevent dirt from entering the compressor.
4. Disconnect the drive coupling.

If the compressor or prime mover must be unfastened from the frame, save and mark all mounting shims if any, for reuse.

5. Remove the compressor input shaft drive hub.
6. Remove the rotary seal retainer attaching cap screws and remove the retainer with the gasket or o-ring seal.
7. Remove the oil seal assembly, including the spring and spring guide, from the input shaft.
8. Remove the oil seal face insert, with o-ring, from the seal retainer.
9. Thoroughly clean all remaining parts.
10. Lubricate the new seal face insert and o-ring with clean compressor oil and install the insert in the seal retainer.
11. Lubricate the rotary seal assembly with clean compressor oil, including the carbon ring, and install the spring guide, spring and seal assembly on the input shaft

BE CAREFUL NOT TO SCRATCH THE SEAL FACE INSERT OR BREAK OR SCRATCH THE CARBON RING. WIPE THE LAPPED (MATING) SURFACES WITH A CLEAN, LINT-FREE CLOTH BEFORE INSTALLING THE SEAL RETAINER.

12. Carefully reinstall the seal retainer, retainer capscrews and tighten all capscrews securely.
13. Reinstall the compressor input shaft drive hub. Reconnect the drive coupling and align, if necessary, following the coupling manufacturer's instructions
14. Reinstall all coupling guards and/ or shields.

