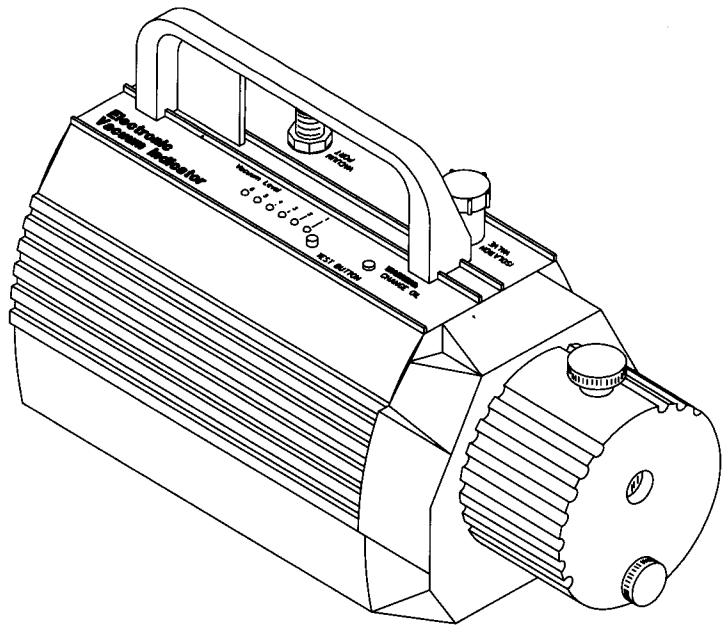
MAC TOOLS, INC.
Washington Court House
Ohio 43160

MADE IN U.S.A.

PATENT APPLIED FOR

PM068MAC 5/91

AC9100V
ELECTRONIC VACUUM SYSTEM
OWNER'S MANUAL



be attracted to the oil; all three will mix and be soluble in one another.

Sludge can exist as minute slimy or sticky solids, powdery solids or thick, slimy and oily liquids. Sludge will break the oil down and reduce its lubricating abilities, causing severe mechanical damage to the system. If any mechanical parts have corroded from the hydrochloric acid, small particles from the corroded parts will be carried in the sludge.

These sludges and solids tend to build up at the hottest point in the system, where the discharge valve seats. The valves will no longer seat properly, and "wiredrawing" occurs. (Wiredrawing is vapor being forced through a very small orifice at a very high speed, creating friction and elevating temperature up to 1000°F.)

Technicians must realize that, to avoid corrosion and sludging problems in cooling systems, moisture must be kept out through good service practices and effective preventative maintenance.

Sludging and corrosion will cause expansion devices, filter driers and strainers to plug up and malfunction. So, once moisture is in a cooling system, the only sure way to rid the system of its presence is with good evacuation procedures using a high vacuum pump.

Once sludge is formed, standard cleanup procedures must be followed using over-size driers specified for removing solids. Vacuum pumps are just not designed to remove those. Assuredly, deep vacuum procedures will not take the place of liquid line or suction line driers, because the vacuum pump can't remove solids.

Deep Vacuums

Many service technicians believe that a vacuum pump actually sucks out "liquid" moisture particles from the system. This is incorrect. Even if there was moisture in the cooling system that existed as both liquid and vapor, the vacuum still couldn't draw out liquid water.

What actually happens with a vacuum pump is that the system's pressure is reduced to the boiling point of water at normal temperatures. For example, water boils at 212°at an atmospheric pressure of 14.696 psia (0 psig). So, to vaporize any liquid moisture from the cooling system at atmospheric pressure, the system would have to be at 212°, which is not considered normal temperature.

To vaporize (boil) water at lower temperatures, the cooling system's internal pressure must be lowered. If it can be lowered significantly, any liquid water will be vaporized and, thus, drawn through the vacuum pump and expelled into the atmosphere.

The lower the internal pressure, the lower the moisture's boiling point. By referring to the Boiling Point Chart, a technician can see that, if the system's internal pressure is lowered to 1.006 psia (27.75 in. Hg.) water in the system will boil at 104 °. But the system still must be exposed to 104° temperatures for vaporization to occur.

