GROUP
CLIMATE CONTROL SYSTEM 12
(18000 & 19000)

SECTION 12-00 Climate Control System—Service

VEHICLE APPLICATION

Taurus/Sable.

BASIC PRINCIPLES

Vehicle air conditioning is the cooling or refrigeration of the air in the passenger compartment. Refrigeration is accomplished by making practical use of three laws of nature. These laws of nature and their practical application are outlined.

Heat Transfer

If two substances of different temperature are placed near each other, the heat in the warmer substance will always travel to the colder substance until both are of equal temperature. For example, a cake of ice in an ice box does not communicate its coldness to the bottle of milk standing nearby. Rather, in obedience to nature's law, the heat in the warm milk automatically flows into the ice which has a lesser degree of heat. In order to determine the amount of heat that transfers from one substance to another, science has established a definite standard of measurement called the British Thermal Unit or BTU. One BTU is the amount of heat required to raise the temperature of one pound of water 0.55°C (1°F). For example, to raise the temperature of one pound of water from 0°C (32°F) to 100°C (212°F), one BTU of heat must be added for each 0.55°C (1°F) rise in temperature or a total of 180 BTUs of heat. Conversely, in order to lower the temperature of one pound of water from 100°C (212°F) to 0°C (32°F), 180 BTUs of heat must be removed from the water.

Latent Heat of Vaporization

When a liquid boils (changes to a gas), it absorbs heat without raising the temperature of the resulting gas. When the gas condenses (changes back to a liquid), it gives off heat without lowering the temperature of the resulting liquid.

For example, place one pound of water at 0°C (32°F) in a container over a flame. With each BTU of heat that the water absorbs from the flame, its temperature rises 0.55°C (1°F). Thus, after it has absorbed 180 BTUs of heat, the water reaches a temperature of 100°C (212°F). Here the law of nature is encountered. Even though the flame continues to give its heat to the water, the temperature of the water remains at 100°C (212°F). The water, however, starts to boil or change from the liquid to the gaseous state, and it continues to boil until the water has passed off into the atmosphere as vapor. If this vapor were collected in a container and checked with a thermometer, it also would show a temperature of 100°C (212°F). In other words, there was a rise of only 82°C (180°F), from 0 to 100°C (32-212°F) in the water and vapor temperature even though the flame applied many more than 180 BTUs of heat. In this case, the heat is absorbed by the liquid in the process of boiling and disappears in the vapor. If the vapor were brought in contact with cool air, the hidden heat would reappear and flow into the cooler air as the vapor condensed back to water. Scientists refer to this natural law as the latent (hidden) heat of vaporization.

Water has a latent heat of vaporization of 970 BTUs and a boiling point of 100°C (212°F). This means that one pound of water at 100°C (212°F) will absorb 970 BTUs of heat in changing to vapor at 100°C (212°F). Conversely, the vapor will give off 970 BTUs of heat in condensing back to water.

This tremendous heat transfer that occurs when a liquid boils or a vapor condenses, forms the basic principle of all conventional refrigeration systems.

For a liquid to be a good refrigerant, the amount of heat that it absorbs when vaporizing is not the only factor. It must also have a low boiling point. That is, the temperature at which it boils must be lower than the substance to be cooled. To illustrate with water, place a bottle of milk at room temperature 21.6°C (70°F) next to boiling water 100°C (212°F). The heat would flow from the (higher temperature) water to the (lower temperature) milk. The milk would be heated rather than cooled, because the boiling point of water is too high.

In order to make practical use of the heat transfer that takes place when a liquid boils, we must choose a liquid with a low boiling point. Refrigerant-12 is the liquid most commonly used in automotive air conditioning systems because it boils at -29.85°C (21.7°F) below zero in an open container. Here is a liquid that boils or vaporizes well below passenger compartment temperatures and, in vaporizing, will absorb tremendous amounts of heat without getting any warmer itself.

Effect of Pressure on Boiling or Condensation

The saturation temperature (the temperature where boiling or condensation occurs) of a liquid or vapor increases or decreases, according to the pressure exerted on it.

In the fixed orifice tube refrigerant system, liquid refrigerant (Refrigerant-12) is stored in the condenser under high-pressure. When the liquid Refrigerant-12 is released into the evaporator through the fixed orifice tube, the resulting decrease in pressure and partial boiling lowers its temperature to its new boiling point. As the Refrigerant-12 flows through the evaporator, passenger compartment air or outside air passes over the outside surface of the evaporator coils. As it boils, the Refrigerant-12 absorbs heat from the air and thus cools the passenger compartment. The heat from the passenger compartment is absorbed by the boiling refrigerant. The refrigeration cycle is now under way. To complete the cycle, the following remains to be done:

1. Dispose of the heat in the vapor.
2. Convert the vapor back to liquid for reuse.

BASIC PRINCIPLES (Continued)

3. Return the liquid to the starting point in the refrigeration cycle.

The compressor and condenser perform these functions. The compressor pumps the refrigerant vapor (containing the hidden heat) out of the evaporator and suction accumulator drier, then forces it under high-pressure into the condenser which is located in the outside air stream at the front of the vehicle. The increased pressure in the condenser raises the Refrigerant-12 condensation or saturation temperature to a point higher than that of the outside air. As the heat transfers from the hot vapor to the cooler air, the Refrigerant-12 condenses back to a liquid. The liquid under high-pressure now returns through the liquid line to the fixed orifice tube for reuse.

It may seem difficult to understand how heat can be transferred from a comparatively cooler vehicle passenger compartment to the hot outside air. The answer lies in the difference between the refrigerant pressure that exists in the evaporator, and the pressure that exists in the condenser. In the evaporator, the compressor suction reduces the pressure and the boiling point below the temperature of the passenger compartment. Thus, heat transfers from the passenger compartment to the boiling refrigerant. In the condenser, the compressor raises the condensation point above the temperature of the outside air. Thus, the heat transfers from the condensing refrigerant to the outside air. The fixed orifice tube and the compressor simply create pressure conditions that permit the laws of nature to function.

GENERAL INFORMATION

Tools Required:

- Rotunda Safety Shield Goggles 063-00003

Safety Precautions

The refrigerant used in the air conditioner system is Refrigerant-12. Some vehicles may have Refrigerant-134a in the system. The same safety precautions as for R-12 should be observed. Refrigerant-12 is non-explosive, non-flammable, non-corrosive, has practically no odor and is heavier than air. Although it is classified as a safe refrigerant, certain precautions must be observed to protect the parts involved and the person working on the unit. Use only Refrigerant-12 such as Motorcraft YN-1A or YN-7 or equivalent. Liquid Refrigerant-12, at normal atmosphere pressures and temperatures, evaporates so quickly that it has the tendency to freeze anything it contacts. For this reason, **extreme care must be taken to prevent any liquid refrigerant from coming in contact with the skin and especially the eyes.**

Refrigerant-12 is readily absorbed by most types of oil. For this reason, a bottle of sterile mineral oil and a quantity of weak boric acid solution must always be kept nearby when servicing the air conditioning system. Should any liquid refrigerant get into the eyes, immediately use a few drops of mineral oil to wash them out, then wash the eyes clean with the weak boric acid solution. Seek a doctor's aid immediately even though irritation may have ceased. **Always wear safety goggles such as Rotunda Safety Shield Goggles 063-00003 or equivalent, when servicing any part of the refrigerant system.** The Refrigerant-12 in the system is always under pressure. Because the system is tightly sealed, heat applied to any part could cause this pressure to build up excessively.

To avoid a dangerous explosion, never weld, use a blow torch, solder, steam clean, bake body finishes, or use any excessive amount of heat on or in the immediate area of any part of the refrigerant system or refrigerant supply tank, while they are closed to the atmosphere, whether filled with refrigerant or not.

Ensure that Refrigerant-12 is both stored and installed in accordance with all state and local ordinances.

When admitting Refrigerant-12 gas into the cooling unit, always keep the tank in an upright position. If the tank is on its side or upside down, liquid Refrigerant-12 will enter the system and may damage the compressor.

Service Precautions

1. **Never open or loosen a connection before removing the refrigerant from the system with a recycling machine such as the Rotunda A/C Refrigerant Reclaim System (078-00800) or equivalent.**
2. **When loosening a connection, if any residual pressure is evident, allow it to leak off before opening the fitting.**
3. **A system which has been opened to replace a component or one which has discharged through leakage must be evacuated before charging.**
4. **Immediately after disconnecting a component from the system, seal the open fittings with a cap or plug.**
5. **Before disconnecting a component from the system, clean outside of the fittings thoroughly.**
6. **Do not remove sealing caps from a replacement component until ready to install.**
7. **Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open an oil container until ready to use, and install cap immediately after using. Store oil only in a clean, moisture-free container.**

GENERAL INFORMATION (Continued)

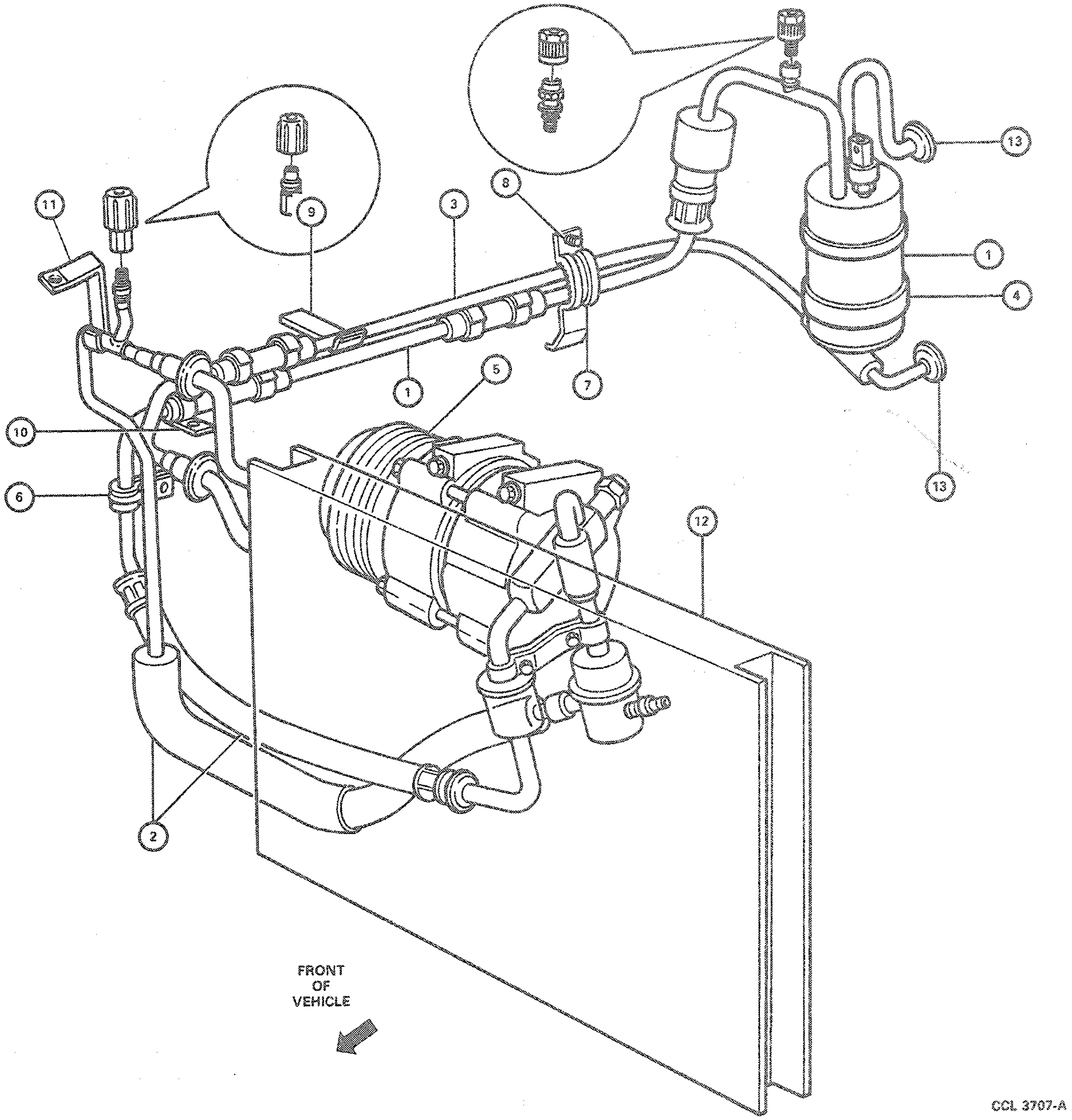
8. **Before connecting an open fitting, always install a new O-ring seal. Coat fitting and O-ring seal with refrigerant oil before connecting.**
9. **When installing a refrigerant line, avoid sharp bends. Position line away from exhaust or any sharp edges which may chafe the line.**
10. **Tighten fittings only to specified torque. Do not overtighten.**
11. **When disconnecting a fitting use a wrench on both halves of the fitting to prevent twisting of refrigerant lines or tubes.**
12. **Do not open a refrigerant system or uncap a replacement component unless it is as close as possible to room temperature. This will prevent condensation from forming inside a component which is cooler than surrounding air.**
13. **Keep service tools and work area clean. Contamination of a refrigerant system through careless work habits must be avoided.**
14. **Whenever components in engine compartment or instrument panel areas are being serviced, the battery ground cable must be disconnected to eliminate possibility of electrical shorts, burned-up wiring and dangerous fires. Extreme care must be exercised when performing electrical tests where the battery must be connected to operate the system.**

DESCRIPTION AND OPERATION

The A / C refrigerant system is the fixed orifice tube—cycling clutch type. The system components are the compressor and magnetic clutch, condenser, evaporator, suction accumulator / drier and the necessary connecting refrigerant lines. System operation is controlled by the fixed orifice tube and the clutch cycling pressure switch.