Service Procedure Components

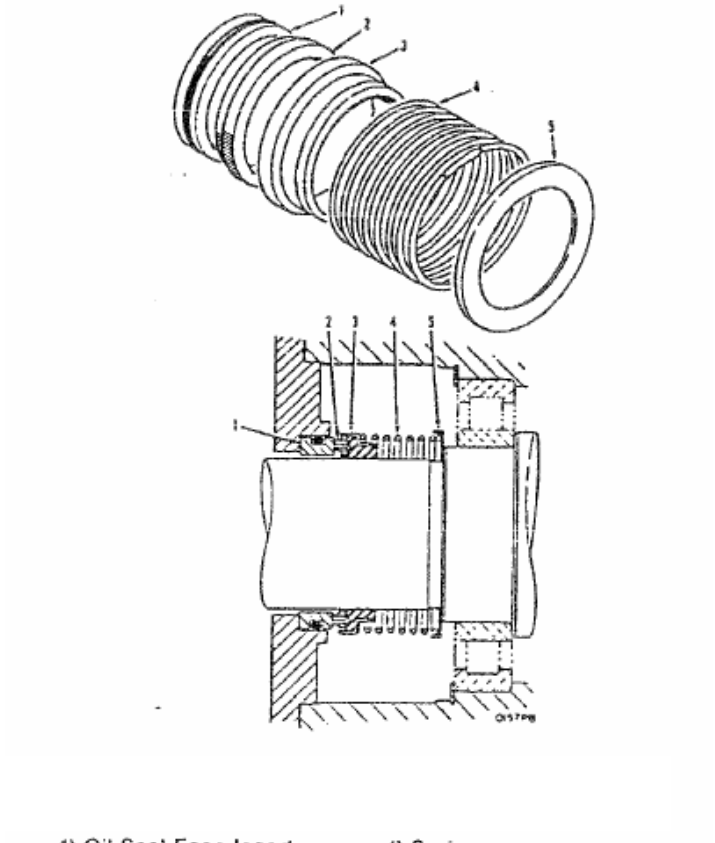


Figure 21-Compressor Input Shaft Seal

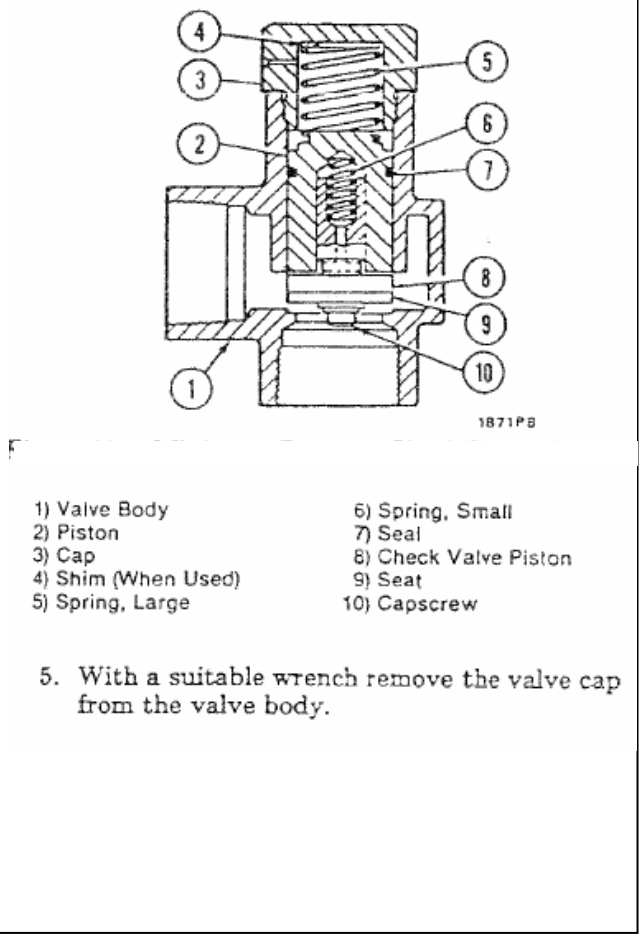


Figure 22- Minimum Pressure Check Valve (Small)

Minimum Pressure/ Check Valve Service

The minimum pressure valve may be purchased as an assembly if required. Service parts are available, however, to repair/overhaul this valve. This valve may be serviced as follows:

1. Make certain the unit cannot be started and that all the pressure has been removed from the system.
2. Remove the service piping from the minimum pressure valve.
3. Remove the valve from the receiver-oil reservoir cap.
4. Securely clamp the valve in a vertical position (cap end up) in a suitable fixture (bench vise).
5. With a suitable wrench remove the valve cap from the valve body.

The spring beneath the cap is under pressure; exercise extreme care when removing the cap

Service Procedure-Components

6. Remove the spring from the body.
   Save spring shim(s) (washers) (if any) for reuse.
7. Insert a suitable tool (wood stick) into the inlet port of the valve and push the piston and the valve assembly upward and out of the body.
8. Remove the check valve piston from inside the larger piston. Take care not to lose the small spring.
9. Remove the o-ring from the large piston and discard the o-ring.
10. Thoroughly clean all the remaining parts. Visually inspect all parts for damage or wear. Replace as required.
11. Install a new o-ring on the large piston.
12. Reassemble the small check valve piston, with the spring, in the large piston.
13. Lubricate the o-ring on the piston with a silicone base lubricant. (Example: Dow Corning 55M).
14. Reinstall the check valve and piston assembly in the valve body. Take care not to damage the o-ring during installation.
15. Install the large spring in the valve body on top of the piston. Reinstall spring shim(s).
16. Lightly coat the cap threads with "Loctite" 271 and install the cap (compress spring) by threading the cap into the valve body. Torque the cap to 60-70 ft lbs.
17. Reinstall the minimum pressure valve on the receiver-oil reservoir cover. Use a good grade of pipe thread sealer on all pipe threads. Tighten securely. Do not over tighten.
18. Reconnect the service piping to the valve using pipe thread sealer on the pipe threads. Tighten service piping securely. Do not over tighten.

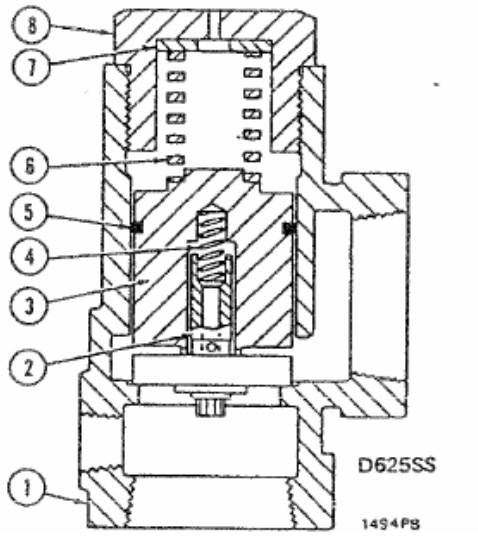


Figure 23- Minimum Pressure/Check Valve (Large)