Now, if the internal system pressure was brought down further to 28.67 in. Hg. any moisture in the system would vaporize at 86°- a more reasonable temperature, since it would not require artificial heat.

Once all moisture has been vaporized from the system, the vapor pressure and the heat dissipation rate will decrease; thus, the measurement will decrease. This low measurement, not the time on a wristwatch, will tell the service technician when evacuation is complete.

The more vaporization of water, or degassing of unwanted gases, the more time it takes to reach a high vacuum level (when using the same size vacuum pump). Vacuum pump capacity is measured in cubic feet per minute (CFM).

Vacuum pump capacity has little to do with evacuation, because of internal restrictions innate to cooling systems. Metering devices, length of tubing, return bends and service valve orifices all offer restrictions during evacuation.

The only way to increase flow through a fixed orifice is to increase the pressure difference across that orifice. However, when evacuating a system, the pressure source in and out of the system on a 3/16 in. gauge orifice isn't much to work with.

For this reason, vacuum pumps in the 1 to 3 CFM range should handle 95% of the work. Reducing the system's pressure drop will, though, decrease the evacuation time. This can be accomplished by pulling a vacuum through the system's high and low sides, provided the connecting hoses and manifold are not too restrictive.

TABLE OF CONTENTS

WARRANTY

This unit is designed and produced to provide unlimited service. Should it become inoperative after performing the recommended maintenance, a no charge replacement will be made to the original purchaser within one year from date of purchase.
This warranty applies to all repairable units and components (except as noted below) which have not been tampered with, misused or damaged.
This warranty does not cover filters or sensors which are subject to contamination or normal wear of pumping components, and/or seals.

BEFORE RETURNING THE UNIT FOR REPLACEMENT OR SERVICE

1. TAKE THE FOLLOWING STEPS TO MAKE SURE THAT UNIT RETURN IS REALLY NECESSARY:
   A) Read the operating instructions to make sure the unit is being operated properly.
   B) Consult the Troubleshooting Guide to determine of the problem can be easily resolved.
   C) Verify suspected faults by following the prescribed test procedure.
   D) Contact Technical Service at 1-800-327-5060
   E) Follow instructions outlined by Customer Service Representative.

NOTE: A $25.00 PROCESSING FEE WILL BE CHARGED BACK TO THE CUSTOMER IF THE UNIT IS RETURNED TO THE FACTORY FOR REPAIR AND FOUND TO BE IN GOOD WORKING CONDITION.

2. PREPARE UNIT FOR RETURN SERVICING:
   A) Drain ALL oil from the pump reservoir.
   B) Pack the unit in the original shipping carton or a secure equivalent and ship to:

MAC TOOLS, INC.
Customer Repair Dept.
3360 N.W. 110th Street
Miami, FL 33167

Note: C.O.D. shipments will not be accepted.

FEATURES

- ELECTRONIC VACUUM SENSOR WITH LED INDICATORS
- OIL CONTAMINATION SENSOR AND WARNING LIGHT
- BUILT-IN ISOLATION VALVE FOR LEAK CHECKING
- AUTOMATIC PURGE TO PREVENT ROTOR LOCK-UP
- DIAGNOSTIC TEST BUTTON
- OFFSET ROTARY VANE PUMP DESIGN
- VACUUM SENSOR/INDICATOR NEEDS NO CALIBRATION AND IS UNAFFECTED BY TEMPERATURE
- OIL LEVEL WINDOW
- EXTRUDED ALUMINUM AND ABS HOUSING
- ONE YEAR WARRANTY
- MADE IN THE USA

WARNINGS

This unit is intended for use only by trained and qualified professional service personnel. This unit should only be used on Air Conditioning and Refrigeration systems utilizing halogenated refrigerants (e.g. R-12, R-22, R-502, R-134a). The same unit should never be used for both CFC (R-12, 22, 502) and HFC (R-134a) evacuation due to the possibility of cross contamination. Always take adequate precautions and wear safety goggles when working with such systems. A manifold gauge set should be used in conjunction with this unit. Any misuse or improper application of this unit will automatically void the warranty.