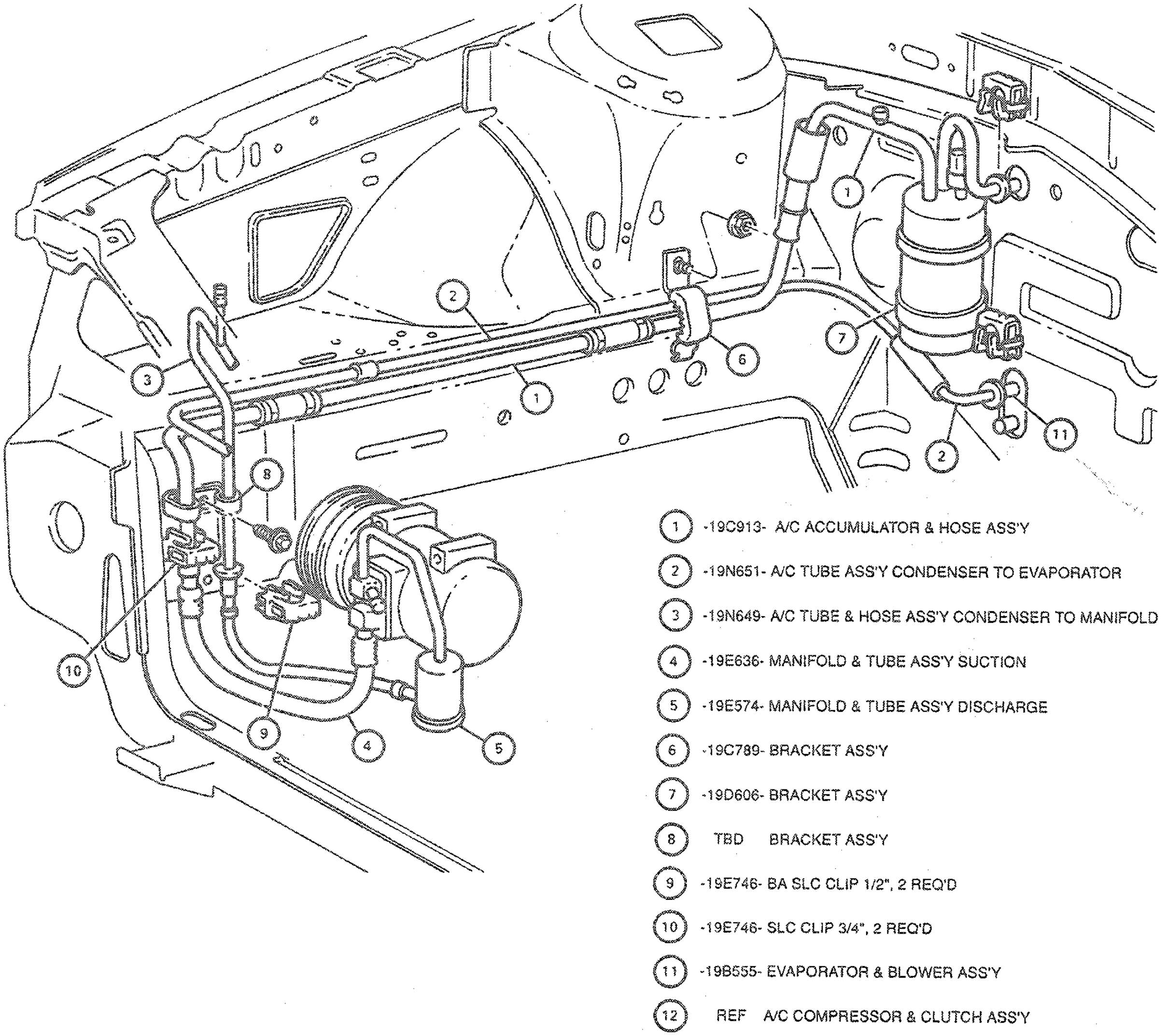
DESCRIPTION AND OPERATION (Continued)

A/C Refrigerating System



ITEM	DESCRIPTION
1.	ACCUMULATOR & HOSE ASSY - 19C913
2.	MANIFOLD & TUBE ASSY - 19D734
3.	CONDENSER TO EVAPORATOR TUBE ASSY - 19N651
4.	BRACKET ASSY - 19D606
5.	COMPRESSOR & CLUTCH ASSY - 19D629
6.	CLIP - N805191-S100
7.	CLIP - N806439-S100
8.	SCREW & RETAINER ASSY - N800358-S2
9.	CLIP - N805732-S
10.	CLIP - N804200-S100
11.	INLET TUBE BRACKET - 19D720
12.	CONDENSER
13.	TO EVAPORATOR

DESCRIPTION AND OPERATION (Continued)



① -19C913- A/C ACCUMULATOR & HOSE ASS'Y

② -19N651- A/C TUBE ASS'Y CONDENSER TO EVAPORATOR

③ -19N649- A/C TUBE & HOSE ASS'Y CONDENSER TO MANIFOLD

④ -19E636- MANIFOLD & TUBE ASS'Y SUCTION

⑤ -19E574- MANIFOLD & TUBE ASS'Y DISCHARGE

⑥ -19C789- BRACKET ASS'Y

⑦ -19D606- BRACKET ASS'Y

⑧ TBD BRACKET ASS'Y

⑨ -19E746- BA SLC CLIP 1/2", 2 REQ'D

⑩ -19E746- SLC CLIP 3/4", 2 REQ'D

⑪ -19B555- EVAPORATOR & BLOWER ASS'Y

⑫ REF A/C COMPRESSOR & CLUTCH ASS'Y

CCL 3781-A

Refrigerant Systems

Taurus / Sable vehicles offer two types of A / C systems. The main difference between these systems involve the mandatory requirement of the use of different refrigerants. The two types of A / C systems are:

1. Fixed orifice tube type system with cycling clutch using the chlorofluorocarbon (CFC) based Refrigerant 12 (R-12).
2. Fixed orifice tube type system with cycling clutch using the non-chlorofluorocarbon (Non-CFC) based Refrigerant 134a (R-134a).

NOTE: It is necessary to determine whether or not the refrigerant system contains R-134a refrigerant before any system service is performed. Refer to Refrigerant-134a (R-134a) Systems in this section.

NOTE: When diagnosing or servicing the A / C refrigerant system, time can be saved if the proper procedures are carefully followed.

DESCRIPTION AND OPERATION (Continued)

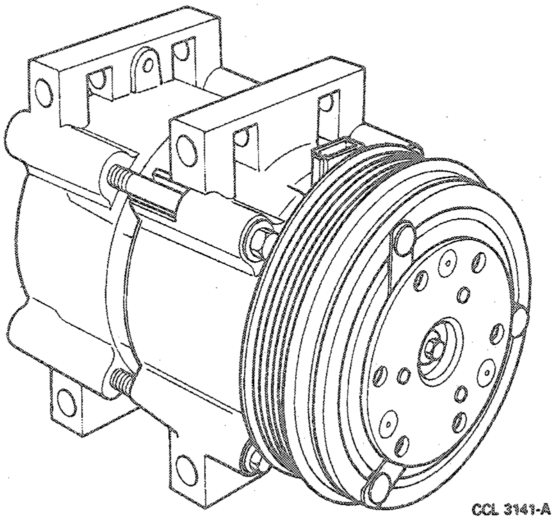
Compressor and Magnetic Clutch Assembly

FX-15 Compressor

NOTE: Whenever a compressor is replaced, it will be necessary to replace the suction accumulator / drier and orifice tube.

The FX-15 compressor is used in all Taurus / Sable vehicles equipped with a base 3.0L or 3.8L engine.

FX-15 Compressor



The FX-15 compressor is manufactured by Ford and has a displacement of 171 cc (10.4 cu. in.). It is a ten cylinder axial design requiring a 7 ounce charge of Motorcraft YN-9 refrigerant oil.

The hose manifold is attached to the compressor rear head with one screw. A pressure relief valve is threaded into a hole in the manifold that is connected to the discharge port.

The clutch is unique to the FX-15 compressor and consists of three basic components: the pulley, the hub and the field coil. The field coil is pressed on the compressor front head and the pulley is retained with a snap ring. The compressor shaft and the clutch hub are splined for positive engagement and a screw is used to retain the hub on the compressor shaft.

The FX-15 is a swashplate design 10 cylinder aluminum compressor utilizing the tangential design mounting system.

10P15F Compressor

NOTE: Whenever a compressor is replaced, it will be necessary to replace the suction accumulator / drier and orifice tube.

The 10P15F compressor is used in Taurus SHO models. The compressor is a swashplate 10 cylinder axial design, driven by the accessory drive belt. Refer to Section 12-03B for 10P15F compressor and clutch service procedures.

High-Pressure Relief Valve

A pressure relief valve is used to prevent excessive high-pressure buildups of 3102 kPa and above (450 psi and above) and to prevent damage to the compressor and other system components. The pressure relief valve is located on the side of the discharge manifold on top of the compressor.

Condenser

NOTE: Whenever a condenser is replaced, it will be necessary to replace the suction accumulator / drier.

The air conditioning condenser is an aluminum fin and tube design heat exchanger located in front of vehicle radiator. It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat, and condenses gas to liquid refrigerant as it is cooled.

The condenser inlet and outlet connections are the male fitting of a spring lock coupling and require a special service tool to disconnect the refrigerant lines from the condenser. The procedure to disconnect and reconnect the spring lock coupling is shown in.

Spring Lock Coupling

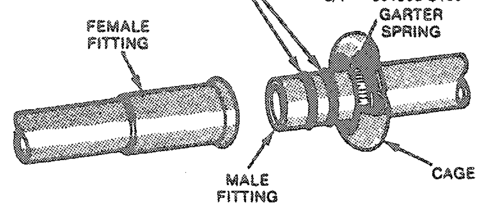
The spring lock coupling is a refrigerant line coupling held together by a garter spring inside a circular cage. When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting. The garter spring and cage then prevent the flared end of the female fitting from pulling out of the cage.

DESCRIPTION AND OPERATION (Continued)

Spring Lock Coupling

*ALSO SUPPLIED IN
KIT E35Y-19D690-A

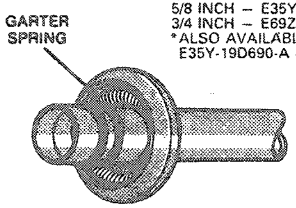
REPLACEMENT O-RINGS
3/8 " - 391302-S100* ⎤
3/8 " - 391396-S100* ⎦ OPT
1/2 " - 391303-S100* ⎤
1/2 " - 391397-S100* ⎦ OPT
5/8 " - 391304-S100*
3/4 " - 391305-S100*



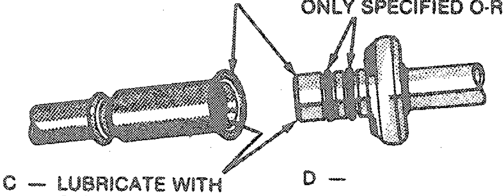
SPRING LOCK COUPLING DISCONNECTED

TO CONNECT COUPLING

REPLACEMENT GARTER SPRINGS
3/8 INCH — E1ZZ-19E576-A*
1/2 INCH — E1ZZ-19E576-B*
5/8 INCH — E35Y-19E576-A*
3/4 INCH — E69Z-19E576-A
*ALSO AVAILABLE IN
E35Y-19D690-A KIT WITH O-RINGS



❶ CHECK FOR MISSING OR DAMAGED GARTER SPRING — REMOVE DAMAGED SPRING WITH SMALL HOOKED WIRE — INSTALL NEW SPRING IF DAMAGED OR MISSING.



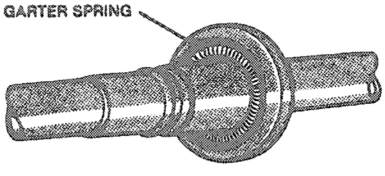
A — CLEAN FITTINGS

B — INSTALL NEW O-RINGS — USE ONLY SPECIFIED O-RINGS

C — LUBRICATE WITH CLEAN REFRIGERANT OIL

D — ASSEMBLE FITTING TOGETHER BY PUSHING WITH A SLIGHT TWISTING MOTION

❷

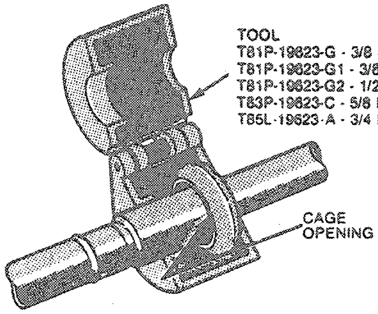


❸ TO ENSURE COUPLING ENGAGEMENT, VISUALLY CHECK TO BE SURE GARTER SPRING IS OVER FLARED END OF FEMALE FITTING.

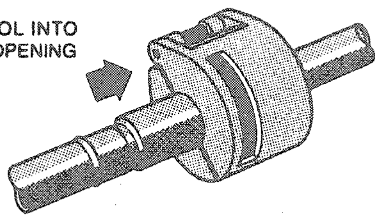
TO DISCONNECT COUPLING

CAUTION — DISCHARGE SYSTEM BEFORE DISCONNECTING COUPLING

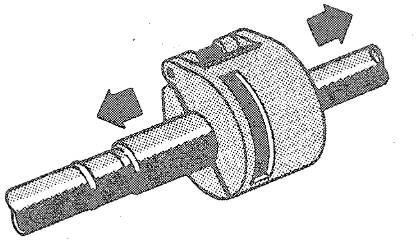
TOOL
T81P-19623-G - 3/8 & 1/2 INCH
T81P-19623-G1 - 3/8 INCH
T81P-19623-G2 - 1/2 INCH
T83P-19623-C - 5/8 INCH
T85L-19623-A - 3/4 INCH



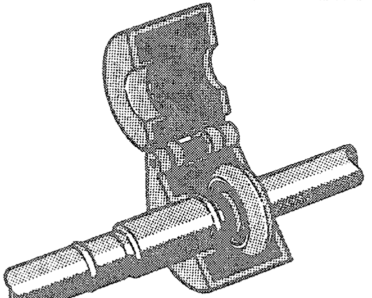
① FIT TOOL TO COUPLING SO THAT TOOL CAN ENTER CAGE OPENING TO RELEASE THE GARTER SPRING.



② PUSH THE TOOL INTO THE CAGE OPENING TO RELEASE THE FEMALE FITTING FROM THE GARTER SPRING.



