GENERAL INFORMATION

REFRIGERANT

The refrigerant used in the air conditioning systems of all Ford Motor Company Products is called "Refrigerant 12." It is manufactured by DuPont Company, under the name of "Freon 12"; General Chemical Company, under the name of "Genetron 12"; and by Penn Salt Company, under the name of "Isotron 12". All three have the same chemical formula – CCL_2F_2.

To avoid confusion, we will refer to the gas as "refrigerant 12." This refrigerant is nonexplosive, non-inflammable, noncorrosive, has practically no odor, and is heavier than air.

Safety Precautions

Liquid Refrigerant 12, at normal atmospheric pressure and temperature, evaporates so quickly that it freezes anything it contacts.

CAUTION: *Extreme care must be taken to prevent any liquid refrigerant from coming in contact with the skin and expecially the eyes.*

Refrigerant 12 is readily absorbed by most types of oil. It is recommended that a bottle of sterile mineral oil and a solution of weak boric acid be kept available when servicing the air conditioning system.

Should any refrigerant get into the eyes, use mineral oil to wash them out, followed by a wash of weak boric acid solution. Immediately following this first aid treatment, seek a doctor's aid.

CAUTION: *Always wear safety goggles when servicing any part of the system. The refrigerant is always under pressure. NEVER SUBJECT THE CAR TO ANY INTENSE HEAT THAT WOULD CAUSE THIS PRESSURE TO BUILD UP EXCESSIVELY.*

Liquid refrigerant evaporates very rapidly when it is discharged into the atmosphere. Being heavier than air, it will displace the air where the refrigerant is released.

CAUTION: *To avoid possible suffocation in enclosed areas, always discharge the refrigerant into the garage exhaust collector or outside the building.*

Always maintain good ventilation around the work area. Small traces of refrigerant gas in the air around the work area can prevent accurate leak testing.

CAUTION: *Never heat the Refrigerant 12 tank with a torch. A dangerous explosion may result.*

Refrigerant 12, under normal conditions, is non-poisionous. However, a very poisioning gas is generated when the refrigerant is discharged near an open flame. This same gas is also generated in small quantities when the flame-type leak detector is used. Therefore, THE FUMES FROM THE LEAK DETECTOR SHOULD NOT BE INHALED.

If any service operation requires the use of bake ovens, heat lamps, steam cleaning or welding equipment in an area near the air conditioning components, the system should be discharged. (Refer to "Discharging the System".) When the car temperature has returned to normal, recharge the air conditioning system. (Refer to "Charging the System".)

Refrigerant 12, like other commercial gases, must be stored and handled in accordance with all state and local ordinances.

REFRIGERATION OILS

The Air Conditioning compressor is somewhat similar to the automobile engine insofar as it has pistons, rings and a crankshaft. Just as in the engine, these parts which rub against each other must be protected against wear and heat. This is the job of the lubricant, but the demands for a suitable lubricant are far different from those of an engine. For one thing, Refrigerant 12 has a very high miscibility for lubricating oils. That is, the lubricating oils and the refrigerant mix together very well. If we allow the refrigerant to escape from an Air Conditioning system too rapidly, you will notice a small pool of oil form at the outlet end of the escape hose. Because of the manner in which the refrigerant and oil mix, the lubricating oil is carried throughout the entire air conditioning system. It is subjected to high temperatures within the compressor and condenser and lower than freezing temperatures at the expansion valve and evaporator. Because of the conditions under which this oil must lubricate, a very careful study was made of available oils. It is also important that, in service, we use ONLY the specified oil and also that we PROTECT this oil and prevent it from becoming contaminated. It goes without saying that dirt and other foreign material should be kept from it. Remember, moisture, even in minute amounts, can freeze within the expansion valve and cause a malfunction. If exposed to the atmosphere for any appreciable length of time, the refrigerating oil will absorb some of the moisture in the air with a resulting freezing in the expansion valve. *When not in use, always keep the refrigerating oil container tightly sealed.*

NOTE: *All Ford Motor Company Air Conditioning Systems use Suniso 5G or Capella E refrigerating lubricant. These are preferred. If, however, neither of these oils are available, it is permissable to substitute Suniso 4G or Capella D. It is important that the oil level of the compressor be checked from time to time. It is also advisable to run the Air Conditioning System once a week in the winter months in order to circulate the oil and thus prevent the compressor shaft seal from drying and cracking.*

REFRIGERANT LINES AND FITTINGS

The following general practices should be observed when performing any service operation involving the refrigerant carrying lines and connecting fittings.