PRECAUTIONS

- Connect only to 110-130 VAC/60Hz (or 220-250 VAC/50Hz for International versions) Do not defeat the ground by removing or cutting the ground pin.
- If an extension cord is necessary, use only a three wire cord of at least 16 gauge (16/3).
- Do not operate unit without the proper amount of the correct grade oil. Use of an improper grade oil may reduce performance and will void the warranty.
- Use only on A/C or Refrigeration systems utilizing halogenated refrigerants. Do not use on ammonia or other such systems.
- Do not evacuate full systems or systems which still contain refrigerant. Refrigerant should be recovered with an approved recovery unit and ONLY empty systems should be evacuated.
- Do not evacuate both CFC and HFC systems with the same unit.
- Keep cap on vacuum port when not in use to prevent dirt and moisture from entering unit.

TROUBLE SHOOTING GUIDE

If you encounter a problem with the unit, check the possible causes listed below and/or call Customer Service TOLL FREE at 1-800-327-5060 before returning the unit.

Problem	Cause	Solution
Unit will not run	• Not plugged into live outlet • Thermal overload on motor triggered	• Check plug connections • Check outlet • Wait 15 minutes and try again.
Vacuum Indicators do not light when diagnostic test button is depressed	• Unit not plugged into live outlet • Faulty PCB or LEDs	• Check plug • Check outlet • Return for repair
No VACUUM Indicators light during evacuation but test "OK" with diagnostic test button.	• Isolation valve closed • Large leaks in connections/ system • Faulty vacuum sensor	• Open valve • Check as described on pg. 11, if tests "OK", there is a leak in refrigeration system; repair. • Verify sensor fault by testing as described on pg.11 . Replace with 9101 kit if necessary.
Some indicators will not light during evacuation	• Contaminated oil • Moisture laden refrigerant system • Low oil level	• Check oil warning light, if on, change oil. • Close isolation valve and verify moisture presence as described on pg. 17. Continue evacuation and check until moisture is removed. • Check level and fill, if necessary.
All Vacuum Indicator Lights go out when Isolation Valve is closed	• Leak in connections • Leak in Refrigerant System	• Test as described p.13 , and repair if necessary. • Locate and Repair
Some lights slowly go out when Isolation Valve is closed	• Moisture remains in system	• Open Isolation Valve and continue evacuation

DESCRIPTION OF PARTS & CONTROLS

■ POWER SWITCH & AUTO PURGE FEATURE

The power switch is used to turn the unit ON and OFF. It should only be operated when the unit is plugged into the correct power supply. When switched to the OFF position an automatic purge feature is activated and vacuum is released. (see diagram 2)

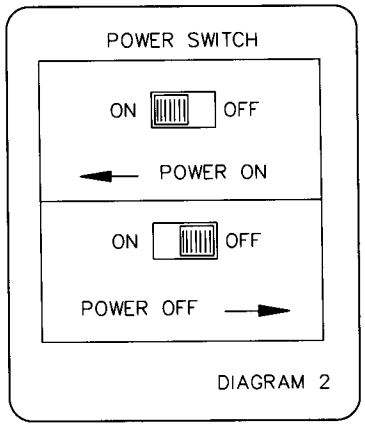


DIAGRAM 2

■ WARNING - CHANGE OIL LIGHT

(OIL CONTAMINATION INDICATOR)

This warning light will constantly illuminate when the pump oil needs to be changed. It is possible that this light may flash on and off during initial evacuation, disregard a flashing indicator. If the warning light is on CONSTANTLY the oil must be changed. (see diagram 3)