③ PULL THE COUPLING MALE AND FEMALE FITTINGS APART.



④ REMOVE THE TOOL FROM THE DISCONNECTED SPRING LOCK COUPLING.

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DESCRIPTION AND OPERATION (Continued)

Two O-rings are used to seal between the two halves of the coupling. **These O-rings are green in color and are made of special material and must be replaced with an O-ring made of the same material.** The O-rings normally used in refrigerant system connections are not the same material and should not be used with the spring lock coupling. **Use only the green O-rings listed in the Ford Master Parts Catalog for the spring lock coupling.**

A plastic indicator ring is used on spring lock couplings to indicate, during vehicle assembly, that the coupling is connected. Once the coupling is connected, the indicator ring is no longer necessary but will remain captive by the coupling near the cage opening.

The indicator ring may also be used during service operations to indicate connection of the coupling. After the coupling has been cleaned, and new, green O-rings are lubricated and installed, insert the tabs of the indicator ring into the cage opening. Connect the coupling together by pushing with a slight twisting motion. When the coupling is connected, the indicator ring will snap out of the cage opening but will remain captured on the coupling by the refrigerant line.

Fixed Orifice Tube

The fixed orifice tube assembly is the restriction creating the dividing point between the high and low-pressure liquid refrigerant, and meters the flow of liquid refrigerant into the evaporator core. Evaporator temperature is controlled by sensing the pressure within the evaporator core and suction accumulator / drier with a pressure-operated electric switch. The pressure switch controls compressor operation as necessary to maintain the evaporator pressure within specified limits.

The fixed orifice tube is located in the liquid line near the condenser and has a filter screen located on the inlet ends of the tube body. The filter screens act as a strainer for the liquid refrigerant flowing through the fixed orifice opening. O-rings, on the tube body, prevent the high-pressure liquid refrigerant from bypassing the orifice. Adjustment or service cannot be made to the fixed orifice tube assembly which cannot be removed from the liquid line. The liquid line must be replaced, or an Orifice Tube Replacement Kit (E5VY-190695) installed if replacement of the orifice tube is necessary.

The fixed orifice tube should be replaced whenever a compressor is replaced. If the high pressure reading is higher than normal and the suction pressure drops rapidly creating a faster than normal clutch cycle rate, the orifice tube may be restricted and should be replaced. This condition is usually indicated by the compressor having a short ON time and a long OFF time.

Evaporator Core

NOTE: Whenever an evaporator core is replaced, the suction accumulator / drier must also be replaced.

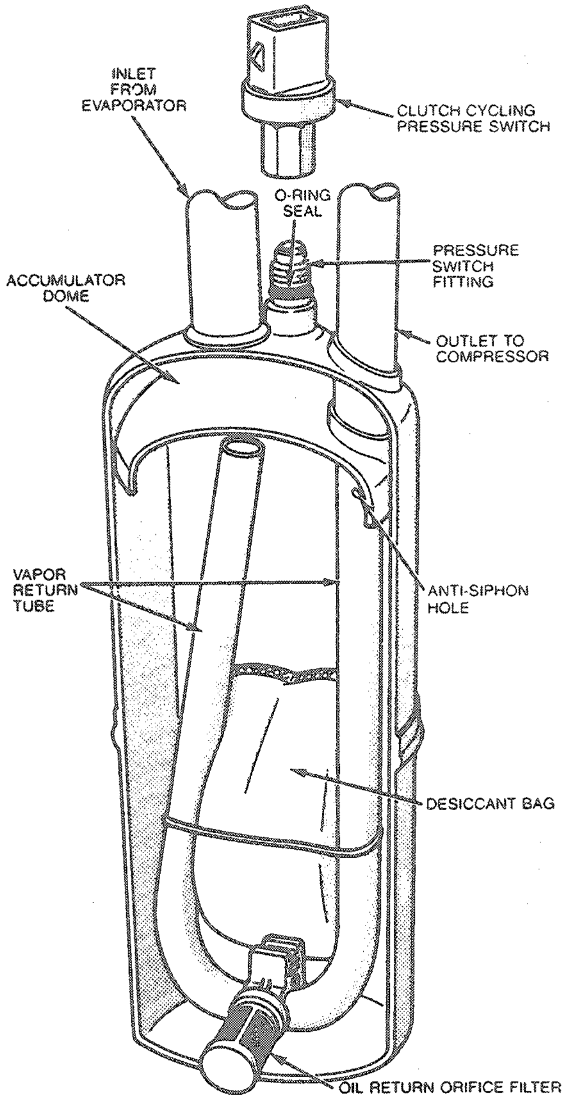
The evaporator core is the plate / fin type with an S-flow multi-pass refrigerant path. A mixture of refrigerant and oil enters the bottom of the core through the evaporator inlet tube and is routed so that it flows upward through the partitioned first three plate / fin sections. The next four plate / fin sections are partitioned to force the refrigerant to flow downward toward the bottom of the evaporator core. The refrigerant then continues over to the remaining five plate / fin sections and then moves upward and out of the evaporator via the evaporator outlet tube. This S-pass flow pattern accelerates the flow of refrigerant and oil through the evaporator core.

Suction Accumulator / Drier

The suction accumulator / drier is mounted to the engine side of the dash panel on the RH side of the vehicle. The inlet tube of the accumulator / drier attaches directly to the evaporator core outlet tube.

DESCRIPTION AND OPERATION (Continued)

Typical Suction Accumulator / Drier



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Refrigerant enters the accumulator / drier canister from the evaporator core through the inlet tube and the heavier, oil-laden refrigerant falls to the bottom of the canister. A small diameter oil bleed hole is located in the side of the outlet tube near the bottom of the canister. This bleed hole is covered with a filter screen and allows a small amount of the heavier liquid refrigerant and oil mixture to re-enter the suction line at a controlled rate. When the heavier liquid refrigerant and oil mixture enters the compressor suction line, it has a second opportunity to vaporize and circulate through the compressor without causing damage to the compressor due to refrigerant slugging.

A desiccant bag is mounted inside the suction accumulator / drier canister to absorb any moisture which may be in the refrigerant system.

A fitting located on the top of the canister is used to attach the clutch cycling pressure switch. A long-travel Schrader-type valve stem core is installed in the fitting opening to prevent refrigerant loss when the clutch cycling pressure switch is removed.

If it is necessary to check the suction accumulator / drier for excessive refrigerant oil, the oil must be poured from the accumulator through the pressure switch fitting when the Schrader valve stem is removed.

Clutch Cycling Pressure Switch

The clutch cycling pressure switch is mounted on a Schrader valve-type fitting on the top of the suction accumulator / drier assembly (refer to Suction Accumulator / Drier illustration). A valve depressor, located inside the threaded end of the pressure switch, presses in on the Schrader valve stem as the switch is mounted and allows the suction pressure inside the accumulator / drier canister to act on the switch. The electrical switch contacts will open when the suction pressure drops to 22 to 28 psi on R-12 systems, 22-25 psi on R-134a systems. The contacts will close when the suction pressure increases to 40-47 psi on R-12 systems and 39-47.5 on R-134a systems.

Ambient temperatures below approximately 45-50°F during cold weather seasons will prevent the pressure switch contacts form closing. This is due to the pressure / temperature relationship of the refrigerant and the requirement of the system pressure to reach the pressure required psi to close the switch contacts. The switch contacts control the electrical circuit to the compressor magnetic clutch coil. When the switch contacts close, the signal to energize the A / C clutch is sent to the Constant Control Relay Module (CCRM). The CCRM then supplies the voltage to energize the magnetic clutch for compressor operation. When the pressure switch contacts open, the CCRM opens the clutch electrical circuit to de-energize the clutch and compressor operation stops. The clutch cycling pressure switch, when functioning properly, will control the evaporator core pressure at a point where the plate / fin surface temperature will be maintained slightly above freezing which prevents evaporator icing and the blockage of airflow.

Service Gauge Port Valves (R-12 System)

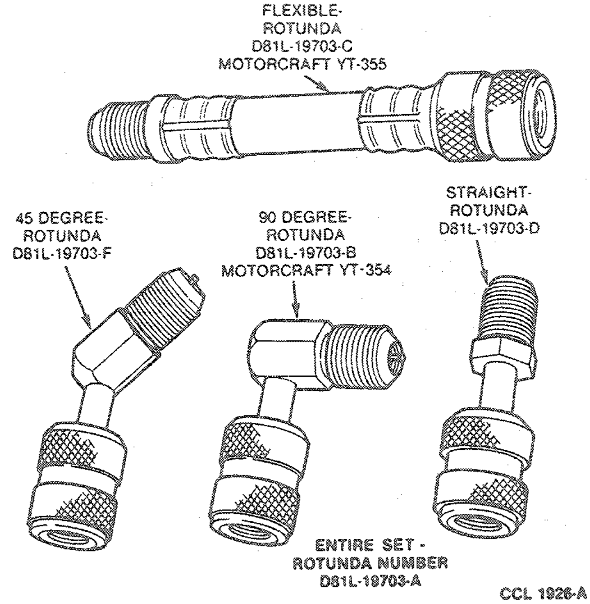
Tools Required:

- High Side Adapter Set D81L-19703-A
- Tee Adapter Tool D87P-19703-A

The refrigerant system has a high-pressure (discharge) and a low-pressure (suction) gauge port valve. These are Schrader-type valves which provide access to both sides (high-pressure and low-pressure) of the system for service hoses and a manifold gauge set so system pressures can be read. Rotunda High Side Adapter Set D81L-19703-A or Motorcraft® Tool YT-354 or 355 or equivalent, is required to connect a manifold gauge set or charging station to the high-pressure gauge port valve.

DESCRIPTION AND OPERATION (Continued)

R-12 System High Pressure Gauge Port Valve Adapters



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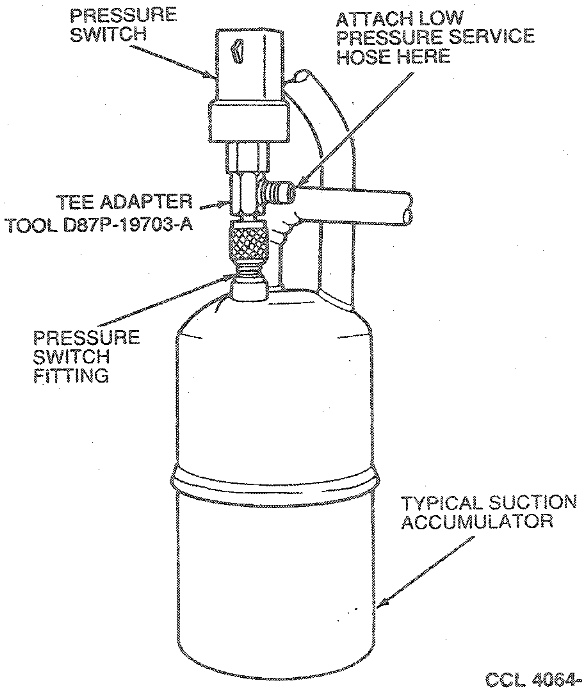
Tee-Type Service Adapter Tool D87P-19703-A or equivalent may be used when diagnosing the low-pressure side of the R-12 refrigerant system.

Tee Adapter Tool Installation



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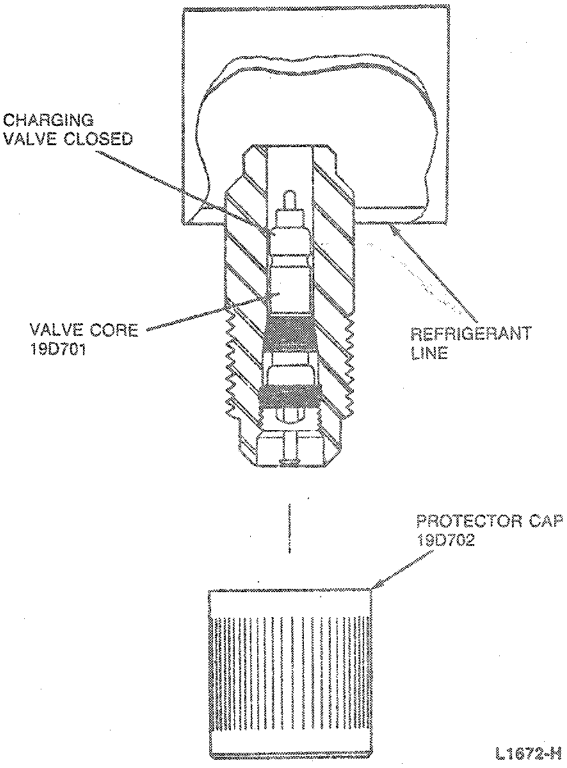
A service gauge port valve assembly is shown in the following illustration with the valve in the closed position. The next illustration shows a gauge port valve in the open position with a manifold gauge set hose attached.

R-12 System Service Gauge Port Valve



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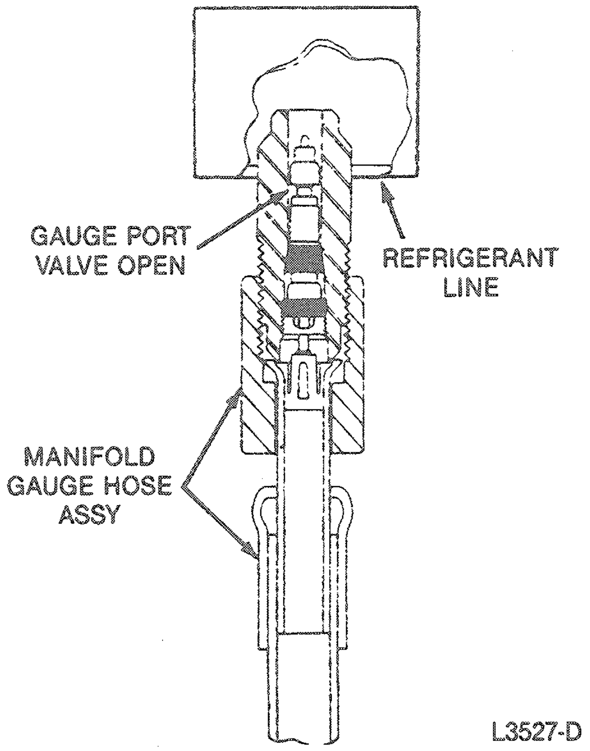
DESCRIPTION AND OPERATION (Continued)

R-12 System Manifold Gauge Set Hose Connected to Gauge Port Valve



DIAGNOSIS AND TESTING

Diagnosis is more than just following a series of interrelated steps in order to find the solution to a specific condition. It is a way of looking at systems that are not functioning the way they should and finding out why. Also, it is knowing how the system **should** work and whether it is working correctly. All good diagnosticians use the same basic procedure.

