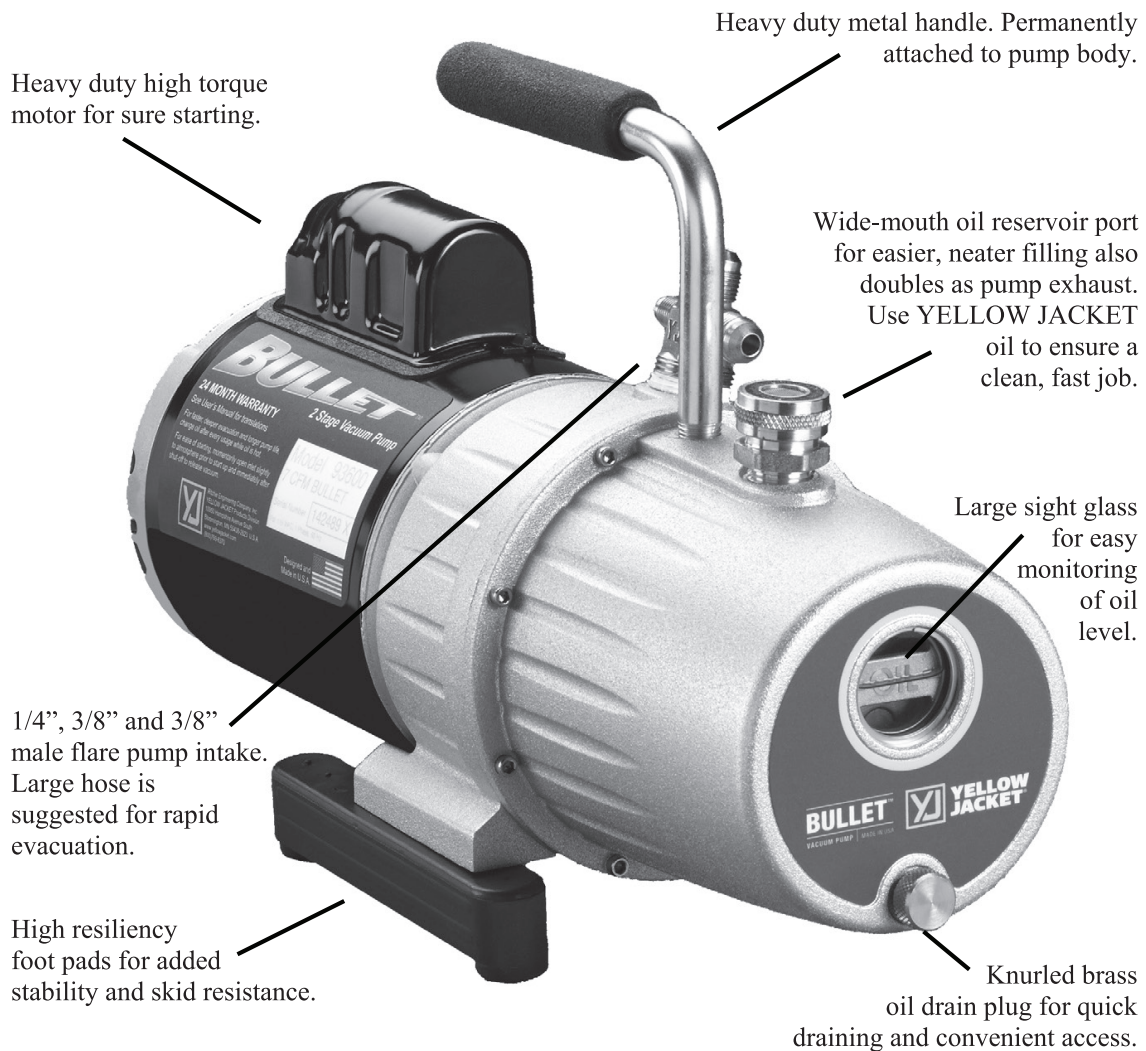




# BULLET™



## Operation and Maintenance Manual

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## **Important Notices to Purchaser**

Check for damage immediately. Prior to shipment, all YELLOW JACKET vacuum pumps are completely tested and inspected to assure compliance with Ritchie Engineering factory specifications.