1. When disconnecting any fitting in the system, proceed cautiously regardless of the gauge readings. Open the connection very slowly and wear safety goggles to protect the eyes should any liquid refrigerant be discharged.

2. When any connection is opened, it should be capped or sealed immediately to prevent the entry of dirt, air, or moisture.

3. Tubing flares and flare seats should be coated with compressor oil before they are tightened. Flares and flare seats must be in perfect condition. The slightest burr or the most minute particle of dirt can result in a leak after the fitting is tightened.

4. The refrigerant lines should be free of kinks or sharp bends. The refrigeration efficiency can be greatly reduced by improper routing of lines during installation.

5. Use two wrenches to loosen or tighten fittings. Always hold the flare seat stationary so that the seal between the seat and line will not be broken.

Checking for Leaks.

The system should be leak-tested if it has been opened for any service operation, if cooling in insufficient, or when bubbles are observed passing through the liquid sight glass.

A gas-operated torch-type leak detector with a replacable gas cylinder is used to locate refrigerant leaks. (See figure 2-1)

Following are instructions for use of the leak detector:

1. Open the valve of the leak detector until a slight hiss of gas is heard; then, ignite the gas at the opening in the burner.

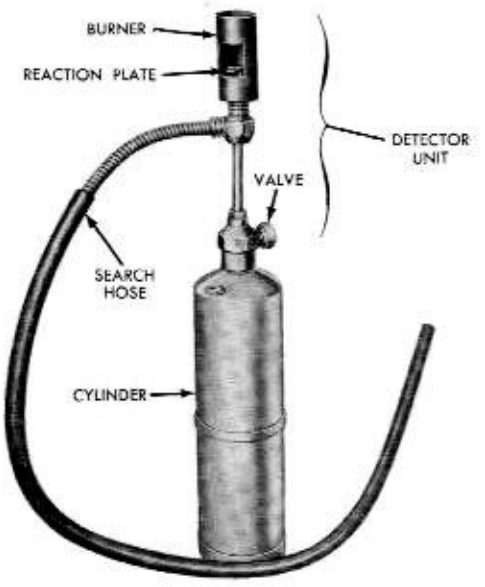


Fig. 2-1–Torch-Type Leak Detector–(E-2618)

2. Adjust the leak detector torch to a very small flame and allow the reaction plate to become bright red. Hold the tip of the search hose all around each connection, especially the compressor shaft seal. *Be sure to allow enough time for the refrigerant gas to travel through the search hose before moving to another fitting.*

The refigerant is heavier than air. Therefore, a leak at the top of a connection may be detected when the search hose is held at the bottom of the connection. (See figure 2-2.) Small amounts of refrigerant gas will cause the flame to turn green. A large leak will turn the flame blue.

3. If a leak is found, correct the leak and charge the system as necessary. Refer to "Partially Charging the System", "Evacuating the System", and "Charging the System".

