Service Reference Book

MASTER TECHNICIANS SERVICE CONFERENCE

SESSION NO. 160

AIR-CONDITIONING DIAGNOSIS

PREPARED BY CHRYSLER CORPORATION
PLYMOUTH • DODGE • CHRYSLER • IMPERIAL

Thought Starter

Back in the "GOOD OLD DAYS", the automobile business was relatively simple . . . and so, for that matter, were the cars themselves. The first consideration in virtually every sale of an automobile was dependable transportation. The higher priced models of that era featured a little more comfort and a little more performance as measured by acceleration and top speed.

Mechanics with a good set of hand tools, a sharp pair of eyes, a keen pair of ears and a bag of tricks gained through years of experience, were recognized as the "Master Technicians" of the day. By and large, the old-time mechanic had to understand engines, transmissions, brakes, and rear ends to qualify as an expert. By today's standards, the major units of an automobile of that era were extremely simple.

Accessories were few and far between, and even more primitive than the cars themselves. What's more, they weren't "factory installed" but more often than not, were added on by the owner after he took delivery from the selling dealer. All of this brings us to an important point about the automobile sales and service business today.

Not only are accessories factory installed and part of the sale; *frequently a major accessory featured by a car manufacturer helps sell that manufacturer's cars.* In other words, many a customer will buy a particular make of car in order to get the kind of power steering, power brakes, automatic transmission, heater or AIR CONDITIONING he prefers.

More and more, the proper maintenance and servicing of major accessories is playing a key role in keeping customers satisfied with the entire automobile.

For several years, the combination air-conditioning and heating system available on Chrysler-built cars *has been superior to those offered by competitors.* Protecting and maintaining an owner's investment in this highest priced of all accessories is a mighty important job. That's why this session of the Master Technicians Service Conference is devoted to diagnosis tips that will help you locate and correct trouble in the refrigeration part of the air-conditioning system.

The service end of the business gets more complicated every year, *and,* it plays an increasingly important role in new-car sales with each model year. The very nature of the service business is enough to make pessimists out of every service technician and service engineer. It's tough for anyone who spends every day in the trouble end of the business to remember that, for every problem car in your shop, there are thousands out on the road giving trouble-free performance.

It's equally hard to remember that your competitor's service department is full of cars that are giving his owners their share of problems. It's a fact that owners are more apt to believe what a mechanic says about a car than they are to believe what a salesman says. It's impossible to overemphasize the importance of the service technician in the over-all success of the dealership. Who else in this complex automobile business can do so much to—

Keep customers happy by taking care of their service needs;

Get new customers by talking up your dealership, your service department, and your line of Chrysler-built cars?

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INTRODUCTION

PURPOSE

This Reference Book supplements information contained in regular service manuals and bulletins. It is your personal copy of up-to-date diagnosis information on the refrigeration part of the air-conditioning system. It is based on the practical knowledge of some of the best air-conditioning diagnosticians in the business, gained through years of personal experience and experimentation.

There's a lot of valuable information packed in these easy-to-read pages. Read it over *now* so you'll know where to find the information when you need it. Keep this reference book handy . . . it'll save you time, and help you to look good on your next air-conditioning trouble-shooting job.

GENERAL

The behavior of the Refrigerant 12 (R-12) in an air-conditioning system that is performing normally is exactly predictable. Temperatures and pressures of the refrigerant will vary depending on operating conditions and weather conditions. But, these variations in pressure inside the system are always predictable for any given set of operating conditions.

It isn't necessary to have an engineer's knowledge of the physics of refrigerants to locate the cause of trouble in a refrigeration system. It is necessary to know what the pressures *should be* throughout the system, and to be able to accurately measure these pressures in order to determine whether or not they are correct.

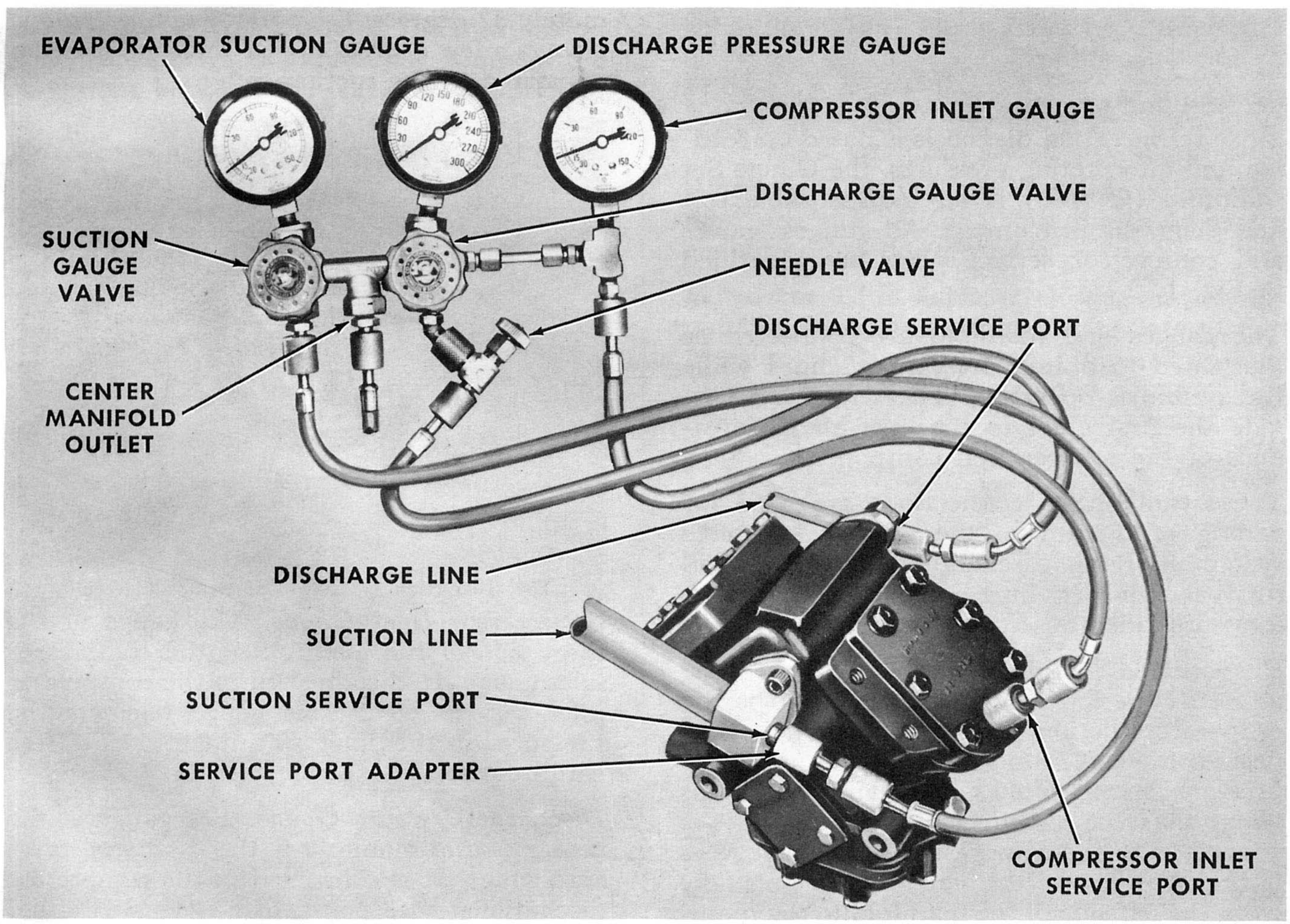


Fig. 1—Gauge set manifold connections

Incorrect pressures for a given set of operating conditions not only prove that the trouble is in the refrigeration part of the system . . . they indicate which unit in the system is at fault.