The CARRIER ALONE is responsible for handling and settling your claim. Ritchie Engineering will cooperate in assessing damage if the pump is returned to the factory prepaid.

If the pump carton is damaged, check contents immediately. Note damage on shipper's Bill of Lading and have shipper sign your statement. Notify the carrier immediately of the damage to arrange inspection of the pump and packaging.

Carton contents include:

- BULLET™ vacuum pump
- Start-up bottle of YELLOW JACKET® SuperEvac™ Pump Oil
- Owner's manual
- Warranty registration card

**To validate warranty, mail registration card within 10 days.**

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## **Warning:**

- This unit generates a deep vacuum that can be harmful to human tissue. Do not expose any part of the human body to the vacuum.
- Do not operate this unit with the exhaust blocked or restricted. Remove red shipping cap prior to use.
- Keep unit a minimum of 4" (10 cm) from objects to provide adequate cooling of motor.
- Continuous sound pressure level of this unit can exceed 70dB (A).
- Always wear goggles and protective clothing when using this product.

## The Purpose of the BULLET™ Design

The BULLET vacuum pump is a 2-stage rotary vane design (at right) that increases efficiency and evacuation speed.

The pump lowers the internal pressure of a refrigeration system until moisture boils into a vapor. As the moisture is vaporized, it is evacuated by the pump, helping dehydrate the system. Most technicians try to achieve between 250 and 1000 microns.

A manometer or electronic vacuum gauge are the only ways to monitor evacuation progress. Manometer readings are approximate in inches of mercury. Only an electronic vacuum gauge (see page 5) is accurate enough to show when you reach the desired micron range.

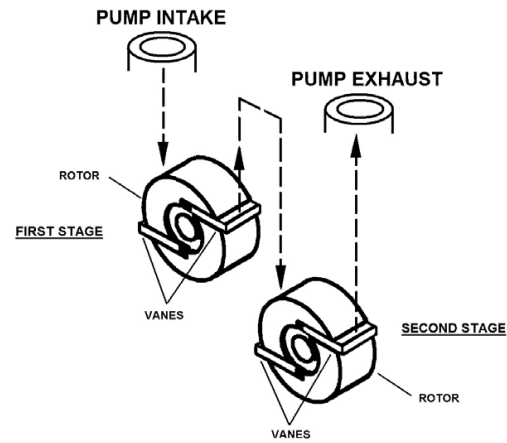
As the chart shows, only an electronic gauge reads fine differences to provide assurance that the vacuum is low enough to boil the greatest possible amount of moisture.

| Boiling temp<br>of water | Inches<br>mercury | Microns |
|--------------------------|-------------------|---------|
| 212°F (100°C)            | 0                 | 760,000 |
| 151°F (66°C)             | 22.05             | 200,000 |
| 101°F (38°C)             | 27.95             | 50,000  |
| 78°F (26°C)              | 28.95             | 25,000  |
| 35°F (2°C)               | 29.72             | 5,000   |
| 1°F (17°C)               | 29.882            | 1,000   |
| - 50°F (-46°C)           | 29.919            | 50      |

### How one small drop dampens your profits.

A small drop of moisture can hurt your profits and reputation.

During new system set-up, protective caps are removed admitting moisture and air into system components.



*First stage exhausts into the intake of the second stage similar to two single stage pumps connected together.*

If air – a non-condensable – remains in the system, it collects on the high side reducing system efficiency. This causes a rise in head pressure. The discharge valve gets hotter than normal and organic solids form causing compressor failure.

Moisture in the system can form ice which closes off openings in expansion valves and cap tubes, and prevent adequate cooling.

Ultimately moisture and air can produce acids and sludge which could cause in-warranty failures.

During service and parts replacement, the same contaminants get in again, and you could be called back for repairs by a dissatisfied customer.

Moisture and air can even enter through system leaks. And as the moisture in the air increases, so does the amount of contamination. The higher the humidity, the bigger your problem.

A vacuum pump "pulls" air and moisture out of the system before the system is damaged. The higher and more complete the vacuum, the more moisture is removed. That's why your BULLET vacuum pump is specifically engineered for high vacuums.

