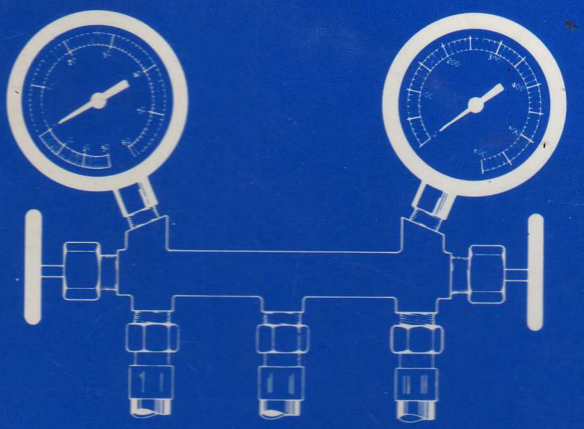

FIAT

FIAT

Technical Training

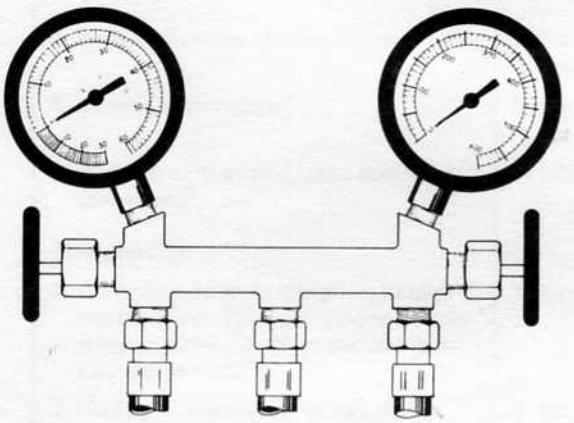
Air Conditioning Service

–Technician's Information–



Fiat Motors of North America, Inc.

Air Conditioning Service



–Technician's Information–

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DESCRIPTION

GENERAL DESCRIPTION

Air conditioning is a system which circulates, cools and dehumidifies the air inside the passenger compartment. The air is circulated by a three-speed fan and ducting. The air is cooled by removing heat at the evaporator and discharging it at the condenser. The air is dehumidified as the water vapor in the air condenses on the cold surface of the evaporator.

Factory installed air conditioning is offered as optional equipment in the Brava, Strada, and X1/9. A port or dealer installed air conditioner produced by ARA, is offered as optional equipment in the Spider 2000.

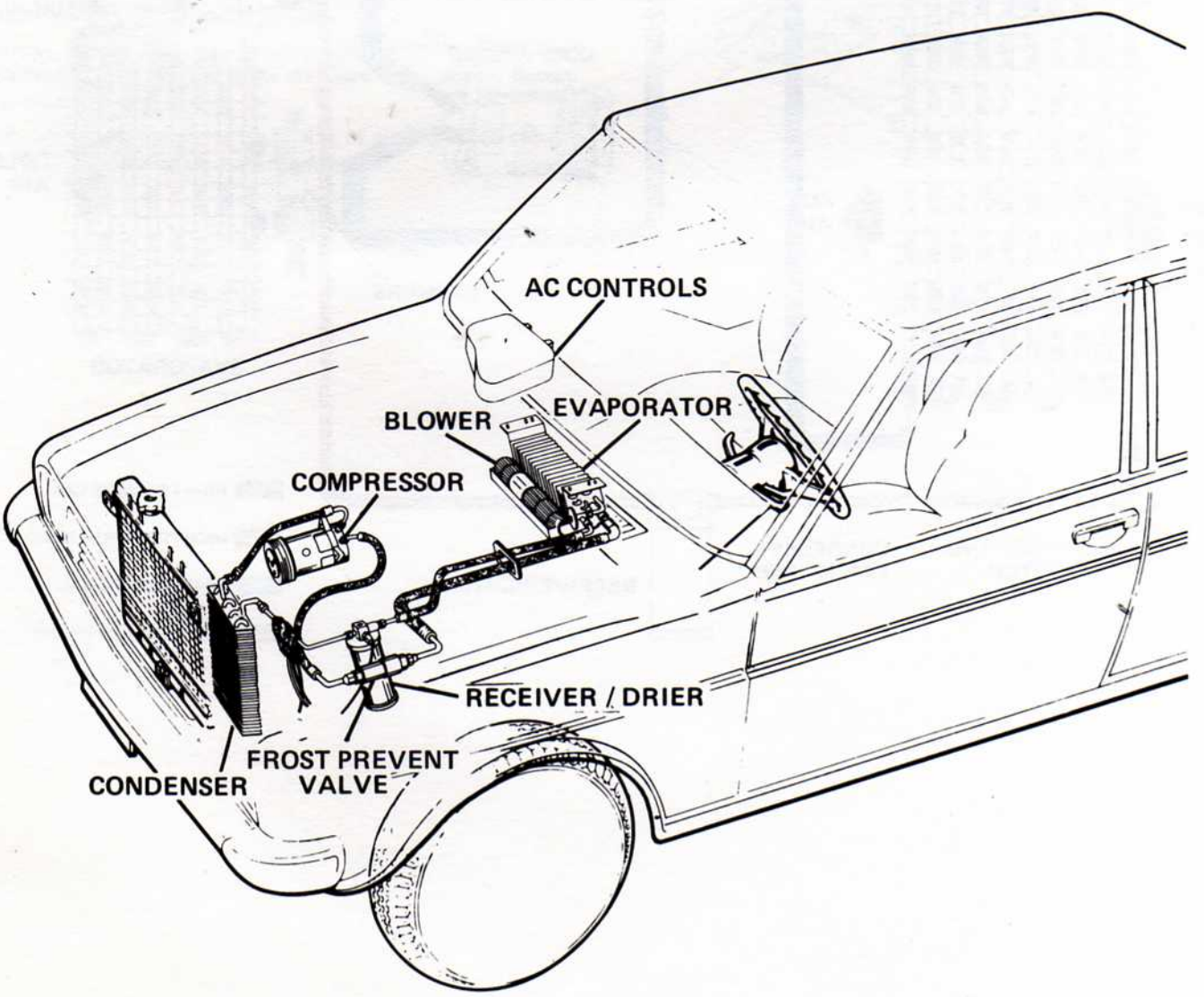
NOTE: This manual contains information on both systems. Because of minor differences in operation the ARA unit is described separately. Servicing, operational checks and troubleshooting are the same for both systems unless otherwise noted.

SYSTEM DESCRIPTION – Brava – Strada – X1/9

REFRIGERATION SYSTEM

The refrigeration system consists of:

- Compressor – mounted on and driven by engine.
- Condenser – mounted in front of or along side radiator.
- Receiver/drier – mounted between condenser outlet and evaporator inlet.
- Evaporator – mounted in the air conditioner/heater unit.
- Frost prevent valve – mounted between evaporator outlet and compressor inlet.
- Expansion valve – mounted on evaporator inlet.
- Connecting tubes and hoses.

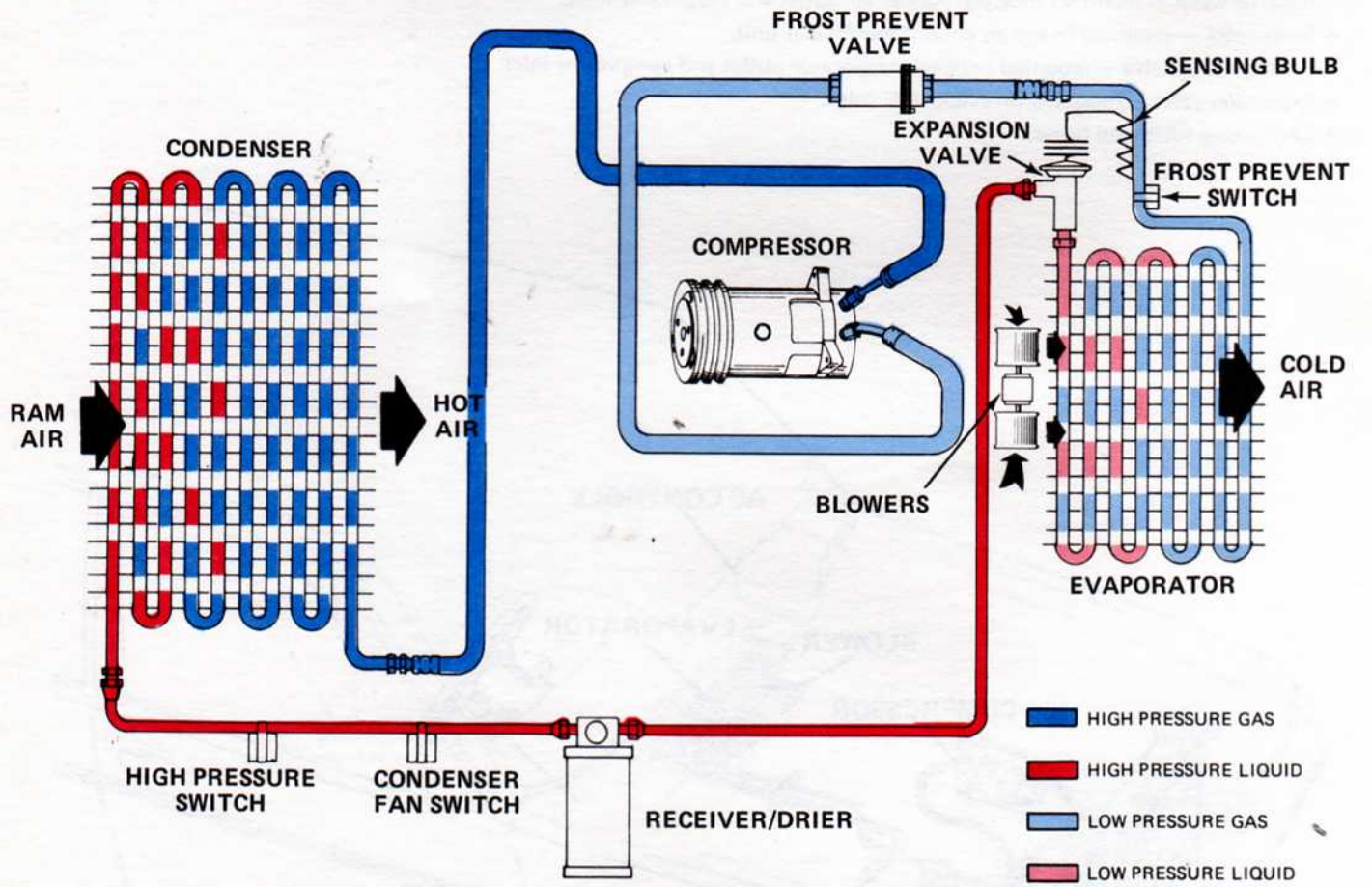


Refrigeration System Operation

The compressor pumps heat-laden refrigerant vapor from the evaporator. It is compressed and then sent under high pressure to the condenser as a superheated vapor. Since the vapor is hotter than the outside air, the heat is transferred to the air flowing through the condenser. This causes the refrigerant to condense and change to a high pressure liquid. The liquid refrigerant then passes to the receiver/drier where any traces of moisture are removed and the liquid is stored under pressure until needed by the evaporator.

The high pressure liquid is supplied to the thermostatic expansion valve. The valve controls the flow of refrigerant in this part of the system. The pressure of the liquid is lowered by the expansion valve. This causes the liquid to boil and change to a vapor. During this process, the refrigerant picks up heat from the warm air passing through the fins of the evaporator. The expansion valve contains a sensing bulb which senses the temperature of the evaporator outlet and regulates the refrigerant flow.

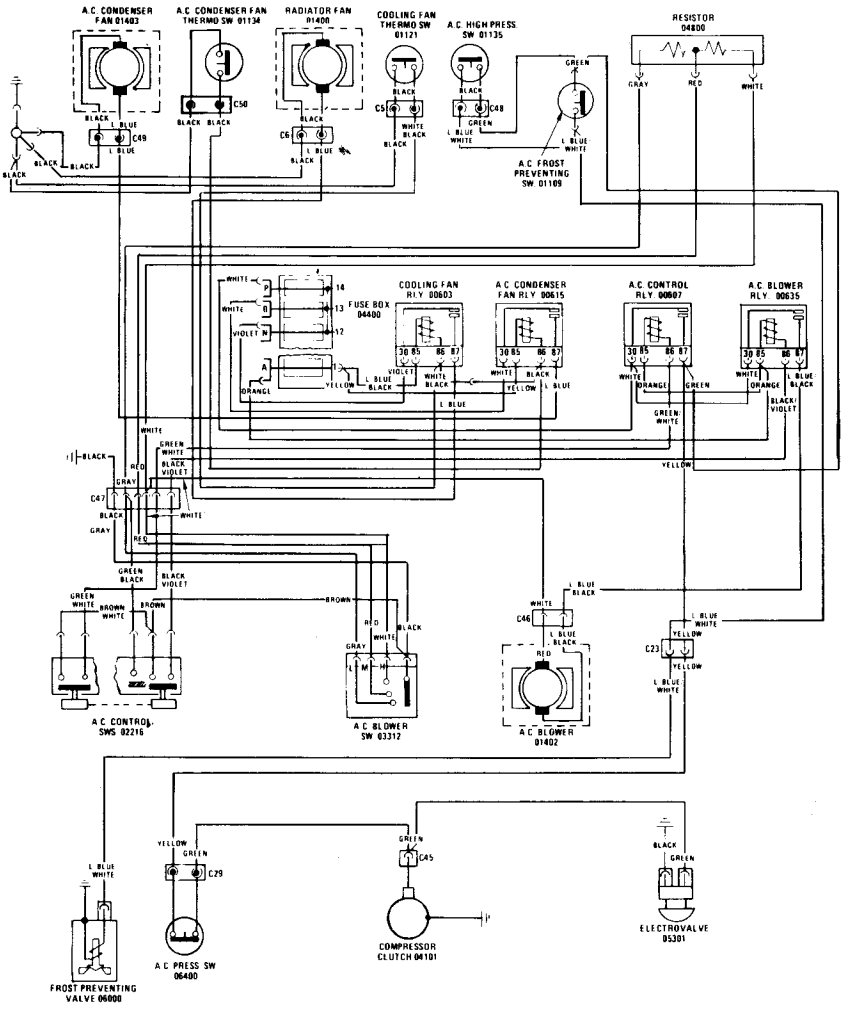
The refrigerant is now in a low pressure heated gas stage and is drawn in by the compressor through the frost prevent valve. The frost prevent valve regulates the flow of low pressure gas to the compressor in order to control system pressure. A solenoid in the frost prevent valve closes to restrict refrigerant flow to the compressor by 2/3 if the evaporator temperature falls below 32°F or if the condenser pressure becomes excessive.