In any mechanical system, trouble is most apt to occur in the units which have moving parts. In the refrigeration part of the air-conditioning system these units are:

The Compressor. It compresses or pressurizes refrigerant vapor so that it can be condensed into a liquid.

The Expansion Valve. It opens and closes, to feed just the right amount of liquid refrigerant into the evaporator.

The Evaporator Pressure Regulator Valve. (EPR Valve) It controls minimum evaporator *temperature,* to prevent frosting of the fins, by controlling the *pressure* of the refrigerant vapor leaving the evaporator.

When one of these units fails to function normally, peculiar things start to happen to refrigerant pressures, and air-conditioning performance suffers.

THE GAUGE SET MANIFOLD

Since refrigeration diagnosis is based on reading and interpreting pressures, the Gauge Set Manifold (C-3740) is an indispensable test and diagnosis instrument. All gauges, valves and compressor service ports are identified in Fig. 1.

The gauges and manifold are connected as illustrated to obtain pressure readings while the system is operating. These readings provide the first clues to the over-all performance of the refrigeration components.

These same basic connections are used for adding refrigerant to the system, complete system charging, discharging the system and for evacuating (pulling a vacuum) to remove moisture-laden air from a discharged system.

Evaporator Suction Pressure Gauge. The gauge at the left side of the manifold is the evaporator suction pressure gauge. It is connected to the suction service port of the compressor. The manifold gauge valve below this gauge must be *closed* before the test hose is connected to the compressor. This valve does not control flow to the gauge. It controls flow from the left side of the manifold to the manifold center outlet.

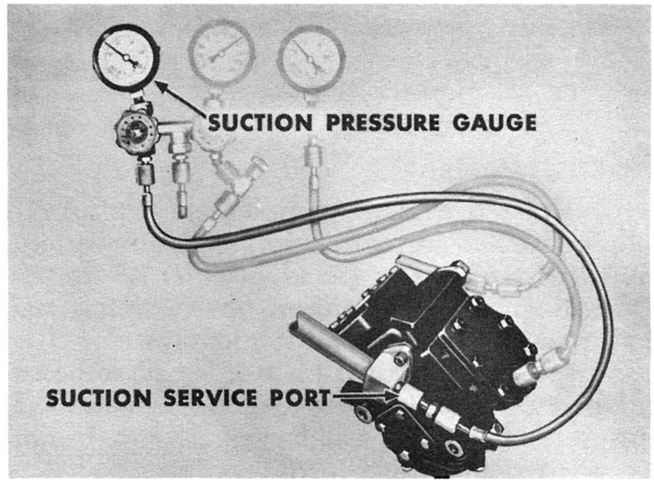


Fig. 2—Evaporator suction pressure gauge

The evaporator suction pressure gauge registers the pressure of the refrigerant vapor leaving the evaporator. This provides an important clue to the *temperature* of the refrigerant leaving the evaporator. For example, if evaporator suction pressure is 30 pounds, the temperature of the refrigerant is approximately 32 degrees. Evaporator *temperature* is always a few degrees higher than the *pressure* registered at the suction gauge.

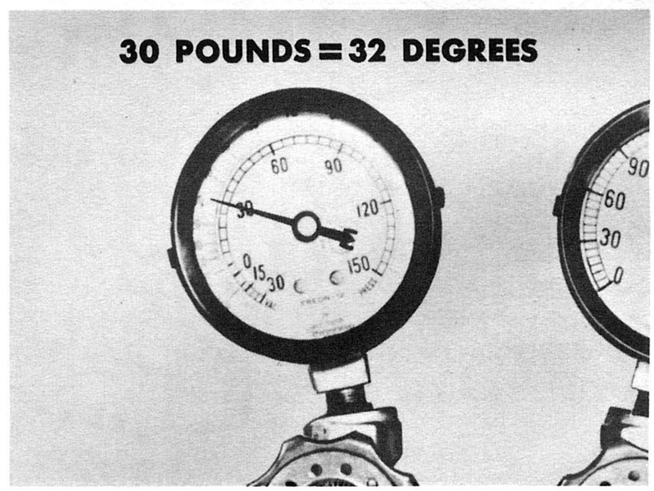


Fig. 3—Suction pressure indicates temperature

Compressor Inlet Gauge. The gauge at the right side of the manifold is the compressor inlet gauge. It is connected to the compressor inlet service port. This gauge registers the pressure at the inlet or intake side of the compressor.

Discharge Pressure Gauge. The gauge at the center of the manifold is the discharge pressure gauge. It is connected to the compressor discharge service port which is located either in the muffler or the muffler elbow. The manifold valve below this gauge must be *closed* before connecting the test hose to the compressor. The discharge gauge valve controls flow from the right side of the manifold to the center manifold outlet.

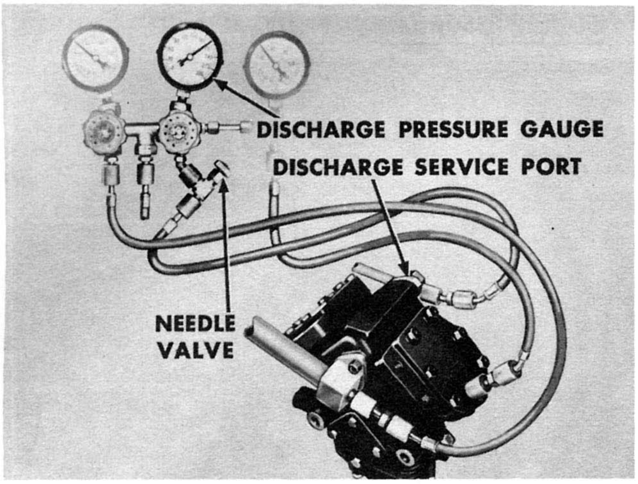


Fig. 4—Discharge pressure gauge

The discharge gauge registers the pressure of the refrigerant vapor leaving the compressor. Any restrictions or abnormal temperature conditions between the compressor outlet or in the receiver-drier-strainer will cause abnormal discharge pressures. This gauge helps locate troubles in the receiver-drier-strainer, condenser, sub-cooler, and connecting lines.

The Needle Valve, located below the discharge pressure gauge, is used to damp out gauge pointer oscillations so that accurate readings can be obtained. This valve is turned clockwise just enough to steady the gauge needle. It must not be fully closed, or it will isolate the gauge from the compressor.