## The 7 Important Steps of Initial Start-Up

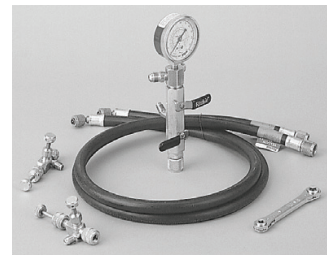
- 1) Make sure motor is off and name plate voltage on motor bottom matches outlet voltage.
- 2) Remove oil fill cap on pump cover. Fill with **YELLOW JACKET SuperEvac Pump Oil** until oil level is even with oil level line.
- 3) Loosen intake cap to open intake to the atmosphere and then switch on the motor. When pump reaches running speed, replace cap. **Stay clear of the oil fill/exhaust port!**
- 4) To check the pump's performance, attach a micron gauge to the 1/4" male flare fitting, making sure that the intake is capped. Turn pump on. The micron gauge will display the ultimate vacuum reached.
- 5) Improve cold weather starting by opening intake and running your pump for 10-15 seconds.
- 6) When turning pump off, open intake fitting until vacuum is released.
- 7) Disconnect pump and put cap on intake to keep out contaminants.
- 8) If an extension cord is needed, use the chart below to determine the proper length:

**RECOMMENDED EXTENSION  
CORD SIZES**

| Total Extension Cord Length (Feet) |        |        |
|------------------------------------|--------|--------|
| 25'                                | 50'    | 100'   |
| 16 Ga.                             | 14 Ga. | 12 Ga. |
| Wire Gauge (AWG)                   |        |        |

## Vacuum Tips for Best Performance

- 1) For the fastest vacuum, connect your pump **directly** to the system. Going through a manifold slows the job.
- 2) Use as **large** a hose as possible, even though the system has 1/4" fittings. A 1/2" or 3/8" hose allows a much faster and more complete vacuum.
- 3) Use as **short** a hose as practical to get maximum evacuation speed. Short hoses make evacuation faster than longer hoses. Long hoses slow the process.
- 4) **Metal hoses** are the most impervious so will be the most effective in evacuation.
- 5) Evacuate through **both high and low** sides at the same time to speed evacuation.
- 6) Use the **4-in-1 Vacuum/Charge Valve and Core Tool** to remove the Schrader valves from the system and evacuate through unrestricted lines for a faster and higher vacuum. Removing Schraders **saves over 30%** in time.
- 7) Use **two pumps** on very large systems to reduce vacuum time. Put one of the pumps on the low side of the system.
- 8) Use a **SuperEvac System I or II** to decrease vacuum time by over 50%. These systems include a 2-valve vacuum manifold and two 3/8" vacuum hoses which can evacuate three times faster than a 1/4" hose.
- 9) Use a heat gun on the condenser and evaporator to speed the evacuation process.



**Part #18975**



## Oil Changes

### CHANGE OIL AFTER EACH USAGE

to protect pump components from contaminants pulled into pump during service. Place used oil in a sealable container and dispose of properly in accordance with local regulations.

YELLOW JACKET vacuum pump oil is specially refined and formulated for extremely low vapor pressure and high pump efficiency at all temperature conditions. This means it can help you get a **continued return on your pump investment.**

In fact, with **proper maintenance**, your pump can keep making money for you up to ten years and more. Proper maintenance includes:

- 1) Change the oil immediately after every use while the oil is still warm. This insures that contaminants are still in suspension and are removed with the oil.

If contaminants cool, solidify and stay in the pump, the lower vacuum efficiency. In extreme cases, the oil stops lubricating and the pump seizes.

- 2) Oil may look clean, but still be contaminated. "Looking clean" is not enough. One job is more than enough to contaminate oil. The only way to determine oil condition is to test vacuum pulled with an electronic vacuum gauge.

When finished with the pump, replace the tethered cap on the intake fittings (check for o-rings in caps). This keeps out moisture and contaminants.

Vacuum levels can be reached only when the correct amount of YELLOW JACKET oil is used. **Damage done by improper oil maintenance or by using the wrong type of oil is not covered under warranty. Refrigerant oil, brake fluid and any other oil such as motor oil cannot be used.**

## Dual Voltage Motor Power Conversion (if applicable)

### STEP 1

Disconnect the motor from the power supply and remove. Remove the yellow "CAUTION" sticker from the back of the motor.