ELECTRICAL SYSTEM

The electrical system consists of:

- AC controls – on dash panel.
- Compressor clutch – mounted on compressor.
- Minimum pressure switch – mounted between compressor outlet and evaporator inlet.
- Compressor cutout relay – (Brava only) in engine compartment.
- AC idler step-up electrovalve – mounted in engine compartment.
- AC control relay – attached to relay panel (X1/9), under AC control panel (Strada), in engine compartment (Brava).
- Frost prevent valve – mounted between evaporator outlet and compressor inlet.
- Frost prevent switch – attached to condenser outlet line.
- High pressure thermoswitch – attached to condenser outlet line.
- Condenser fan – mounted in front of or behind condenser.
- Condenser fan thermoswitch – attached to condenser outlet line.
- Condenser fan relay – attached to relay panel (X1/9), under AC control (Strada), in engine compartment (Brava).
- Radiator fan – mounted behind radiator.
- Cooling fan thermoswitch – mounted in bottom of radiator.
- Cooling fan relay – attached to relay panel.
- Blower motor – in air conditioner/heater unit.
- Blower switch – on dash panel.
- Blower resistor – mounted in engine compartment or front trunk.
- Blower relay – attached to relay panel (X1/9), under AC control panel (Strada), in engine compartment (Brava).
- Related fuses and wires.

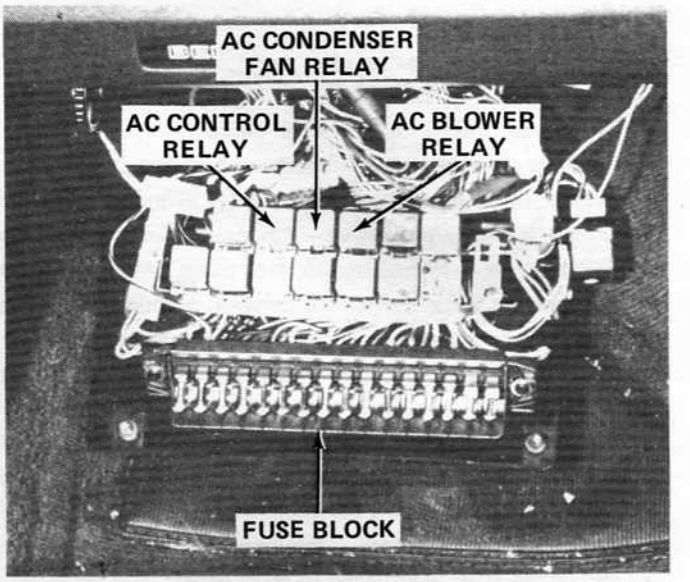


Electrical System Operation

NOTE: Representative components are shown for identification. Location varies between models.

The driver controls operation of the air conditioning system with the AC controls.

With the ignition switch in "START" or "RUN", power is applied to the coil of the AC blower relay and AC control relay.



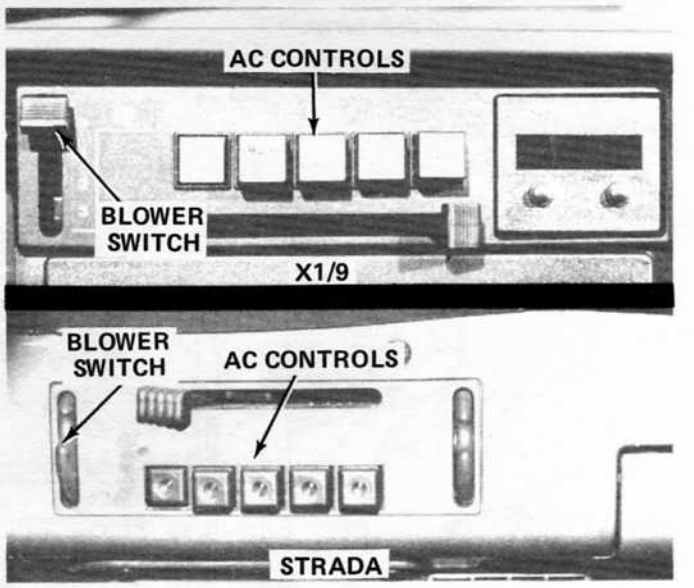
When any operating mode is selected, power is applied through the AC blower relay to the blower motor.

Setting the switch to the first position completes the circuit through the blower resistor to ground. The blower runs at low speed.

Setting the switch to the second position completes the circuit through half of the resistor to ground. The blower runs at medium speed.

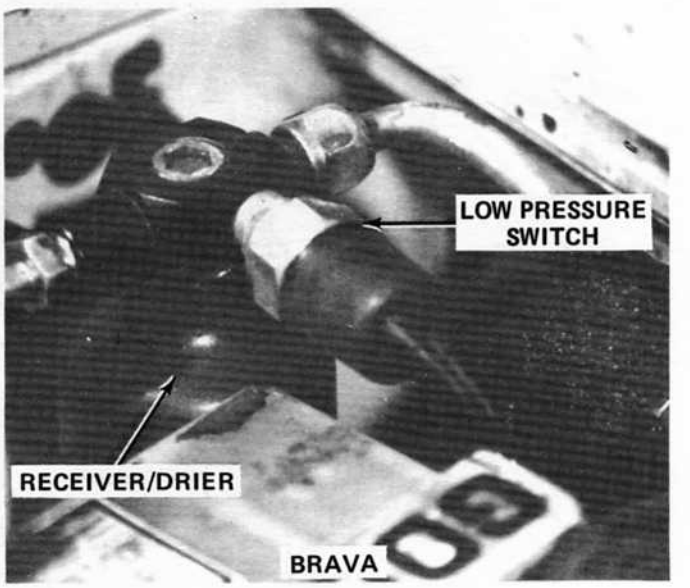
Setting the switch to the third position by-passes the resistor. The blower runs at high speed.

When "MAX AC" or "AC" is selected, the blower will run in low speed with the blower switch off. This helps keep the evaporator core from freezing up.



When "MAX AC" or "AC" is selected, power is applied through the AC control relay to the low pressure switch.

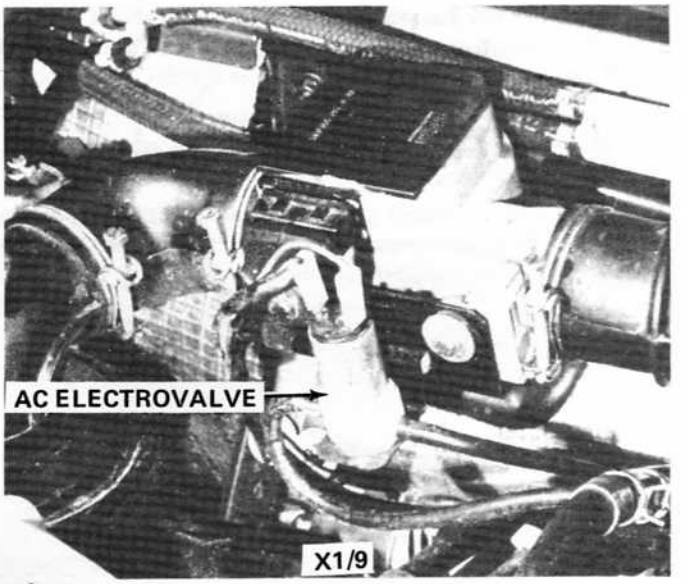
With 40 ± 5 psi pressure in the system the low pressure switch is closed. This connects the power to the electromagnetic clutch on the compressor causing the compressor to operate. If system pressure drops below 40 ± 5 psi, the switch will open. This disengages the compressor clutch, preventing damage to the system.



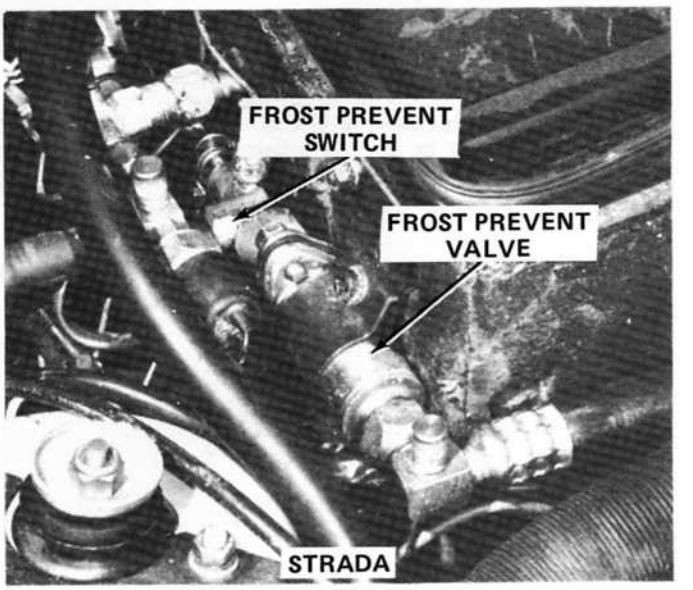
When the compressor clutch is activated, power is also applied to the AC idle step-up electrovalve.

In fuel injected vehicles, the electrovalve opens an air bypass around the throttle plate which increases idle speed to compensate for compressor load.

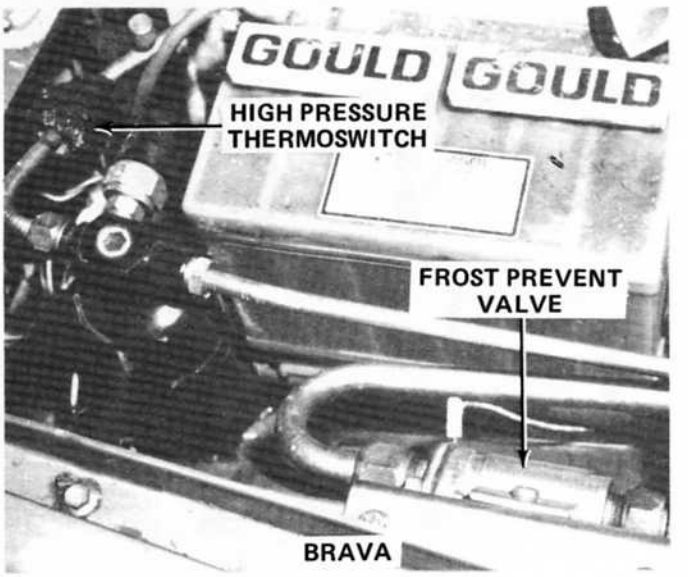
In carburetored vehicles, the electrovalve provides vacuum to the AC fast idle diaphragm on the carburetor which prevents the primary throttle plate from closing completely, increasing idle speed.



The frost prevent switch senses the temperature of the refrigerant at the evaporator outlet. If the temperature drops below 32°F the switch closes. This connects power to the frost prevent valve. The valve reduces refrigerant flow by 2/3 and the temperature increases. This prevents the evaporator from icing up.



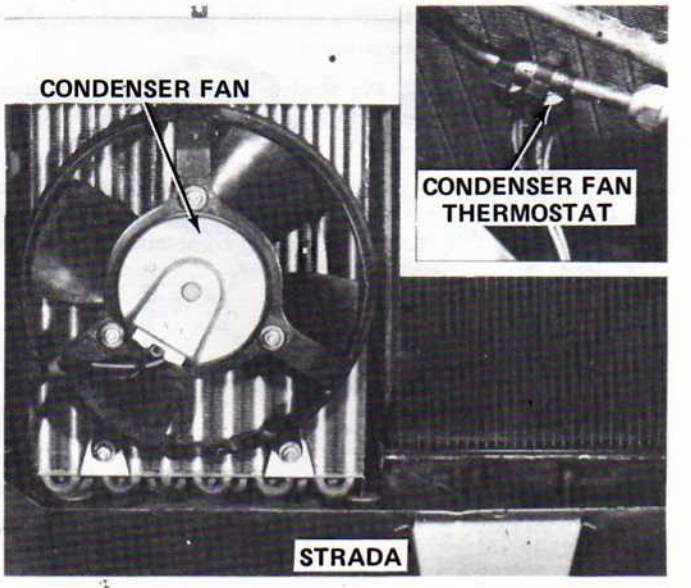
The high pressure thermoswitch is set to close when pressure in the high pressure section of the system is 340 to 360 psi. This connects power to the frost prevent valve. Energizing the valve causes a reduction in refrigerant flow. This causes the pressure to drop. When the pressure drops to 140 to 160 psi, the high pressure switch opens. This deenergizes the frost prevent valve and the flow increases to normal.



The condenser fan thermoswitch senses the refrigerant temperature. This switch is set to close at a temperature equal to 225 to 325 psi in the high pressure side of the system.