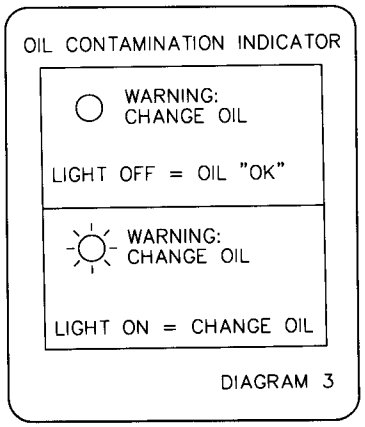


DIAGRAM 3

■ INTAKE FILTER MAINTENANCE

A fine mesh filter is attached to the bottom of the vacuum port, in order to keep any contaminants from entering the pump mechanism.
From time to time it is advisable to check that adequate suction is being maintained through the port. Simply switch the unit on and cover the port with a finger to determine if there is a strong vacuum (make certain the isolation valve is open).

If necessary, remove the vacuum port with a 5/8" open ended wrench and clean the filter screen with a solvent or compressed air. Reinstall with tape dope or other thread sealant, tighten finger tight and then snug up with a wrench.

■ ISOLATION VALVE REPLACEMENT

If the isolation valve has been diagnosed as faulty, it can be repaired in the field. Make certain that you have a repair kit before proceeding. This kit (Part #9106) can be ordered from your local distributor.

- Turn the isolation valve in a counter-clockwise direction until valve is completely open.
- Remove the isolation valve knob by grasping knob firmly and pulling in an upward direction off the valve stem. (see diagram 24)

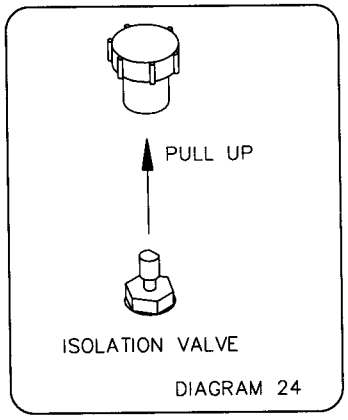


DIAGRAM 24

- Use a 9/16" open ended wrench on the mounting nut and unscrew the valve in a counter-clockwise direction and remove.
- Use a small slotted screwdriver and unscrew the retaining screw that holds the seal onto the bottom of the valve. Discard the old seal and replace with the new seal provided in the repair kit. Carefully tighten in place with retaining screw. (see diagram 25)

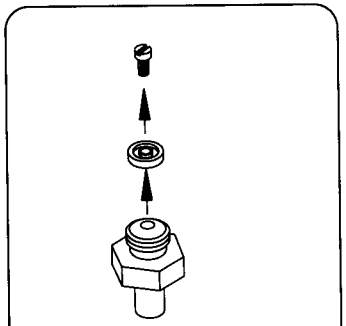


DIAGRAM 25

■ VACUUM PORT

This is the intake of the 9100V. It is a standard 1/4" male flare fitting. Connect the vacuum hose (usually black or yellow) from a manifold gauge set to this port. Use the cap provided when not in operation or when performing the initial test. The port includes a fine mesh screen to prevent external contaminants from entering the unit. From time to time, check the port to verify free passage as described in the Maintenance section. (see diagram 6)

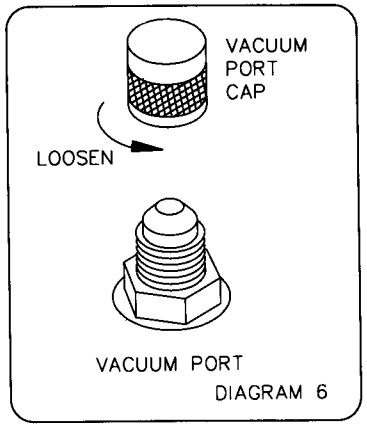


DIAGRAM 6

■ FILL PLUG/EXHAUST VENT

Remove the plug to fill the oil reservoir (turn counter-clockwise to remove and clockwise, till finger tight, to insert). Never operate the unit without this plug properly installed. This plug has been cross-drilled to provide an exhaust for the evacuated gases. (see diagram 7)

Note: Water vapor will be released and may appear in the form of steam; this vapor is completely harmless.