### STEP 2

Pull up on the white plastic "arrow" switch using needle-nosed pliers until the switch is loose inside the motor housing (it will not come completely out of the motor).



Note: Do not try to turn or rotate the switch until it has been pulled up and is loose.

### STEP 3

Point the arrow toward the desired voltage setting and push the switch back down into the motor. The arrow on the switch should be sub-flush of the motor housing when correctly installed at the desired voltage.



HI = 230 VAC / 50 Hz  
LO = 115 VAC / 60 Hz

### STEP 4

Replace the yellow "CAUTION" sticker over the voltage selector switch.

Ensure that the voltage setting corresponds with the power supply that the motor is plugged into.\*



**\*Warranty is void if the set vacuum pump voltage does not match the power supply.**  
Dual voltage motors are factory set to 230 V/50Hz.

## Basic Troubleshooting

### 4 most common comments on pump return paperwork

- 1) **"Will not pump"** This usually means the pump will not pull a high enough vacuum. This can be caused by valve being left open, missing "O"-rings under caps or contaminated oil.

SUGGESTION: Change valve and "O"-rings, change oil twice and recheck vacuum.

- 2) **"Will not pull below 1000 microns."**

SUGGESTION: Check for "O"-rings. Test pump to determine actual pull down. Remove all hoses and adapters and connect vacuum sensor directly to the pump.

- 3) **"Noisy."** Pumps are noisy when they have not achieved a high vacuum. In intermediate vacuum, there will be oil, vane and exhaust noises.

SUGGESTION: Listen to the pump at high vacuum. If relatively quiet, the pump is running properly. If still noisy, there may be a system leak.

- 4) **"Repair and return."** This is the most difficult return comment to handle, since we are unsure of what needs to be done to keep the customer satisfied.

SUGGESTION: Be specific about the problem with your pump if returning it.

### Starting problems

- Be sure pump is plugged into live receptacle with line voltage plus or minus 10% of voltage on motor nameplate. Long extension cords can greatly reduce voltage and cause problems.
- Pump/oil temp. must be 30°F (-1°C) or higher. Open intake to atmosphere and switch on pump; run up to speed before connecting to system.

- Your YELLOW JACKET vacuum pump features a heavy-duty high torque motor for cold weather starting, but dirty oil makes starting more difficult, causing unnecessary wear on your unit.
- Dropping your pump can damage it. In a locked pump condition, motor will not run and the thermal overload will kick out.
- Disconnect power cord, drain oil, and set pump with front cover face down on table. Reach into coupling area and try to rotate the coupling. Do not use pliers. If the pump does not rotate, it is "locked up."

### Oil leakage

- If leak develops between front and rear half of oil case, tighten all eight screws. Replace gasket if necessary.
- If shaft seal leaks, replace it.
- Wipe pump dry and watch for source of leak. Tighten screws and repair.

The steps to solving 95% of all problems

- 1) **Check oil level when pump is running.** It should be 1/2 to 5/8 up in the sight glass, the level necessary for proper operation.
- 2) **Check vacuum pump.** Connect micron gauge directly to the 1/4" port and cap intake port. Turn on pump and check vacuum reading. If reading is good, check the system for leaks. OR, if testing a system, isolate pump with blank-off valve and get vacuum reading from the pump alone. If the pump does not pull and stay at a good vacuum level, run until hot and change oil.
- 3) **Check all flare connections.** Make sure they are tight with good seals.