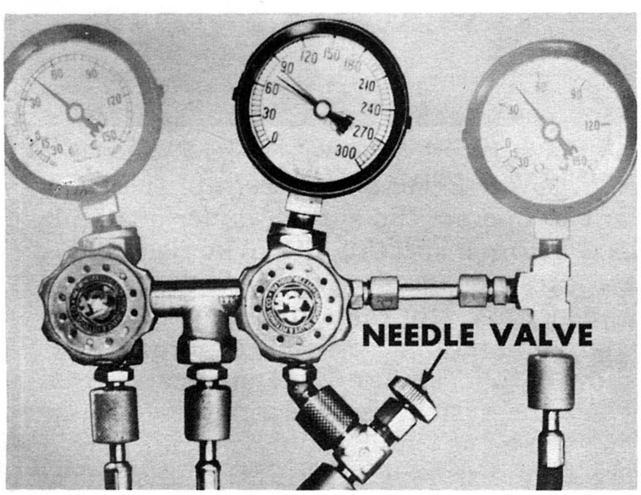


Fig. 5—Needle valve steadies gauge needle

THE EVAPORATOR PRESSURE REGULATOR VALVE

The evaporator pressure regulator valve, commonly called the EPR valve, is externally mounted on 1960 models, and is located inside the compressor on 1961 models. Functionally, it is placed between the compressor inlet port and the evaporator suction port. Its function, as previously stated, is to control the minimum evaporator temperature by controlling the minimum pressure of the refrigerant vapor leaving the evaporator.

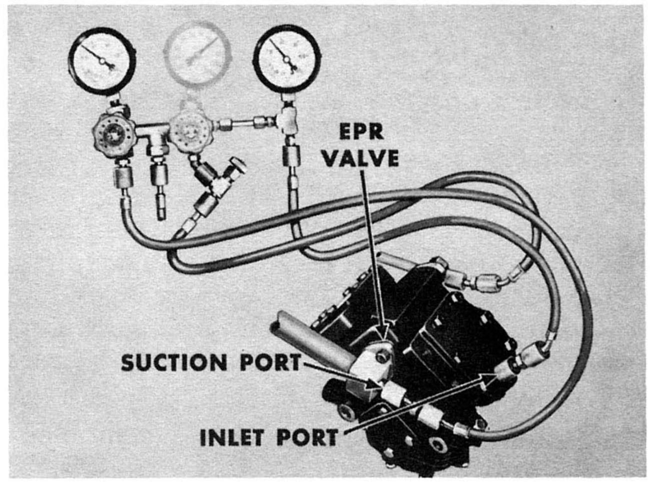


Fig. 6—EPR valve location—1961 models

When the EPR valve is open, the compressor inlet pressure will be about the same as the evaporator suction pressure.

When the EPR valve is closed, or is alternately opening and closing to regulate suction pressure and evaporator temperature, the pressure registered by the inlet gauge will be *lower* than shown on the suction gauge.

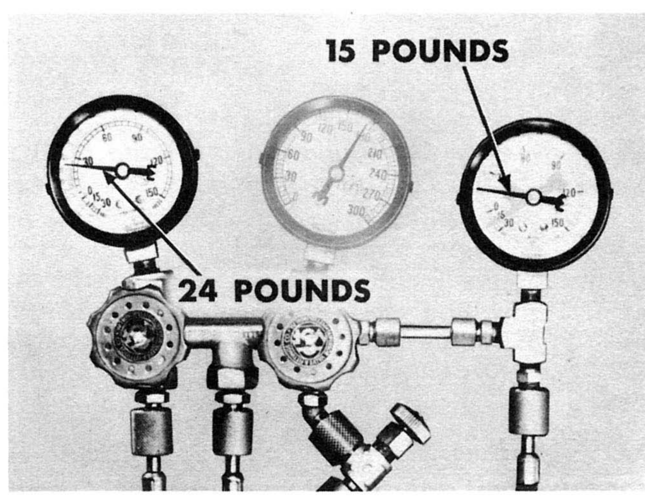


Fig. 7—EPR valve closed, inlet pressure is lower than suction pressure

PRELIMINARY TESTS AND INSPECTIONS

Preliminary tests and inspections will frequently help locate the cause of trouble. Complete instructions for making these tests and inspections are contained in the appropriate Shop Manual and the Air-Conditioning Manual. Important highlights of these tests and inspections are given here because they have a definite bearing on gauge readings.

Connecting and Purging The Test Hoses. Install the gauge set manifold test hoses—engine *not* running. Figure 1 identifies all of the test connections to be made at the compressor service ports and the gauge manifold. After tightening all three service port adapters, make certain that the needle valve below the discharge gauge is open. The following procedure will purge all air from the test hoses and gauge manifold:

1. Open the discharge gauge valve momentarily, then close it.
2. Open the suction gauge valve momentarily, then close it.
3. Loosen the compressor inlet suction hose connection *at the gauge* momentarily, then retighten it.

Normalizing The System. It is important that the entire system be up to operating temperature before attempting to interpret pressure readings. Start the engine and adjust speed to 1250 r.p.m. Set the air-conditioning controls for maximum heat load by pushing the "Fresh Cool" button in. Set the blower control on "High", and open the car windows.

Related Inspections and Tests. Some of the following inspections can be made while the system is warming up. Others must be made when the engine is not running. Detailed instructions are included in the Air-Conditioning Manual and the appropriate Shop Manual. The following tests are mentioned here to point out external conditions that may affect pressures and gauge readings.

NOTE: A recent change was made in compressor drive belt adjustment specifications. On all engines and models; used drive belts must be tightened to 40 foot-pounds; tighten new belts to 60 foot-pounds.

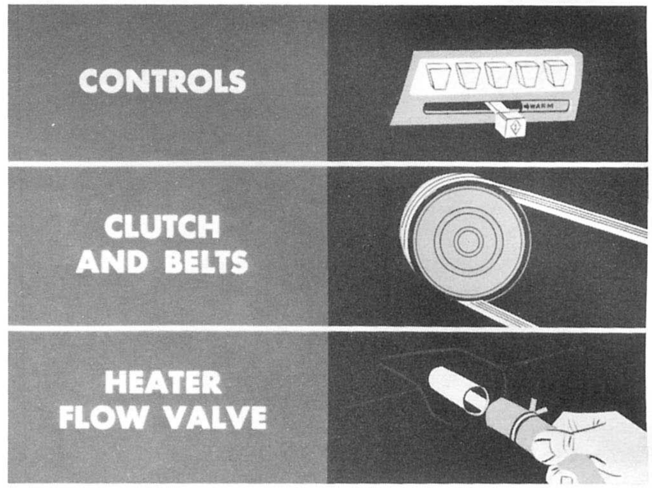


Fig. 8—Inspect controls, drive belts, heater flow valve

Inspections. Reminders of inspections that can be made while the system is warming up are illustrated in Figures 8 and 9.

