AC System Help – Introduction

Porsche AC System Help

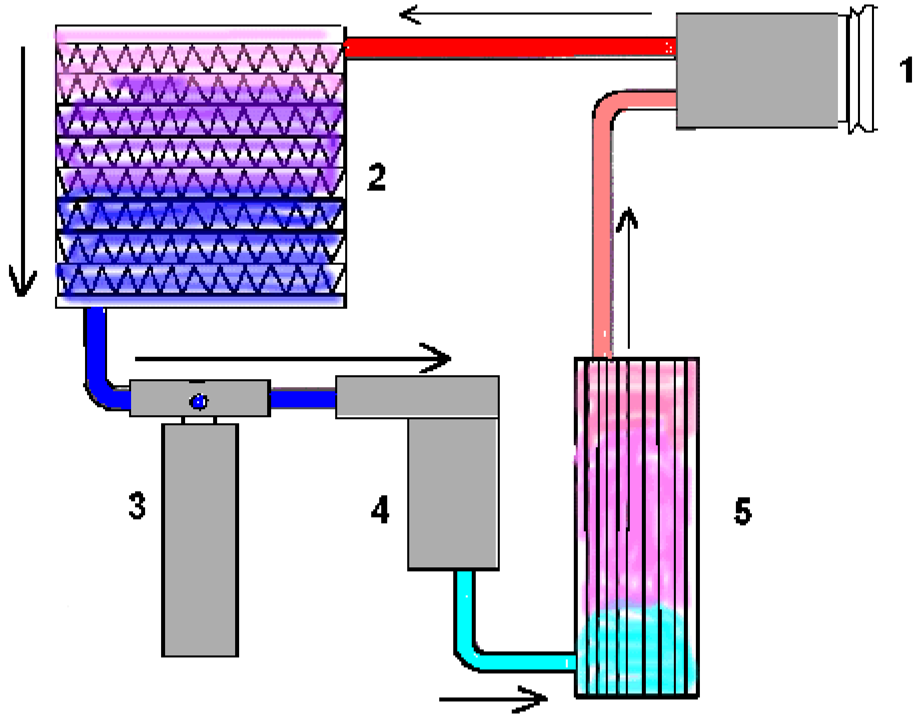
The Porsche AC System Help pages are directed toward early air and water cooled Porsche models. The information contained in this section discusses some of the basic principles related to automotive air conditioning. We hope this information will help you.

Learn About The Basic System

Basic Porsche Air Conditioning System Operation

The basic Porsche AC System- air conditioning circuit has a “high” and “low” side. The high side starts at the compressor outlet and continues through the condenser, receiver dryer (drier) and ends at the outlet of the expansion valve. The “low” side starts at the outlet of the expansion valve, continues through the evaporator and ends at the inlet to the compressor.

The three basic states of matter are: solid, liquid and gas. When the refrigerant gas is compressed its pressure rises. As the pressure rises so does the temperature of the gas molecules. Hotter molecules have a tendency to travel toward cooler molecules. This is the basic concept that makes your air conditioning system work and your engine’s cooling system works on the same principle: hot molecules move toward cooler molecules.



There are two types of a/c systems found in automobiles:

1. “Expansion” valve systems, which use a Thermal Expansion Valve and a “Drier”
2. The Orifice Tube system, which uses a orifice tube and a “Accumulator”

Expansion valve systems are commonly used today. The information in these pages is directed toward those systems.

Expansion Valve Systems

1. The Compressor pulls (pumps) refrigerant in a gaseous state from the low side of the circuit. As gas moves through the compressor pump it rises in pressure and temperature as it’s compressed.
2. The hot high pressure gas enters the top of the Condenser. This “heat laden” gas travels downward through the condenser. The gas’s hot molecules are attracted to the cooler surfaces of the condenser. As the vehicle moves down the road, or the engine or condenser fan moves air through the condenser, the heated air molecules on the condenser’s outer surface move toward (exchange) the cooler air molecules moving over the surfaces, hence the condenser is called a “heat exchanger”. By the time the gas reaches the bottom of the condenser it loses enough heat to change its state from a gas to a liquid.
3. The liquid refrigerant enters the receiver dryer (drier) where it is stored until some point when the expansion valve opens. While the refrigerant passes through the drier a drying material called a “desiccant” absorbs water moisture

and contamination from the refrigerant. As a footnote you may have heard of the term “liquid side” of the system. The liquid side we say starts when the refrigerant leaves the condenser and continues up to the evaporator.