There are basic rules for diagnosis. If these rules are followed, the cause of the condition will usually be found the first time through the system.

Know the System

Know how the parts go together. Also, know how the system operates, its limits and what happens when something goes wrong. Sometimes this means comparing a system that is working properly with the one you are servicing.

Know the History of the System

Has it been serviced in the past in such a manner that might relate to the present condition? What is the service history? A clue in any of these areas might save a lot of diagnosis time.

Know the Probability of Certain Conditions Developing

It is true that most conditions are caused by simple things rather than by complex ones and they occur in a fairly predictable pattern. Electrical concern conditions, for instance, usually occur at connections rather than in components. An engine no-start is more likely to be caused by a loose wire or some component out of adjustment than a sheared-off camshaft. Know the difference between **impossible** and **improbable.** Many good technicians have spent hours diagnosing a system because they thought certain failures were impossible, only to eventually find out the failures were just "improbable" and actually had happened.

Don't Cure the Symptom and Leave the Cause

Recharging a refrigerant system may correct the condition of insufficient cooling, but it does not correct the original concern unless a cause is found.

Be Sure the Cause is Found

Do not be fooled into thinking the cause of the concern has been found. Perform the proper tests, then double check the results. The system should have been checked for refrigerant leaks. If no leaks were found, perform a leak test with the system under extremely high pressure.

Diagnosis Charts

No matter what form charts may take, they are simply a way of expressing the relationship between basic logic and a physical system of components. It is a way of determining the cause of a condition in the **shortest possible amount of time.** Diagnosis charts combine many areas of diagnosis into one visual display:

- **Probability** of certain things occurring in a system.
- **Speed** of checking certain components, or functions, before others.
- **Certainty** of narrowing down the search to a small portion before performing in-depth testing.
- **Simplicity** of performing certain tests before others.
- **Elimination** of checking huge portions of a system by performing simple tests.

The fastest way to find a condition is to work with the tools that are available, which means working with proven diagnosis charts and the proper special tools for the system being worked on.

System Visual Inspection

It is often possible to detect concerns by a careful visual inspection of the A/C refrigerant system. This includes broken belts, obstructed condenser air passages, excessive clutch air gap, loose or broken mounting brackets, disconnected or broken wires and refrigerant leaks.

DIAGNOSIS AND TESTING (Continued)

A refrigerant leak will usually appear as an oily residue at the leakage point in the system. The oily residue soon picks up dust or dirt particles from the surrounding air and appears greasy. Through time, this will build up and appear to be a heavy, dirt-impregnated grease.

Most common leaks are caused by damaged or missing O-ring seals at the various hose and component connections. When these O-rings are replaced, the new O-rings should be lubricated with silicone or refrigerant oil. Care should be taken to keep lint from shop towels or cloths from contaminating the internal surfaces of the connection. Leakage may occur at a spring lock coupling if the wrong O-rings are used at the coupling. Use **only** the green O-rings listed in the Ford Master Parts Catalog for the spring lock coupling.

Another type of leak may appear at the internal Schrader-type A / C charging valve core in the service gauge port valve fittings. If tightening the valve core does not stop the leak, it should be replaced with a A / C Charging Valve Core (19D701).

Missing Service Gauge Port Valve Caps (19D702) can also cause a refrigerant leak. If this important primary seal (the valve cap) is missing, dirt will enter the area of the A / C charging valve core. When the service hose is attached, the valve depressor in the end of the service hose forces the dirt into the valve seat area and the dirt will destroy the sealing surface of the A / C charging valve core. When a service gauge port valve cap is missing, the protected area of the A / C charging valve core should be cleaned and a new Service Gauge Port Valve Cap (19D702) should be installed.

CAUTION: Service gauge port valve caps must be installed finger-tight. If tightened with pliers, the sealing surface of the service gauge port valve may be damaged.

Electrical

Refer to the Taurus / Sable Electrical Vacuum Troubleshooting Manual for a complete schematic and wire colors.

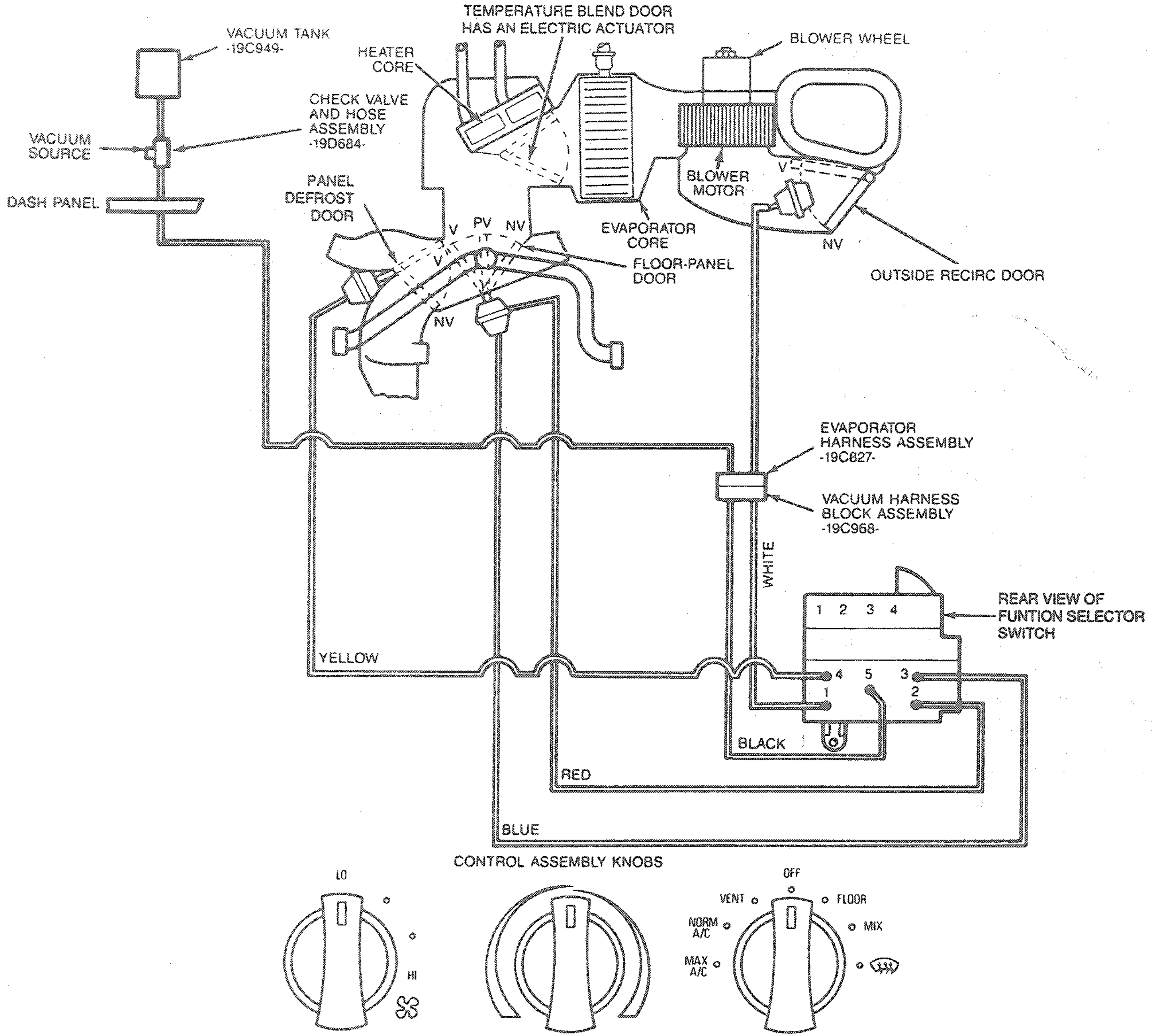
Vacuum System

To test the A / C-heater control system, start the engine and rotate the function selector control knob slowly from one position to another. A momentary hiss sound should be heard as the function control knob is rotated indicating that vacuum is available at the control assembly. A continuous hiss at the control assembly indicates a major leak **somewhere** in the system. It **does not** necessarily indicate that the leak is at the control assembly.

If a momentary hiss **cannot** be heard when the function selector control knob is rotated from one position to another, check for a kinked, pinched or disconnected vacuum supply hose. Also inspect the check valve between the intake manifold and the vacuum reservoir to ensure it is working properly.

DIAGNOSIS AND TESTING (Continued)

A / C System Schematic and Vacuum Control Chart



FUNCTION SELECTOR KNOB POSITION	OUTSIDE-RECIRC. AIR DOOR	FLOOR-PANEL DOOR	PANEL-DEFROST DOOR	BLOWER MOTOR
MAX — A/C	V	NV	V	ON
NORM — A/C	NV	NV	V	ON
VENT	NV	NV	V	ON
OFF	V	V	V	OFF
FLOOR	NV	V	NV	ON
MIX	NV	PV	NV	ON
DEFROST	NV	NV	NV	ON
VACUUM HOSE COLOR CODE	WHITE	RED BLUE①	YELLOW	—

①BLUE — PARTIAL VACUUM; BLUE AND RED — FULL VACUUM

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DIAGNOSIS AND TESTING (Continued)

If a momentary hiss can be heard when the function selector knob is rotated from one position to another, vacuum is available at the control assembly, then cycle the function selector control knob through each position with the blower on HI and check the location(s) of the discharge air. The airflow schematic and vacuum control chart shows the vacuum motors applied for each position of the function control knob along with a system airflow diagram. The airflow diagram shows the position of each door when vacuum is applied and the no-vacuum position. Using this chart, airflow for each position of the control assembly can be determined. If a vacuum motor fails to operate, the motor can readily be found because the airflow will be incorrect.

If a vacuum motor is inoperative, check the operation of the motor with Rotunda Vacuum Tester 021-00014 or equivalent. If the vacuum motor operates properly, the vacuum hose is probably pinched, kinked, disconnected or has a hole in it.

If the vacuum system functions normally at idle but goes to defrost during acceleration, a small leak exists in the system. The leak can be located by turning off the engine and using a gauge to check for vacuum delay while selectively blocking off vacuum hoses.

Refrigerant System

System Using Refrigerant R-134a

The major components of R-134a A/C systems are similar to those used previously on Ford R-12 fixed orifice tube type systems. R-12 and R-134a components are similar in design and function. As a result, all Diagnosis and Testing procedures for R-12 components can be used for R-134a components. However, it is very important to note that R-134a system components can only be replaced with other R-134a components. R-134a components cannot be replaced with components used with R-12 systems. The same is true for R-12 components: they cannot be replaced with R-134a components.

CAUTION: R-12 and R-134a components are not interchangeable. Do not replace components from an R-134a system with components for an R-12 system. Also, do not replace components from an R-12 system with components for an R-134a system. Mixing components from these two types of systems may cause component failure and damage to the A/C system.

The best way to diagnose a condition in the refrigerant system is to note the system pressures (shown by the manifold gauges) and the clutch cycle rate and times. Then, compare the findings to the following charts.

- The system pressures are low (compressor suction) and high (compressor discharge).
- A clutch cycle is the time the clutch is engaged plus the time it is disengaged (time on plus time off).
- Clutch cycle times are the lengths of time (in seconds) that the clutch is ON and OFF.

R-134a Special Servicing Equipment

R-134a systems require the use of special servicing equipment designed specially for R134a systems. R-12 servicing equipment cannot be used when servicing R-134a A/C systems. R-134a special servicing equipment includes:

- R-134a Manifold gauge set
- R-134a Charging station
- R-134a Reclaimation system
- R-13a Leak detector

For more information on R-134a special tools and equipment, refer to the Rotunda Equipment Catalog.

CAUTION: Do not use R-12 Special Tools and Equipment when servicing an R-134a system. Also, do not use R-134a Special Tools and Equipment when servicing an R-12 system. Doing so may cause damage to the A/C system. Refer to the Rotunda Equipment Catalog for more information on R-134a Special Servicing Equipment.

Test equipment must be connected to the refrigerant system in order to make system tests. If a charging station is used, follow the instructions of the station manufacturer.

DIAGNOSIS AND TESTING (Continued)

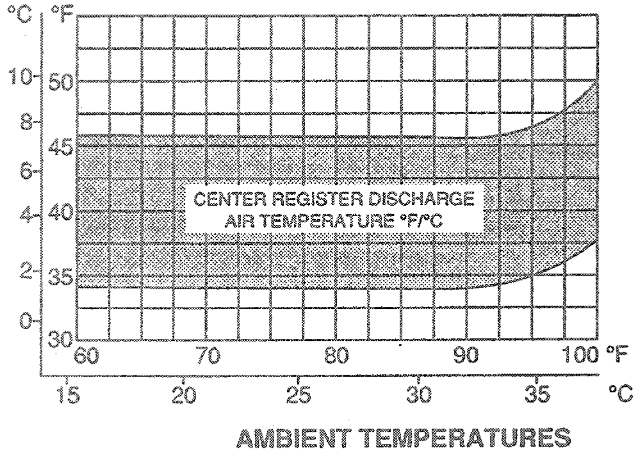
Normal Fixed Orifice Tube Refrigerant System Pressure Temperature Relationships

IMPORTANT TEST REQUIREMENTS

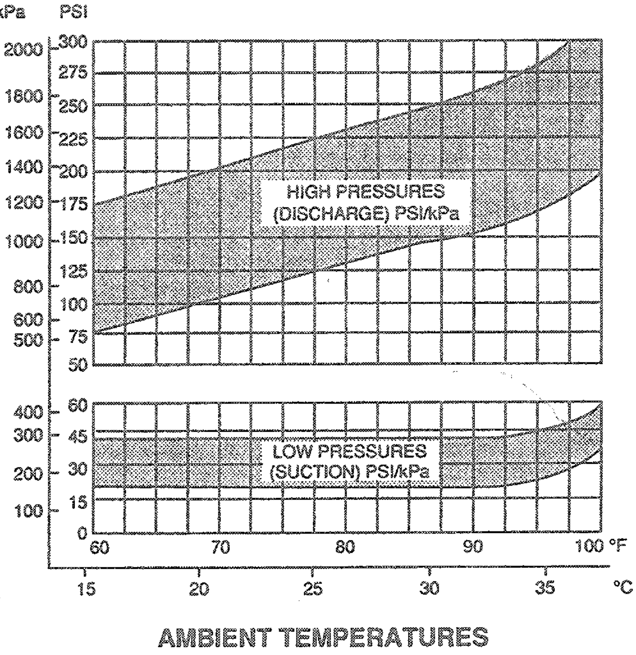
The following test conditions must be established to obtain accurate clutch cycle rate and cycle time readings:

- Run engine at 1500 rpm for 10 minutes.
- Operate A/C system on max A/C (recirculating air).
- Run blower at max speed.
- Stabilize in-car temperature ° 70° F. to 80° F. (21° C. to 22, C.).