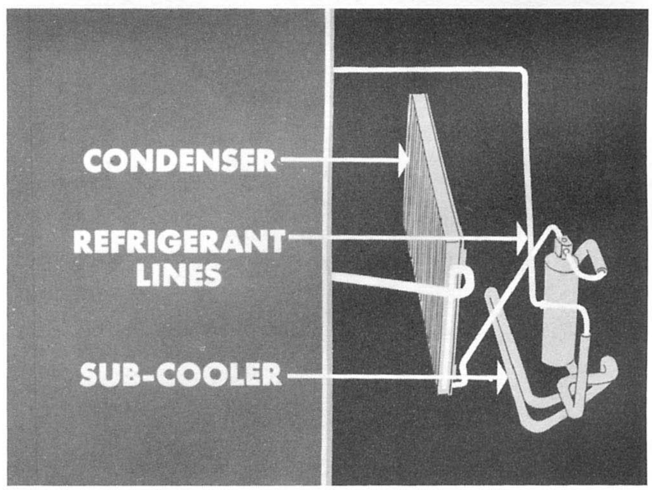


Fig. 9—Inspect condenser, lines and sub-cooler

Refrigerant Level and Moisture. It is important to operate the system under a good heat load before inspecting the sight glass and dry-eye. Restrict air flow through the condenser, if necessary, to raise discharge pressure to approximately 200 psi. The sight glass should show a solid stream of foam-free refrigerant when the system is operating at 1250 r.p.m. The "dry-eye" unit should remain blue. Excessive moisture will turn this moisture-sensing unit pink.

Any irregularities uncovered by preliminary tests and inspections should be corrected before further tests are made. Complete corrective procedures are contained in the appropriate manuals.

Never add too much refrigerant. Excess refrigerant will not only impair cooling; it may damage the compressor.

Fig. 10—Foam means low refrigerant supply

KEEP REFRIGERANT CANS UPRIGHT

Never tip a can of refrigerant on its side or turn it upside down, particularly when charging the system. A slug of liquid refrigerant fed into the suction side of an operating compressor will damage the reed valves and perhaps the compressor itself.

Fig. 11—Never tip container while charging system

ANALYSIS OF SYSTEM PERFORMANCE AND PRESSURES

OVER-ALL PERFORMANCE

It is seldom necessary or desirable to make the over-all performance test outlined in the Shop Manuals and the 1960 Air-Conditioning Manual. This test was developed before extensive field experience could be obtained on regular production units. It was designed to provide a performance standard for the entire system including air leaks, air circulation, and refrigeration system performance. Subsequent experience has proved that the unit design and construction of the evaporator assembly, introduced with the 1960 models, has eliminated virtually all performance problems caused by hot air leaking into the system.

In the majority of cases, it will not be difficult to tell the difference between questionable performance caused by air circulation problems, and poor performance of the refrigeration part of the system.

Generally speaking, there are only two possible situations where a performance test *might* be desirable. First, this test can be used to demonstrate to a customer how extreme conditions of high relative humidity and high temperature can affect cooling performance. Second, it can be used in cases of marginal performance to determine whether or not

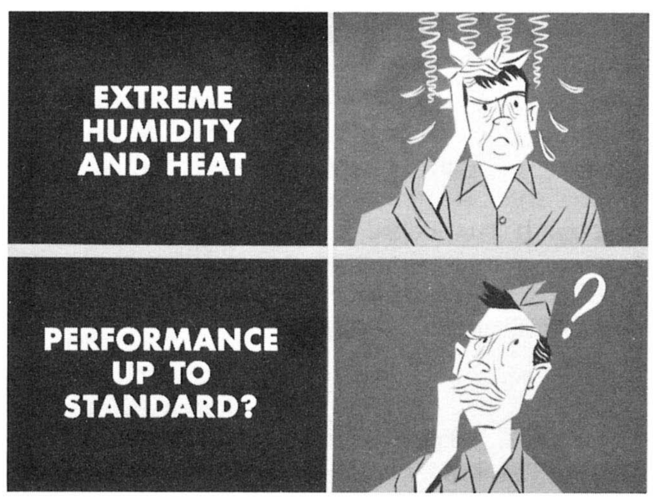


Fig. 12—Over-all performance test made only under unusual conditions

performance meets design standards. With these two exceptions, it is rarely necessary or desirable to make an over-all performance test.

REFRIGERANT LEAK TEST

On every new car equipped with air conditioning, test all lines and connections for leaks *before the car is delivered* to the customer. It doesn't take long to make a thorough leak test. This is excellent insurance against poor performance and other more serious troubles that can result from loss of refrigerant. A system that is tight and properly charged with the correct amount of refrigerant will keep its charge and deliver continuous, trouble-free performance.

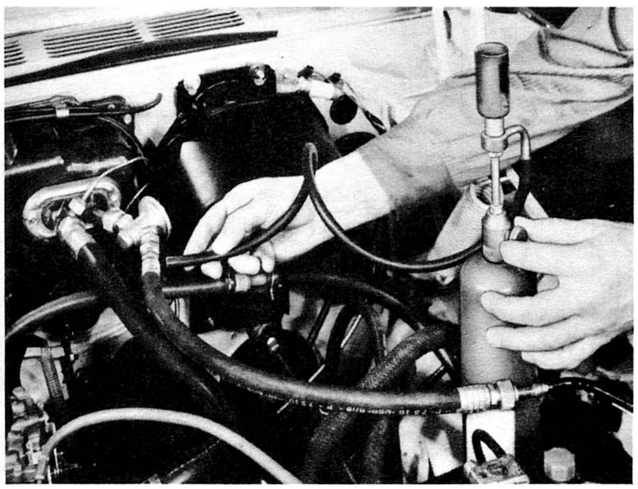


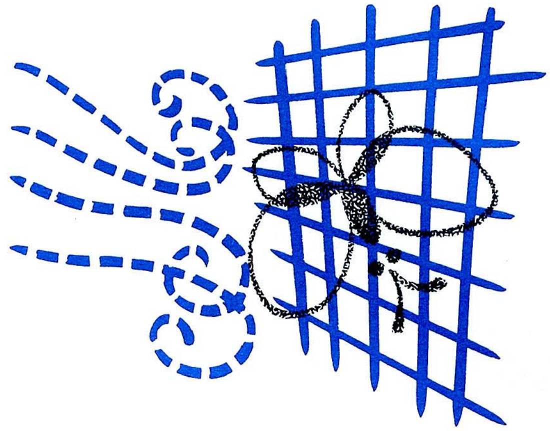
Fig. 13—Testing for refrigerant leaks

REFRIGERATION SYSTEM PRESSURES

A great deal can be learned by analyzing the pressures registered at the three test gauges while the system is operating. Often this preliminary analysis will narrow the *probable* cause of trouble down to one unit, or to one part of the system. However, this preliminary analysis does not take the place of the compressor capacity, evaporator pressure regulator valve, and expansion valve tests. *Always* test each suspected unit before removing it from the system for repair or replacement. (Refer to appropriate Shop Manuals and to Air-Conditioning Manual.)