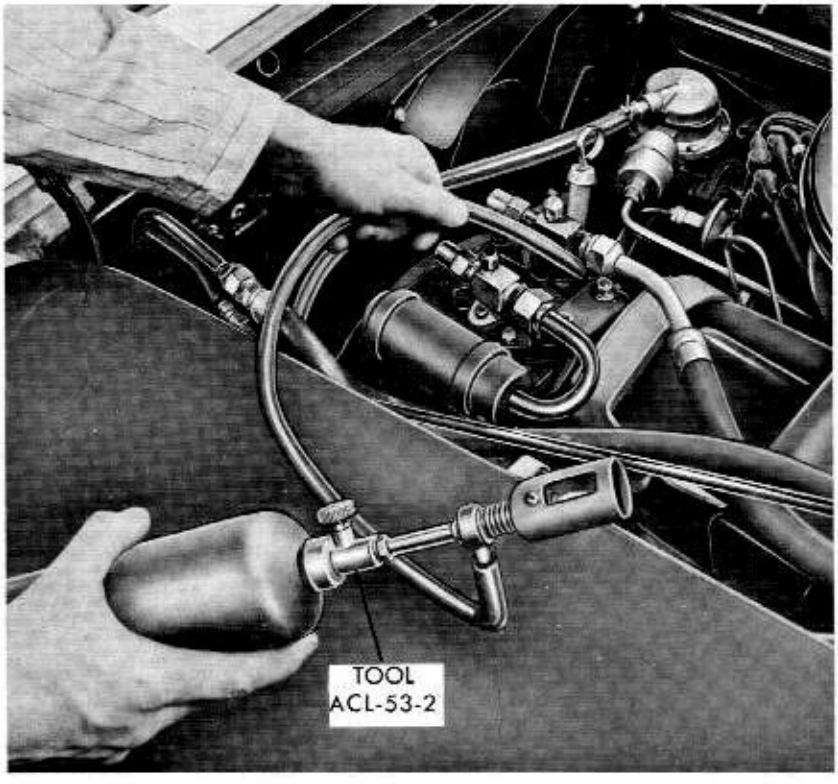


Fig. 2-2–Testing For Leaks–(61LM-8806)

MANIFOLD GAUGE SET

The manifold gauge set is used when charging, evacuating, and diagnosing trouble in the system.

The gauge at the left (Figure 2-3) is the low pressure gauge. The dial of this compound gauge is graduated from 0 to 150 p.s.i. and in the opposite direction, from 0 to 30 inches of vacuum. This is the gauge used in checking pressure on the low pressure (suction) side of the system.

The gauge at the right is the high pressure gauge. The dial of this gauge is graduated from 0 to 300 p.s.i. and is used in checking pressure on the high pressure (discharge) side of the system. Both gauges incorporate a zero correction factor for calibration purposes.

NOTE: *Always refer to the gauges' outer scale labled "Freon-12" when servicing the Air Conditioner.*

Flexible hoses connect to the flare-type fittings on the manifold directly below each gauge and are then connected to the respective gauge ports of the service valves on the compressor.

The center connection of the manifold is connected to the suction and discharge connections through a cored passage in the manifold. This connection is used to connect a flexible hose to a tank of refrigerant for charging the system or to a vacuum pump for evacuating the system.

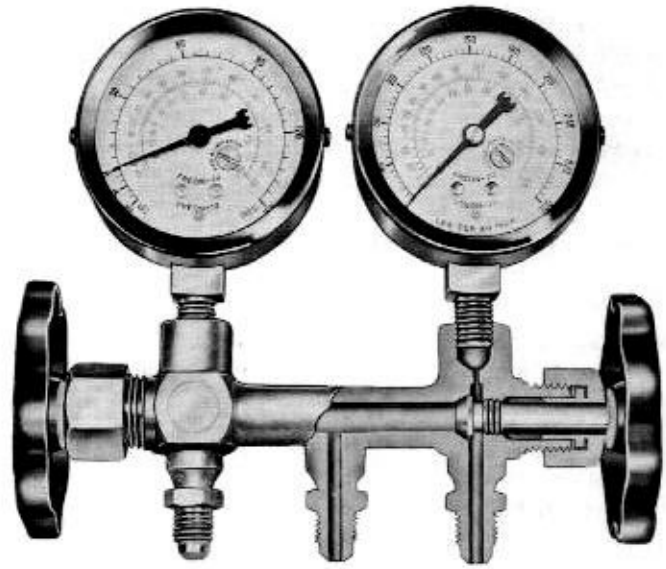
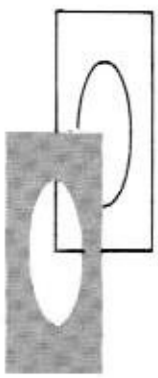


Fig. 2-3–Manifold Gauge Set–(E-2625)

NOTE: *When this connection is not required, it should be capped.*

The hand shut-off valves on either end of the manifold close both the suction and discharge openings to the center connection when the valves are in their closed (clockwise) position. The hand shut-off valves do not have anything to do with opening or closing off of pressure to the gauges; they merely close each opening to the center connection and to each other.