1) Valve Body
2) Check Valve/Piston Assembly
3) Large Piston
4) Small Spring
5) Piston Seal (o-Ring)
6) Large Spring
7) Shim (When Used)
8) Cap

Service Procedure-Components (Continued)

Changing Minimum Pressure Valve Spring

This section contains the instructions to replace a high-pressure spring in a minimum pressure valve with a low-pressure spring.

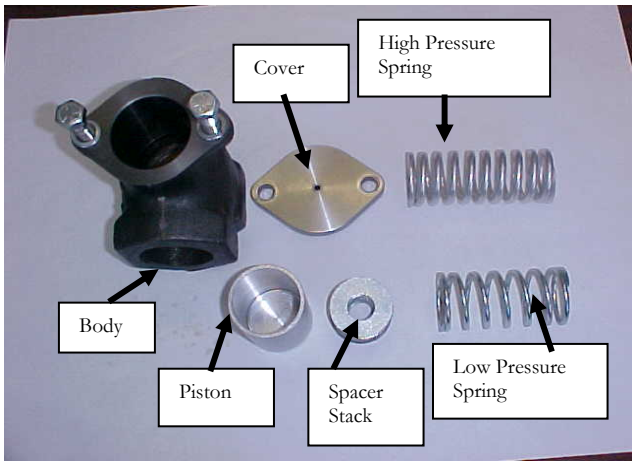


Figure 24 - MPV Parts.

Figure 25 – Seated Piston Depth.
Approximately 7/8 inch from the top of the body. May be installed before or after spacers shown in figures 26 and 27.

Figure 26 – Installation of First Spacer.
Marked "1". Install "Down" side down (chamfered to keep sharp edges from I.D. of piston)

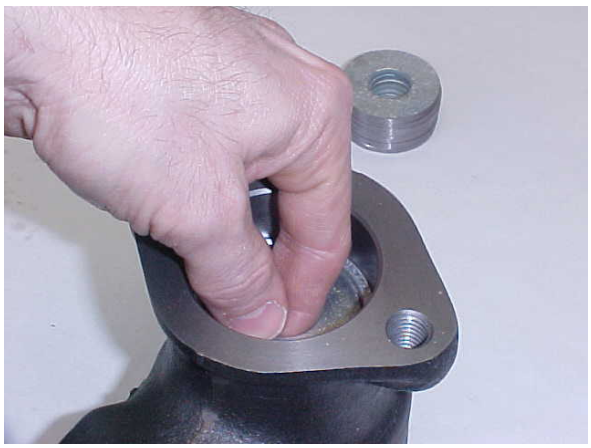


Figure 27 – Installation of remaining spacers.
Install 1 or 2 at a time to insure they slide in smoothly. ***Ten*** spacers are used for 40 PSI pressure.

Service Procedure-Components (Continued)

Changing Minimum Pressure Valve - Continued

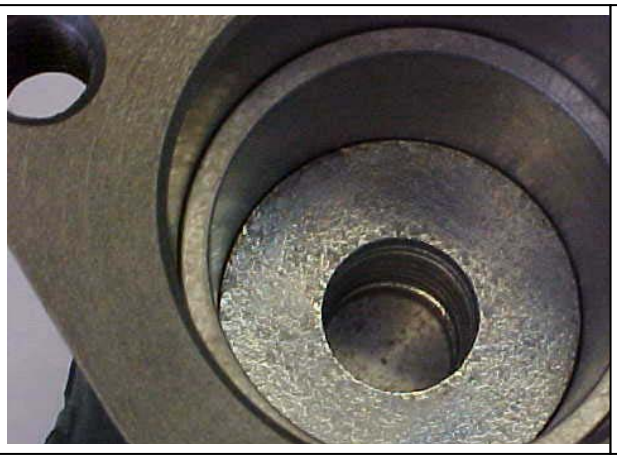


Figure 28 – Ten Spacers Installed in Piston.