High Discharge Pressure. High condenser temperature, or restriction to refrigerant flow anywhere between the compressor and the sight glass outlet, will cause an abnormal increase in discharge pressure. Possible causes of high discharge pressure are:

1. High condenser temperature
   - a. Dirty or bent condenser fins
   - b. Air flow restricted by bug screen
   - c. High ambient (room) temperature
   - d. Air in the system accumulated in the condenser

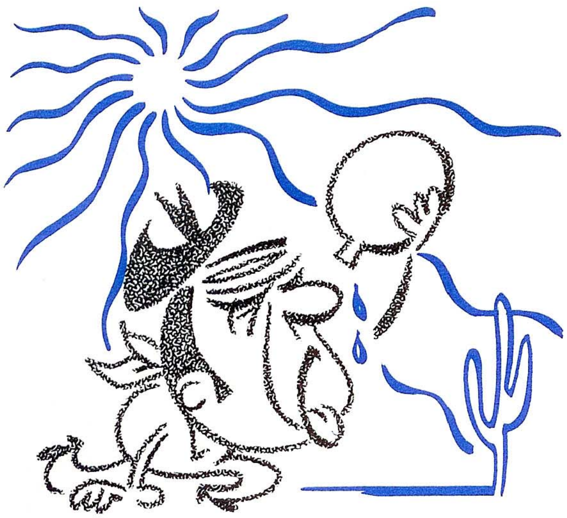


2. Restricted refrigerant flow
   - a. A kinked refrigerant line anywhere between the compressor and the outlet side of the sight glass.
   - b. Too much refrigerant in the system
3. Evaporator flooding caused by an open expansion valve
   - a. Poor thermal bulb contact
   - b. A plugged expansion valve equalizer tube

High discharge pressure caused by evaporator flooding will always be accompanied by high suction pressure.

Low Discharge Pressure. Inadequate refrigerant supply to the evaporator will cause low discharge pressure and inadequate cooling. Possible causes are:

1. System low on refrigerant
2. A restriction in the liquid line somewhere between the sight glass outlet and the expansion valve inlet screen.
3. Expansion valve starving the evaporator because of:
   - a. A plugged expansion valve inlet screen
   - b. Loss or partial loss of thermal bulb charge



Whenever low discharge pressure is caused by evaporator starving, suction pressure will also be low and compressor inlet pressure will pull down to zero or lower, and the evaporator will be warm.

High Suction Pressure. This is usually an indication of evaporator flooding caused by:

1. A wide-open expansion valve
   a. Inspect thermal bulb contact
2. A plugged equalizer tube
   a. Test expansion valve

Low Suction Pressure. This could be caused by an evaporator pressure regulator valve which is not controlling *minimum* action pressure within specifications. If this is the case, the suction and the compressor inlet pressures will be approximately the same, will go lower than twenty-two pounds, and the evaporator will be very cold, even below freezing.

If the suction pressure is lower than the minimum, and the compressor inlet pressure pulls down to zero or lower, but the evaporator is warm, the most probable cause is loss of expansion valve thermal bulb charge.

SUMMARY OF SYSTEM PRESSURE ANALYSIS

System pressures provide valuable clues to possible causes of trouble. However, they do not eliminate the necessity of making one or more of the individual unit tests before removing the compressor, expansion valve, or EPR valve for repair or replacement.

NOTE: The compressor capacity test should always be performed before the expansion valve test. The EPR valve test is not performed first unless the individual complaint definitely indicates EPR valve trouble. After repair or replacement of the compressor or expansion valve, always test the EPR valve.

THE EVAPORATOR PRESSURE REGULATOR VALVE TEST

The EPR valve is calibrated to produce maximum cooling without causing frost or ice on the evaporator fins and tubing. If for any reason calibration is incorrect, the EPR valve may restrict the flow of refrigerant at an evaporator pressure which is either too high for maximum performance or too low to prevent coil freeze up. The evaporator pressure regulator test determines whether or not the valve is functioning properly.

EPR VALVE TEST CONDITIONS

Adjust engine speed to 1250 r.p.m. Turn the blower on "HIGH". Push the "Fresh Cool" button, and open the car windows.

The heat load on the evaporator will soon call for continuous operation of the refrigeration system. The EPR valve will open and the pressure at both the suction port and the compressor inlet service port will be approximately the same. It is normal for the compressor inlet pressure to be slightly lower than evaporator suction pressure.

Both the evaporator suction gauge and the compressor inlet gauge should register 22 to 26 psi or higher. This indicates that the EPR valve is open. The next step is to determine the minimum evaporator suction pressure maintained in the line by the EPR valve.

EPR valve action can be accelerated by reducing the heat load on the evaporator. Close the car windows. Push blower control switch

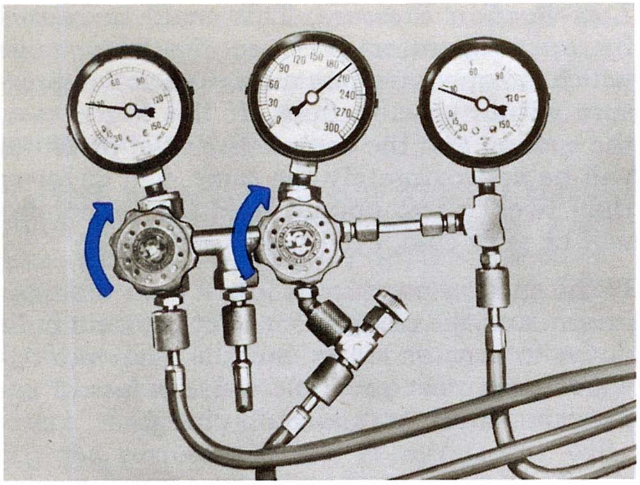


Fig. 14—Pressures, EPR valve open

to "LOW SPEED" position to reduce the volume of air passing through the evaporator. Push the "MAXIMUM COOL" button so no fresh air will be circulated. Immediately, the evaporator will start to get colder.

As soon as the blower switch is changed to low speed, and the "MAXIMUM COOL" button is pushed, watch both suction gauges for the following reactions:

1. Pressure registered at the evaporator suction gauge will become progressively lower.
2. The compressor inlet gauge will start to fluctuate. This fluctuation is caused by the alternate opening and closing of the EPR valve. It indicates that suction pressure is reduced to the point where it just about balances the internal spring pressure on the diaphragm. The EPR valve is actually operating as a modulating valve.
3. When fluctuation at the compressor inlet gauge stops and the pressure registered drops steadily, the EPR valve is maintaining minimum suction line pressure. Allow pressure registered at the compressor inlet gauge to drop to 15 psi or lower, then read the evaporator suction gauge. It should be from 22 to 26 psi. This indicates that the suction pressure maintained by the EPR valve is correct. Again, determine the pressure at which the valve is fully open.

Suction Pressure Above 26 psi. If the minimum suction pressure is higher than 26 psi (Step 3), the evaporator will not get as cold as it should for maximum performance. It will be necessary to replace the EPR valve and repeat the EPR valve test.

Suction Pressure Below 22 psi. If suction pressure goes below 22 psi (Step 3), the evaporator is too cold. The correction is to replace EPR valve and repeat the EPR valve test.

NOTE: If, and only if compressor inlet pressure will not pull down to 15 psi, increase engine speed to approximately 2000 r.p.m. Suction pressure will increase to 24 to 28 psi with this increase in compressor speed.