NORMAL CENTER REGISTER DISCHARGE TEMPERATURES



NORMAL FIXED ORIFICE TUBE CYCLING CLUTCH REFRIGERANT SYSTEM PRESSURES



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DIAGNOSIS AND TESTING (Continued)

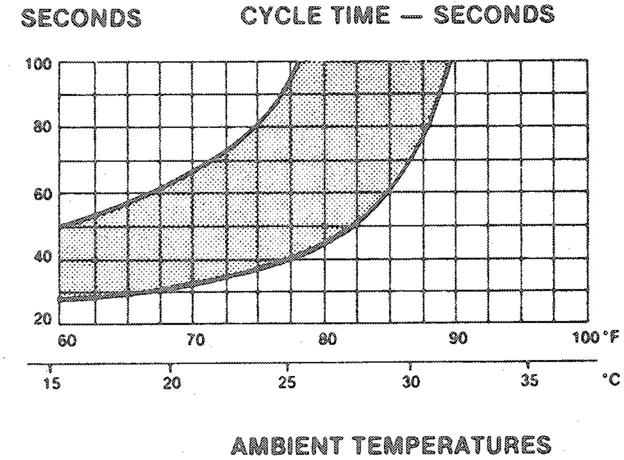
Normal Fixed Orifice Tube Refrigerant System Clutch Cycle Timing Rates

IMPORTANT — TEST REQUIREMENTS

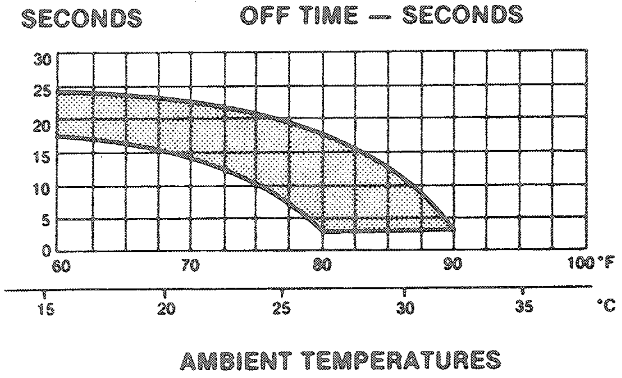
The following test conditions must be established to obtain accurate clutch cycle rate and cycle time readings:

- Run engine at 1500 rpm for 10 minutes.
- Operate A/C system on max A/C (recirculating air).
- Run blower at max speed.
- Stabilize in car temperature @ 70°F to 80°F (21°C to 22°C).

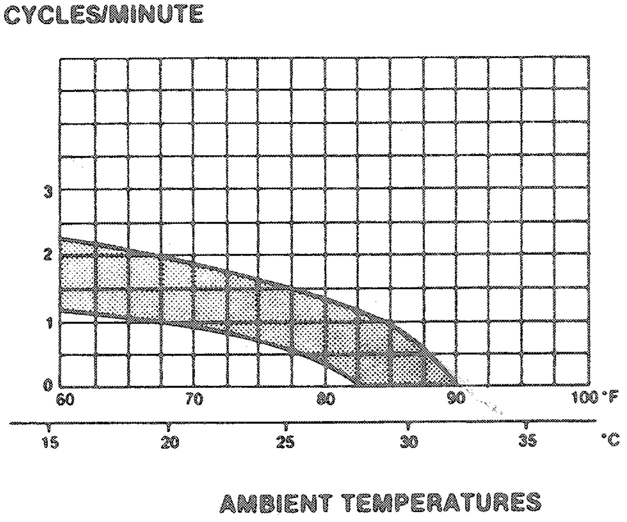
TOTAL CLUTCH CYCLE TIME — SECONDS



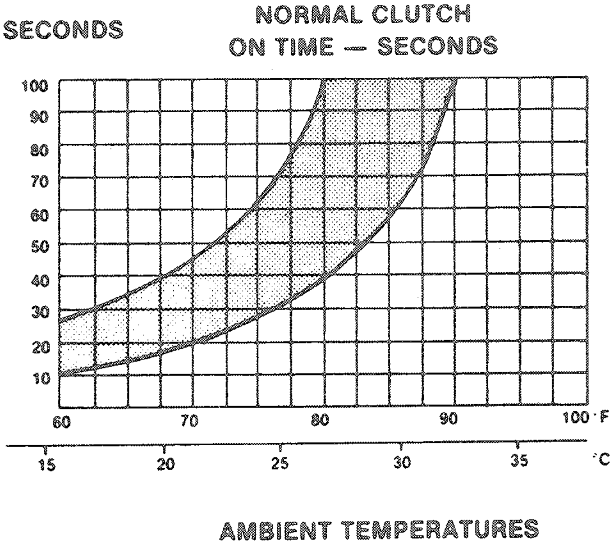
NORMAL CLUTCH OFF TIME — SECONDS



NORMAL CLUTCH CYCLE RATE PER MINUTE



NORMAL CLUTCH ON TIME — SECONDS



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The following procedure is recommended for achieving accurate diagnosis results in the least amount of time.

NOTE: Steps 10 through 14 **DO NOT** apply to systems using refrigerant R-134a.

DIAGNOSIS AND TESTING (Continued)

1. Connect a manifold gauge set, part of Rotunda Air Conditioning Service Kit 063-00010 or equivalent, to the system. Purge air from red and blue hoses by loosening fittings at gauge set. Open only long enough for air to escape and then tighten fittings.

   NOTE: The test conditions, specified at the top of each chart, must be met to obtain accurate test results.
2. Start the engine and turn ON A/C system.
3. As soon as the system is stabilized, record the high- and low-pressures as shown by the manifold gauges. Normally the suction pressure should decrease to a range between 22 and 28 psi and the pressure switch should open. When the pressure switch opens, the suction pressure should start to rise to a range between 40 and 47 psi. Somewhere between 40 and 47 psi, the pressure switch should close and the suction pressure should start to drop.

   The discharge (high) pressure should operate the reverse of the suction pressure. When the suction pressure is dropping the discharge pressure should increase. When the suction pressure is increasing, the discharge pressure should decrease.
4. Determine the clutch cycle rate per minute (clutch on time plus off time is a cycle).
5. Record clutch OFF time in seconds.
6. Record clutch ON time in seconds.
7. Record center register discharge temperature.
8. Determine and record ambient temperatures.
9. Compare test readings with applicable previous charts.
   - Plot a vertical line for recorded ambient temperature from scale at bottom of each chart to top of each chart.
   - Plot a horizontal line for each of the other test readings from scale at LH side of appropriate chart.
10. Disconnect the electrical connector at the clutch cycling pressure switch and remove the switch from the switch fitting.
11. Install a new clutch cycling pressure switch and O-ring on the Tee-Adapter Tool. Leave it on the adapter as a permanent part of the tool. Be sure to lubricate the O-ring before installation.
12. Install the Tee Adapter Tool on the clutch cycling pressure switch fitting and tighten it securely.
13. Connect the low-pressure hose of the manifold gauge set to the side fitting of the Tee Adapter Tool.
14. Connect the electrical connector to the clutch cycling pressure switch on the Tee Adapter Tool.

With the Tee Adapter Tool installed in this manner, the refrigerant system can be operated under normal conditions with clutch cycling pressure switch control and evaporator (suction) pressure can be observed. This will give a more accurate low-pressure reading than can be obtained from a low-pressure gauge port located in the suction line or near the the compressor.

After completing service, disconnect the manifold gauge set from the Tee Adapter Tool. Disconnect the electrical connector from the clutch cycling pressure switch on the tool and remove the tool from the pressure switch fitting. Install the removed clutch cycling pressure switch and connect the electrical connector.

Always replace the protector caps on the gauge port valves after servicing the refrigerant system.

At the bottom of the chart, additional cause components are listed for poor compressor operation or a damaged compressor condition.

DIAGNOSIS AND TESTING (Continued)

Refrigerant System Pressure and Clutch Cycle Timing Evaluation Chart—Fixed Orifice Tube/Clutch Cycling Pressure Switch

REFRIGERANT SYSTEM PRESSURE AND CLUTCH CYCLE TIMING EVALUATION CHART FOR FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEMS

NOTE: System test requirements must be met to obtain accurate test readings for evaluation. Refer to the normal refrigerant system pressure/temperature and the normal clutch cycle rate and times charts.

HIGH (DISCHARGE) PRESSURE	LOW (SUCTION) PRESSURE	CLUTCH CYCLE TIME (b)			COMPONENT — CAUSES
		RATE	ON	OFF	
HIGH	HIGH	CONTINUOUS RUN			CONDENSER — Inadequate Airflow Refrigerant overcharge
HIGH	NORMAL TO HIGH				ENGINE OVERHEATING
NORMAL TO HIGH	NORMAL				REFRIGERANT OVERCHARGE (a) AIR IN REFRIGERANT. HUMIDITY OR AMBIENT TEMP. VERY HIGH (b)
NORMAL	HIGH				FIXED ORIFICE TUBE — Missing O-Rings Leaking/Missing
NORMAL	NORMAL	SLOW OR NO CYCLE	LONG OR CONTINUOUS	NORMAL OR NO CYCLE	MOISTURE IN REFRIGERANT SYSTEM EXCESSIVE REFRIGERANT OIL
NORMAL	LOW	SLOW	LONG	LONG	CLUTCH CYCLING SWITCH — Low Cut-Out
NORMAL TO LOW	HIGH	CONTINUOUS RUN			Compressor — Low Performance
NORMAL TO LOW	NORMAL TO HIGH				A/C SUCTION LINE — Partially Restricted or Plugged (c)
NORMAL TO LOW	NORMAL	FAST	SHORT	NORMAL	EVAPORATOR - Low or Restricted Airflow
			SHORT TO VERY SHORT	NORMAL TO LONG	CONDENSER, FIXED ORIFICE TUBE, OR A/C LIQUID LINE — Partially Restricted or Plugged
			SHORT TO VERY SHORT	SHORT TO VERY SHORT	LOW REFRIGERANT CHARGE
			SHORT TO VERY SHORT	LONG	EVAPORATOR CORE — Partially Restricted or Plugged
NORMAL TO LOW	LOW	CONTINUOUS RUN			A/C SUCTION LINE — Partially Restricted or Plugged. (d) CLUTCH CYCLING SWITCH — Sticking Closed
ERRATIC OPERATION OR COMPRESSOR NOT RUNNING		—	—	—	CLUTCH CYCLING SWITCH — Dirty Contacts or Sticking Open. POOR CONNECTION AT A/C CLUTCH CONNECTOR OR CLUTCH CYCLING SWITCH CONNECTOR. A/C ELECTRICAL CIRCUIT ERRATIC — See A/C Electrical Circuit Wiring Diagram A/C Cut Out -- By Engine Control Assembly (ECA)
ADDITIONAL POSSIBLE CAUSE COMPONENTS ASSOCIATED WITH INADEQUATE COMPRESSOR OPERATION					
• COMPRESSOR DRIVE BELT — Loose • COMPRESSOR CLUTCH — Slipping • CLUTCH COIL Open — Shorted, or Loose Mounting • CONTROL ASSEMBLY SWITCH — Dirty Contacts or Sticking Open • CLUTCH WIRING CIRCUIT — High Resistance, Open or Blown Fuse • COMPRESSOR OPERATION INTERRUPTED BY ENGINE COMPUTER					
ADDITIONAL POSSIBLE CAUSE COMPONENTS ASSOCIATED WITH A DAMAGED COMPRESSOR					
• CLUTCH CYCLING SWITCH - Sticking Closed or Compressor Clutch Seized • SUCTION ACCUMULATOR DRIER — Refrigerant Oil Bleed Hole Plugged • REFRIGERANT LEAKS					

(a) Compressor may make noise on initial run. This is slugging condition caused by excessive liquid refrigerant

(b) Compressor clutch may not cycle in ambient temperatures above 80 °F depending on humidity conditions.

(c) Low pressure reading will be **normal to high** if pressure is taken at accumulator and if restriction is downstream of service access valve.

(d) Low pressure reading will be **low** if pressure is taken near the compressor and restriction is upstream of service access valve.

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DIAGNOSIS AND TESTING (Continued)

The diagnosis charts provide the most direct and sure way to determine the cause of any concern in a poorly performing refrigerant system.

After servicing and correcting a refrigerant system concern, take additional pressure readings and observe the clutch cycle rate while meeting the conditional requirements to ensure the concern has been corrected.

In ambient temperatures above 27°C (80°F), the compressor clutch will not normally cycle off. This will depend on local conditions and engine / vehicle speed. Also, clutch cycling will normally not occur when the engine is operating at curb idle speed.