4. When the expansion valve “asks” for liquid refrigerant, the liquid passes through the expansion valve inlet and is metered and atomized (misted) which causes a pressure drop on the outlet side of the valve. By the way there are basically two methods of atomizing the refrigerant: the first we mentioned is with an “expansion valve”, the second is with an “orifice tube”; either type works, it’s just a matter of system design. TIP: One of the signs of a “normally” functioning system is that the inlet a/c line entering the expansion valve will usually be very warm to hot as compared to the outlet tube coming out of the evaporator. The outlet tube of the evaporator should be cool to cold and may be sweating. If you notice the “inlet” side of the expansion valve is sweating or frosted then you probably have a defective valve or blockage.
5. The atomized refrigerant, now at a lower pressure, enters the Evaporator. Since the refrigerant is at a lower pressure it also contains less heat. The evaporator’s fan moves warm air molecules across the evaporators outer surface. The outer warm molecules are exchanged with the inner cooler molecules (the evaporator is simply another heat exchanger like the condenser). As the outer warm air molecules contact the evaporator surfaces moisture from the vehicles interior condenses on the surface thus removing humidity from the air for additional comfort. The cool dry air is transferred through the air vents to the inside of vehicle. By the time the refrigerant exits the evaporator it’s state changes from an cool atomized liquid to a warm gas. And, the cycle of refrigerant through the air conditioning circuit is repeated.

Troubleshoot the AC System

Common AC Problems

To trouble shoot the Porsche air conditioning system can be simple, then maybe not so simple. And you don’t want to hear the cliche “take it to a qualified Porsche technician”. Maybe you don’t have the time to make an appointment at the shop, or maybe you just prefer to find and fix the problem yourself. This section was written for those who have the time to explore the problem but not the unique tools or certifications. Remember, chances are you will have to make the appointment with the qualified technician later. And, for you "pro's" who read this section, we are open to your suggestions. Before we start you'll need to know where the compressor, receiver drier and evaporator are located.

> Remember…SAFETY. SAFETY. SAFETY. THINK about what you are doing and what's around you BEFORE you start this project (no loose hanging ties to get wrapped around the pulley belts, and keep your fingers away from fans, pulleys and belts).

If the A/C does not work

The problem could be as simple as a blown fuse or low refrigerant. Most of the time it's simply low of refrigerant (we are saying "most" of the time"). So let's start up the engine and turn on the a/c. Here we are assuming: (i) the evaporator or climate fan is pushing the air through the vents, the air is warm and stays that way… forever and (ii) the reason for the warm air is not related to a climate control problem involving air mixtures of fresh outside air or air from the heater core. We'll discuss these items later.

Checking the Clutch

Clutch works OK.

With the engine running and a/c turned on, pop the hood open (car is in "park" & the emergency brake is on, a/c fan switch turned on, temp control set to coldest setting, you've got no loose ties or long sleeves, your safety glasses are on). Locate the compressor. There should be a belt on the compressor's clutch pulley. The pulley is always turning when the belt is moving. In front of the pulley is the clutch "hub" which is attached to the compressor shaft. If the hub is turning along with the pulley then that's a good sign, the clutch is working! Jump below to the section titled 'Checking the Site Glass". If the clutch hub is not turning then we need to check a few things.

Clutch works only when hot wired.