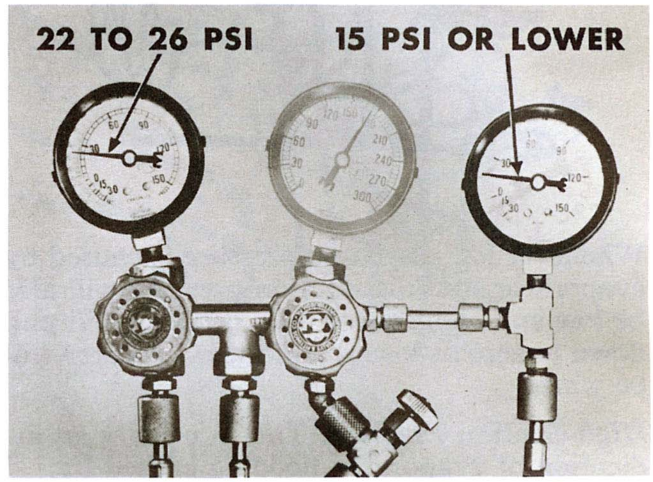


Fig. 15—EPR valve test pressures

4. Turn the blower on high, push the "FRESH COOL" button and open the car windows to increase the heat load on the evaporator. This will increase suction pressure, causing the EPR valve to open fully.
5. Watch both the evaporator suction and the compressor inlet pressure gauge. The pressure registered at the compressor inlet gauge will increase quite rapidly. Both suction gauges should again stabilize at a pressure of 22 to 26 psi or higher within a few minutes.

If the minimum suction pressure registered (Step 3, above) is 22 to 26 psi and the suction pressure registered with the valve open (Step 5, above) is 26 psi or higher, the EPR valve is functioning normally.

EPR Valve Adjustment—1960 Models. On these models an external, adjustable EPR valve was used. In some instances the valve may stick during the "Off Season" period if the air-conditioning system is not operated for long periods of time. Frequently the valve can be freed by tapping it lightly while the system is operating. Once the valve is freed, lubricant is circulated through the valve, and the sticking condition will not occur again during the entire "Cooling Season".

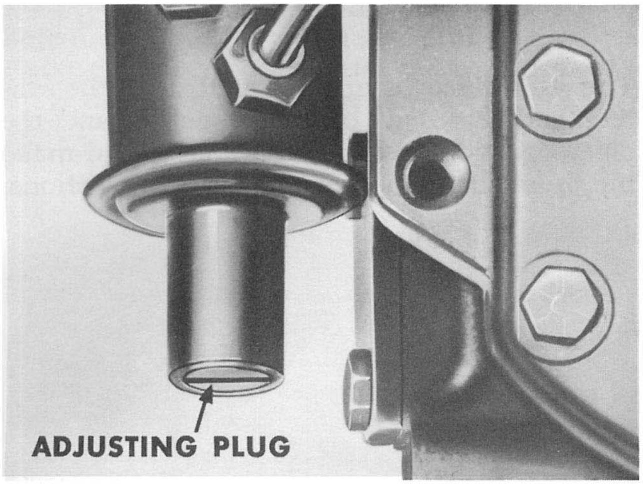


Fig. 16—EPR valve, 1960 models

In other instances, a 1960 EPR valve which does not control minimum suction pressure within limits can be adjusted to specifications as follows:

1. *If minimum suction pressure is higher than 25 pounds,* turn the slotted adjusting plug at the lower end of the EPR valve slightly counterclockwise to reduce minimum suction pressure.
2. *If minimum suction pressure is lower than 23 pounds,* turn the adjusting plug slightly clockwise to increase minimum suction pressure.

After adjusting the EPR valve, *always retest* to make sure minimum suction pressure is 23 to 25 pounds. *Never* adjust to obtain a minimum suction pressure lower than 23 pounds.

THE COMPRESSOR CAPACITY TEST

If the system has been standing any length of time, it will be necessary to perform the following operations before starting the compressor capacity test:

1. Attach the gauge set manifold.
2. Start the engine and adjust speed to 1250 r.p.m.
3. Pull blower switch to "HIGH" position, move temperature control to "OFF" and push "FRESH COOL" button.
4. Allow air-conditioning system to operate at full capacity for at least 15 minutes. This will cause most of the compressor oil in the system to be returned to the compressor crankcase. *It will also insure that the compressor is up to operating temperature, which is very important when making this test.*

DISCHARGE THE SYSTEM

When making the compressor capacity test the compressor must be disconnected from the rest of the system. That means the system must be discharged. (See Figure 1 for identification of hoses, valves and connections.)

1. Lead the manifold discharge hose into an exhaust ventilation system or to the outside of the building so the service area will not be filled with refrigerant vapor.
2. Fully open the manifold needle valve.
3. Open the discharge (right-hand) gauge valve a small amount. This will allow the refrigerant vapor to discharge *slowly.* **CAUTION: Do not open the valve fully and allow the system to discharge rapidly, since this would sweep some of the refrigerant oil out with the refrigerant.**
4. Allow the system to discharge until discharge pressure registers zero.
5. Open the suction (left-hand) gauge valve to release any vapor trapped at the suction side of the gauge.

TEST PREPARATION AND CONNECTIONS

After the system is completely discharged, isolate the compressor and connect the gauge set manifold as follows:

1. Disconnect the discharge line from the compressor muffler. Plug the discharge outlet with a ½″ flare fitting plug. Seal the discharge line.
2. Disconnect the evaporator suction line (hose) from the suction service adapter. Use a ⅝″ flare fitting cap to close off the suction adapter fitting. Seal suction line.

The compressor is now isolated from the system and sealed at both the suction and the discharge sides. Refer to Figure 17, and make the following gauge set manifold connections.