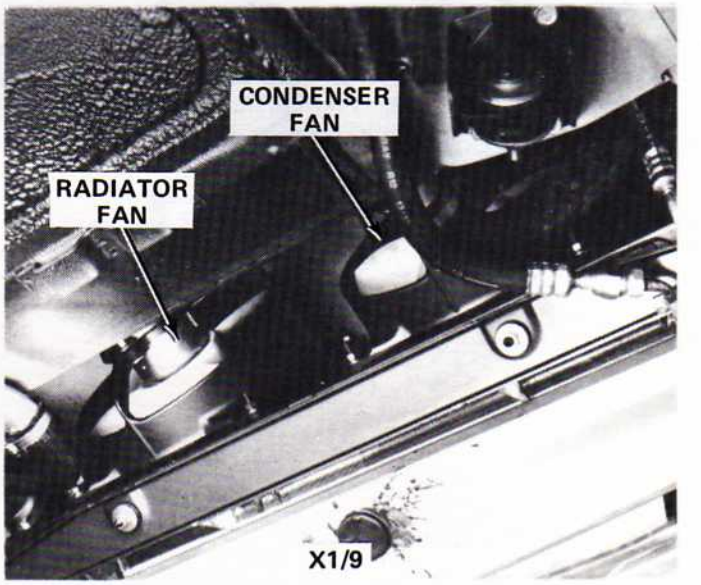
When the switch closes, the circuit is completed through the coil of the relay, pulling the relay in. The relay connects power to the condenser fan.

As the fan runs, it reduces the temperature and pressure of the refrigerant. When the pressure drops to 160 to 140 psi, the switch opens. This shuts the fan off.



In the X1/9 power from the ignition switch is applied to the coil of the radiator fan relay and the coil of the condenser fan relay.

Ground for these coils is provided by either the radiator thermostatic switch or the condenser fan switch. Therefore whenever either switch closes, both relays are energized and both the radiator fan and the condenser fan run.

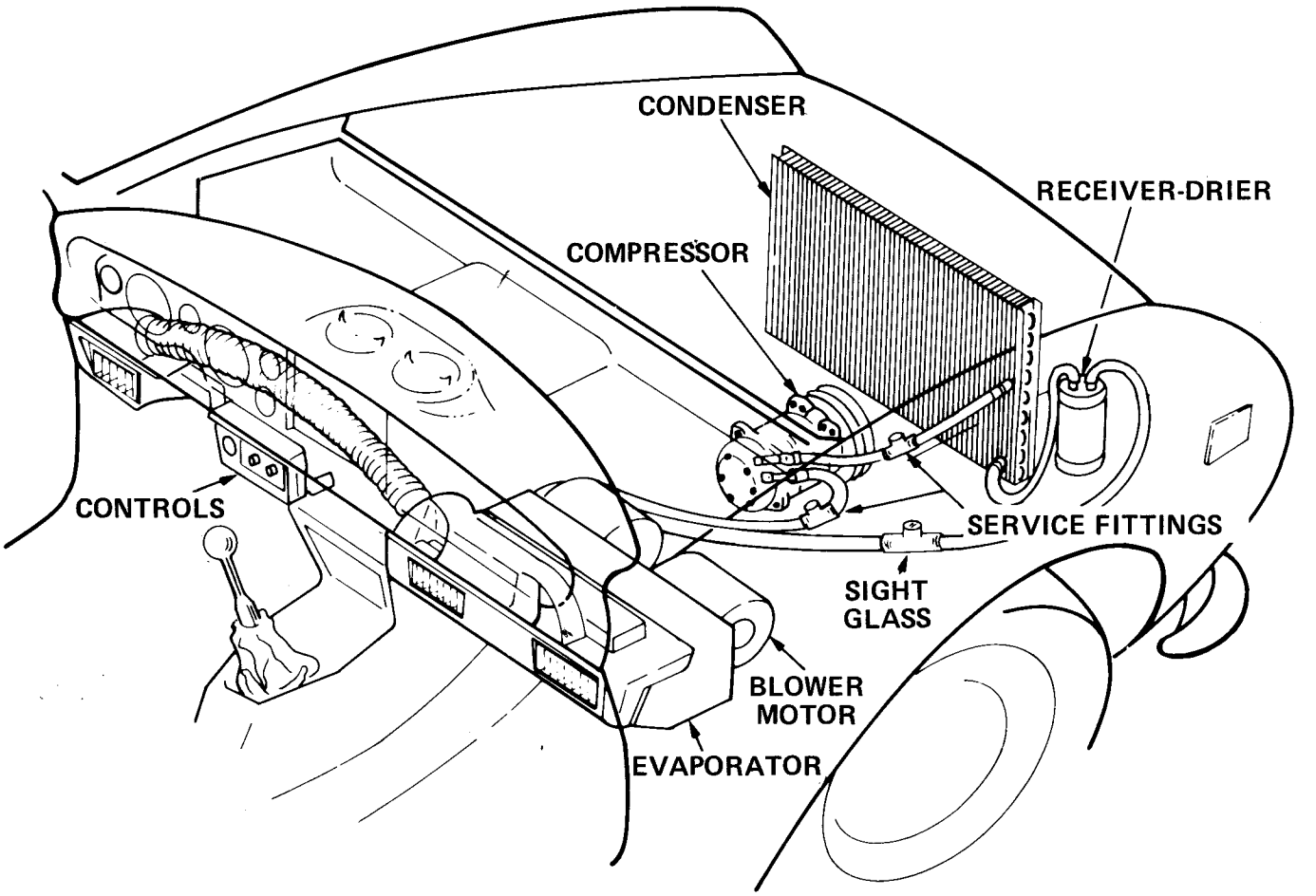


SYSTEM DESCRIPTION – Spider 2000 with ARA unit

REFRIGERATION SYSTEM

The refrigeration system consists of:

- Compressor – mounted on right side of engine.
- Condenser – mounted in front of radiator.
- Receiver/drier – mounted in front of radiator.
- Evaporator – mounted under dash on passenger side.
- Expansion valve – mounted on evaporator inlet.
- Connecting tubes and hoses.



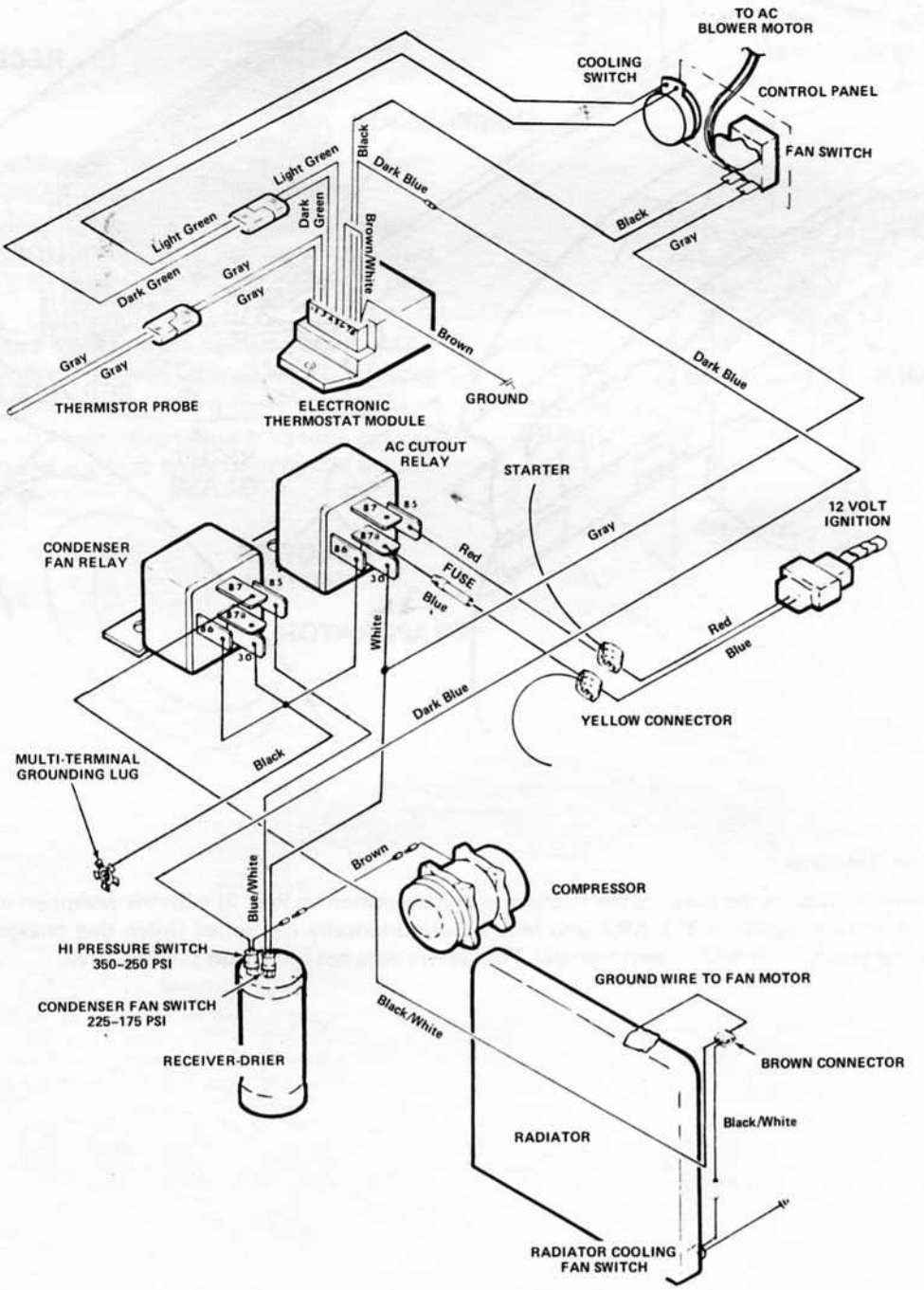
Refrigeration System Operation

Refrigeration system operation is the same as the Factory unit (description on Page 2) with the exception of the method of controlling temperature in the evaporator. The ARA unit uses a thermostatically controlled clutch that engages and disengages the compressor to regulate temperature and prevent freezing. The system does not use a frost prevent valve.

ELECTRICAL SYSTEM

The electrical system consists of:

- AC control – mounted under dash to right of steering column.
- Compressor clutch – mounted on compressor.
- Electronic thermostat module – mounted on firewall behind evaporator case.
- High pressure switch – mounted on receiver/drier.
- AC cutout relay – mounted on right front inner fender.
- Condenser fan (radiator fan) – mounted behind radiator.
- Condenser fan switch – mounted on receiver/drier.
- Radiator fan switch – mounted in lower tank of radiator.
- Condenser fan relay – mounted on right front inner fender.
- Related fuses and wires.

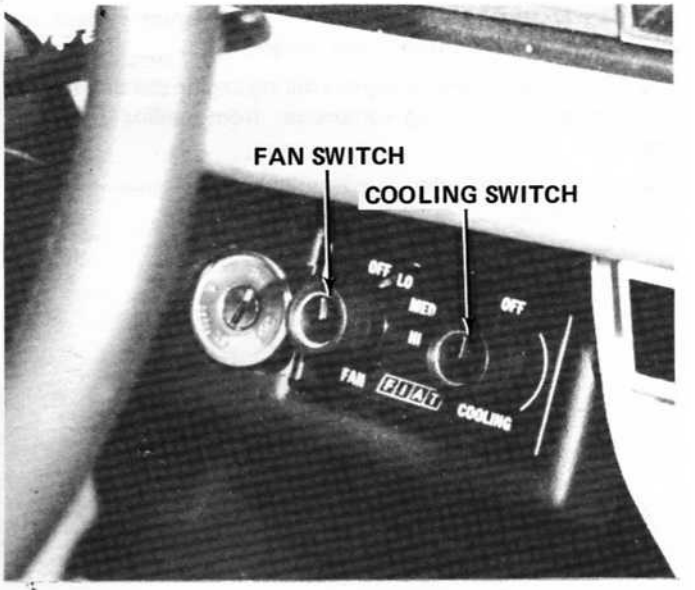


Electrical System Operation

The driver controls operation of the air conditioning system with the AC controls.

The fan switch applies power to the electronic thermostat module and to the three speed AC blower motor.

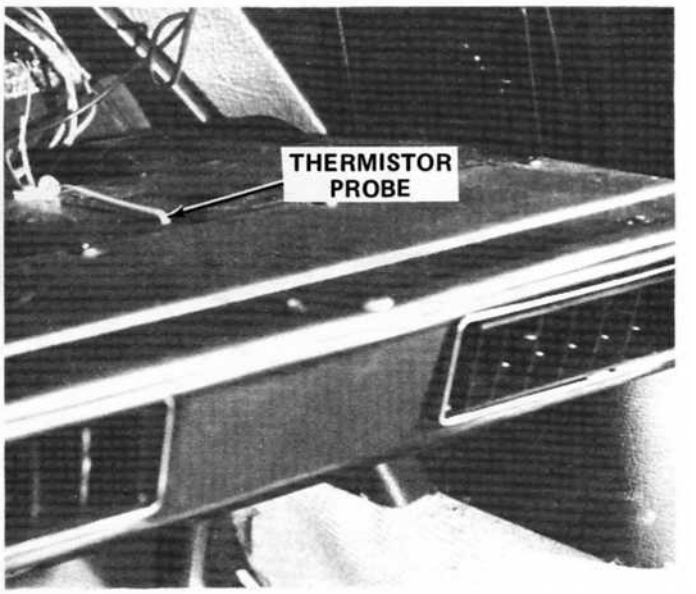
The cooling switch enables the driver to set the desired amount of air conditioning. Rotating the cooling switch clockwise increases the setting and connects power to the compressor clutch.



The electronic thermostat module uses a thermistor probe, located in the evaporator fins, to sense evaporator temperature.

As the air from the evaporator cools, it acts on the thermistor probe until it reaches the setting of the switch. When the setting is reached, the thermostat module opens the circuit to the clutch. As the air heats up, the thermostat module closes the circuit, engaging the clutch.