Manifold Gauge Set Installation



The manifold gauge set should be connected to the system before service operations involving the use or checking of refrigerant are attempted.

1. Remove the valve stem caps from the suction and discharge service valves on the compressor. Made sure that both valves are in the maximum counterclockwise position so that the gauge ports are closed.
2. Remove the gauge port caps from the service valves; then, attach the flexible hoses from the manifold suction and discharge gauges to the respective gauge ports.
3. Turn both of the manifold hand shut-off valves to the closed position; then, turn the service valve stems clockwise about ¼ turn and observe the pressures on the gauges.

NOTE: *To dampen pulsations of the compressor for an accurate reading on the discharge gauge, turn the discharge service valve stem counterclockwise until the gauge pointer is steady. Do not turn the valve so far that the gauge opening is closed.*

4. Purge the air from the manifold gauge set and flexible hoses by slowly opening the hand shut-off valves on the manifold to allow air to escape through the center manifold hose. Close the hand shut-off valves and immediately connect the refrigerant tank. Failure to purge the lines and manifold may result in air entering the system.

SERVICE VALVES

Correct positioning of the suction and discharge service valves is essential for performing the various service operations on the system.

Valve stems and gauge ports are capped and are pressure tight when the system is in operation. Do not remove the gauge ports caps unless the service valves are in their maximum counterclockwise position AS VIEWED FROM THE STEM SIDE OF THE VALVE.

Suction Valve

The suction valve allows access to the low pressure side of the system through a gauge port for attaching a flexible hose to the manifold gauge set.

When the system is in operation, the suction valve must be in the full back-seated (counterclockwise) position. In this position, the line is open from the evaporator to the compressor and the gauge port is closed. When the valve is in the front-seated (clockwise) position, the compressor is shut off from the evaporator and the gauge port is open to the compressor. In this position, the compressor can be isolated and opened, providing the discharge valve is positioned correctly.

When the suction valve is is its mid position, the line from the evaporator is open to both the compressor and the gauge port. This permits pressure gauge readings while the system is in operation.

Discharge Valve

The discharge service valve allows access to the high pressure side of the system through a gauge port for attaching a flexible hose to the manifold gauge set.

When the system is in operation, the discharge valve must be in the full back-seated (counterclockwise) position. In this position, the line is open from the compressor to the condenser and the gauge port is closed. When the valve is in the front-seated (clockwise) position, the line from the compressor to the condenser is closed and the gauge port is open to the compressor. In this position, the compressor can be isolated, opened, or removed without loss of refrigerant from other system components.

When the discharge valve is in its mid position, the line from the compressor is open to both the condenser and the gauge port. This permits pressure gauge readings while the system is in operation.

DISCHARGING THE SYSTEM

Anytime the system is to be opened, except for removal of the compressor, it must be discharged.

1. Install the high pressure manifold gauge set flexible hose to the discharge valve gauge port.

2. Place the open end of the flexible hose of the center manifold connection in the garage exhaust outlet.

3. Turn the shut off valve on the manifold high pressure side to the maximum counterclockwise (open) position.

4. Turn the discharge service valve stem clockwise a slight amount to allow the refrigerant to slowly escape from the system.

CAUTION: *Do not allow the refrigerant to rush out, as the oil in the compressor will be forced out with it.*

5. When the system is completely discharged, turn the discharge valve stem to the maximum counterclockwise position; then, remove the manifold gauge hose.

EVACUATING THE SYSTEM

The system must be evacuated prior to charging after the installation of any refrigerant carrying component except the compressor or after the repair of a refrigerant leak that necessitates complete charging of of the system.

The method used for evacuating the system will depend on the equipment available and the circumstances surrounding the particular job being done.

VACUUM PUMP METHOD.