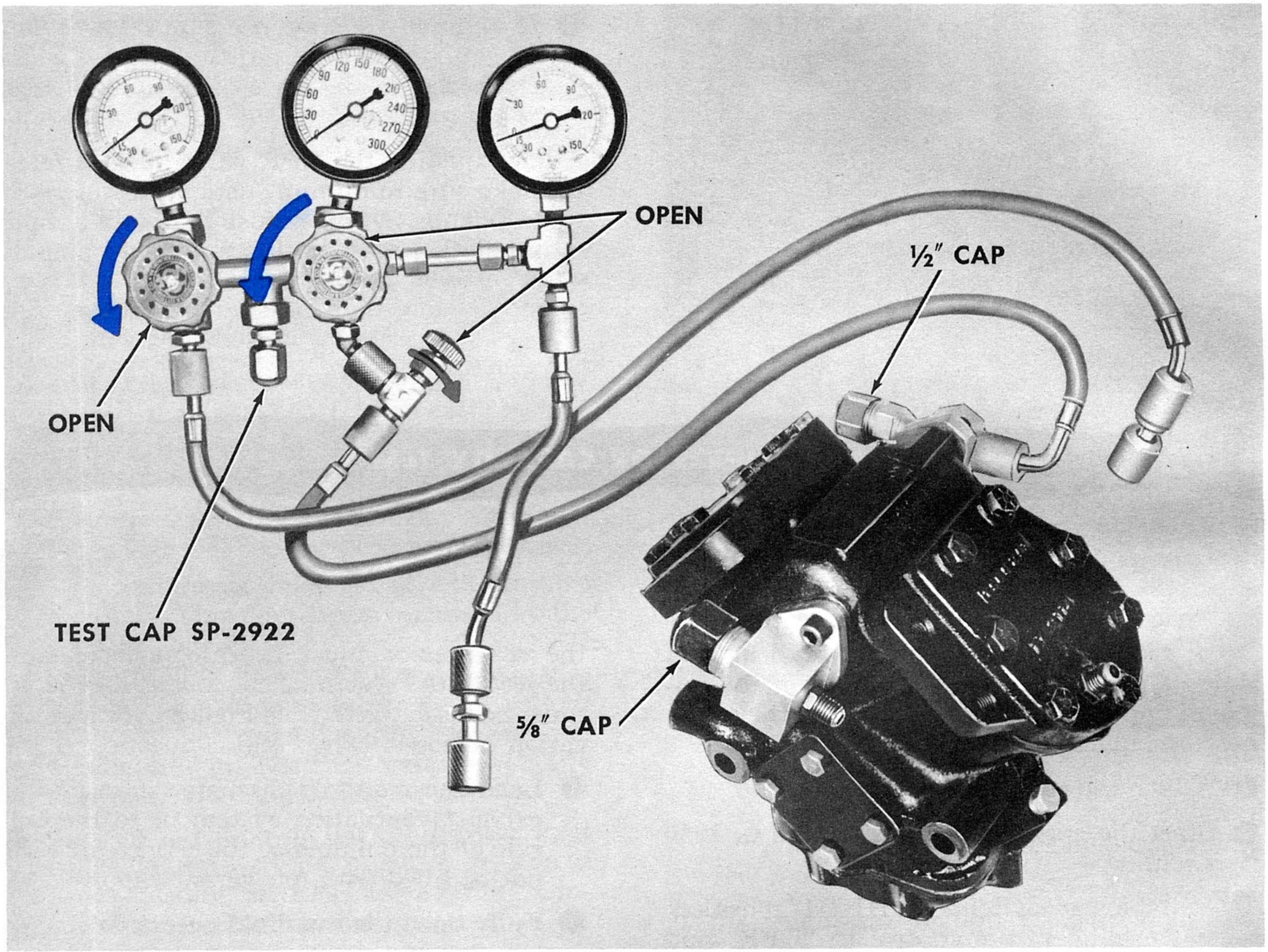


Fig. 17—Compressor test connections

3. Disconnect the test hose and adapter from the compressor inlet port. Remove adapter from test hose.
4. Remove the valve body from the compressor inlet service port. Tire valve stem Tool C-3788 can be used for this purpose.
5. Disconnect the test hose and adapter from the compressor discharge service port. Remove adapter from test hose.
6. Remove the valve body from the compressor discharge service port.
7. Disconnect the test hose and adapter from the suction service port.
8. Connect the discharge test hose to the discharge port. (Leave the compressor inlet port open.)
9. Install test cap (SP-2922) at the center manifold outlet.

NOTE: Be sure the test cap is perfectly clean. Particles adhering to the cap or the metering orifice can restrict flow and cause false readings. Never use a wire or probe of any kind to clean the cap. Wash it with clean solvent and blow dry with compressed air.

10. Make sure both the left and right gauge valves are open.

The compressor can now be operated as an air pump. Air will be drawn in through the compressor inlet port, compressed and delivered (through the test hose attached to the discharge port) to the gauge set manifold. Compressor capacity is determined by noting the pressure registered at the discharge gauge when the compressor is driven at an engine speed of exactly 500 r.p.m. *The tachometer used must be accurate.* Compressor capacity test results are dependent upon controlling engine speed at *exactly* 500 r.p.m.

TEST PRESSURES AND RESULTS

1. Start the engine and adjust speed to *exactly* 500 r.p.m.
2. Slowly close the left-hand gauge valve. All air delivered by the compressor will now be discharged through the metering orifice in the test cap. Pressure on the discharge gauge should build up to at least 190 psi.
3. The load on the compressor may affect engine speed. If necessary, readjust engine to *exactly* 500 r.p.m. Discharge pressure should build up to a minimum of 190 psi.
4. Open the left-hand gauge valve momentarily to allow pressure to drop. Then close the valve to make sure pressure again builds up to a minimum of 190 psi with the engine operating at 500 r.p.m.

CAUTION: To prevent possible compressor damage from excessive heat, do not operate compressor more than a total of five minutes.

If the compressor does not develop a minimum of 190 psi at 500 engine r.p.m., both compressor valve plate assemblies and gaskets must be replaced.

A compressor that consistently builds up to a minimum of 190 psi at *exactly* 500 engine r.p.m. is delivering rated capacity. Reconnect the evaporator suction line, and the discharge line to the compressor discharge adapter. When connecting these lines use a new gasket, and lubricate both male and female threads and the turning surface of the female flare nut with *refrigerant oil.*

THE EXPANSION VALVE TEST

The following procedure permits testing the expansion valve without removing it from the system. This test is made with the system completely discharged.

When testing the expansion valve on dual installations (front and rear or front and roof units) *each expansion valve must be tested separately.* To test the expansion valve of the front unit, disconnect and cap the liquid and suction lines leading to the rear or roof unit evaporator and expansion valve. To test the expansion valve of either the rear or roof unit, disconnect and cap the liquid and suction lines leading to the front evaporator and to the expansion valve.

It is absolutely necessary for the compressor to pass the compressor capacity test before testing the expansion valve in its installed position.

A compressor which does not pass the compressor capacity test may have leaking reed valves or a fractured head gasket. Such a leak would allow refrigerant gas, used in the expansion valve test, to leak from the discharge side of the compressor back into the suction side of the compressor. Such a leak will upset the expansion valve test results.

TEST PREPARATION AND CONNECTIONS

Before connecting the suction hose to the compressor port, remove the valve body from the suction service port and replace the valve body in the compressor inlet port. Remove the special adapters from the suction hose.