When the a/c electrical circuit to the clutch is excited with 12 volts and enough current the clutch's magnet pulls the clutch hub into the pulley. Friction takes over and the two pieces turn in unison. So, let's shut off the engine and locate the clutch's wire. The wires are usually found toward the back side of the pulley close to the body of the compressor. The positive wire should have a connector somewhere it to get it's power. Carefully disconnect the connector. Borrow 12 volts – positive- DC power from either the battery, using a jumper wire, or from a power source such as a battery charger (you'll need at least 5 amps or more). If you use a power source who's ground is not part of the car's circuit, such as another battery or the battery charger, you'll need a ground from that source to the compressor's body. Make sure your ignition is off. Apply 12 volts to the coil side of the wire (that's the wire lead that goes to the compressor side of the circuit). The front clutch hub should move or snap into the clutch pulley. If it does then chances are your clutch coil is OK. If the clutch only works when you hot wired it your system "may" be low on refrigerant so that the low pressure cut out switch won't allow the clutch to engage, or a relay or fuse is preventing current from reaching the coil. Check you wiring back to the source and read the section below "checking the site glass".

Clutch does not work when hot wired.

Inspect the wire's connector for poor contact (corrosion or breaks). Check the negative ground wire from the clutch to the compressor's body. If no problems are found you'll need to verify if clutch is getting electrical power. The power could be controlled by a simple circuit consisting of a switch, fuse & relay, or something very complicated involving additional circuits. With the engine running (be careful here), the a/c turned on – use a circuit testing light attached to the wire/connector leading away from the compressor (the power lead) and ground. If the light comes on then we can assume the compressor is getting some amount of electrical power. You can also use a volt meter and check for 12 volts. Remember these tests do not show the volume (current) electrical power, only that there is power. On the far extreme it could be that the coil, the compressor or the engine has a poor ground. You can check this by repeating the tests above but add an additional ground wire to the compressors body. You can also check the negative ground between the compressor or negative wire and the car chassis. Check the resistance of clutch coil: If you have a digital ohm meter (preferred over analog – needle types), check the resistance of the coil. Good coils "usually" have a reading of 2.9 to 3.2 ohms (the range will vary with manufacturer and the reading is not an absolute assurance of the coils quality). If your inspection of the ground and coil resistance indicate a potential coil problem you'll probably have to remove the clutch assembly from the compressor and repair the broken wire or replace the coil.

Clutch turns but slips.

If the front hub on the compressor seems to "slip" (we are not discussing the belt here) you could have two potential problems:

1. The air-gap between the faces of the front hub and pulley is too large. This does not happen often on it's own, more probably if the compressor was overhauled.

The typical gap (varies with different manufacturers) is .015" to .030", measured using feeler gauges. You check the gap at three points equally spaced around the clutch. You can correct the air gap by removing the clutch's front hub and add or remove washer shims on the shaft's seat.

2. Oil has contaminated the clutch surfaces. Most a/c clutch surfaces are simply metal to metal and can be easily cleaned. Do no attempt to dump degreasing chemicals on the clutch as you can damage the pulley bearing. Instead, remove the assembly and wipe the surfaces clean, and locate the source of the oil.

The Clutch is burnt, fried or toasted.

Clutches typically "burn up" or "fry" because of heat and not so much electrical problems. When compressor run low on refrigerant or oil friction raises temperatures. The excess heat travels away from the aluminum compressor's body and is absorb by the copper wound coil in the clutch. The insulation on the coil's wires melts and shorts out, and the grease in the pulley bearing melts out. So if you think you can fix the problem by just replacing the coil or clutch assembly you odds are 1:10 (not in your favor…. read on). Since the compressor does not have sufficient oil supply and the excessive heat breaks down the oil's lubricating properties the compressor locks up. Time for a new compressor. Read more about "locked up" or "frozen compressors" below.

Checking the Sight Glass

"Most" systems have a sight glass located on the receiver drier. Occasionally you'll see a system that has a side mounted glass with a floating ball. Locate the receiver-drier. The drier is located on the high side of the a/c circuit. It will have a line (metal or rubber hose) entering it (that comes from the condenser) and another line exiting it (that goes to the expansion valve). Hopefully your drier will have a "sight glass" on it, usually on the top but sometimes on the side. Much of the time this little 1/4" diameter eye is covered with dirt so we'll have to wipe it clean to see what's going on. Again, with the engine running and SAFETY in mind, turn on the a/c and examine the sight glass. If the glass has streaks of oil inside the glass or if you see very large stream bubbles then you are probably low on refrigerant. For R12 systems, if you see a strong stream of small bubbles you are low on refrigerant. With R134a systems or conversions we are not to concerned with refrigerant flow observed at the sight glass because the flow can be cloudy and little if any (with R134a you are more concerned with pressures and temperatures). If you see no bubbles then most likely you have a fully charged system or maybe no refrigerant at all (not that easy of a guess). It can be normal to see a few bubbles in any system and common to see some when a system is just turned on. Most systems have a low side cut-out switch that prevents the compressor from operating if the level of refrigerant is too low. Since the compressor relies on the refrigerant to carry the a/c oil to it for lubrication, a lack of refrigerant will reduce the amount of oil to the compressor. Without oil the compressor will lock up.