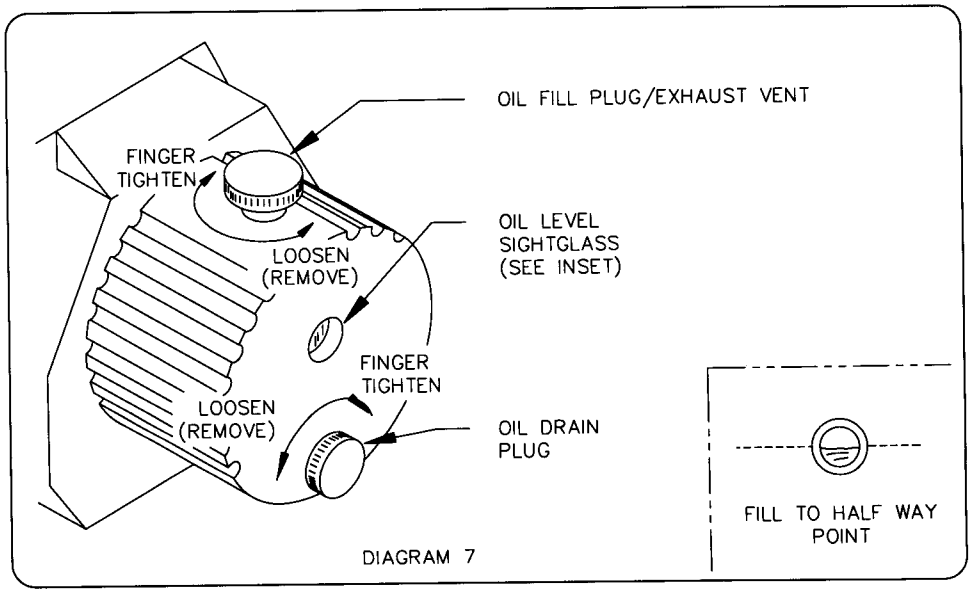


DIAGRAM 7

- Make certain you have a Replacement Kit (part # TIF 9101) before proceeding. DO NOT operate the unit without the vacuum sensor.
- Three common tools will be needed; a 5/16" open ended wrench, a pair of wire cutters and a medium size phillips screwdriver.

TO REPLACE SENSOR:

CAUTION: Make Sure Unit Is Unplugged.

1) Remove the eight (8) screws (see diagram 21) securing the back cover on the unit to expose the sensor (see diagram 22).

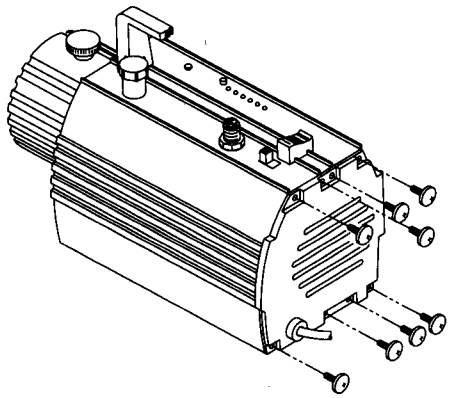
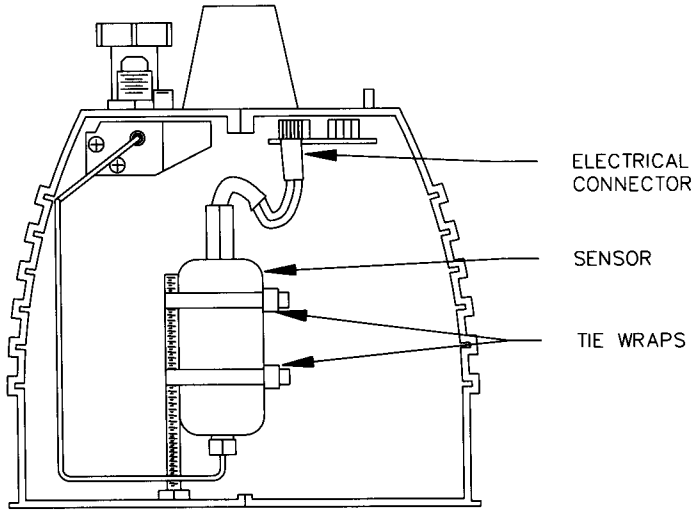