1. Install the manifold gauge set to the compressor service valve gauge ports. Turn the suction valve to the mid position. *Be sure the discharge valve is in the maximum counterclockwise position to prevent pulling a vacuum on the high pressure gauge.*

2. Connect the flexible hose of the center manifold connection to the vacuum pump. Open the valve on the suction side of the manifold. Close the valve on the discharge side of the manifold. (See figure 2-4.)

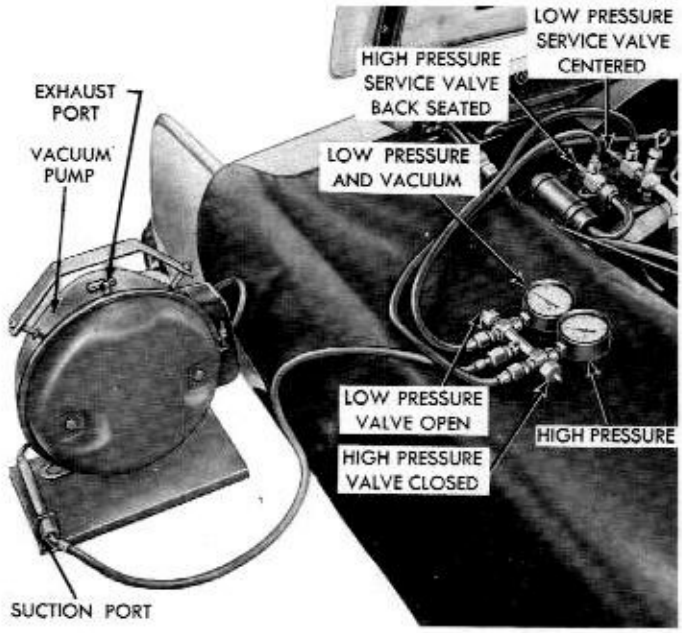


Fig. 2-4—Evacuating the System—(61LM-8804)

3. Start the vacuum pump and evacuate the system to the lowest possible vacuum. A vacuum of 26-28 inches should be reached in approximately ten minutes. However, the vacuum pump should be operated for an additional five minutes to make sure all moisture has been evacuated.

4. When the system has been satisfactorily evacuated, close the valve on the suction side of the manifold and disconnect the vacuum pump.

COMPRESSOR METHOD

If a vacuum pump is not available, the following method may be used:

1. Install the flexible hose of the low pressure manifold gauge to the suction service valve port. Turn the suction valve to the mid position.
2. Remove the gauge port cap from the discharge service valve; then, turn the valve to the maximum clockwise position, which will permit the system to be evacuated to the atmosphere.
3. Close the valve on the low pressure side of the manifold. Operate the engine at 450-475 r.p.m.; then, energize the magnetic clutch on the compressor, using a jumper wire from the battery to the clutch brush holder feed wire. Observe the vacuum gauge; 26-28 inches should be reached in about ten minutes. Operate the compressor for an additional five minutes to be sure that all moisture is evacuated.

NOTE: *While the compressor is in operation, observe the discharge service valve gauge port for the presence of oil being pumped from the compressor. If oil is being discharged, slow engine.*

4. When the system has been satisfactorily evacuated, turn the suction valve to the maximum clockwise position and cap the discharge valve gauge port; then, open the circuit to the magnetic clutch and stop the engine.
5. Install a complete charge of refrigerant.

NOTE: *Care must be exercised when using the compressor to evacuate the system. Prolonged running of the engine can result in overheating and or automatic transmission difficulties.*

CHARGING THE SYSTEM

The system should receive a complete charge of refrigerant only after it has been evacuated of all air and moisture.

If evacuating was accomplished by use of a vacuum pump, the discharge service valve is in the maximum counterclockwise position, the suction service valve is in the mid position, and both manifold valves are closed.

After evacuating, using the compressor method, both of the service valves are in the maximum clockwise position. Before removing the gauge port cap from the discharge service valve to attach the hose of the high pressure manifold gauge, turn the discharge service valve to the maximum counterclockwise position.