Compressor locked up, frozen or makes awful noise

Compressors are simply "pumps" with closely machined tolerances. They pump the refrigerant by means of pistons, rotary vanes or scroll technology. Like your car's engine they need a lubricant to reduce friction and reduce heat. R12 refrigerants use a mineral type oil, R134a refrigerants use either PAG or Esters. Each type of refrigerant requires that the oil mix with it. Either way you need oil (lubrication) especially since most compressors have aluminum cylinders and pistons and no rings. Two common problems will wear out or kill a compressor: excessive pressures or lack of oil. Lack of oil is the most common cause of failure. Lack of oil is caused by either:

1. A low level of oil related to refrigerant loss over the years. As the refrigerant escapes from the system the oil is carried out with it. If your system was topped off or recharged without adding oil the result is similar to running your car's engine without oil ….. worn cylinders and rings, but with aluminum as opposed to steel you get a melt down… quickly.
2. Inadequate flow rate of refrigerant through the compressor, which can be related to several problems, such as running with a very low refrigerant level for a long period of time, failed expansion valve preventing refrigerant and oil to get back to the compressor. The a/c system relies on the refrigerant to "carry" the oil with it through the compressor. No refrigerant and no oil return, yet a compressor constantly running at a given RPM ….. means you are going to compressor melt down.

If the compressor is noisy (clanking or rapping or otherwise) don't run it.

If you do run it you will contribute to the problem of system contamination. Have the compressor replaced and read below about de-contaminating the system.

If you are considering attempts to "loosen" up a locked compressor.

Forget about it, the damage is already done (scratched pistons and bores and or wobble plate or vanes). The smartest thing to due is to dispose of the bad compressor and get a remanufactured or new unit.

Inspection for Contamination

One method, however not always 100% accurate, of checking for particulate contamination is the cotton swab test . Assuming the system is “open” (without refrigerant pressure), is to take a cotton swab and wipe the inner diameters of key components or connections to see if there is any visible particulates, such as pieces of aluminum or heavy black or grey matter. Deep black particles could be a sign that the inner diameter of the refrigerant hoses are breaking down due to age. Grey matter could be the coating on the aluminum pistons is wearing away. Small white or tan in color “beads” could mean a blown receiver drier bag (the desiccant has broken away from the drier).

You can start your simple inspection at the compressor’s high side or outlet hose, and then work forward to the condenser inlet, the condenser outlet, the receiver drier inlet and outlet, inlet to the expansion valve, inlet to the evaporator, outlet from the evaporator, and back at the inlet to the compressor. If the car has an “accumulator” rather than “receiver drier”, you’ll be checking the orifice tube rather than the expansion valve.

Decontaminating the System

Before you install the remanufactured or new compressor in a system that is contaminated you need to “properly” clean the system which is accomplished using a specific auto air conditioning approved “flush”, a solvent that won’t interact with your components or refrigerant. You should AVOID mineral spirits, alcohol, Tri-Clor 111 or other solvents that have not been approved. You can’t simply use high pressure air, it does no work. The procedure requires dedicated “liquid flushing” equipment … and it must be done properly. Liquid flushing would include condensers, evaporators (with expansion valve or pre-entrance orifice tube, removed), and hose lines. The drier or accumulator, or expansion valve or orifice tube, or solenoid valve if equipped should be replaced and should not flushed. It is extremely difficult to decontaminate a compressor unless you thoroughly take it apart. In any case that you feel doubtful about the success of flushing you should replace the component as in the end the cost to do the job twice is not economical. Remember … liquid flushing does not 100% guarantee the removal of contaminates, but it is the next best thing you can do besides replacing every component.