DIAGRAM 21

DIAGRAM 22



PREPERATION & SET-UP

■ OIL FILL

After unpacking, and before using, the oil reservoir must be properly filled. Included with your unit is a bottle of premium Vacuum Pump Oil which contains the exact amount of oil necessary for one complete fill. (see diagram 8)

- Remove the Fill Plug and make certain the Drain Plug is finger tight
- Remove the cap from the oil bottle and slowly pour the entire contents into the reservoir.
- Wipe up any oil that may have been spilled.
- Replace fill plug and tighten finger tight.

Note: Refer to the maintenance section for information regarding refills and replacement parts.

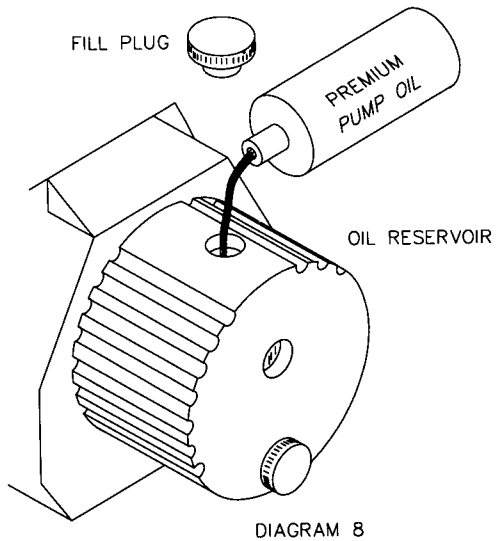
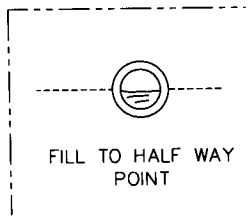


DIAGRAM 8



MAINTENANCE

■ OIL CHANGES

For optimum performance, change the oil after each evacuation. The oil should be changed whenever the Warning Change Oil light is CONSTANTLY ON. Failure to do so will reduce efficiency and decrease the performance life of the unit.

NOTE: Use only oil designed specifically for vacuum pumps. Use of an improper grade oil may affect performance and will automatically void the warranty.

TO DRAIN THE OIL RESERVOIR (see diagram 19):

1) Place an appropriate container beneath the drain plug and oil reservoir.
2) Remove the fill plug by turning counter-clockwise.
3) Remove the drain plug and allow oil to drain from the reservoir. It will be necessary to tilt the back of the unit in order for all oil to flow out.
4) Clean any sludge away from, and out of, drain hole.
5) Clean and replace drain plug, turn clockwise until finger tight.