1. With the manifold gauge set high and low pressure hoses connected to the gauge ports and the manifold valves closed, turn both service valves to the maximum counterclockwise position. Attach the center manifold hose to the refrigerant tank; then, open the valve on the drum.
2. Purge the air from the manifold and hoses by turning the manifold valves counterclockwise about 1½ turns and loosen the connections at the service valve gauge ports. When the manifold and hoses are purged of all air, tighten the connections.
3. Turn both compressor service valves to the mid position to allow refrigerant vapor to enter the system. When the two gauges read 40 p.s.i. or more, leak test the system thoroughly.

CAUTION: *Do not turn the refrigerant tank on its side in an attempt to build up pressure in the system. The tank should be in an upright position and more than half full for best results.*

4. Place the tank of refrigerant on a scale and note the weight. Position the valves on the compressor, manifold gauge set, and refrigerant drum as shown in figure 2-5.

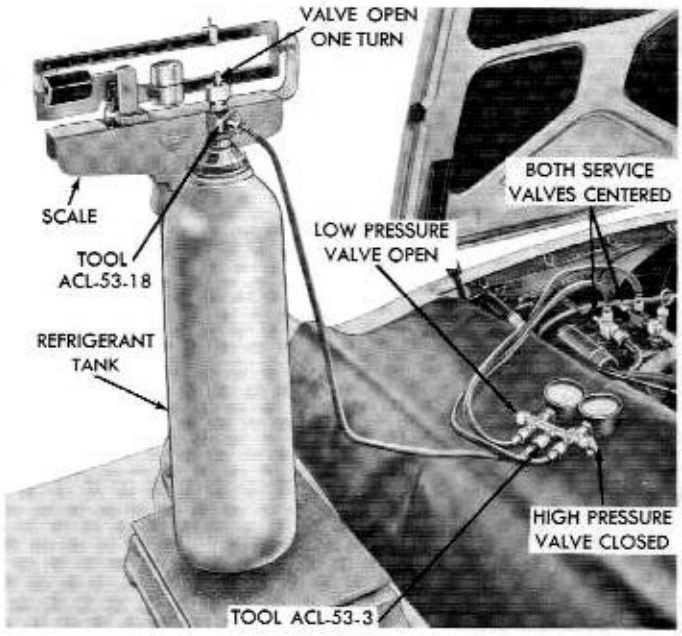


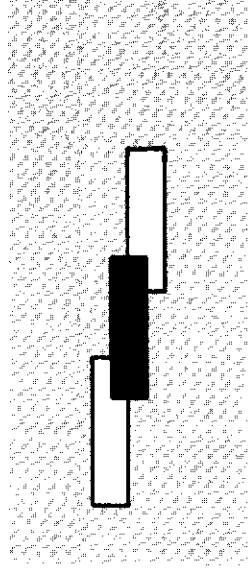
Fig. 2-5–Charging the System–(61LM-8805)

5. Start the engine, turn the Temp control to the MAX position in the cool range and position the blower switch on high speed. Operate the engine at 1500 r.p.m. *Place a fan in front of the car to aid in cooling the engine.*

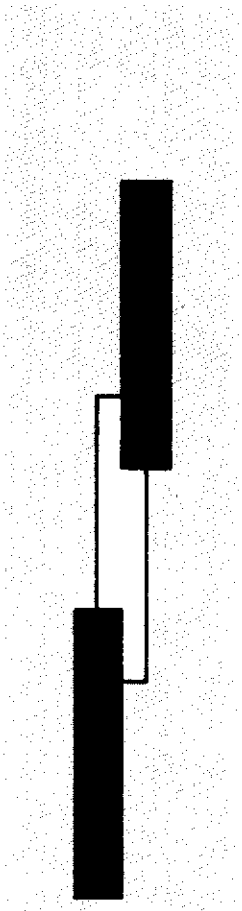
6. Check the weight of the refrigerant tank on the scale frequently during the charging operation. When the recommended amount of refrigerant has entered the system, close the valves on the low pressure side of the manifold and refrigerant tank. Turn both service valves to the maximum counterclockwise position.

NOTE: *Under certain circumstances (low ambient temperature or if the refrigerant tank is almost empty), it may be necessary to place the refrigerant tank in a pail of warm water (125 degrees maximum) to help the refrigerant flow into the system.*

7. Observe the liquid sight glass. If the glass is clear and shows no foaming or bubbles, the system is properly charged.
8. Carefully remove all charging equipment; then, install the service valve stem and gauge port caps.