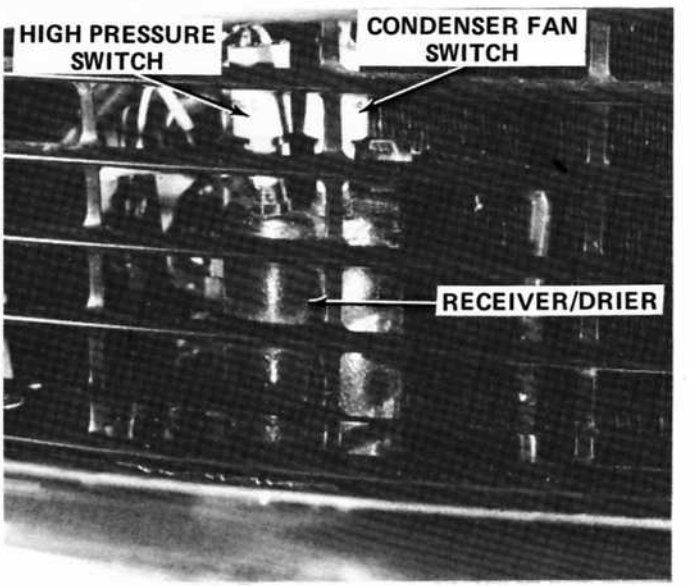
This cycling continues in order to keep the air at the temperature set by the switch.



The high pressure and condenser fan switches are mounted on the receiver/drier.

The high pressure switch protects the system from excessive pressure by deenergizing the compressor clutch. The switch opens the compressor clutch circuit at 350 psi and closes it again at 250 psi.

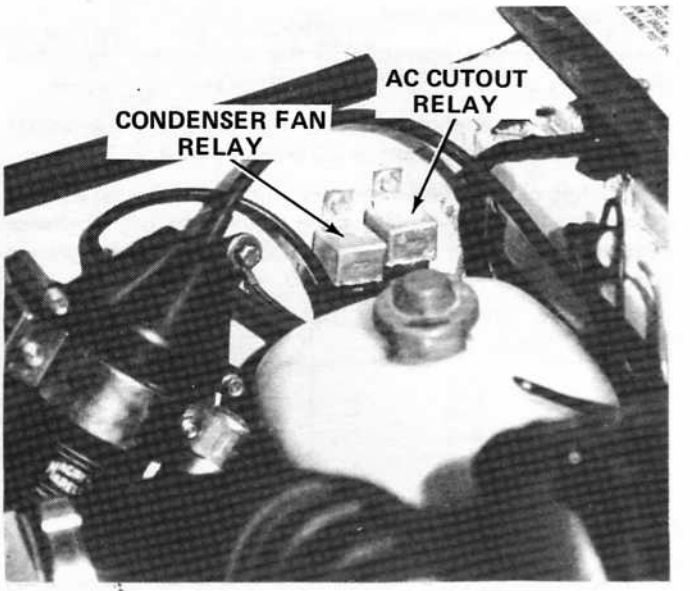
The condenser fan switch controls the condenser fan relay to turn the radiator fan on and off. The switch turns the fan on at 225 psi and off at 175 psi.



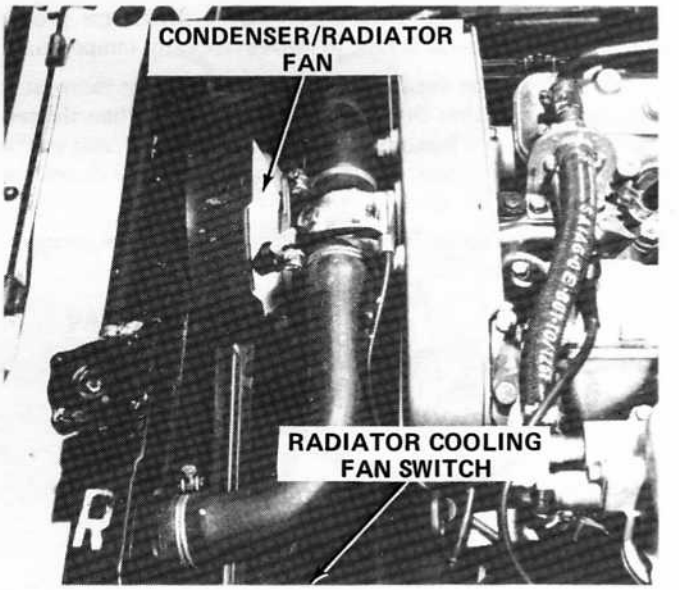
The two control relays for the air conditioning system are mounted on the right front inner fender.

The AC cutout relay is energized during engine starting to prevent the air conditioning compressor from loading down the engine.

The condenser fan relay is controlled by the condenser fan pressure switch.



Power is applied at all times to the condenser/radiator fan motor. Ground is provided by either the radiator cooling fan switch, if the coolant is too hot, or the condenser fan switch and relay, if the condenser pressure becomes excessive.

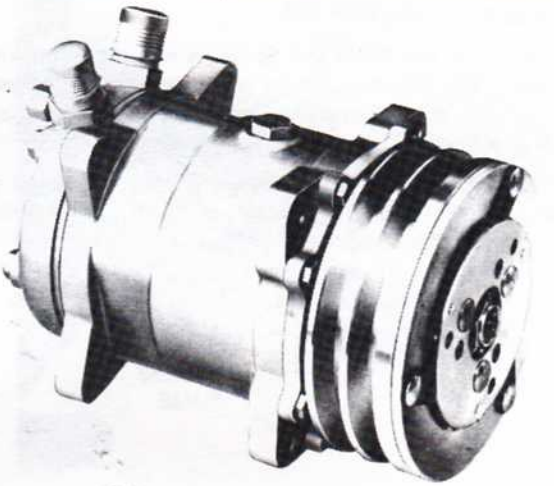


COMPONENT DESCRIPTION

COMPRESSOR

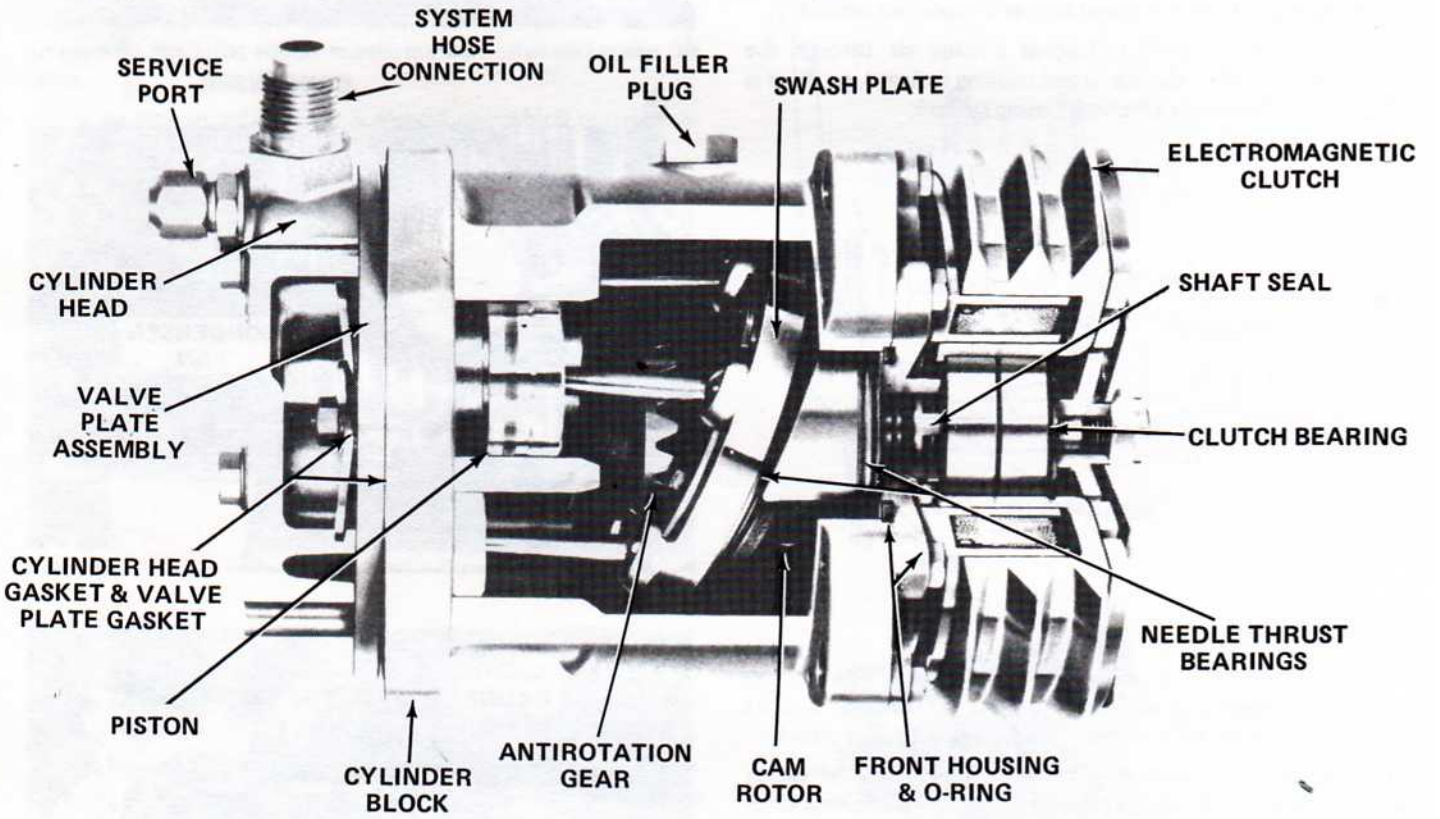
The compressor is mounted on and driven by the engine. It is a pump designed to raise the pressure of the refrigerant. In so doing, the refrigerant will condense more rapidly in the next component, the condenser.

Two types of compressors in use are the Sankyo SD 505 in the Spider Turbo, and the Sankyo SD 508 in all other models.



Both types are five cylinder, axial piston units with a suction and discharge reed valve for each cylinder. The pistons are driven by a swash plate in contact with a cam rotor.

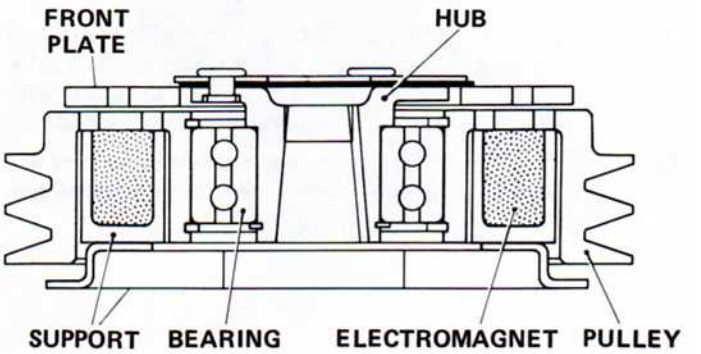
The Sankyo SD 505 is smaller and is used in the Spider Turbo because of space limitations.



COMPRESSOR ELECTROMAGNETIC CLUTCH

The electromagnetic clutch is mounted on the compressor and couples the compressor to the drive belts.

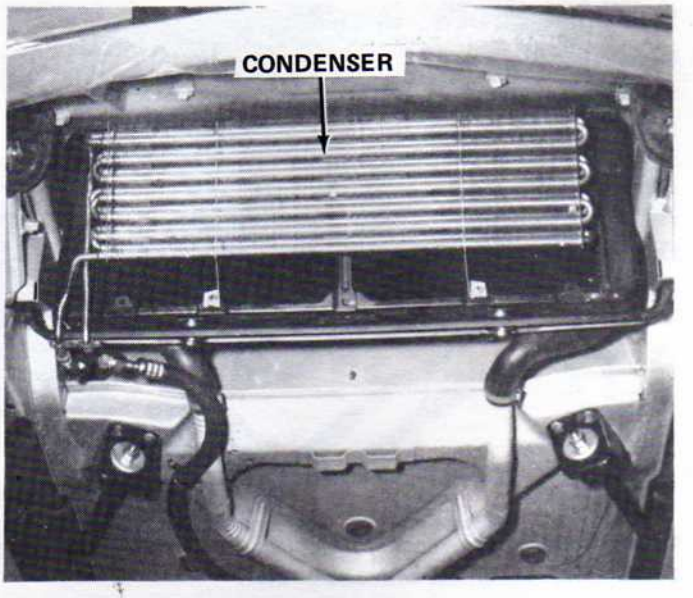
When the air conditioner is turned off, the pulley turns freely on the bearings. When the air conditioner is turned on, the front plate is attracted to the pulley. This causes the hub to turn with the pulley and drive the compressor.



CONDENSER

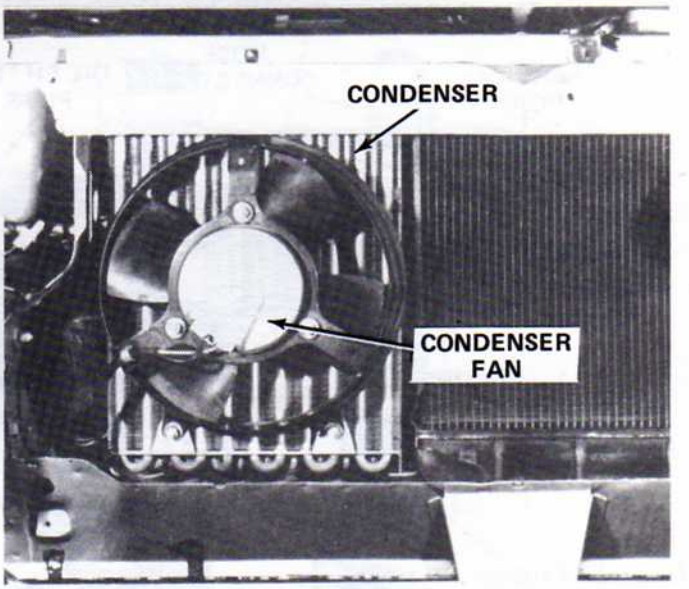
The condenser in the X1/9 and Spider is mounted in front of the radiator. It is a heat exchange which is made of copper or aluminum tubes with aluminum fins to increase the effective heat exchange area.