Figure 29 – Installation of Spring Part No. 24-810.
Either end may be installed down.

Figure 30 – Installation of Cover.
Keep cover fairly level during installation, tightening bolt on either side a little at a time so cover does not tilt. Bolts should be tightened securely, but do not need to be torqued accurately (50 – 80 ft-lb is adequate).

Service Procedure-Components (Continued)

Oil Separator Service

An oil separator may be removed as follows:

1. Make certain the unit cannot be started and that all pressure has been removed from the system.
2. Disconnect the piping from the minimum pressure valve.
3. Disconnect the separator drain line and remove the drain tube from the separator. Mark the position of the receiver-reservoir cover to aid in correct assembly.
4. Remove the separator cover to receiver-reservoir attaching capscrews (nuts) and remove the cover.
5. Remove the separator element by lifting it out of the reservoir.
6. Clean the cover and reservoir cover mounting flange. Make certain all traces of gasket material are removed.

If the gaskets do not have grounding staples, install two large copper clad staples in each gasket.

7. Inspect the new element gaskets to make certain the electrical grounding staples are installed.
8. Reinstall the separator element in the receiver-reservoir.
9. Reinstall the reservoir cover, correctly positioned, with attaching capscrews (nuts) and tighten securely.
10. Reinstall the separator drain tube and fitting.

The drain tube must extend into the separator element far enough to touch the bottom of the element. If the tube is not long enough to touch bottom, obtain/make a new tube.

11. Reconnect the separator drain line.

MAKE CERTAIN THE DRAIN LINE FILTER AND CHECK VALVE ARE CORRECTLY INSTALLED

12. Reconnect the service piping to the minimum pressure valve. Use a quality pipe thread sealer on all pipe threads. Tighten securely. Do not over tighten.

Rebuild Kits

Please refer to the engineering print below to order a rebuild kit for your unit.

UNIT NUMBER	MODEL	REBUILD KIT
A219-50	245	A204-1798
3A219-106 S/N	3138X223 AND 3172X169 BEFORE	A204-2310
3A219-106 S/N	3138X224 AND 3172X170 AFTER	A204-2311
A219-137	175X1.65	A204-1807
A219-138	TS-17	A204-1805
A219-140 SERIES	245	A204-2004
A219-141-1	175X1.2	A204-1811
A219-142	W2E300	A204-1812
A219-146	TS24	A204-1814
2A219-146	TS24	A204-1815
A219-148	245	A204-1750
A219-152-3	175	A204-1797
A219-152-4	175	A204-1751
A219-153-1	175X1.65	A204-1804
A219-172 SERIES	175	A204-2056
A219-177	127.5	A204-1754
A219-178	127.5	A204-1801
A219-179-2	127.5	A204-1806
A219-180	127.5	A204-1752
A219-184	127.5	A204-2116
3/4A219-184	127.5	A204-2238
A219-190	127.5	A204-1754
3A219-190	127.5	A204-2263
A219-191	127.5	A204-1754
A219-194	127.5	A204-1754
1A219-194	127.5	A204-1971
A219-195**	G24XX	A204-1822
A219-195-1	G24XX	A204-1822
A219-198	108	A204-1753
A219-199	108	A204-1800
A219-200*	108	A204-1753
2A219-201	309MM	A204-2156
A219-202	309MM	A204-1813
A219-210	TS-30	A204-2088
A219-214	127.5	A204-1802
2A219-214	127.5	A204-2074
3A219-214	127.5	A204-2074
A219-220 AIR SERIES	175X1.2	A204-1799
A219-220 GAS SERIES	175X1.2	A204-1799-1
A219-221-1	175X1.2	A204-1803
A219-223	127.5	A204-1809
A219-225	127.5	A204-1810
2A219-227	127.5	A204-2190
A219-227-1	127.5	A204-1769
A219-232 SERIES	309	A204-1820
A219-234	127.5	A204-2129
1A219-234	127.5	A204-2129
4A219-234	127.5	A204-2099
A219-235	127.5	A204-2022
1A219-235	127.5	A204-2022
1A219-235-1	127.5	A204-2264
2A219-235	127.5	A204-2190
2A219-235-1	127.5	A204-2264
3A219-235	127.5	A204-2022