PARTIALLY CHARGING THE SYSTEM



Before adding refrigerant to replace that lost by leakage, check the system for leaks and make the necessary repairs. Check the compressor oil level, and add oil if necessary.

1. Install the manifold gauge set. Refer to "Manifold Gauge Set Installation".
2. Connect the center hose of the manifold gauge set to a tank of refrigerant.
3. Place the refrigerant tank on a scale and record its weight; then, open the valve on the refrigerant tank.
4. Purge the air from the manifold and hoses by opening the manifold valves about 1½ turns and loosening the connections at the service valve gauge ports. When the manifold and hoses are purged of all air, tighten the connections and turn the manifold valves to the closed position.
5. Start the engine and turn the temperature control to the Maximum Cool position and the blower on high. Operate the system for about 5 minutes at 1500 engine r.p.m.
6. Turn the suction service valve clockwise to the mid position. Turn the discharge service valve clockwise approximately ¼ turn so that a reading can be obtained on the manifold high pressure gauge.
7. Record the weight of the refrigerant tank on the scale. Open the valve on the low pressure side of the manifold and allow refrigerant to enter the system through the suction side. Obersve the liquid sight glass and when the bubbles disappear, close the valve on the low pressure side of the manifold. Note the weight of the refrigerant tank; then, open the manifold valve and add an additional ½ pound of refrigerant. Record the total weight of refrigerant added. Close the valve on the low pressure side of the manifold.
8. Stop the engine; then, turn the suction and discharge valves to the maximum counterclockwise position. Close the valve on the refrigerant tank and remove the manifold hoses from the tank and service valve gauge ports.
9. Install the service valve stem and gauge port caps. Check the system thoroughly for leaks.

NOTE: *The high and low pressure readings on the manifold gauges and the air register outlet temperatures observed after charging will vary according to the ambient temperature.*

ISOLATING THE COMPRESSOR

The compressor must be isolated from the system when checking the oil level or when removing the compressor from the car.

1. Remove the service valve stem caps; then, turn both the suction and discharge valve stems to the extreme clockwise position.
2. Loosen the cap on the suction valve gauge port slightly and allow the refrigerant to escape until the pressure inside the compressor is relieved.

CAUTION: *Loosen the cap a small amount only. Do not remove it until the pressure is completely relieved.*

EVACUATING THE COMPRESSOR

The compressor should be evacuated whenever it has been isolated from the system and opened for any service operation.

1. Be sure both service valve stems are in the maximum clockwise position.
2. Remove the discharge gauge port cap; then, attach the flexible hose of the low pressure gauge of the manifold gauge set to the discharge gauge port.

NOTE: *Make sure the cap on the suction valve gauge port is tight.*

3. Attach the flexible hose of the manifold gauge set center connection to the vacuum pump.
4. Open the low pressure shut off valve on the manifold.
5. Operate the vacuum pump until the low pressure gauge reads 25-28 inches of vacuum.
6. Close the low pressure manifold valve; then, shut off the vacuum pump.
7. Turn both service valves to the maximum counterclockwise position and remove the low pressure gauge hose from the discharge gauge port; then, install the gauge port cap.
8. Check the system for leaks.
9. Operate the system at maximum cooling and check the sight glass for bubbles. If bubbles appear, an additional charge of refrigerant is required.

PURGING THE COMPRESSOR

1. Remove the high and low pressure service valve stem caps.
2. Check both service valve to be sure they are front seated (full clockwise).
3. Remove both service valve port caps and connect a hose to the low pressure service valve port.
4. Connect the other end of the hose to a tank of refrigerant 12.
5. Open the tank valve slightly and allow refrigerant 12 to flow through the compressor from the low pressure side.
6. Close the tank valve and install the port cap on the high pressure service valve.
7. Remove the hose from the low pressure service valve and install the low pressure port cap.
8. Back seat both service valves (full counterclockwise) and install the service valve stem caps.