

HVAC-02, Air Conditioning Troubleshooting and Repair

Introduction

Since I'm constantly receiving questions on 944 air conditioning systems, I figured it's time to come up with some helpful troubleshooting tips. Working on the 944 A/C system is no different than working on any other automotive A/C system. They have all the same components which function in the same manner as any other A/C system.

First, if you're having a problem with the A/C system on your 944, there are two ways you can approach solving the problem. The first is to just start replacing components and hope you get lucky by replacing the faulty component the first time. The other method involves doing some actual testing to narrow down the cause of the problem. In order to properly test the A/C system and narrow down the possible causes of your problem, you're going to have to invest in a set of A/C gauges.

Before we begin with the actual troubleshooting, to properly troubleshoot the A/C system, it's extremely helpful to understand how the automobile A/C cycle works. So, we'll begin by discussing automotive air conditioning theory of operation.

There are two basic types of automotive air conditioning systems. The type of system is determined by the device used to control the expansion of the high pressure, high temperature liquid to a low pressure, low temperature liquid. One system uses an expansion valve while the other uses an orifice tube. 944s use an expansion valve system. We'll discuss the operation of both.

The first component in the A/C cycle is the compressor. The compressor takes low temperature refrigerant gas and compresses it into a high pressure, high temperature gas. The refrigerant is then sent to the condenser which sits in front of the radiator. The condenser removes some of the heat from the refrigerant which causes the refrigerant to change phase from a hot gas to a warm liquid.

In the expansion valve A/C system, the warm liquid is then passed through a receiver-drier which removes moisture (via a desiccant in the drier) from the refrigerant to maximize the efficiency of the heat exchange capability of the refrigerant. On 944s, the receiver-drier is a small canister (probably with a sightglass on top) located near behind the driver's side headlight (LHD cars). No phase change occurs as the refrigerant passes through the receiver-drier. From there, the refrigerant is then passed through the expansion valve. The expansion valve has a sensing line that is attached to the suction of the A/C compressor. The expansion valve senses the pressure at the suction of the A/C compressor and modulates to maintain the pressure at the compressor suction. On 944s, the expansion valve is located near in the passenger's footwell (LHD cars) near the center console next to the firewall.

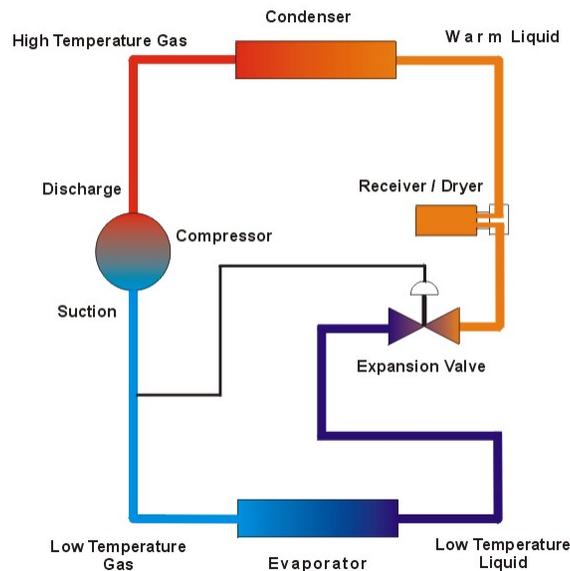
In the orifice tube system, the warm liquid refrigerant passes directly from the condenser to the orifice tube. The orifice tube is a fixed expansion device. The pressure drop across the orifice tube is proportional to the pressure into the orifice tube. So, the orifice tube system maintains the pressure at the suction of the A/C compressor by cycling the compressor on and off via a clutch. This is the type of system typically used by GM vehicles.

The expansion of the warm liquid through the expansion valve or orifice tube causes a pressure drop and hence a temperature drop in the refrigerant. So, out of the expansion device we get a low temperature liquid refrigerant.

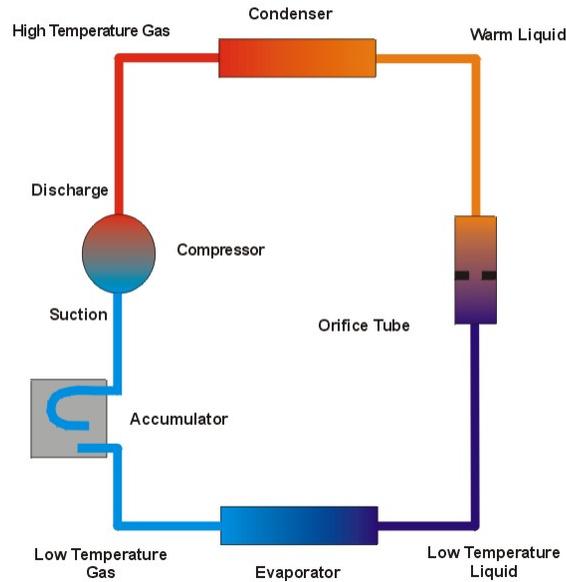
The next component in the A/C system is the evaporator. Air from the passenger's compartment passes across one side of the coils in the evaporator. The low temperature liquid refrigerant passes through the other side of the coils. The refrigerant removes heat from the air in the passenger's compartment and returns to the A/C compressor suction as a low temperature gas (phase change).