UNIT NUMBER	MODEL	REBUILD KIT	
4A219-235	127.5	A204-2022	
5A219-235 & -1	127.5	A204-2176	
6/8A219-235 SERIES	127.5	A204-2177	
7A219-235	127.5	A204-2240	
9A219-235	127.5	A204-2265	
A219-235-1	127.5	A204-2083	
A219-235-2 &-4	127.5	A204-2022	
A219-235-3	127.5	A204-2083	
12A219-235-1	127.5	A204-2022	
15A219-235	127.5	A204-2302	
A219-238 SERIES	245	A204-2004	
A219-239	TS-30	A204-2089	
A219-240 SERIES	245	A204-2004	
A219-241	TS24	A204-1928	
A219-245 SERIES	245	A204-2052	
A219-247	309	A204-2080	
A219-250 & -1	127.5	A204-2078	
1A219-250	127.5	A204-2084	
2A219-250	127.5	A204-2078	
2A219-250-1	127.5	A204-2078	
2A219-250-2	127.5	A204-2078	
2A219-250-3	127.5	A204-2084	
3A219-250	127.5	A204-2266	
4A219-250 & -1	127.5	A204-2213	
6A219-250	127.5	A204-2267	
7A219-250	127.5	A204-2268	
8A219-250	127.5	A204-2213	
A219-251 SERIES	175	A204-2130	
A219-252	175	A204-2079	
A219-278 & -5	245	A204-2131	
A219-278-1,2,3,4	245	A204-2132	
A219-280 & -1	108	A204-2133	
1A219-280 & -1	108	A204-2134	
2A219-280 & -1	108	A204-2134	
A219-281 SERIES	175	A204-2135	
3A219-281 SERIES	175	A204-2303	
A219-282 SERIES	175	A204-2136	
A219-283 SERIES	309X2.2	A204-2348	
4/5/6/7A219-288	175	A204-2239	
4/5/6/7A219-288	175	A204-2269	SPECIAL HI PRESSURE GASKET
A219-288 SERIES	175	A204-2260	VARIABLE VI SEALS ONLY
A219-318 SERIES	108	A204-2214	
A219-320	108	A204-2296	
1A219-320	108	A204-2296-1	
1A219-320-1	108	A204-2295	
A219-332	HGT-17	A204-2305	
A219-335 SERIES	245	A204-2131	
A219-343 SERIES	175	A204-2261	
A219-346 SERIES	309	A204-2080	
A219-349 SERIES	108	A204-2290	
A219-368	LGL30	A204-2353	W/ ROTARY SHAFT SEAL
A219-368	LGL30	A204-2353-1	W/O ROTARY SHAFT SEAL

CONVERSION KITS

TO REBUILD GASEND AND CONVERT FROM ANGULAR CONTACT TO TAPERED ROLLER BRG'S

4A219-234		A204-2178
A219-184 SERIES	W/ FAN	A204-2187 (P)
	W/O FAN	A204-2188
A219-190 SERIES	W/FAN	A204-2179
	W/O FAN	A204-2183

TO ADD VARIABLE Vi TO THE FOLLOWING:

245mm A219-222 SERIES	A204-2037
309mm A219-232 SERIES	A204-2051
309mm A219-232 SERIES (INCLUDES DISCH. BEARINGS)	A204-2053

UPGRADE KITS FOR CAPACITY CONTROL OPERATORS (FOR GAS COMPRESSORS ONLY)

CONTAINS INDICATOR SUPPORT, INDICATOR SHAFT & SEALS/O-RINGS TO UPGRADE TO THE ROLL PIN ARRANGEMENT.
ONE (1) KIT PER OPERATOR (POSITION)

A204-2272	HG12
A204-2273	HG17
A204-2274	HG24
A204-2275	LG30

REFERENCE:
SERVICE COMPLETE ASSEMBLIES WITH:

A1-877 WITH A1-883 HG17
A1-876 WITH A1-884 HG24
1A1-875 WITH A1-885 LG30

A1-882 IS HG12 ASSEMBLY

FOR REFERENCE, CURRENT VERSATROL/ECONOTROL OPERATORS FOR AIR COMPRESSORS ONLY:

1A1-879	175mm	KIT A204-2170
1A1-868	245mm	
1A1-869	309mm	

TO CONVERT THE FOLLOWING GAS ENDS FROM ANGULAR CONTACT TO TAPERED ROLLER BRGS AND ADD VARIABLE Vi:

175mm A219-172 SERIES	W/PUMP	A204-2119 (K)
	W/O PUMP	A204-2118
245mm A219-240 SERIES	W/PUMP	A204-2108
	W/O PUMP	A204-2107

TO REBUILD ENTIRE GASEND AND MAKE THE ABOVE CONVERSION:

175mm A219-172 SERIES	W/PUMP	A204-2121 (K)
	W/O PUMP	A204-2120
245mm A219-240 SERIES	W/PUMP	A204-2113
	W/O PUMP	A204-2112
175mm A219-172 SERIES	W/PUMP	A204-2270
	W/O PUMP	A204-2271

SPECIAL HI PRESSURE GASKET FOR RGS

*A219-200 FOR SOUR GAS APPLICATION USE A204-1753-1

**A219-195 GEAR REPLACEMENT KIT A204-2041 (GEARS ORDERED SEPARATELY)

**A219-245 GEAR REPLACEMENT KIT A204-2236 (GEARS ORDERED SEPARATELY)

KIT TO REBUILD HORZ. 2-STAGE A219-239 AND CONVERT TO A219-210: A204-2087

REF. NOTE: CURRENT HORZ. 2-STAGE PRODUCTION IS
A219-319 AIR
A219-344 GAS

DWG. No. CH-2306C

CHANGE DESCRIPTION	ECN No.	DATE	SYM
ADDED A204-2353-1 FOR A219-368	48243	10/06	AN
ADDED A204-2296-1 FOR 1A219-320	48230	8/06	AM
REDRAWN AND REVISED	48220	8/06	AL
ADDED A219-239, A219-210 AND A204-2087	46969	5/00	F
ADDED A219-247 THRU A219-252	46887	4/00	E
UPDATED	46854	1/00	D
UPDATED FOR SERVICE	46729	1/00	C
ADD A219-195, A219-232 KITS	44057	3/96	B
PRODUCTION RELEASE	44019	2/96	A

LeROI Gas Compressors by Rotary Compression Technologies, Inc.
211 E. Russell Road
Sidney, OH USA 45365

MATERIAL: N/A

Unless otherwise specified tolerances on decimal dimensions are:
One place decimals (.X) ±.030
Two place decimals (.XX) ±.010
Three place decimals (.XXX) ±.005

SCALE: N/A
MODEL: ALL
DRAWN BY: JAH DATE: 8/06
ACAD FILE S: CH-2306C
CHECKED BY: DATE:
DIR. ENG.: DATE:
NAME: REBUILD KITS AIRENDS/ GASENDS
DWG. No. CH-2306C

Website

LeROI-RCT has a website that contains useful tips, features, sizing information, and technical data. We encourage using and exploring the website to learn what tools are available to you. Visit us at www.leroigas.com

Contact List

Below is a list of contacts in case you need any assistance. In order to provide you with the latest information this list is also available on the website: www.leroigas.com

Gas Compressor Sales/ Pricing/ Specifications/ Literature
Ron Keen
Phone: 937-498-2558
Fax: 937-492-3424
Email: sales@leroigas.com

Application Engineering/ Website/ Compressor Sizing
Jeff Huddleston
Phone: 937-498-2530
Fax: 937-492-3424
Email: jeff.huddleston@leroigas.com

Compressor Orders & Shipping/ Parts Orders & Shipping/ Warranty
Tina Edwards
Phone: 937-498-2555
Fax: 937-492-3424
Email: tina.edwards@leroigas.com
Note: All warranty claims now submitted thru the web. Visit www.leroigas.com

Technical Support
John Bazaar
Phone: 937-498-2502
Fax: 937-492-3424
Email: john.bazaar@leroigas.com