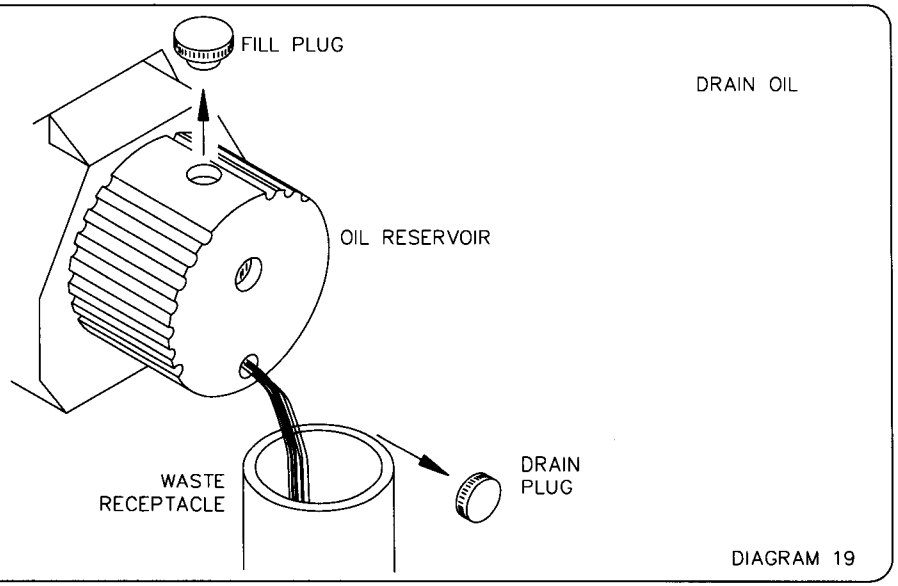


DIAGRAM 19

OIL QUALITY TEST

Monitor the Warning Change Oil Light: if light is CONSTANTLY ON the pump oil should be changed before proceeding; refer to the maintenance section. If light remains OFF the oil quality is OK, proceed with sensor test.

VACUUM SENSOR TEST

(see diagram 11)

1. Seal vacuum port with cap provided. Make sure the O-ring is properly seated at the bottom of the cap.
2. With power cord connected, turn unit on.
3. Open isolation valve (counter-clockwise).

4A. The LED vacuum indicators should begin to light after a few seconds. Run until all LEDs are lit. If all indicators light, the vacuum sensor is OK.

4B. If any or all indicators do not light, check the following: Isolation Valve open; Vacuum Port sealed; Warning Change Oil light off. If any of the indicators do not light after performing these checks then the Vacuum Sensor must be replaced. Refer to the maintenance section of this manual for detailed replacement instructions.