## Diagnostics Chart

| Condition        | Pump Area                                                           | Possible Problem                                                                                                                         | Solution                                                                                                                                        |
|------------------|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Poor vacuum      | Quiet pump                                                          | Dirty oil<br>Drive coupling or set screw loose<br>Bent or broken exhaust valve<br>Pump not oiling<br>Vaness not functioning              | Flush 1 to 3 times<br>Repair or replace<br>Repair or replace<br>Call factory<br>Call factory                                                    |
|                  | Ultimate of pump - does not meet mfg. spec (read with thermocouple) | Pump dropped<br>Micron gauge malfunction<br>Poor motor performance<br>Dirty oil<br>Air leaks<br>System leaks<br>Fitting sealant compound | Call factory<br>Verify with second gauge<br>Repair or replace<br>Flush 1 to 3 times<br>Repair or replace<br>Isolate/repair<br>Repair or replace |
| Oil Leaks        | Exhaust                                                             | Oil level high<br>System vented pressure through pump<br>Pump tipped over                                                                | Adjust oil level<br>Check oil level, add or replace oil<br>Check oil level, add or replace oil                                                  |
|                  | Seal                                                                | Worn or damaged seal<br>Motor loose                                                                                                      | Replace<br>Adjust/tighten, check seal                                                                                                           |
|                  | Case                                                                | Gasket bolts loose<br>Oil drain fitting<br>Gasket damaged                                                                                | Tighten<br>Repair or replace<br>Replace                                                                                                         |
| Pump won't start | Motor stalled hot/cold                                              | Damaged motor<br>Damaged pump<br>Closed intake                                                                                           | Repair or replace<br>Replace/call factory<br>Open intake fitting                                                                                |
|                  | Thermal                                                             | Low voltage<br>Cold weather cut-out<br><br>Dirty oil                                                                                     | Shorter extension cord<br>Open intake fitting for 10 - 15 seconds to warm up while starting<br>Flush 1 to 3 times                               |
| Poor vacuum      | Noisy pump                                                          | System leaks<br>Low oil level<br>Dirty oil<br>Worn pump<br>Air leaks and fittings or gasket seals                                        | Repair leaks<br>Add/replace<br>Flush 1 to 3 times<br>Replace cartridge<br>Replace/repair                                                        |

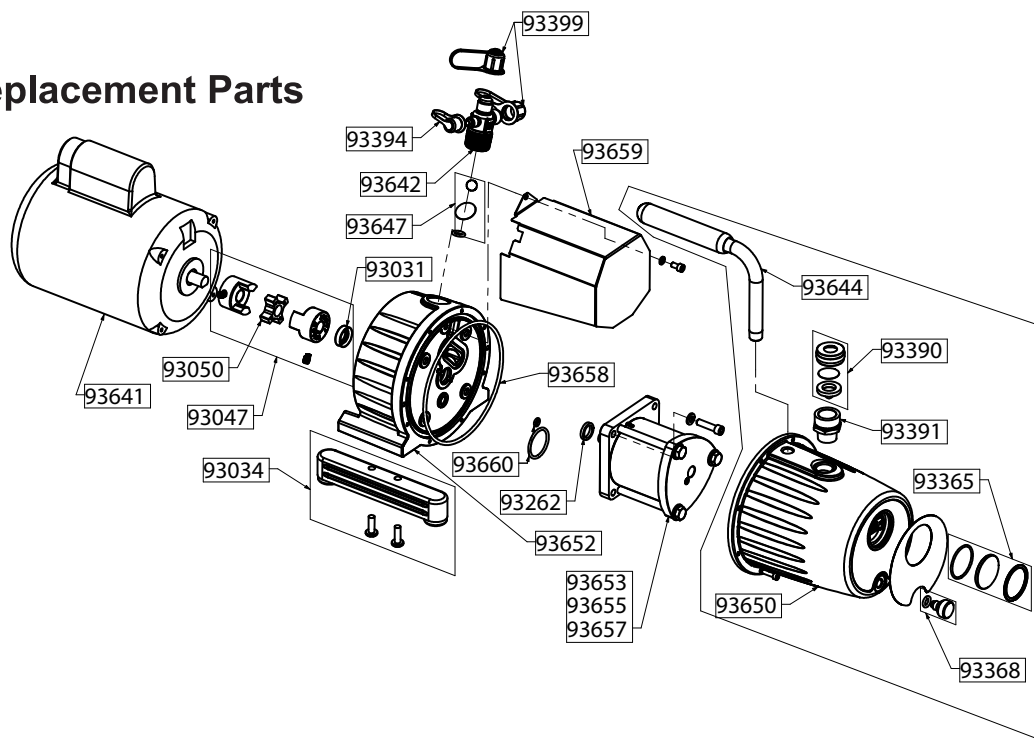
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## Diagnostics Chart, cont.