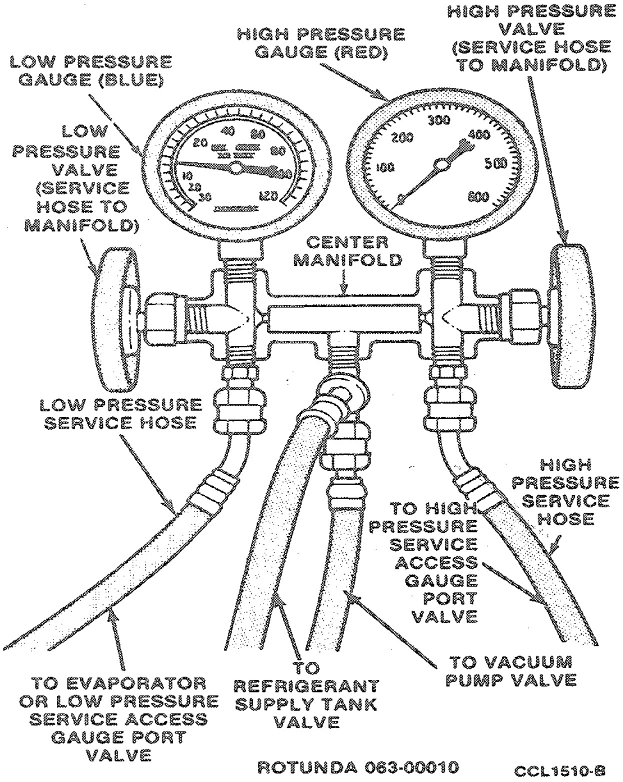
If the system contains no refrigerant or is extremely low on refrigerant, the clutch will not engage for compressor operation. A rapid cycling compressor clutch is usually an indication that the system is low on refrigerant. Refer to Insufficient or No A / C Cooling—Fixed Orifice Tube Cycling Clutch System Diagnosis chart.

Checking for Leaks

WARNING: GOOD VENTILATION IS NECESSARY IN THE AREA WHERE A/C LEAK TESTING IS TO BE DONE. IF THE SURROUNDING AIR IS CONTAMINATED WITH REFRIGERANT GAS, THE LEAK DETECTOR WILL INDICATE THIS GAS ALL THE TIME. ODORS FROM OTHER CHEMICALS SUCH AS ANTIFREEZE, DIESEL FUEL, DISC BRAKE CLEANER OR OTHER CLEANING SOLVENTS CAN CAUSE THE SAME CONCERN. A FAN, EVEN IN A WELL VENTILATED AREA, IS VERY HELPFUL IN REMOVING SMALL TRACES OF AIR CONTAMINATION THAT MIGHT AFFECT THE LEAK DETECTOR.

Attach the manifold gauge set. Leave both manifold gauge valves at the maximum clockwise (closed) position. Both gauges should show approximately 413-551 kPa (60-80 psi) at 24°C (75°F) with engine not running. If very little or no pressure is indicated, leave the vacuum pump valve closed, open the Refrigerant-12 cylinder valve, and set the low-pressure (suction) manifold gauge valve to the counterclockwise position. This opens the system to cylinder pressure.

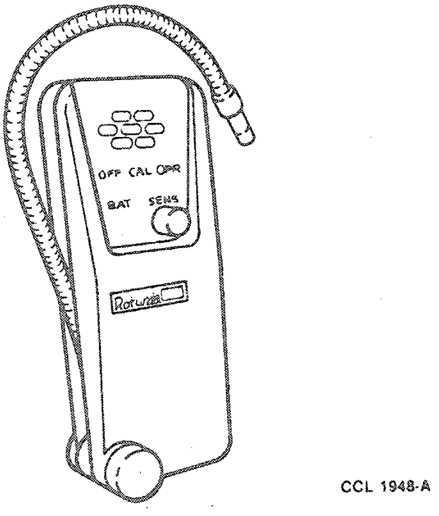
Manifold Gauge Set



Check all system connections, the compressor head gasket and shaft seal for leaks, using a good leak detector. Pass the leak detector along the underside of all points being checked. Refrigerant is heavier than air and will show most readily in those locations.

Use Rotunda Electronic Leak Detector 055-00014, 055-00015 or equivalent (R-12 systems only, systems with refrigerant R134a require different equipment).

R-12 Leak Detector—Electronic 055-00014 or 055-00015



DIAGNOSIS AND TESTING (Continued)

The electronic leak detector is operated by moving the control switch to the ON position. The detector automatically calibrates itself when it is turned on. Move the probe approximately 25mm (1 inch) per second in the suspected area. When escaping refrigerant gas is located, the ticking / beeping signal will increase in ticks / beeps per second. If the gas is relatively concentrated the signal will be increasingly shrill. Follow the instructions included with the detector to improve handling and operating techniques.

Leak Tracer Dye

Tools Required:

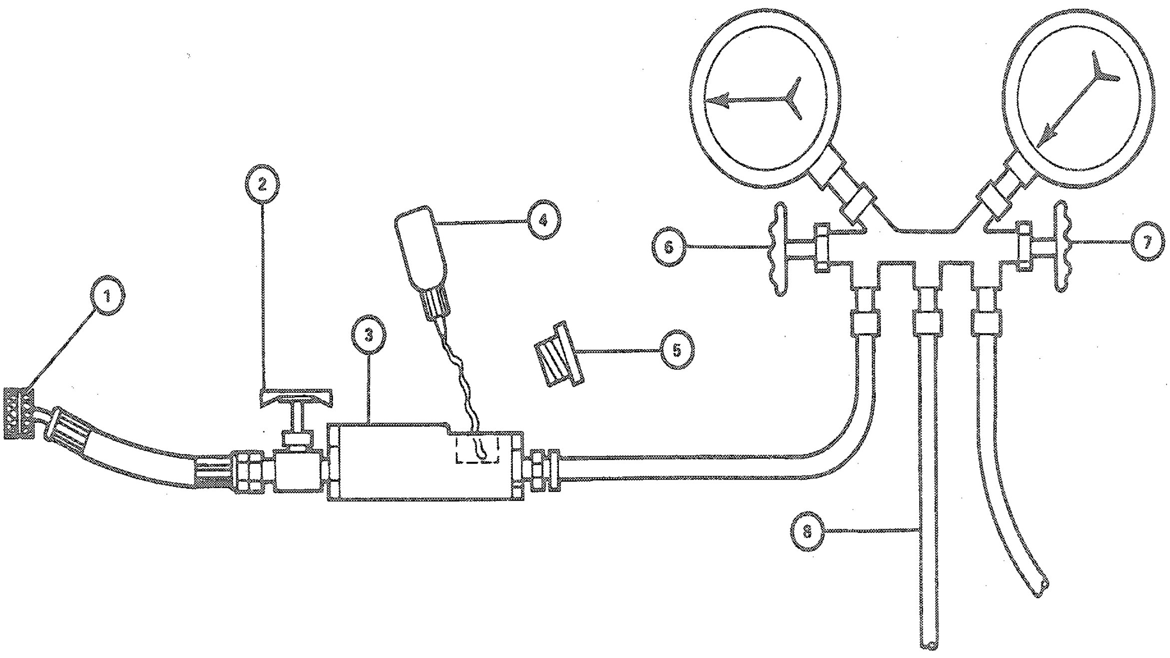
- Rotunda Fluoro-Lite Tracer Dyes 112-00027
- Rotunda A / C Tracer Dye Injector 112-00028
- Rotunda Ultraviolet Lamp 112-00021

NOTE: Rotunda Fluoro-Lite Leak Tracer Dye **CANNOT** be used in systems with refrigerant R-134a.

Rotunda Fluoro-Lite 112-00027 or equivalent may also be used to detect refrigerant leaks. With the tracer dye in the system, use Rotunda Ultraviolet lamp 112-00021 or equivalent to find the leak or leaks. The tracer dye will glow a bright yellow / green color at the point of refrigerant leakage when the light is directed toward the leak. If the system pressure is above 60 psi, there is no need to add refrigerant to the system for this operation.

Rotunda Fluoro-Lite tracer dye may be introduced into the A / C system using Rotunda A / C Tracer Dye Injector 112-00028 or equivalent. Inject the dye and check for leaks as follows:

Tracer Dye Injector 112-00028



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ITEM	DESCRIPTION
1.	TO LOW PRESSURE SERVICE PORT
2.	RESERVOIR VALVE
3.	TRACER DYE RESERVOIR (1/4 OZ. CAPACITY)
4.	FLUORO-LITE TRACER DYE
5.	RESERVOIR CAP
6.	LOW PRESSURE VALVE
7.	HIGH PRESSURE VALVE
8.	TO R-12 CYLINDER

DIAGNOSIS AND TESTING (Continued)

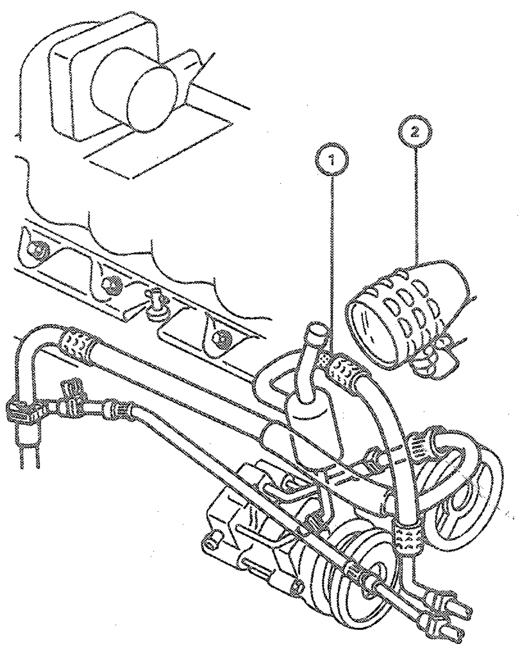
1. Close valve on dye injector.
2. Connect the hose end of the dye injector to the system low pressure gauge port valve. Tighten securely.
3. Close both valves on manifold gauge set and connect the center hose to a charging cylinder. Leave center hose loose at manifold gauge set. Momentarily open charging cylinder valve to purge air out of the center hose, then tighten the center hose at the manifold gauge set connection. Close the valve on the charging cylinder.
4. Connect manifold gauge set low pressure hose to dye injector, leaving the connection at the manifold gauge set loose.
5. Open dye injector valve to allow A / C system pressure to purge air from the dye injector reservoir and the low pressure hose to the manifold gauge set. Tighten the hose connection at the manifold gauge set. Close valve on dye injector.

   CAUTION: Do not overfill.
6. Remove reservoir cap from top of the dye injector and fill reservoir with 1 / 4 ounce of Fluoro-Lite tracer dye.
7. Replace reservoir cap and tighten securely.
8. Open valve on charging cylinder, then open manifold gauge low pressure valve. Open valve on dye injector for 5 to 10 seconds to allow the dye to be forced into the A / C system. Close dye injector valve. Close manifold gauge low pressure valve and valve on charging cylinder.
9. Start engine and operate the A / C system at MAX to stabilize the system (approximately 10-15 minutes).

   NOTE: Small leaks may require considerably longer before the tracer becomes evident under the ultraviolet light.
10. Shut OFF engine.
11. Disconnect all hoses slowly to dissipate any residual refrigerant pressure that may be present.
12. Using Rotunda Ultraviolet Lamp 112-00021 or equivalent, check system for leaks. The tracer dye will glow a bright yellow / green when the ultraviolet light hits it.

    NOTE: Periodically lubricate dye injector reservoir valve stem with refrigerant oil.

Ultraviolet Lamp 112-00021



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ITEM	DESCRIPTION
1.	PRESENCE OF DYE INDICATES LEAK HERE
2.	ULTRAVIOLET LIGHT ROTUNDA NO. 112-00021

Evaporator Core and Condenser On-Vehicle Leak Test

Tools Required:

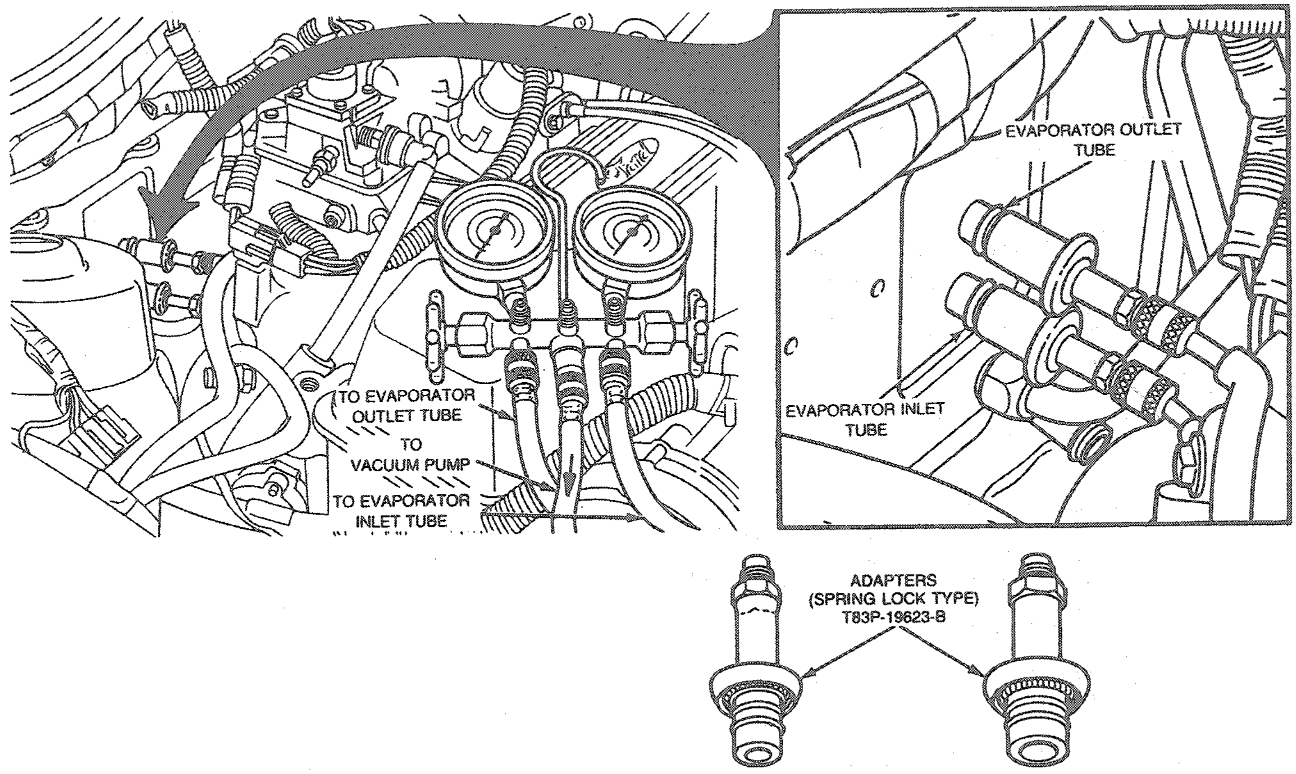
- Rotunda A / C Refrigerant Reclaim System 078-00800
- Leak Test Adapter Kit D88P-19703-B

If an evaporator core or condenser is suspected of leaking, the leak must be verified prior to removing the component from the vehicle. This leak test should be performed as outlined below. **DO NOT** rely solely on the results of an electronic leak detector as chemicals other than R-12 will activate the leak detector.