The refrigerant entering the condenser is a high pressure gas. As it passes through the condenser, it condenses (liquifies). As it condenses it gives up heat which was removed from the passenger compartment. Warm air or the air drawn in by the condenser fan removes the heat. The refrigerant leaving the condenser is a high pressure liquid.



The condenser in the Brava and Strada is mounted vertically.

The condenser fan pulls additional outside air through the condenser fins when the car is not moving forward, or there is a high heat load on the air conditioning system.



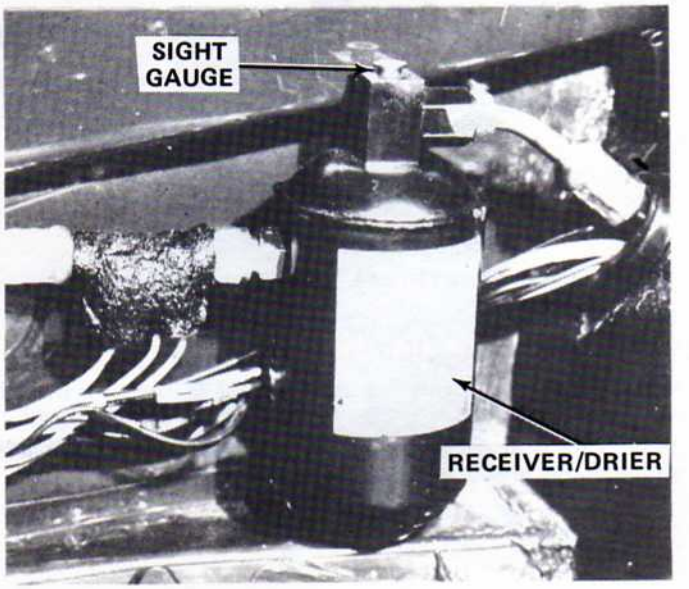
RECEIVER/DRIER

The receiver/drier is a reserve tank mounted between the condenser outlet and evaporator inlet. It contains a sight gauge to determine the condition of the high pressure circuit.

The receiver/drier contains a substance called silica gel which removes moisture from the refrigerant. It also contains a filter which removes impurities which might block the expansion valve.

The sight gauge is used to check the condition of the system charge. If the gauge remains clear then the refrigerant is sufficient. If bubbles or foam appear in the gauge, there is insufficient refrigerant or the refrigerant is not completely liquid.

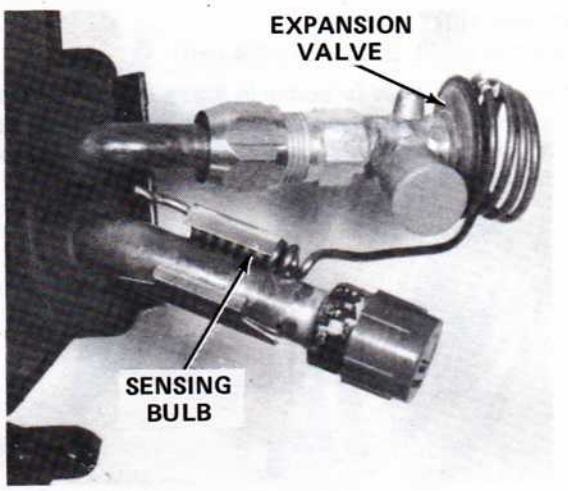
NOTE: Even with a full charge, a small amount of bubbles will be visible in systems using a vertically mounted condenser.



EXPANSION VALVE

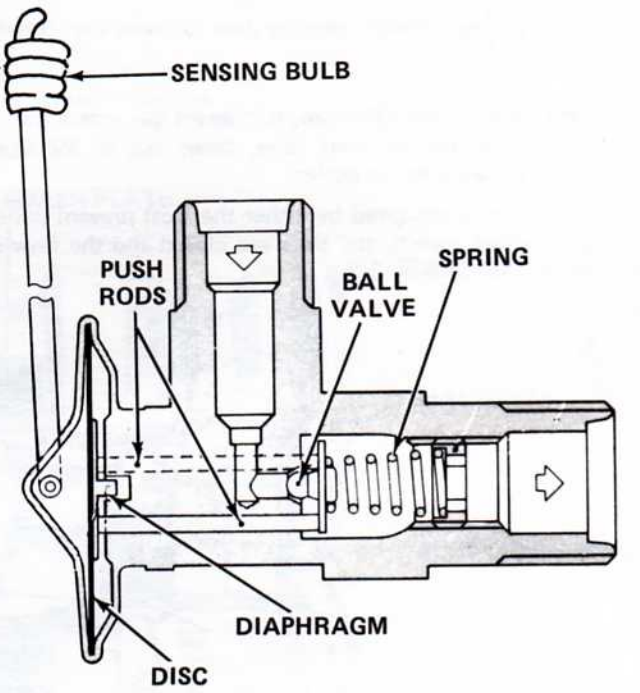
The expansion valve is mounted on the inlet side of the evaporator. It controls refrigerant flow into the evaporator and reduces it to a low pressure liquid.

The valve contains a sensing bulb which senses the temperature of the refrigerant in the evaporator outlet pipe. If it is too cold the expansion valve reduces the flow of refrigerant into the evaporator. If it is too warm the valve increases the flow.



When the temperature is too cold the volume of fluid in the bulb decreases. This allows evaporator pressure and the spring to move the push rod, ball valve, disc, and diaphragm to the left, closing the inlet. When the temperature is too warm the volume of fluid in the bulb increases. This pushes the diaphragm to the right which moves the ball valve and opens the inlet.

Some expansion valves have a second line which senses pressure at the evaporator outlet.

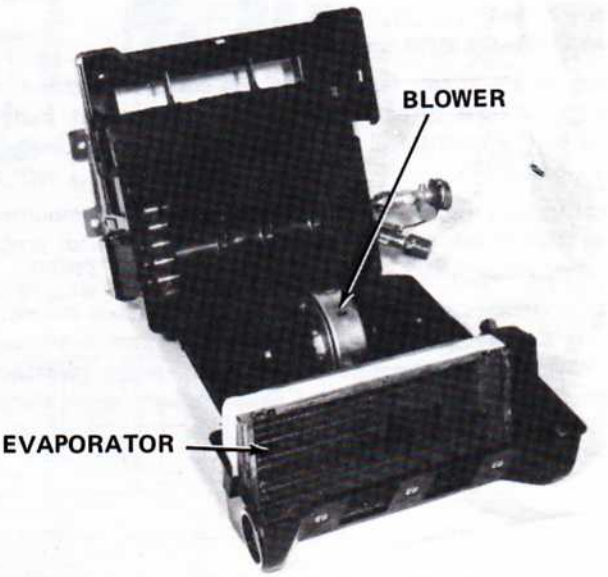


EVAPORATOR

The evaporator is mounted in the air conditioner/heater unit. It is a heat exchanger which is made of copper or aluminum tubes with aluminum fins to increase the heat exchange area.

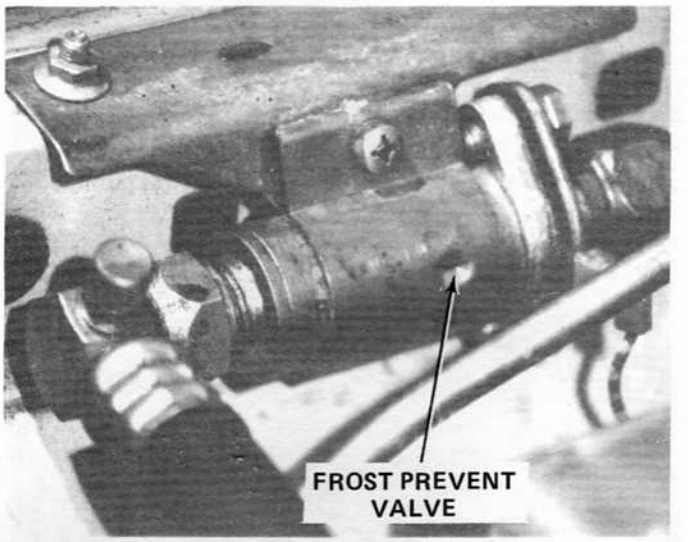
The refrigerant enters the evaporator as a liquid. As the pressure drops at the expansion valve the liquid starts to boil and takes on heat from air passing through evaporator. The refrigerant leaving the evaporator is a low pressure gas.

The air conditioner/heater unit contains a blower which forces air in the passenger compartment to pass over the evaporator. As the liquid in the evaporator boils, the heat and humidity is removed from the air and cool, dry air is discharged back into the passenger compartment.



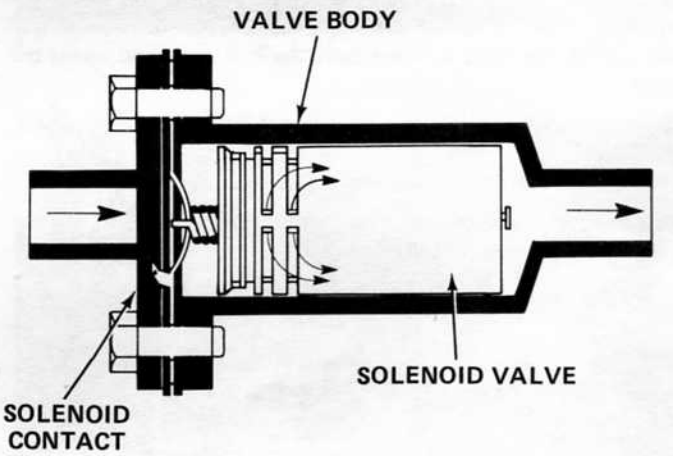
FROST PREVENT VALVE
(Not used on Spider 2000 with ARA unit)

The frost prevent valve is located in the low pressure (suction) gas line between the evaporator outlet and the compressor inlet. It controls the discharge pressure of the compressor by regulating the suction flow of gas to the compressor.



When the valve is not energized, refrigerant gas enters the inside cylinder of the solenoid valve, flows out of the slots, around the solenoid to the outlet.

When the valve is energized by either the frost prevent switch or high pressure switch, the slots are closed and the flow of refrigerant is reduced by 2/3.

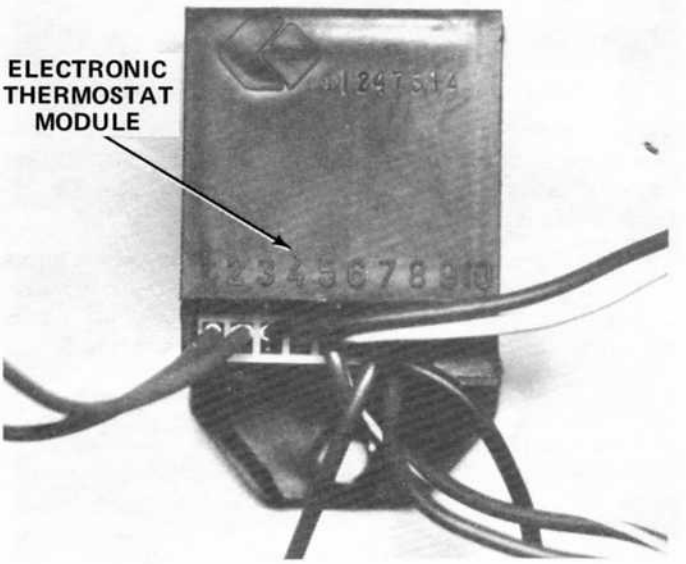


THERMOSTAT
(Spider 2000 with ARA unit only)

To regulate evaporator temperature, the compressor clutch in the Spider 2000 is cycled on and off by a thermostat. Earlier models used a mechanical thermostat with a sensing bulb in the evaporator fins.

Current models use an electronic thermostat module mounted on the firewall behind the evaporator and a thermistor probe in the evaporator fins.

When the temperature is too cold, probe resistance increases signaling the module to interrupt the compressor clutch circuit. When the temperature is too warm, probe resistance decreases signaling the module to close the compressor clutch circuit.



SERVICING

Insufficient air conditioning may be caused by problems other than AC components.

Before removing any components, check for the following:

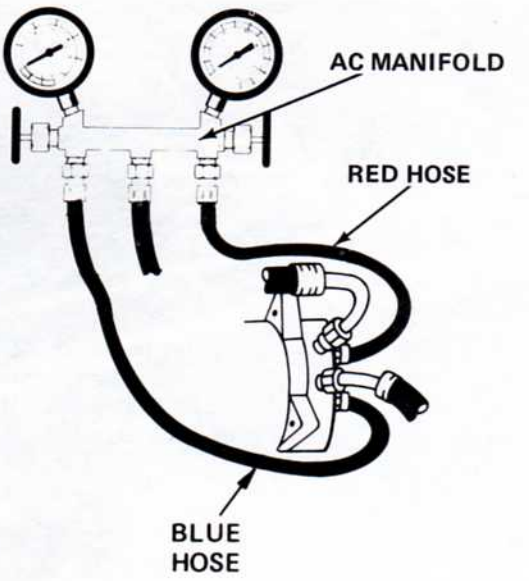
- Controls set properly.
- Low refrigerant charge.
- Compressor belt condition and tension.
- Condenser and evaporator free from obstructions.
- Blown fuse or faulty electrical system components.
- Kinked or disconnected vacuum lines.

CONNECTING SERVICING EQUIPMENT

Close both valves on AC manifold gauge set. Remove caps from discharge and suction fittings. Connect blue hose (low pressure) to suction fitting and red hose (high pressure) to discharge fitting.