| Condition       | Pump Area      | Possible Problem                                                                                                     | Solution                                                                                                                                 |
|-----------------|----------------|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Unusually noisy | Motor areas    | Worn motor<br>Loose motor bolts<br>Drive coupling                                                                    | Replace motor<br>Tighten bolts<br>Adjust/replace coupling                                                                                |
|                 | Pump cartridge | Dirt, low, improper oil<br>Air leaks:<br>1) caps/connection<br>2) Gaskets/"O"-rings<br>3) Fittings<br>4) System leak | Flush and replace oil<br><br>Tighten<br>Replace/put on oil<br>Replace/reseal<br>Isolate pump with blank-off valve and repair system leak |
| High temp       | Motor          | Low voltage                                                                                                          | Short extension cord                                                                                                                     |
|                 | Pump           | Dirty oil<br>Low oil<br>Parts friction<br>Too small for system<br>Air leaks                                          | Flush and replace<br>Add/replace<br>Replace oil/call factory<br>Size pump for system<br>Replace/repair                                   |



## Replacement Parts



| Part #                   | Description                                            | Part #              | Description                                            |
|--------------------------|--------------------------------------------------------|---------------------|--------------------------------------------------------|
| 93031                    | Shaft seal                                             | 93513               | 1/2 hp motor - dual voltage<br>115V/60 Hz, 230V/50 Hz  |
| 93034                    | Universal pump leg (1)                                 | 93394               | 1/4" flare cap and strap                               |
| 93047                    | Drive Coupling                                         | 93399               | 3/8" flare cap and strap                               |
| 93050                    | Coupling spider for 93047                              | 93641               | 1/2 hp motor - 115V/60 Hz                              |
| 93115*                   | 8' long US cord                                        | 93642               | 3/8", 3/8" and 1/4" male flare intake fitting          |
| 93262                    | Cartridge ring                                         | 93644               | BULLET pump handle                                     |
| 93365                    | Sight glass                                            | 93647               | BULLET anti-suckback assembly                          |
| 93368                    | Oil drain                                              | 95431*              | 8' long EU cord (detachable IEC-320)                   |
| 93390                    | Oil fill cap                                           | 95432*              | 8' long UK cord (detachable IEC-320)                   |
| 93391                    | Oil fill fitting                                       |                     |                                                        |
| <b>Built 2010 - 2013</b> |                                                        | <b>Built 2014 -</b> |                                                        |
| 93633                    | 3 CFM (85 L/M) complete cartridge with intake gaskets  | 93653               | 3 CFM (85 L/M) complete cartridge with intake gaskets  |
| 93635                    | 5 CFM (142 L/M) complete cartridge with intake gaskets | 93655               | 5 CFM (142 L/M) complete cartridge with intake gaskets |
| 93637                    | 7 CFM (200 L/M) complete cartridge with intake gaskets | 93657               | 7 CFM (200 L/M) complete cartridge with intake gaskets |
| 93643                    | BULLET pump cover gasket                               | 93658               | BULLET pump cover gasket                               |
| 93646                    | BULLET cartridge baffle                                | 93659               | BULLET cartridge baffle                                |
| 93648                    | BULLET cartridge gaskets                               | 93660               | BULLET cartridge gaskets                               |
| 93649                    | BULLET pump cover assembly                             | 93650               | BULLET pump cover assembly                             |
| 93661**                  | BULLET conversion kit                                  | 93652               | Complete BULLET mounting body                          |

\*Damaged supply cords must be replaced by special assemblies available from the manufacturer or its distributors.

\*\*BULLET conversion kit includes all parts required to convert 2010-2013 BULLET pumps to 2014-BULLET pumps. Includes 93658, 93659, 93660, 93650 and 93652 (2010-2013 mounting body not available).

## WARRANTY INFORMATION

Ritchie Engineering guarantees YELLOW JACKET products to be free of defective material and workmanship which could affect the life of the product when used for the purpose for which it was designed. This warranty does not cover items that have been altered, abused (including failure to use the correct type of vacuum pump oil) or returned solely in need of field service maintenance.

If found defective, we will either replace or repair at our option products within warranty period. Returns must be prepaid.

Warranty does not cover use of lithium bromide, ammonia or leak stop type products.

## How to Obtain Service

Most returned pumps are merely in need of normal field service maintenance, such as changing oil or making minor adjustments. In many instances, the troubleshooting information in this manual can save you the time and effort of returning your pump. When the information contained in this manual, however, does not solve the problem, please call for service.