1. Remove the refrigerant from the system, with a refrigerant recovery machine such as the Rotunda A / C Reclaim system (078-00800) or equivalent following the recommended service procedure.
2. Disconnect the inlet and outlet connections from the evaporator core or condenser. Immediately install protective caps on the removed connections to prevent excess moisture from entering the system.
3. Install the mating adapters from the evaporator core / condenser Leak Test Adapter Kit, Tool D88P-19703-B, on both fittings of the component being tested.

DIAGNOSIS AND TESTING (Continued)

Evaporator Core / Condenser Leak Test Adapter Kit D88P-19703-B



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4. Connect the two outside hoses of a manifold gauge set to the adapter fittings. Be sure the connections are tight.
5. Connect the center hose of the manifold gauge set to a vacuum pump. Start the vacuum pump and open the valves of the gauge set.
6. Operate the vacuum pump and watch the low pressure gauge. It should show almost 30 in-Hg within one or two minutes. Then, close the gauge set valves and stop the vacuum pump.
7. Observe the low pressure gauge for fifteen minutes and watch for a drop in the gauge reading. If a slow leak is suspected, leave component connected to gauge set overnight. If the gauge reading drops, the component is leaking and should be replaced. If the gauge reading does NOT drop, the component is not leaking. Look elsewhere for the source of the leak.
8. Disconnect the vacuum pump, manifold gauge set and the adapters from the component being tested.
9. Assemble the original component into the system if it was not leaking. Use new green O-rings lubricated with clean refrigerant oil.
10. If the component was leaking, install a new part and a new suction accumulator. Use new green O-rings lubricated with clean refrigerant oil.
11. Leak test, evacuate and charge the system following the recommended service procedures.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A:
INSUFFICIENT OR NO A/C COOLING—FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEM

TEST STEP		RESULT ▶	ACTION TO TAKE
A1	VERIFY THE CONDITION		
	● Check system operation. ● **Does system cool properly?**	Yes ▶	INSTRUCT vehicle owner on proper use of the system.
		No ▶	GO to A2.
A2	CHECK A/C COMPRESSOR CLUTCH		
	● **Does the A/C compressor clutch engage?**	Yes ▶	GO to A3.
		No ▶	REFER to clutch circuit diagnosis in this section.
A3	CHECK OPERATION OF COOLING FAN		
	● Check to ensure electro-drive cooling fan runs when the A/C compressor clutch is engaged. ● **Is cooling fan operational?**	Yes ▶	GO to A4.
		No ▶	REFER to engine cooling fan circuit diagnosis, Section 03-03.
A4	COMPONENT CHECK		
	● Underhood check of the following: — Loose, missing or damaged compressor drive belt. — Loose or disconnected A/C clutch or clutch cycling pressure switch wires/connectors. — Disconnected resistor assembly. — Loose vacuum lines or misadjusted control cables. ● Inside vehicle check for: — Blown fuse/proper blower motor operation. — Vacuum motors/temperature door movement—full travel. — Control electrical and vacuum connections. ● **Are components OK?**	Yes ▶	GO to A6.
		No ▶	SERVICE and GO to A5.
A5	CHECK SYSTEM		
	● Check system operation. ● **Does system operate properly?**	Yes ▶	Condition corrected. GO to A1.
		No ▶	GO to A6.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST A: INSUFFICIENT OR NO A/C COOLING—FIXED ORIFICE TUBE CYCLING CLUTCH SYSTEM (Continued)

TEST STEP		RESULT	▶	ACTION TO TAKE
A6	CHECK COMPRESSOR CLUTCH ● Use refrigerant system pressure / clutch cycle rate and timing evaluation charts. ● After preparing vehicle as follows: — Hook up manifold gauge set. — Set function control at MAX A/C. — Set blower switch on HIGH. — Set temperature lever full COLD. — Close doors and windows. — Use a thermometer to check temperature at center discharge register, record outside temperature. — Run engine at approximately 1500 rpm with compressor clutch engaged. — Stabilize with above conditions for 10-15 minutes. ● Compare readings with normal system pressure ranges.	Compressor cycles very rapidly (5 seconds on) (5 seconds off) Suction pressure within limits	▶	GO to A7.
		Clutch cycles within limits, system pressure within limits	▶	System OK. GO to A1.
		Compressor runs continuously (normal operation in ambient temperature above 27°C (80°F) depending on humidity conditions)	▶	GO to A8.
		Compressor cycles high or low ON above 259 kPa (52 psi) OFF below 144 kPa (20 psi)	▶	REPLACE clutch cycling pressure switch. Do not discharge system. Switch fitting has Schrader valve. CHECK system. OK—GO to A1.
			▶	NOT OK—RE-INSTALL original switch. GO to A7.
A7	CHECK SYSTEM ● Leak check system. ● Is system leaking?	Yes	▶	SERVICE, discharge, evacuate and charge system. System OK, GO to A1.
		No	▶	CHECK for restricted orifice tube or liquid line, SERVICE if necessary. GO to A1.
A8	CHECK CLUTCH CYCLING ● Disconnect blower motor wire and check for clutch cycling off at 152 kPa (22 psi) (suction pressure).	Clutch cycles OFF at 152-193 kPa (22-28 psi)	▶	If ambient temperature is below 27°C (80°F) RECYCLE refrigerant-12 and charge to specified weight. If temperature is above 27°C (80°F), system is OK. GO to A1.
		Pressure falls below 152 kPa (22 psi)	▶	REPLACE clutch cycling pressure switch. Do not discharge system. Switch fitting has Schrader valve. System OK, GO to A1.

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DIAGNOSIS AND TESTING (Continued)

Operation of the A / C compressor clutch is dependent on the ambient temperature and signals from the engine computer. Strategies are programmed into the engine computer to interrupt A / C compressor operation when certain conditions exist. The A / C compressor clutch can be shut off (or kept off) for several seconds at engine start-up, at high engine speeds, during acceleration, when the engine coolant temperature exceeds a predetermined temperature and during low engine idle conditions (approximately 200 rpm below low idle specifications. Refer to the following diagnostic procedures and, if necessary, the Powertrain Control / Emissions Diagnosis Manual[1] to correct an inoperative compressor clutch condition.

NOTE: The ambient temperature must also be above approximately 50°F for A / C compressor operation.

PINPOINT TEST B: A / C CLUTCH CIRCUIT DIAGNOSIS

TEST STEP		RESULT ▶	ACTION TO TAKE
B1	CHECK SYSTEM OPERATION ● Start engine. ● Set the A / C control MAX A / C. Check battery voltage (if not 12.5 volts or more, refer to Charging System Diagnosis). ● **Does clutch engage?**	Yes ▶	Circuit functioning properly
		No ▶	GO to B2.
B2	BY-PASS PRESSURE SWITCH ● Disconnect electrical connector from pressure switch on accumulator. Jumper the harness connector pins. Engine must be running and system set at MAX A / C. ● **Does clutch engage?**	Yes ▶	GO to B3.
		No ▶	GO to B4.
B3	CHECK REFRIGERANT SYSTEM PRESSURES ● Connect gauge set to service ports and observe pressure. ● **Does pressure measure above 50 psi?**	Yes ▶	REPLACE clutch cycling pressure switch. GO to B1.
		No ▶	CHECK refrigerant system for leaks. SERVICE leak test and charge as necessary. GO to B1.
B4	CHECK VOLTAGE AT PRESSURE SWITCH ● Check for battery voltage at pressure switch electrical connector 348 circuit (LG / P wire) to ground. ● **Is there battery voltage?**	Yes ▶	GO to B8.
		No ▶	GO to B5.
B5	CHECK A / C CONTROL SWITCH ● Check for battery voltage at the A / C control switch 348 circuit (LG / P wire). ● **Is there voltage?**	Yes ▶	SERVICE wiring as necessary. GO to B1.
		No ▶	GO to B6.
B6	CHECK EATC OR CONTROL ASSEMBLY OUTPUT VOLTAGE ● Check for battery voltage at: EATC Control Assembly Pin 25 (clutch output signal). A / C Control Assembly output. ● **Is there voltage?**	Yes ▶	CHECK circuit between control assembly and pressure switch for open. SERVICE as necessary. GO to B1.
		No ▶	GO to B6.

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[1] Can be purchased as a separate item.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST B:
A/C CLUTCH CIRCUIT DIAGNOSIS (Continued)

TEST STEP		RESULT ▶	ACTION TO TAKE
B7	CHECK FUSE ● Check for voltage at fuse panel 295 circuit (LB/PK wire). Ignition switch must be in the run position. ● Ignition switch must be in the run position. ● **Is there voltage?**	Yes ▶	SERVICE wiring between control assembly and fuse. GO to B1.
		Less than 10 volts ▶	CHECK charging system operation and for high resistance in clutch circuit.
		No ▶	CHECK fuse. SERVICE circuit as required. CHECK diode in IRCM for short. (Pins 16 and 23). GO to B1.
B8	CHECK CLUTCH CIRCUITS ● Check for voltage across harness connector at clutch field coil. — A minimum of 10 volts is required. ● **Are there 10 volts or more?**	Yes ▶	GO to B9.
		No ▶	GO to B11.
B9	JUMP FIELD COIL ● Disconnect field coil and jump battery voltage and ground to clutch field coil. ● **Does clutch engage?**	Yes ▶	CLEAN coil electrical terminals and RETEST.
		No ▶	GO to B10.
B10	CHECK CLUTCH AIR GAP ● Check air gap between clutch hub and pulley. ● **Is air gap within specified limits?**	Yes ▶	REPLACE clutch field coil.
		No ▶	RESET clutch air gap (see compressor section of shop manual). GO to B10.
B11	CHECK IRCM OUTPUT VOLTAGE ● Check for voltage between Pins 16 and 23 of the IRCM. — A minimum of 10 volts is required. ● **Is voltage present?**	Yes ▶	CHECK clutch coil wiring harness for open circuit. SERVICE as necessary. GO to B1.
		No ▶	GO to B12.
B12	CHECK CLUTCH SIGNAL AT IRCM ● Check for minimum of 11 volts at Pin 21 of the IRCM (clutch input signal). ● **Is voltage present?**	Yes ▶	GO to B13.
		No ▶	CHECK circuit between pressure switch and Pin 21 of IRCM for open. SERVICE as necessary.
B13	CHECK A/C CUT-OUT SIGNAL ● Remove RED wire from Pin 22 of IRCM harness connector. Start engine and set system set at MAX A/C. ● **Does the clutch energize?**	No ▶	REPLACE the IRCM.
		Yes ▶	GO to B14.

DIAGNOSIS AND TESTING (Continued)

PINPOINT TEST B:
A/C CLUTCH CIRCUIT DIAGNOSIS (Continued)

TEST STEP		RESULT ▶	ACTION TO TAKE
B14	CHECK POWERTRAIN CONTROL MODULE (PCM) 12A650 INPUT SIGNAL		
	● Check for minimum of 11 volts at Pin 10 of PCM. ● Is there voltage?	▶	The PCM is causing the CCRM to energize and interrupt the compressor circuit. Any of the following can be cause. REFER to PCM diagnosis in Service Manual. — **Throttle Position Sensor** - Sending WOT signal PCM. Disconnect electrical connector to remove sensor from circuit. Clutch will engage if sensor is sending WOT cut-out signal. — **Hot Engine Coolant** - Sensor sending hot coolant signal to PCM. Disconnect electrical connector from sensor. Clutch will engage if sensor is sending hot coolant signal to PCM. — **A/C On Circuit to PCM Open** - If this circuit is open, PCM will not receive signal from pressure switch to turn A/C clutch on.

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Wiring Diagrams and Actuators

The following illustrations provide an EATC system wiring diagram.

NOTE: Refer to the Taurus/Sable Electrical Vacuum Troubleshooting Manual for complete circuit schematics and wire colors.

EATC Self Test

1. Perform the EATC Functional Test. Record all error codes displayed during the test.
2. The control assembly will detect electrical malfunctions occurring during the self test.
3. Ensure engine is warm (at least 49°C (120°F) coolant temperature). To display the error codes for the malfunction detected, initiate the self test by pushing OFF and FLOOR simultaneously and then AUTOMATIC within two seconds. The test may run as long as 20 seconds, during which time the display will be blank. If the display is blank for more than 20 seconds, go to System Diagnosis When Self-Test and Functional Test indicate NO ERROR.
4. The Self Test can be initiated at any time with the resulting error codes being displayed. Normal operation of the system stops when Self Test is activated. To exit self-test and restart the system, push the blue button. Self Test should be deactivated before turning off the system. Refer to the Error Code Key in the following chart for an explanation of error codes.
5. If error codes appear during the EATC Functional Test, follow the diagnosis procedures outlined in the Error Code Key for each error code recorded.
6. If a malfunction exists but no error code appears during the test in Step 1, refer to Diagnosis When Self-Test Indicates No Error Found.