Check that both gauges read about 70 psi at 70° F.

NOTE: Pressure reading will vary according to ambient temperatures, relative humidity, and atmospheric pressure.



PURGING

WARNING: Make sure there is adequate ventilation. Do not discharge refrigerant near open flame. A toxic gas may result. Wear eye goggles to prevent damage to eyes.

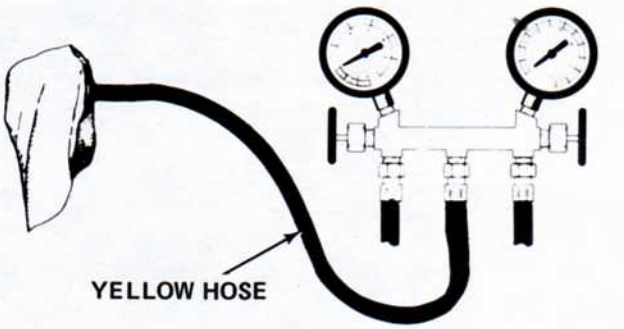
NOTE: The system must be evacuated any time it is purged.

Place yellow hose in a clean rag. Slowly open low and high pressure valves on gauge set. Allow refrigerant to bleed off thru yellow hose.

CAUTION: Open valves only enough to bleed off refrigerant slowly. Rapid bleeding will draw oil from compressor.

Check rag on yellow hose for signs of oil. Replace oil in compressor if drawn out during purging.

When both gauges read zero, system is purged. Close valves on gauge set when refrigerant stops bleeding.



COMPRESSOR OIL LEVEL CHECK

NOTE: Compressor oil level should be checked any time system is purged.

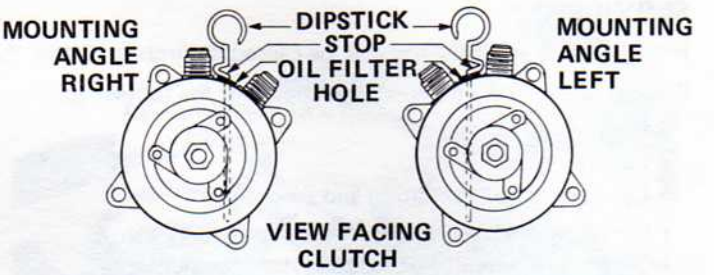
WARNING: Do not remove oil level plug without first purging the system.

Make sure system is purged. Remove oil level check plug. Rotate front plate to position internal parts and insert dipstick into hole to its stop position.

Remove dipstick and measure the length of dipstick wet with oil. Determine mounting angle and compare reading with table.

Add oil as necessary. Use Sunsico 5 or Capella E refrigerator compressor oil or equivalent.

Inspect O ring on plug for damage. Replace if necessary. Install oil level check plug.



MOUNTING ANGLE IN DEGREES	ACCEPTABLE OIL LEVELS IN INCREMENTS
0	4–6
10	6–8
20	7–9
30	8–10
40	9–11
50	9–11
60	9–12
90	9–12

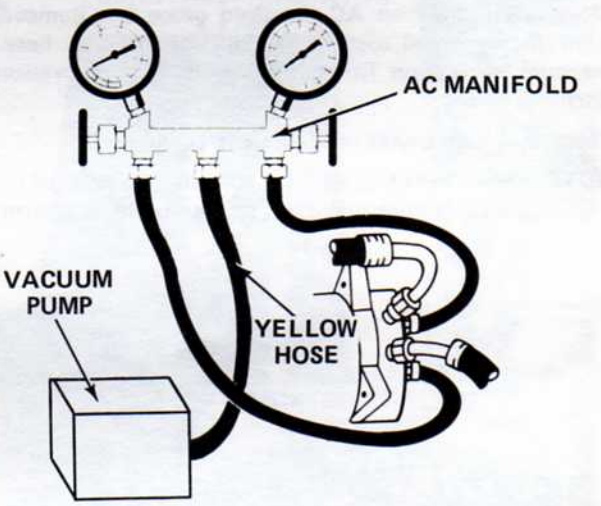
EVACUATING

NOTE: System must not be running and must be purged before starting evacuation.

Remove caps from inlet and exhaust of vacuum pump. Connect yellow hose to inlet of pump. Start pump. Open low pressure valve. Check that low pressure gauge indicates a slight vacuum.

After 5 minutes, check that low pressure gauge reads about 24" Hg. Check that high pressure gauge reads slightly below zero. If high pressure gauge does not read slightly below zero, check system for blockage.

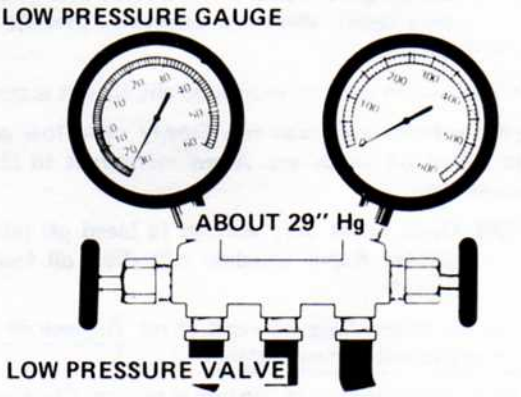
Open high pressure valve and run pump for 15 minutes or more. Check that low pressure gauge reads between 26" and 28" Hg. If not, close both valves. If gauge rises, check system for leaks. Any leak must be repaired.



Operate vacuum pump for a minimum of 30 minutes more. Check that low pressure gauge reads about 29" Hg. (Max. vacuum will be 1" less for each 1000 feet above sea level.)

Close both valves. Check low pressure gauge reading. Reading should not rise faster than 1" in 5 minutes. If reading rises faster, check system for leak.

Shut off vacuum pump. Disconnect gauge set from pump. Place caps on pump. System is now ready for charging.

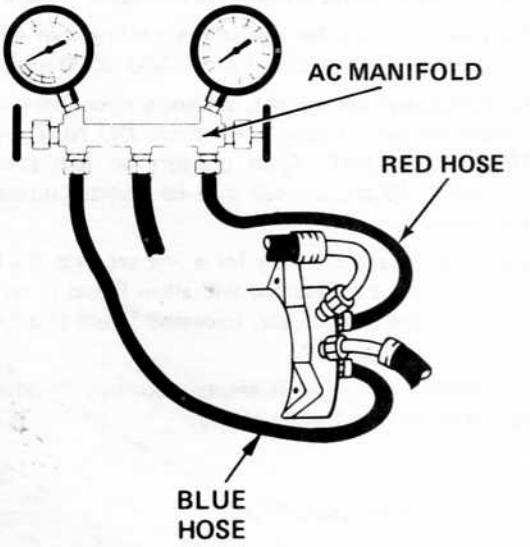


CHARGING

WARNING: Make sure there is adequate ventilation. Do not discharge refrigerant near open flame. A toxic gas may result. Always wear eye goggles to prevent damage to eyes. Do not heat refrigerant container.

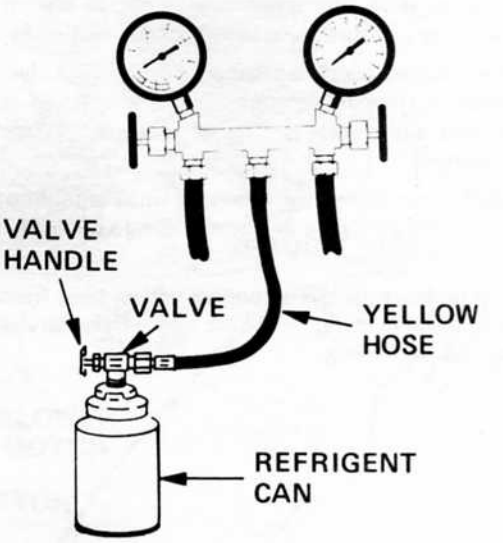
NOTE: Total refrigerant capacities for current models are as follows:

X1/9	2 lbs. (32 oz.)
Strada	2.3 lbs. (37 oz.)
Brava	2.4 lbs. (38 oz.)
Spider (ARA unit)	1.75 lbs. (28 oz.)



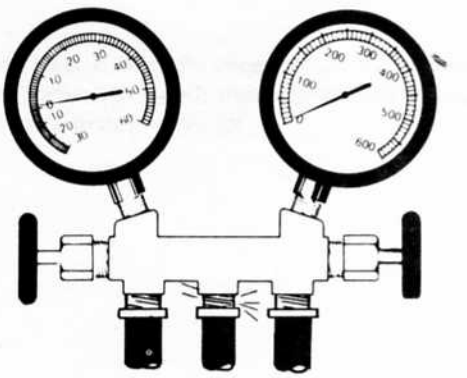
Place can tap on refrigerant can. Attach yellow hose to valve.

Make sure both valves on AC gauge set are closed. Pierce refrigerant can and allow refrigerant to enter yellow hose.



Do not open either high or low pressure valves. Loosen the connector on yellow hose at manifold. Allow gas to escape for a few seconds.

Tighten connector fingertight. Open high pressure valve. Check low pressure gauge. Close high pressure valve. If low pressure gauge did not come out of a vaccum into a pressure, system is blocked. If blockage is indicated, correct it, again evacuate system, and continue charging.



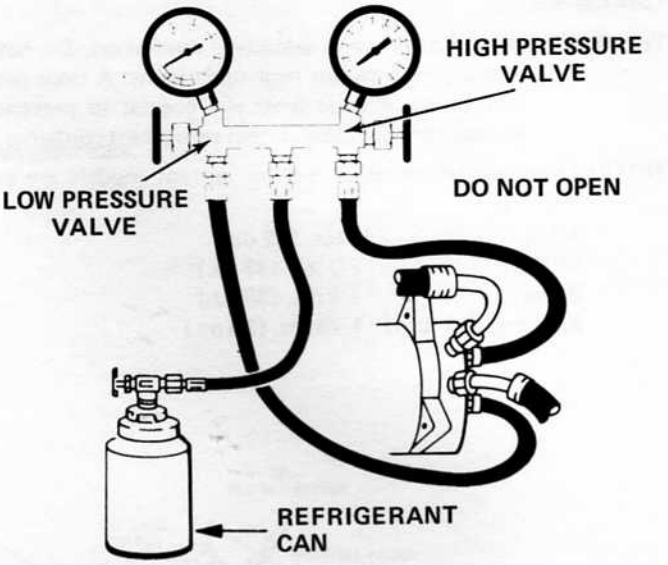
Make sure both valves on manifold are closed. Start engine.

Adjust AC controls for maximum cooling. Set fan switch to high speed. Set engine at fast idle (1500–2000 rpm).

With refrigerant can upright, gradually open low pressure valve to allow refrigerant into the system. DO NOT OPEN HIGH PRESSURE VALVE. After pressure on low pressure gauge drops below 40 psi, the can may be inverted momentarily for faster charging.

CAUTION: Invert can only for a few seconds at a time. Holding can inverted will allow liquid to be drawn into the compressor. Excessive liquid could damage the compressor.

To determine when can is empty, tap it on bottom. A hollow ring should be heard when empty.

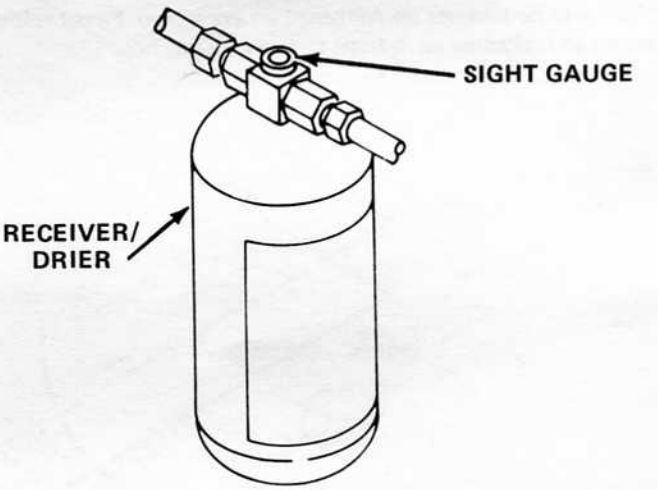


Repeat above with additional cans to charge system to capacity. Close low pressure valve before disconnecting can.

In adding charge, check sight glass on receiver/drier to determine when system is completely charged. When refrigerant passing thru sight glass is free of bubbles, system is completely charged.

CAUTION: Even with a full charge, a small amount of bubbles will be visible in systems using a vertically mounted condenser.

Close low pressure valve. Disconnect yellow hose from can tap. Carefully disconnect red and blue hoses from service fittings. Replace caps on fittings.



OPERATIONAL CHECKS

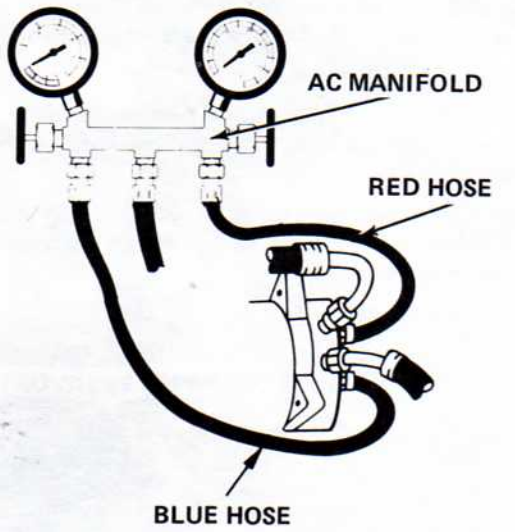
CONNECTING TEST EQUIPMENT

Close both valves on AC manifold gauge set. Remove caps from discharge and suction fittings. Connect blue hose (low pressure) to suction fitting and red hose (high pressure) to discharge fitting.