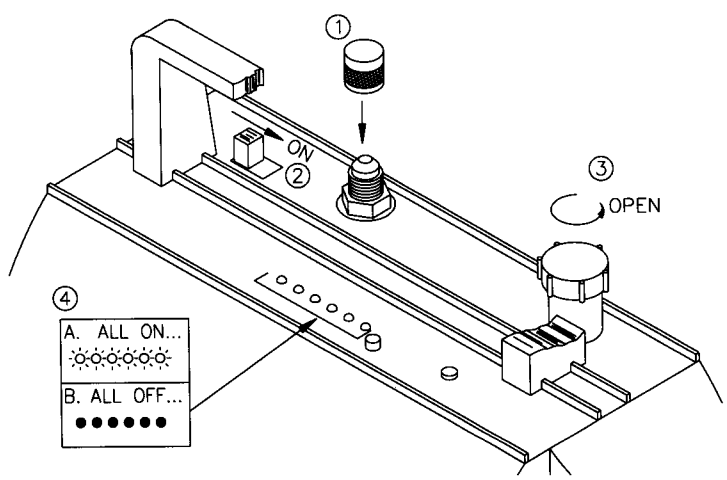


DIAGRAM 11

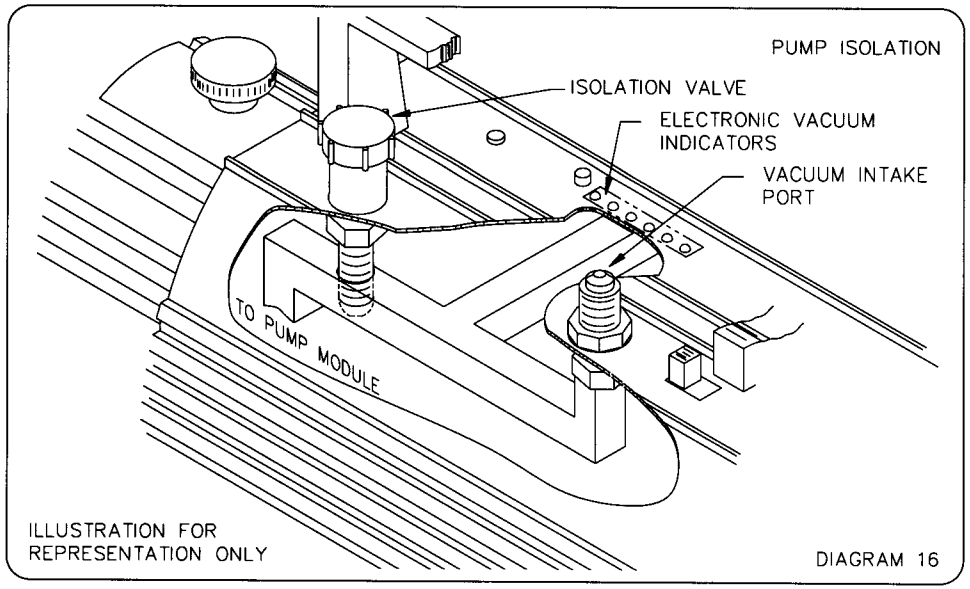


DIAGRAM 16

- Monitor the vacuum indicators for five minutes, this allows vacuum to equalize throughout the entire system; three possibilities may exist: (see diagram 17)

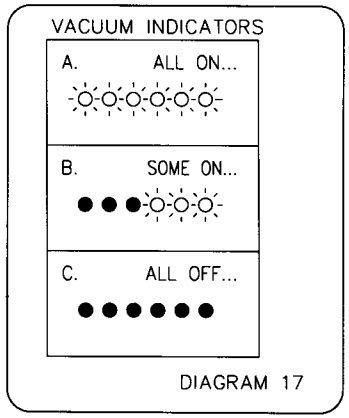


DIAGRAM 17

A) ALL INDICATORS REMAIN ON. Evacuation is complete, a high vacuum has been maintained and no moisture or leaks are present.
B) SOME INDICATORS SLOWLY GO OUT, ONE OR SOME MAY STAY ON. Moisture remains in the system. Open isolation valve and resume evacuation following steps outlined above.
C) ALL INDICATORS GO OUT. A leak is present in the refrigerant system. Identify leak location, repair and repeat test.

- Evacuation is complete when all indicators remain on for several minutes, as described in condition A, above. Close all manifold valves, disconnect hose from vacuum port and turn off 9100V.

- Before proceeding, test manifold and hoses for leaks (see diagram 13). Connect low and high side hoses from their respective inlet ports to blind ports on manifold (ensure that hose seal are in good condition).If using a 2-way manifold, open both valves; if using a 4-way manifold, open low side, high side and vacuum port valves (keep charging port valve closed).

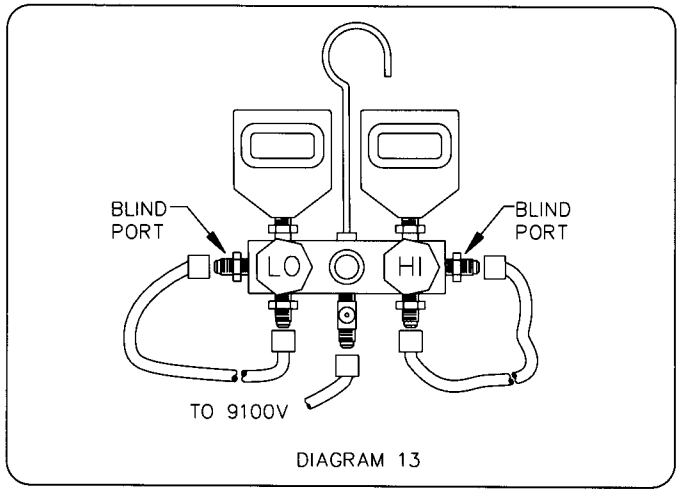


DIAGRAM 13

- Connect 9100V to 115VAC (or 230VAC for International versions) power supply. Open isolation valve (counter-clockwise) and turn unit on. Run until all vacuum indicators are lit. If all lights will not illuminate (and the unit has been checked OK per Test Procedures Section) a leak is present in either the connections, hoses or manifold; locate, repair and re-test. After all LEDs are lit, close isolation valve (clockwise). If any of the LEDs go out a leak is present in either the connections, hoses or manifold; locate, repair and re-test.