DIAGNOSIS AND TESTING (Continued)

ERROR CODE KEY

Error Code	Detected Condition	Troubleshooting/Repair Procedure
01	Replace Control Assembly	
02	Blend Door Problem	● Refer to Blend Door Actuator Diagnosis
03	In-Vehicle Temp Sensor Open or Short	● Refer to In-Vehicle Temp Sensor Diagnosis
04	Ambient Temp Sensor Open or Short	● Refer to Ambient Temp Sensor Diagnosis
05	Sunload Sensor Short	● Refer to Sunload Sensor Diagnosis
888	Testing Complete—No Test Failure (All Segments On)	● Refer to EATC System Functional Check

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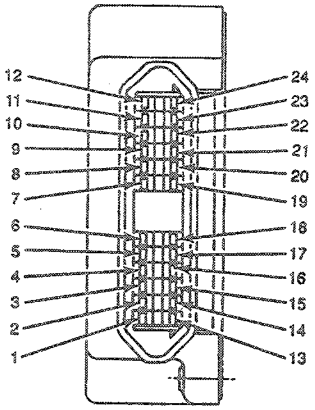
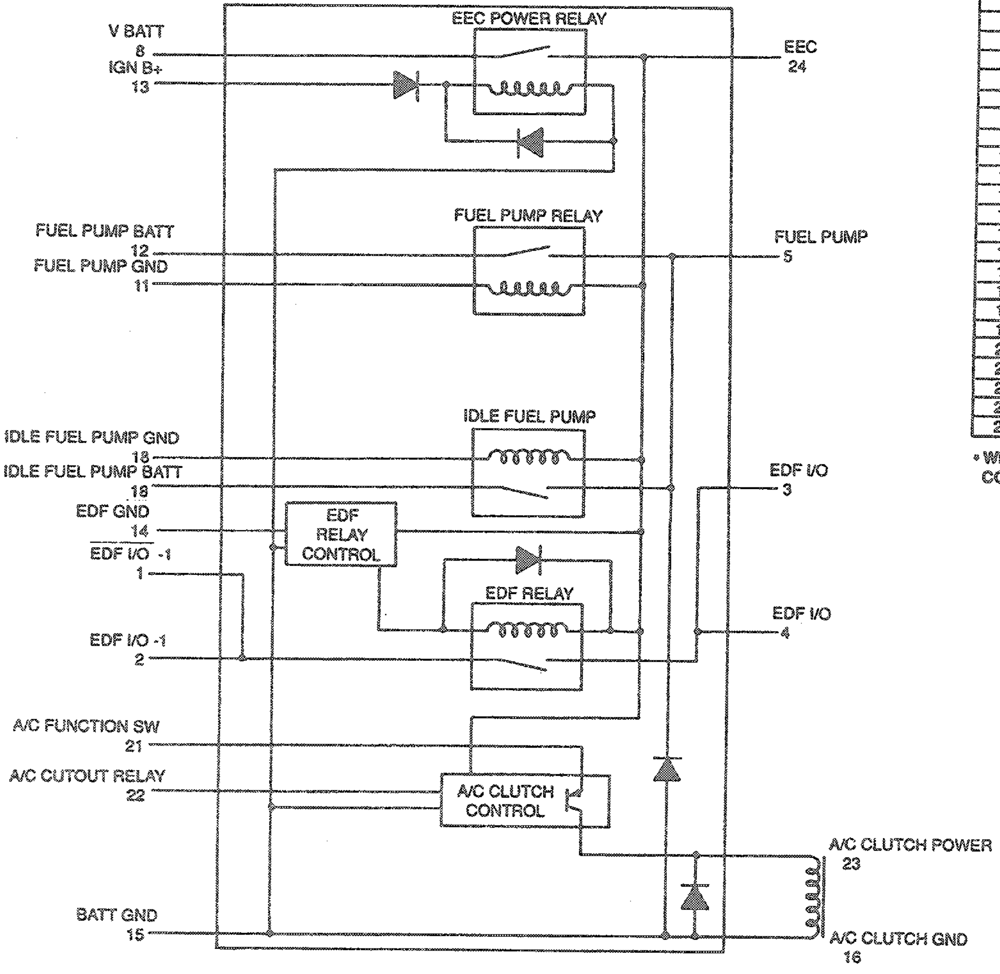
NOTE: The in-vehicle temperature must be greater than 10°C (50°F) for all error codes shown to be valid.

DIAGNOSIS AND TESTING (Continued)

CCRM Circuit and Pin-Outs

INTEGRAL CONNECTOR





TERM NO.	FUNCTION
1	EDF I/O-1
2	EDF I/O-1
3	EDF I/O
4	EDFI/O
5	FUEL PUMP
6	N. C.
7	N. C.
8	V BATT
9	EOL TEST
10	IDLE FUEL PUMP BATT
11	FUEL PUMP GND
12	FUEL PUMP BATT
13	IGN B+
14	EDF GND
15	BATT GND
16	A/C GND
17	N. C.
18	IDLE FUEL PUMP GND
19	EOL TEST
20	EOL TEST
21	A/C FUNCTION
22	A/C CUTOUT RELAY*
23	A/C CLUTCH
24	EEC PWR

* WIDE OPEN THROTTLE-A/C CONTROL SWITCH

NOTE: REFER TO THE EVTM PUBLICATION FOR COMPLETE CIRCUIT SCHEMATIC AND WIRE COLORS.

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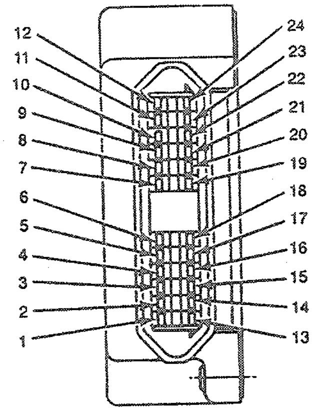
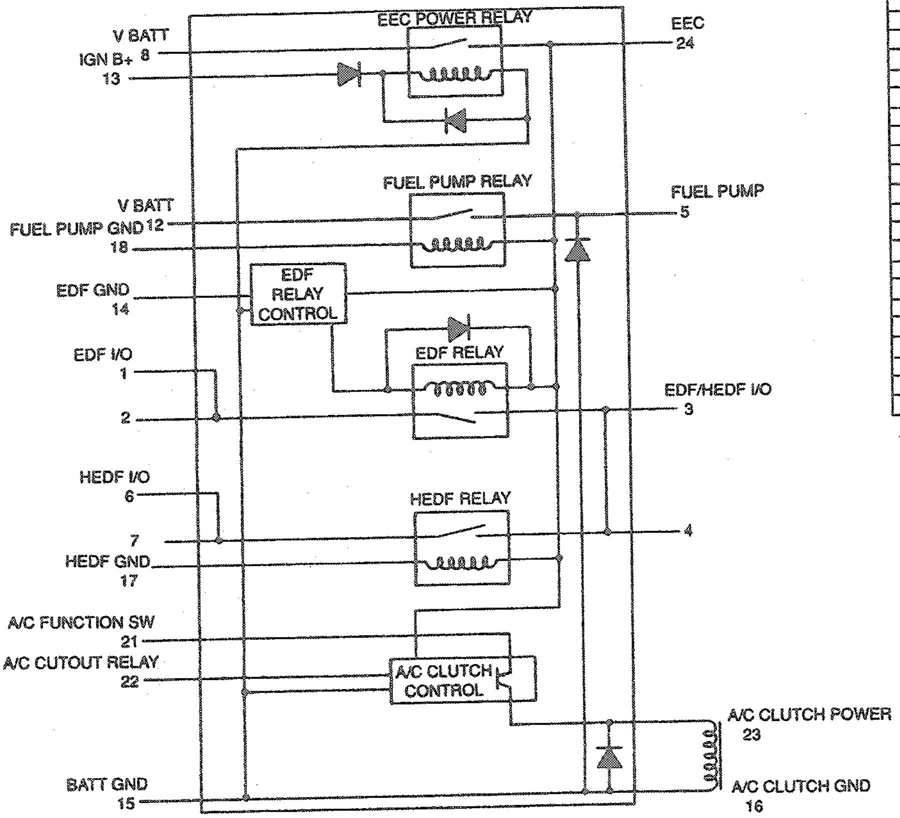
DIAGNOSIS AND TESTING (Continued)

INTEGRAL CONNECTOR





TERM NO.	FUNCTION
1	EDF I/O-1
2	EDF I/O-1
3	HEDF/EDF I/O
4	HEDF/EDF I/O
5	FUEL PUMP
6	HEDF I/O 2
7	HEDF I/O 2
8	V BATT
9	EOL TEST
10	N. C.
11	N. C.
12	FUEL PUMP BATT
13	IGN B+
14	EDF GND
15	BATT GND
16	A/C GND
17	HEDF GND
18	FUEL PUMP GND
19	EOL TEST
20	EOL TEST
21	A/C FUNCTION
22	A/C CUTOUT RELAY*
23	A/C CLUTCH
24	EEC PWR

* WIDE OPEN THROTTLE-A/C CONTROL SWITCH

NOTE: REFER TO THE EVTM PUBLICATION FOR COMPLETE CIRCUIT SCHEMATIC AND WIRE COLORS.

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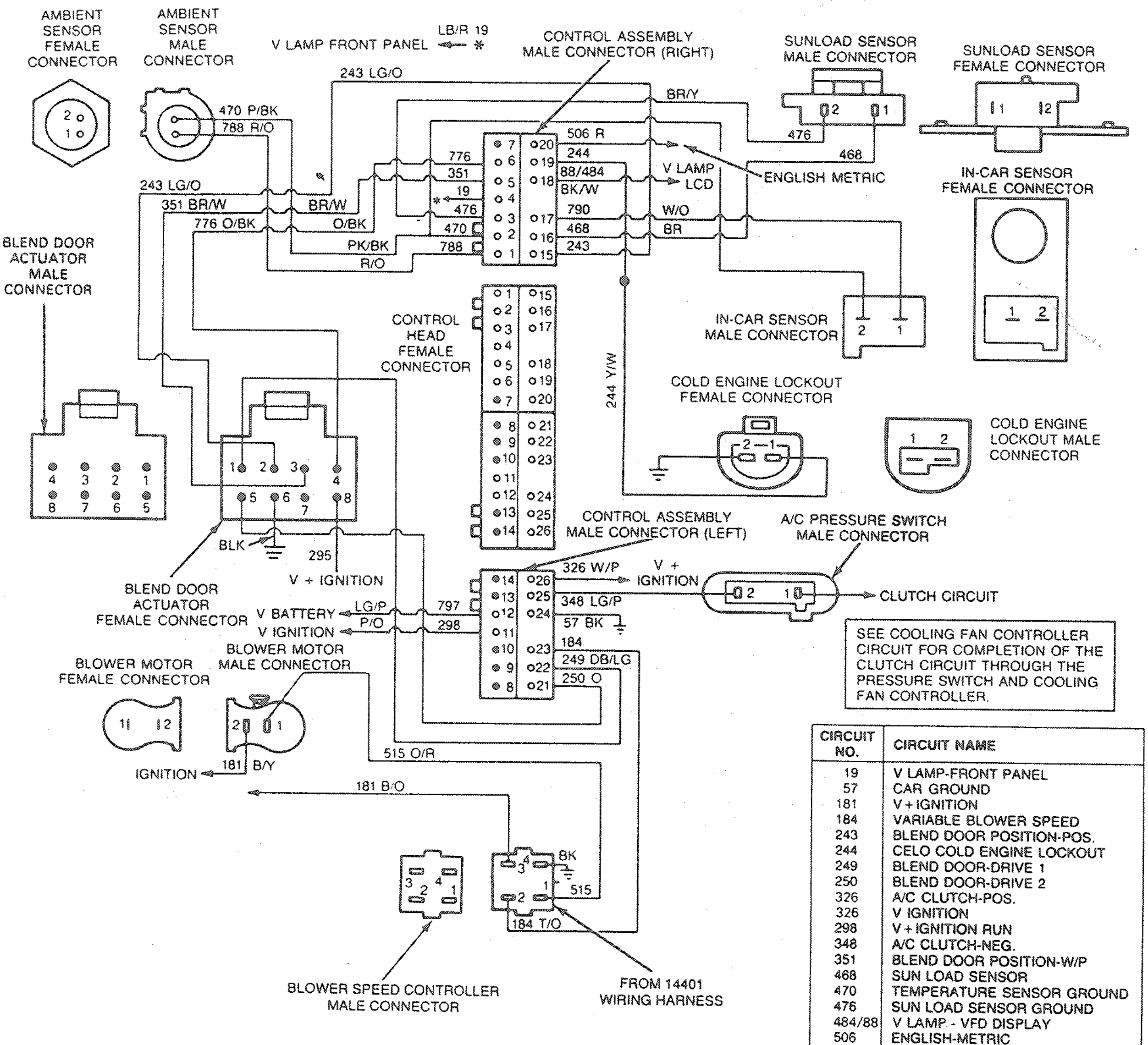
DIAGNOSIS AND TESTING (Continued)

EATC System Wiring Diagram



SEE COOLING FAN CONTROLLER CIRCUIT FOR COMPLETION OF THE CLUTCH CIRCUIT THROUGH THE PRESSURE SWITCH AND COOLING FAN CONTROLLER.

CIRCUIT NO.	CIRCUIT NAME
19	V LAMP-FRONT PANEL
57	CAR GROUND
181	V+IGNITION
184	VARIABLE BLOWER SPEED
243	BLEND DOOR POSITION-POS.
244	CELO COLD ENGINE LOCKOUT
249	BLEND DOOR-DRIVE 1
250	BLEND DOOR-DRIVE 2
326	A/C CLUTCH-POS.
326	V IGNITION
298	V+IGNITION RUN
348	A/C CLUTCH-NEG.
351	BLEND DOOR POSITION-W/P
468	SUN LOAD SENSOR
470	TEMPERATURE SENSOR GROUND
476	SUN LOAD SENSOR GROUND
484/88	V LAMP - VFD DISPLAY
506	ENGLISH-METRIC
515	BLOWER MOTOR
776	BLEND DOOR POSITION-NEG.
788	AMBIENT TEMPERATURE SENSOR
790	IN-CAR TEMPERATURE SENSOR
797	V+BATTERY

NOTE: REFER TO THE EVTM PUBLICATION FOR COMPLETE CIRCUIT SCHEMATIC AND WIRE COLORS.

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