Accounting
Amanda Young
Phone: 937-498-2638
Fax: 937-492-3424
Email: amanda.young@leroigas.com

Service Diagnosis

MALFUNCTION	PROBABLE CAUSE	REMEDY
High Discharge Temperature	1. Insufficient or incorrect oil. 2. Operating above rated pressure or at excessive ratio. 3. Excessive inlet temperature. 4. Restricted oil cooler (inside or outside). 5. Damaged or inoperative thermal by-pass valve. 6. Restricted cooling oil flow.	1. Fill, or drain and re-fill oil reservoir to correct level with correct oil. 2. Operate at correct pressures. 3. Lower inlet temperature. 4. Clean (inside and outside) or replace with new cooler. 5. Service thermal by-pass valve. 6. a. Service oil filter. b. Check oil lines and hoses for restrictions. Service as required.
Low Inlet Pressure	1. Improperly set inlet valve or other control. 2. Restricted inlet (dirty or clogged filters, screens, etc). 3. Damaged or faulty inlet pressure regulator.	1. Set or adjust control correctly. 2. Service inlet filters or screens. 3. Service inlet pressure regulator.
High Inlet Pressure	1. Improperly set inlet valve or other control.	1. Set or adjust control correctly.
High Discharge Pressure	1. Operating at higher than rated pressure. 2. Damaged or worn discharge check valve. 3. Incorrect minimum pressure valve installed. 4. Damaged or worn minimum pressure valve. 5. Excessive restriction in separator or outlet piping.	1. Adjust to operate at rated pressure. 2. Service discharge check valve. 3. Install correct minimum pressure valve. 4. Service minimum pressure valve. 5. Correct cause of excessive restriction.
Excessive Oil Consumption	1. Incorrect oil installed in reservoir. 2. Reservoir over-filled. 3. External oil leaks. 4. Operating with discharge pressure too low. 5. Drain tube missing, broken or not touching bottom of separator element. 6. Worn, damaged, or restricted separator element. 7. Clogged or restricted separator drain line drain tube or filter.	1. Drain unit and install correct oil. 2. Drain to correct level. 3. Check for and correct all leaks. 4. Operate at rated pressure. 5. Replace drain tube with correct length tube. 6. Service separator element. 7. a. Service drain line filter. b. Check condition and installation of drain line check valve. Clean or install correctly. Replace if worn. Service drain line as required.

ROTARY COMPRESSION TECHNOLOGIES, INC
WARRANTY FOR ROTARY SCREW GAS ENDS
USED IN NON-CONSUMER APPLICATIONS
O.E.M. & GAS

Manufactured

LeROI-RCT warrants its rotary screw compressor products and parts to be in compliance with their respective specifications and free from defects in materials and workmanship during a warranty period ending the earlier of (i) 12 months after the product start up date, or (ii) 18 months after the original date of shipment of the product by LeROI-RCT.

LeROI-RCT's only obligation under this warranty will be, at its election, to repair or replace any part determined to be non-conforming or defective during the applicable warranty period, including ground freight for the gas end. Labor to change out the gas end is not covered. THIS WARRANTY DOES NOT COVER CORROSION.

THE OWNER/USER ASSUMES ALL OTHER RISKS, IF ANY, SUCH AS THE RISK OF ANY DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL LOSS OR DAMAGES ARISING OUT OF THE USE OF, OR INABILITY TO USE, THE COMPRESSOR OR ANY PART.

THIS WARRANTY IS MADE IN LIEU OF THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND MAY NOT BE VARIED OR EXTENDED EXCEPT IN WRITING BY AN AUTHORIZED OFFICIAL OF LeROI-RCT.

Remanufactured

LeROI-RCT warrants its remanufactured rotary screw compressor products and parts to be in compliance with their respective specifications and free from defects in materials and workmanship during a warranty period ending the earlier of (i) 90 days after the product start up date, or (ii) 9 months after the original date of shipment of the product by LeROI-RCT.

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Effective 9/2/05

It Pays to use Genuine LeROI Parts

Provided by Rotary Compression Technologies, Inc

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