Check that both gauges read about 70 psi at 70° F.

NOTE: Pressure reading will vary according to ambient temperatures, relative humidity, and atmospheric pressure.

Provide a fan to blow air over front of car during check.



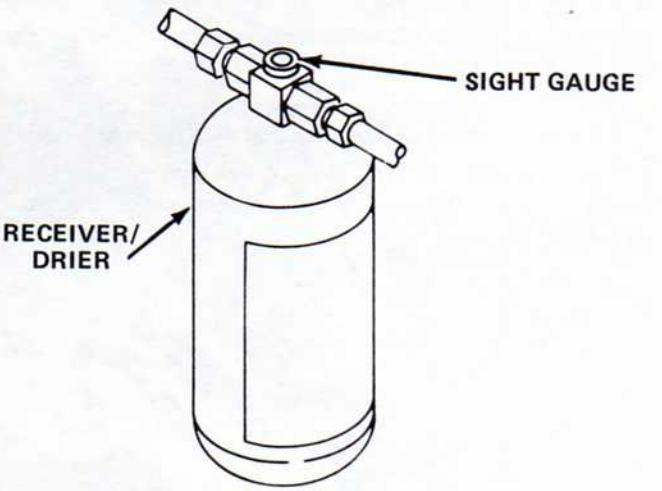
NORMAL SYSTEM OPERATION

Start engine and set AC controls to "MAX AC" with fan switch on "HI".

Accelerate engine and allow it to decrease to idle. If engine does not run at fast idle speed, check idle step-up device.

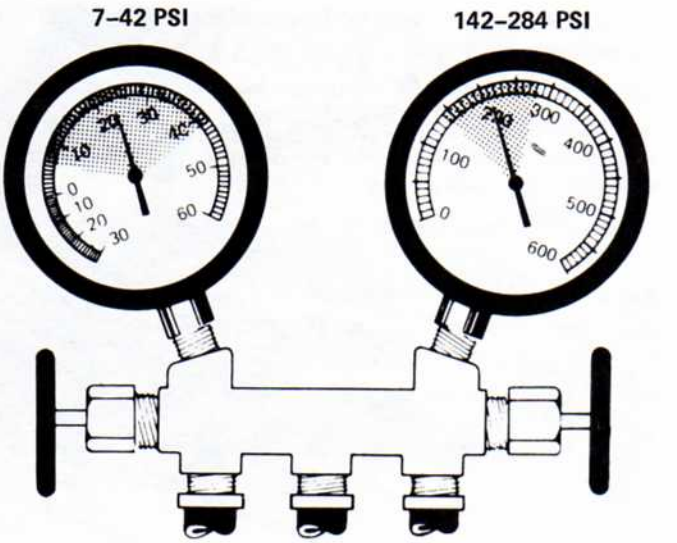
Check that refrigerant passing through sight gauge is clear and free of bubbles.

NOTE: Even with a full charge, a small amount of bubbles will be visible in systems using a vertically mounted condenser.



Accelerate engine to about 1500 rpm. Check that low pressure gauge reads between 7 and 42 psi. Check that high pressure gauge reads between 142 and 248 psi.

Obtain a thermometer and measure the ambient temperature in front of the condenser. Move the thermometer to the center outlet. The temperature should be between 1/2 to 2/3 of the first reading if the system is operating properly.



MINIMUM PRESSURE SWITCH CHECK
(Does not apply to Spider 2000 with ARA unit)

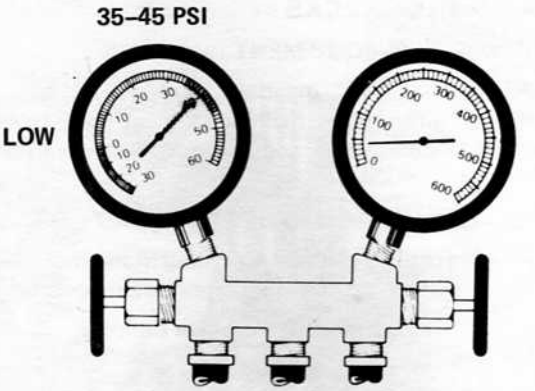
Shut off engine. Turn ignition switch on.

Push "STOP" button and check that compressor clutch disengages. Push "MAX AC" button and check that the clutch engages.

Open low pressure valve on gauge set and slowly bleed refrigerant until clutch disengages. Clutch should disengage at 40 ± psi on low pressure gauge.

Close low pressure valve.

Recharge system. Evacuating system is not required since system was not completely discharged.



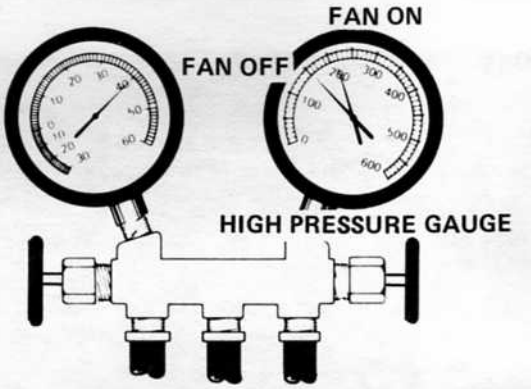
CONDENSER FAN SWITCH CHECK

NOTE: Do not use fan in front of vehicle unless ambient temperature is over 80° F.

Start engine and set AC controls for maximum cooling. Run engine at about 2000 rpm.

Check that condenser fan comes on between 225 to 300 psi on high pressure gauge. This indicates that switch opened.

Allow engine speed to slow down. Check that the fan goes off between 175 and 140 psi. This indicates that switch opened.



HIGH PRESSURE SWITCH CHECK

Connect test light to wire on frost prevent valve. Do not disconnect wire from valve.

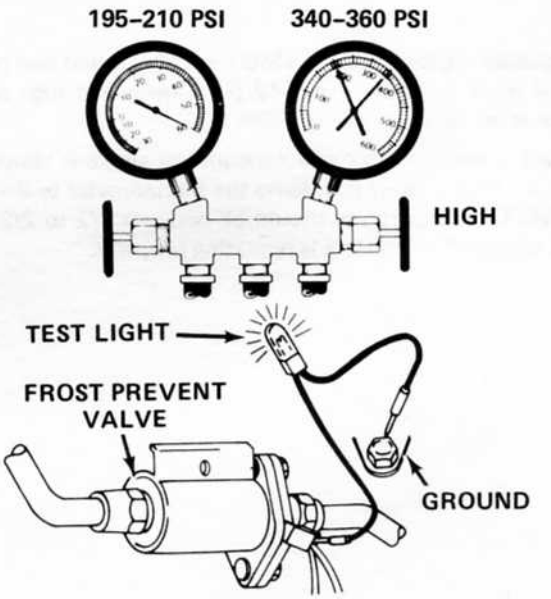
Disconnect connector for condenser fan.

Increase engine speed to increase pressure. Check that test light comes on between 340 and 360 psi. This indicates that high pressure switch closed.

Check that pressure starts to drop. This indicates that frost prevent valve works.

Reconnect condenser fan connector. Check that test light goes out between 210 and 190 psi. This indicates that high pressure switch opened.

NOTE: When testing the high pressure switch in the Spider 2000, observe that the compressor clutch circuit opens between 360 psi and closes between 240 and 260 psi.



FROST PREVENT SWITCH CHECK
(Does not apply to Spider 2000 with ARA unit)

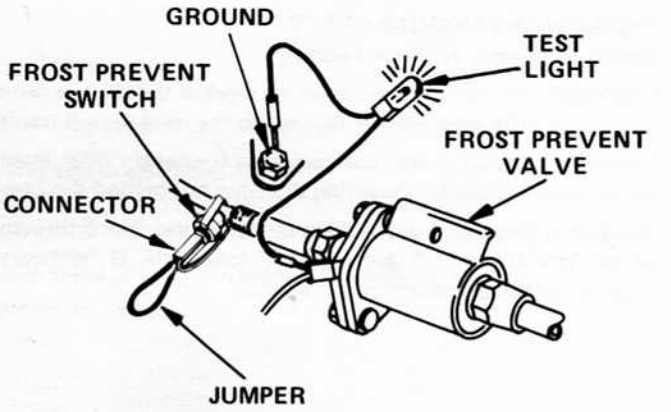
Leave test light connected to frost prevent valve wire.

Run engine at fast idle.

Place wire jumper into frost prevent switch connector.

Check that test light comes on and pressure starts to drop. This indicates that system wiring is good.

Shut engine off. Remove jumper and test light.



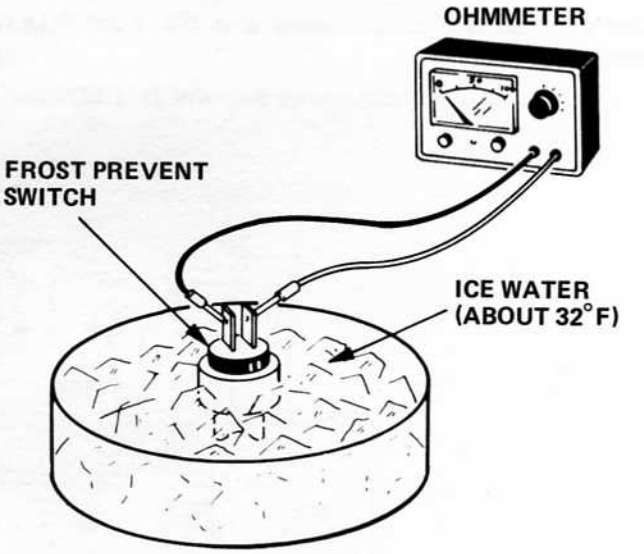
Remove frost prevent switch.

Provide ice cold water about 32°F.

Connect ohmmeter to terminals on switch. Place switch in water. Check that switch closes.

Remove switch from water. Check that switch opens as it warms up.

Install switch making sure surface of switch and pipe are clean. Connect wires and wrap switch with insulation tape.



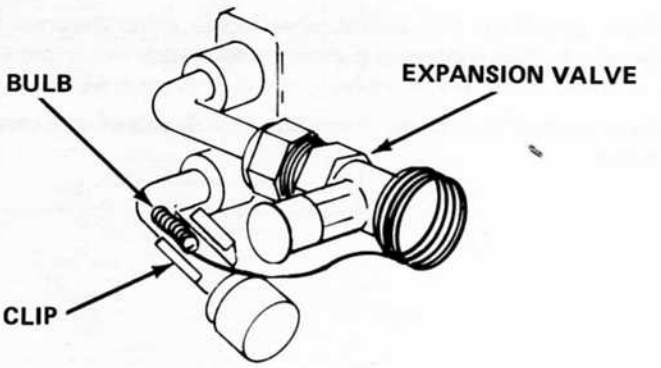
EXPANSION VALVE CHECK

Run engine at 2000 rpm. Set controls for maximum cooling.

Remove insulation and clip retaining sensing bulb for expansion valve. Move bulb away from line.

Using can of refrigerant, cool sensing bulb. Check that low pressure gauge reading starts decreasing. Expansion valve is good if a progressive decrease of pressure is noted.

Heat sensing bulb with warm water. Check that low pressure gauge increases. The expansion valve is good if an increase of pressure to higher than normal is noted.

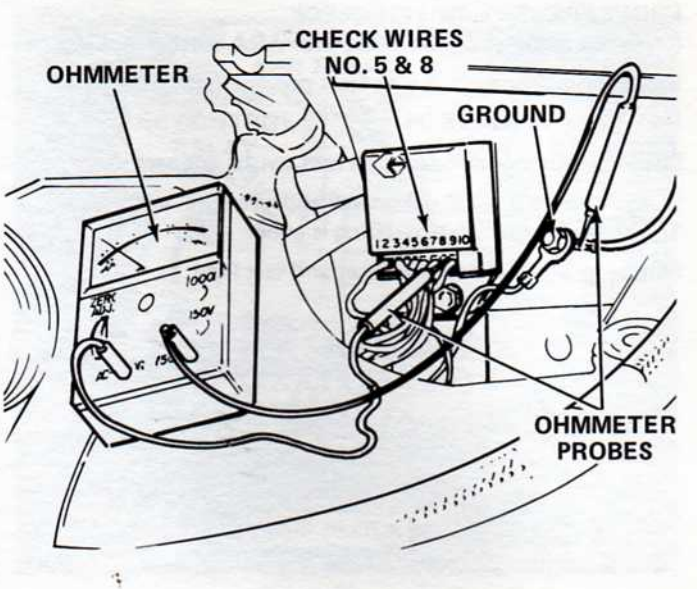


THERMOSTAT MODULE CHECK
(Spider 2000 with ARA unit only)

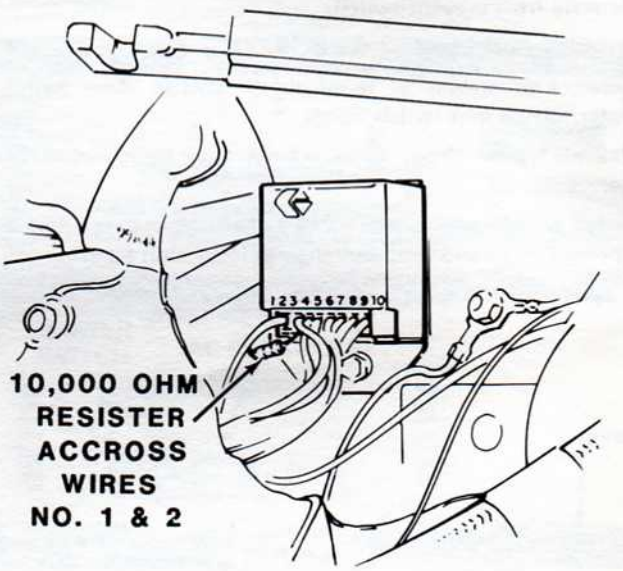
CAUTION: Do not apply current to module unless it is properly grounded or damage to the module will result.