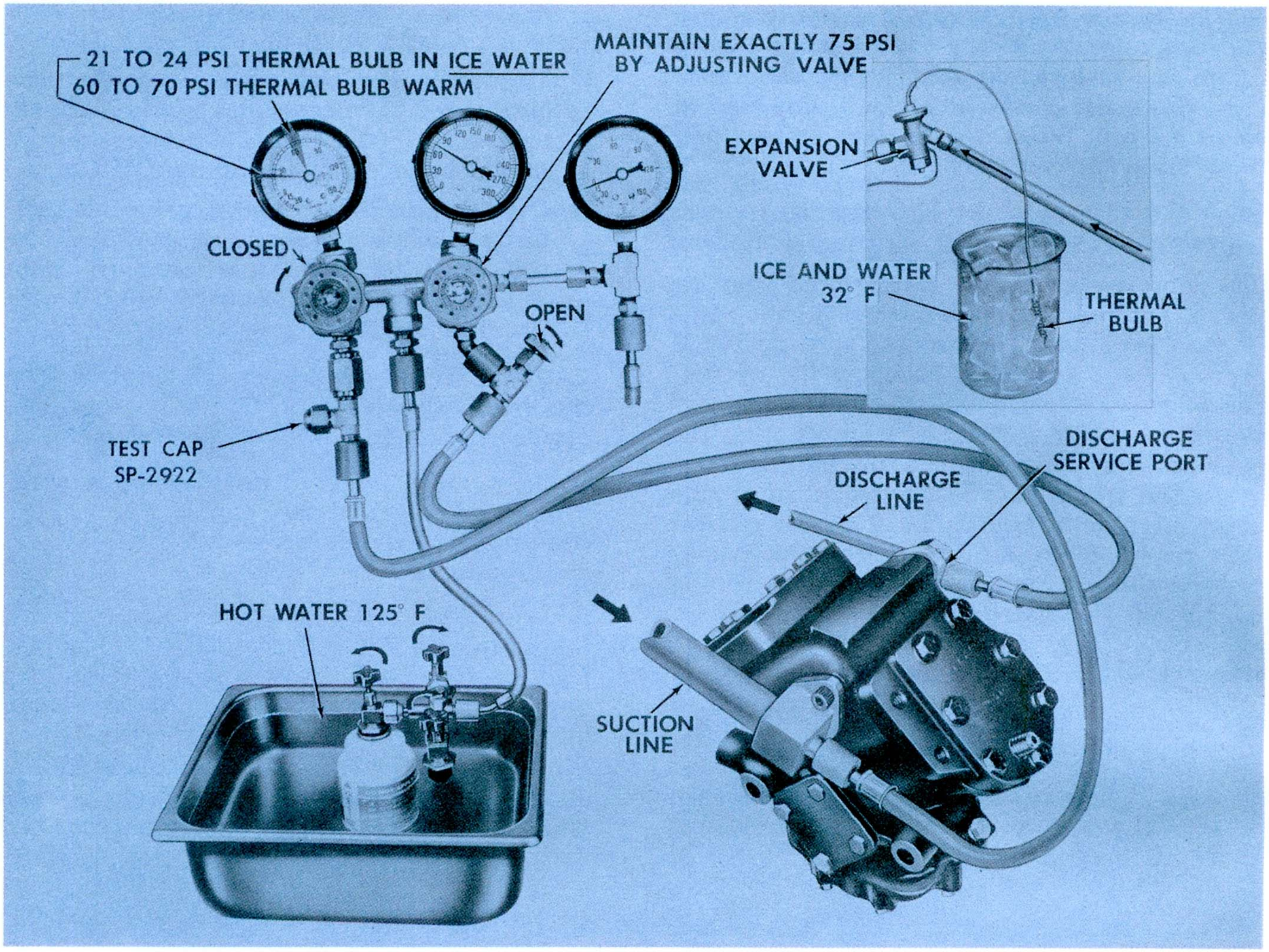


Fig. 18—Expansion valve test

1. Close both the left and right gauge set manifold valves. Open the manifold needle valve.
2. Install a 1/4″ connector and 1/4″ tee fitting at the left side of the gauge manifold. Install the test cap (SP-2922) on the tee fitting, and connect the test hose to the lower end of the tee fitting.
3. Connect the other end of the suction test hose to the suction service port.
4. Connect the discharge test hose to the discharge service port (if not already connected).
5. Connect one end of the long test hose to the center of the gauge manifold, and the other end to the refrigerant dispensing manifold.
6. Close two of the dispensing manifold valves (turn clockwise). Open the remaining dispensing manifold valve (fully counterclockwise). Remove protective cap from *opened* valve.
7. Screw a refrigerant can to the *opened* manifold valve, and tighten 6 to 8 foot-pounds maximum. Tighten the manifold locking nut against the shoulder of the can, again using 6 to 8 foot-pounds maximum to insure a good seal.
8. Turn the manifold valve (above the refrigerant can) *completely clockwise* to puncture the can. This also closes the valve and seals the refrigerant in the can.

This completes all test connections necessary for the expansion valve test. Check the test set-up against those illustrated in Figure 18.

Then, proceed with the following preparation steps:

SAFETY PRECAUTIONS

The refrigerant used in all 1961 air-conditioning installations is Refrigerant 12. It is transparent and colorless in both liquid and vapor state. Since it has a boiling point of 21.7 degrees F. below zero, it will be a vapor at all normal atmospheric temperatures and pressures. The vapor is heavier than air, nonflammable and nonexplosive. It is nonpoisonous except when it is in direct contact with open flame. It is noncorrosive except when combined with water. It is a safe refrigerant. However, the following precautions must be observed when handling Refrigerant 12.

CAUTION: *Wear safety goggles when servicing the refrigeration system.*

Refrigerant 12 evaporates so rapidly at normal atmospheric pressures and temperatures that it tends to freeze anything it contacts. For this reason, extreme care must be taken to prevent any liquid refrigerant from contacting the skin and especially the eyes.

Always wear safety goggles (C-3355) when servicing the refrigeration part of the air-conditioning system. Keep a bottle of sterile mineral oil and a weak solution of boric acid handy when working on the refrigeration system. Should any liquid refrigerant get into the eyes, use a few drops of mineral oil to wash them out. Refrigerant 12 is rapidly absorbed by the oil. Next, wash the eyes with the weak solution of boric acid. Call your doctor immediately even though irritation has ceased after first treatment.

CAUTION: *Do not heat Refrigerant 12 above 125 degrees F.*

In most instances, moderate heat is required to bring the pressure of the refrigerant in its container above the pressure of the system when charging or adding refrigerant. A bucket or large pan of hot water not over 125 degrees F. is all the heat required for this purpose. Do not heat the refrigerant container with a blow torch or any other means that would raise temperature and pressure above this temperature. Do not weld or steam-clean on or near the system components or refrigerant lines.

CAUTION: *Keep Refrigerant 12 containers upright when charging the system.*

When metering Refrigerant 12 into the refrigeration system, keep the supply tank or cans in an upright position. If the refrigerant container is on its side or upside down, liquid refrigerant will enter the system and damage the compressor.

CAUTION: *Always work in a well-ventilated room.*

Always maintain good ventilation in the working area. Always discharge the refrigerant into the service bay exhaust system or outside the building. Large quantities of refrigerant vapor in a small, poorly ventilated room can displace the air and cause suffocation.

Although Refrigerant 12 vapor is normally nonpoisonous, it can be changed into a very poisonous gas if allowed to come in contact with an open flame. Do not discharge large quantities of refrigerant in an area having an open flame. A poisonous gas is produced when using the flame-type leak detector. Avoid inhaling the fumes from the leak detector.

CAUTION: *Do not allow liquid refrigerant to touch bright metal.*

Refrigerant will tarnish bright metal and chrome surfaces. Avoid splashing refrigerant on any surface. Refrigerant in combination with moisture is very corrosive and can cause great damage to all metal surfaces.

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