In the orifice tube system, there is an accumulator located between the evaporator and the A/C compressor suction. The accumulator has moisture removal desiccant just like the receiver-drier used in the expansion valve system. However, it also collects any un-evaporated refrigerant to prevent liquid lock of the compressor. This can occur due to the cycling action of the compressor. The diagrams below show the two different A/C system cycles.

Expansion Valve Air Conditioning System



Orifice Tube Air Conditioning System



Tools

- A/C Gauges and hose set

A/C System Troubleshooting

The following is an general A/C system troubleshooting guide. Realize that it is generic and many of the things listed here may not apply to the 944.

Symptom / Possible Cause	Solutions
<p><u>Low Compressor Discharge Pressure</u></p> <ol style="list-style-type: none"> 1. Leak in system 2. Defective expansion valve 3. Suction valve closed 4. Freon shortage 5. Plugged receiver drier 6. Compressor suction valve leaking 7. Bad reed valves in compressor 	<p><u>Repair</u></p> <ol style="list-style-type: none"> 1. Repair leak in system 2. Replace valve 3. Open valve 4. Add freon 5. Replace drier 6. Replace valve 7. Replace reed valves
<p><u>High Compressor Discharge Pressure</u></p> <ol style="list-style-type: none"> 1. Air in system 2. Clogged condenser 3. Discharge valve closed 4. Overcharged system 5. Insufficient condenser air 	<p><u>Repair</u></p> <ol style="list-style-type: none"> 1. Recharge system 2. Clean condenser 3. Open valve 4. Remove some refrigerant 5. Install large fan

Symptom / Possible Cause	Solutions
<ul style="list-style-type: none"> 6. Loose fan belt 7. Condenser not centered on fan or too far from radiator 	<ul style="list-style-type: none"> 6. Tighten fan belt 7. Center and check distance
<p><u>Low Suction Pressure</u></p> <ul style="list-style-type: none"> 1. Refrigerant shortage 2. Worn compressor piston 3. Compressor head gasket leaking 4. Kinked or flattened hose 5. Compressor suction valve leaking 6. Moisture in system 7. Trash in expansion valve or screen 	<p><u>Repair</u></p> <ul style="list-style-type: none"> 1. Add refrigerant 2. Replace compressor 3. Replace head gasket 4. Replace hose 5. Change valve plate 6. Replace drier 7. Replace drier
<p><u>High Suction Pressure</u></p> <ul style="list-style-type: none"> 1. Loose expansion valve 2. Overcharged system 3. Expansion valve stuck open 4. Compressor reed valves 5. Leaking head gasket on compressor 	<p><u>Repair</u></p> <ul style="list-style-type: none"> 1. Tighten valve 2. Remove some refrigerant 3. Replace expansion valve 4. Replace reed valves 5. Replace head gasket
<p><u>Compressor Not Working</u></p> <ul style="list-style-type: none"> 1. Broken belt 2. Broken clutch wire or no 12v power 3. Broken compressor piston 4. Bad thermostat 5. Bad clutch coil 6. Low Refrigerant - low pressure switch has cut off clutch power 	<p><u>Repair</u></p> <ul style="list-style-type: none"> 1. Replace belt 2. Repair wire or check for power 3. Replace compressor 4. Replace thermostat 5. Replace clutch coil 6. Add refrigerant
<p><u>Evaporator Not Cooling</u></p> <ul style="list-style-type: none"> 1. Frozen coil, switch set too high 2. Drive belt slipping 3. Hot air leaks into car 4. Plugged receiver drier 5. Capillary tube broken 6. Shortage of refrigerant 7. High head pressure 8. Low suction pressure 9. High suction pressure 10. Defective expansion valve 11. Frozen expansion valve 	<p><u>Repair</u></p> <ul style="list-style-type: none"> 1. Turn thermostat switch back 2. Tighten belt 3. Check for holes or open vents 4. Replace drier 5. Replace expansion valve 6. Add refrigerant 7. See problem #2 8. See problem #3 9. See problem #4 10. Replace expansion valve 11. Evacuate and replace drier
<p><u>Frozen Evaporator Coil</u></p> <ul style="list-style-type: none"> 1. Faulty thermostat 2. Thermostat not set properly 3. Insufficient evaporator air 	<p><u>Repair</u></p> <ul style="list-style-type: none"> 1. Replace thermostat 2. Set to driving condition 3. Check for excessive duct hose length, kink or bend.

AC System Gauge Readings

The following table is a general guideline for A/C system pressures and temperatures based on ambient outside temperature. Remember that these are a guideline and your actual temperatures and pressures will vary depending on humidity in the air and the condition of your system.

A/C System Pressure Readings			
Ambient Temperature	Low Side Pressure	High Side Pressure	Center Vent Temperature
60 °F	28-38 psi	130-190 psi	44-46 °F
70 °F	30-40 psi	190-220 psi	44-48 °F
80 °F	30-40 psi	190-220 psi	43-48 °F
90 °F	35-40 psi	190-225 psi	44-50 °F
100 °F	40-50 psi	200-250 psi	52-60 °F
110 °F	50-60 psi	250-300 psi	68-74 °F
120 °F	55-65 psi	320-350 psi	70-75 °F

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