From inside the passenger compartment (passenger side), lower the evaporator case by loosening the wing nut behind the case.

Using an ohmmeter, make certain module wires, No. 5 (brown/white) and 8 (brown) are properly grounded. If necessary, retighten ground connection at firewall.

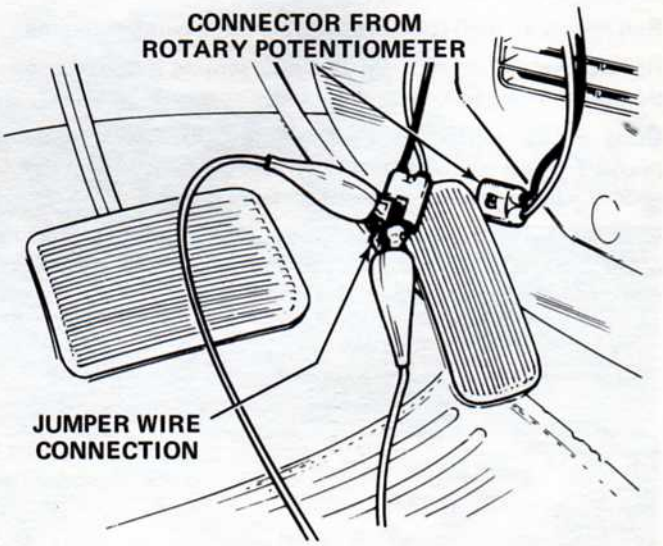


Place a 10,000 ohm resistor across wire, No. 1 and 2 (gray wires) of module.



From behind the AC control panel (driver side), disconnect the wire harness connector from the cooling rotary potentiometer to the thermostat module (light and dark green wires).

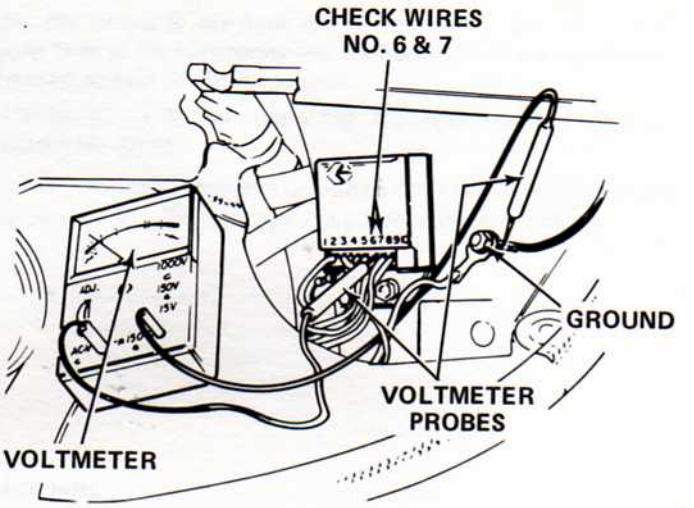
Place a jumper wire across thermostat module side of wire connector.



With the ignition key turned to the "RUN" position, energize the blower control switch.

Using a voltmeter, check that the module has:

- 12 volt current at No. 6 wire (black power source). If no current is evident, check circuits at control switch, AC in-line fuse and relay.
- 12 volt current at No. 7 (dark blue) wire. If no current is evident, replace module.

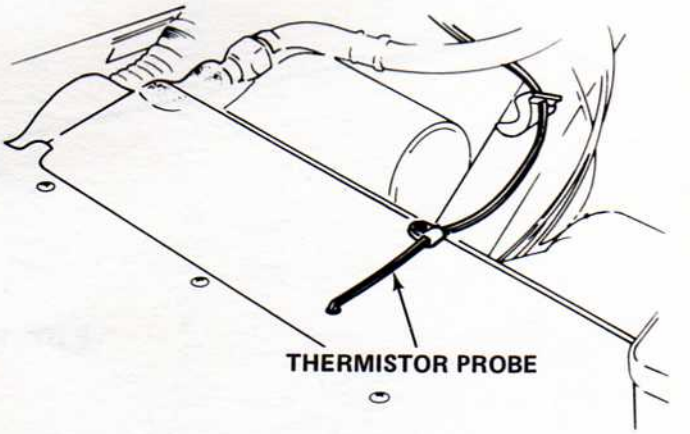


Remove the 10,000 ohm resistor from module.

Using voltmeter, recheck No. 7 wire (dark blue) of module for 12 volt current. If no current is evident, replace the thermistor probe located on the evaporator case.

Remove jumper wire from wire connector of cooling potentiometer/module harness (light and dark green wires). Reconnect wires.

Recheck 12 volt current at No. 7 wire of module. If no current is evident, replace rotary potentiometer.



TROUBLESHOOTING

INDICATIONS	PROBABLE CAUSE	CORRECTION
NO COOLING FROM SYSTEM		
Electrical		
1. Electrical components will not operate.	1. Blown fuse.	1. Replace fuse.
2. Electrical components will not operate.	2. Broken or disconnected wire or ground.	2. Check all terminals for loose connections. Check wiring for breaks. Check grounds. Repair as necessary.
3. Compressor clutch inoperative.	3. Clutch coil disconnected or burned out.	3. Repair or replace clutch coil.
4. Compressor clutch inoperative.	4. Clutch circuit or controls defective.	4. Check clutch circuit. Repair or replace as necessary.
5. Compressor clutch inoperative.*	5. Thermostat defective.	5. Repair or replace thermostat.
6. Blower motor.	6. Blower motor disconnected or burned out.	6. Repair or replace blower motor.
Mechanical		
1. System not functioning properly or not at all.	1. Loose or broken drive.	1. Adjust or replace belt.
2. Compressor pulley slips on belt or will not turn when clutch is engaged.	2. Compressor partially or completely frozen.	2. Replace compressor.
3. Low pressure gauge reads high. High pressure gauge reads low.	3. Compressor reed valve inoperative.	3. Replace compressor valve plate.
4. High pressure gauge reads normal. Low pressure gauge reads high. Evaporator flooded.	4. Expansion valve stuck open.	4. Replace expansion valve.
Refrigeration		
1. Complete loss of refrigeration.	1. Broken refrigerant line.	1. Check all lines for breakage.
2. Low or no pressure on high and low pressure gauges. Bubbles in sight gauge.	2. Leak in system.	2. Add static charge. Leak check system. Repair leak.
3. Clutch and front of compressor oily. System low on refrigerant.	3. Compressor shaft seal leaking.	3. Replace compressor shaft seal.
4. High pressure gauge reads normal to high. Low pressure gauge reads vacuum or very low. Frosting at point of blockage.	4. Clogged screen(s) in receiver/drier or expansion valve. Plugged hose or coil.	4. Repair or replace as necessary.
NOTE: After completing repairs requiring purging of system, replace receiver/drier. Evacuate and charge system. Check system operation.		
INSUFFICIENT COOLING FROM SYSTEM		
Electrical		
1. Small volume of air from discharge outlet. Blower may be noisy.	1. Blower motor runs sluggish.	1. Repair or replace blower motor.
2. Blower motor will not run at low or medium speeds but runs at high speed.	2. Blower resistor or blower switch inoperative.	2. Repair or replace blower resistor or switch.
3. Sufficient cooling at high speed but not at stop and go or low speed driving.	3. Condenser fan will not run.	3. Repair or replace condenser fan.
4. Discharge air remains warm. Excessive clutch cycling.*	4. Thermostat defective.	4. Repair or replace thermostat.

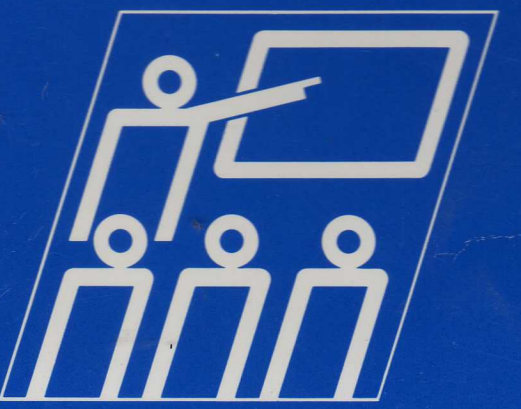
*Spider 2000 with ARA unit only.

INDICATIONS	PROBABLE CAUSE	CORRECTION
INSUFFICIENT COOLING FROM SYSTEM (Cont'd)		
Mechanical		
1. Discharge air remains warm.	1. Compressor clutch slipping.	1. If belt is slipping adjust tension. If clutch is slipping, replace clutch.
2. Blower operates at high speed but air displacement is very small.	2. Blocked air passage through air conditioning unit.	2. Clean air passages. Check operation of doors, cables and outlets. Repair as necessary.
3. Insufficient cooling at discharge outlet. High pressure gauge reads high.	3. Insufficient air circulation over condenser coils. Condenser fins clogged with dirt or bugs.	3. Make sure both condenser and radiator fans work. Clean condenser and radiator.
4. Insufficient cooling at discharge outlet. Normal high and low gauge readings.	4. Evaporator fins clogged with lint, dust or coated with cigarette tars.	4. Clean evaporator with compressed air. Use cleaning solvent to remove cigarette tars. **CAUTION:** Protect car interior.
Refrigeration		
1. Bubbles in sight gauge. High pressure gauge reads excessively low.	1. Refrigerant low.	1. Check for leaks. Recharge system. Check operation.
2. Gauge readings normal or slightly increased. High low pressure readings. Discharge output temperature higher than normal.	2. Expansion valve clogged.	2. Purge system. Remove valve and clean.
3. Excessive high or low pressure gauge reading. May have excessive cooling or not enough cooling.	3. Expansion valve sensing bulb lost charge.	3. Replace expansion valve.
4. High pressure gauge reads high. Low pressure gauge reads low. Receiver/drier cold to touch and may frost.	4. Receiver/drier clogged.	4. Replace receiver/drier.
5. Excessive high and low pressure gauge readings.	5. Excessive oil in system.	5. Inspect system for refrigerant overcharge and correct. If gauges still read high, remove condenser. Inspect for oil clogging.
6. Excessive high and low pressure gauge readings. Sight gauge shows bubbles or is cloudy.	6. Air and/or moisture in system.	6. Purge system and replace receiver/drier. Evacuate and charge system with new refrigerant.
7. Low pressure gauge reads high. Clutch cycles at too high a reading.*	7. Thermostat defective.	7. Replace thermostat.
NOTE: After completing repairs requiring purging of system, replace receiver/drier. Evacuate and charge system. Check system operation.		
INTERMITTENT COOLING FROM SYSTEM		
Electrical		
1. Electrical units operate intermittently.	1. Defective fuse, relay, switch or motor.	1. Locate defective part and repair or replace as necessary.
2. Clutch disengages intermittently during operation.	2. Improper ground, loose connection or partial open in compressor clutch coil.	2. Check connections and repair. Replace clutch coil.
3. System does not operate properly with pressure switch in circuit but does operate when pressure switch is bypassed.	3. Defective pressure switch.	3. Replace pressure switch.
4. Clutch disengages prematurely during operation.*	4. Defective thermostat.	4. Replace thermostat.

*Spider 2000 with ARA unit only.

INDICATIONS	PROBABLE CAUSE	CORRECTION
INTERMITTENT COOLING FROM SYSTEM (Cont'd)		
Mechanical		
1. System operates until head pressure builds up (as viewed on high pressure gauge) at which time clutch starts slipping. May or may not be noisy.	1. Compressor clutch slipping.	1. If belt is slipping, adjust tension. If clutch is slipping, replace clutch.
Refrigeration		
1. Unit ices up intermittently.	1. Defective expansion valve or frost prevent valve.	1. Check for proper operation. Repair or replace as necessary.
2. Unit ices up intermittently. Low and high pressure gauges read low.	2. Excessive moisture in system.	2. Purge system and replace receiver/drier Evacuate and recharge system.
NOTE: After completing repairs requiring purging of system, replace receiver/drier. Evacuate and charge system. Check system operation.		
EXCESSIVELY NOISY SYSTEM		
Electrical		
1. Clutch vibrates.	1. Defective winding or improper connection in compressor clutch coil.	1. Repair or replace as necessary.
Mechanical		
1. Belts slip and are noisy.	1. Loose or excessively worn drive belts.	1. Tighten or replace as required.
2. Noisy clutch.	2. Clutch or bearing defective.	2. Repair or replace clutch.
3. Compressor noisy.	3. Loose mounting. Worn parts inside compressor.	3. Check mountings. Repair or replace compressor.
4. Compressor noisy and hot to touch.	4. Compressor oil level low.	4. Determine cause of oil loss and repair. Fill with specified oil.
5. Excessive rattles during operation.	5. Loose panels in vehicle. Vibration of refrigerant hoses or lines.	5. Tighten panels. Check security of hose clamps, hoses and lines.
6. Blower motor noisy.	6. Excessive wear in blower motor.	6. Check for binding. Repair or replace blower motor.
7. Whining or growling noise during operation.*	7. Idler pulley defective.	7. Replace pulley.
Refrigeration		
1. Rumbling noise or vibration in high pressure line. Thumping noise in compressor. Excessive high and low pressure gauge readings.	1. Excessive charge in system.	1. Discharge refrigerant until pressures drop into specifications.
2. Hissing in evaporator at expansion valve. Bubbles or cloudiness in sight gauge. High pressure gauge reads low.	2. Low charge in system.	2. Check system for leaks. Charge system.
3. Expansion valve noisy. Low pressure gauge reads low.	3. Excessive moisture in system.	3. Purge system and replace receiver/drier. Evacuate and recharge system.
NOTE: After completing repairs requiring purging of system, replace receiver/drier. Evacuate and charge system. Check system operation.		

*Spider 2000 with ARA unit only.



Association of Fiat Service Technicians