If the A/C works, but only warm or cool-warm air comes out of the vent

You are getting only warm air or cool-warm air at the vent

1. Go back and check the site glass as discussed above. You may have just enough refrigerant to allow the low pressure cut off switch (if equipped) to make contact but not enough refrigerant to due the job. Check for bubbles in the drier or system site glass. If you have bubbles then you'll need to find the leak in the system, evacuate it, make repairs and have it recharged and tested.
2. Check to see if the evaporator is getting cold. Is the climate control air mixing box getting cold air from the evaporator or is it getting hot air from the heater core; are there cables or vacuum actuators related to the system. You might have an air flap that is not functioning properly or a heater valve open to the heater core.
3. Is your a/c thermostat control functioning correctly. Read further below The AC Temperature Switch.

If you don't have a/c gauges or know how to use them, you will have will be limited to these simple observations noted above, and let an a/c technician handle the system and pressures portion of diagnositcs.

System is low on refrigerant, where is the leak?

System leaks should be confirmed by a technician, but there are some common areas to check. You'll be looking for signs of oil that escapes with the refrigerant. Refrigerant generally escapes out the high side of the system first, so revisit our help page "Learn about the Basic AC System" in the menu options below to locate the high side circuit. :

1. With the engine off examine the areas around the clutch pulley. Common leak here is the nose seal on the compressor shaft. Since air movement may push the oil toward the back of the car look for a trail running from behind the compressor pulley toward the back. Also, the clutch may fling oil outward in all directions so look at the hood and other components nearby. Most compressors are manufactured in sections so check the seams in the front, middle and rear, and the port connections or manifolds.
2. Check the high side pressure hose from the compressor to the condenser, examining the sections by the hose fittings, areas where there is a bend or sections that touch or rub against the body or other car component. If your

hose seems brittle, stiff or has cracks then it's time to replace it and you might as well get a hose assembly made of barrier hose.
3. Inspect the condenser, looking for oil and dirt accumulation. Check near the hose connections and any joint in the tubing assembly.
4. Look at the receiver-drier, examining it's fittings and hose connections. If there is pressure switch attached or nearby look at it as well.
5. If you can locate your expansion valve (it will be attached to the evaporator) or your evaporator examine them as well.
6. Examine all a/c rubber hose lines for signs age: brittle, hard or cracks.

Beyond these examinations you are best to leave the final leak detection up to a technician who has the equipment and experience to quickly find and fix them.

The Vent temperature is cold, then gets warm

What could be happening is the evaporator core is "icing up or freezing". As humidity enters the evaporator ice can form on the evaporator coils if the evaporator is too cold. The ice insulates the incoming air preventing the evaporator coil from removing the heat, and can further slow down the air flow. This is usually noticed when your ac works when you first turn it on and then a few minutes later the vent temperature starts to rise. However if you park the car for several minutes or turn off the ac for a given time and turn ac back on it works fine for short period again. When you turn off the ac the ice on the evaporator coil melts and afterwards air can make contact with the coil to cool it once again. This is usually caused by failure of the either the capillary tube sensor (from the expansion valve) attached on the evaporator coil to accurately sense the coil's temperature, or in other sensing designs the failure of the electronic thermostatic sensor in the same fashion

The AC Temperature Switch – An example in detail with a typical 911 Porsche

The left hand knob thermostat switch in the knee pad vent panel on pre 77/78 models, or the center console on post 77/78 models, functions in this manner (typical of this design for this application; no defrost function in the circuit):

How The Switch Works

The thermostat switch is a simple 'series' circuit allowing electrical power to travel from the evaporator fan motor speed switch when it is turned on. When the thermostat switches contacts ‘make’ (closed) contact power flows to the compressor clutch and to the front condenser blower motor (for vehicles with front condensers).

The switch has a “bellow” filled with refrigerant. The bellow has a capillary tube attached to it, open to the bellow side, closed at the other end that is inserted in the evaporator coil. As the temperature in the evaporator coil increases (warm air being drawn upward into the coil), the refrigerant expands in the capillary tube. The expansion of the gas in the capillary tube moves the bellow against a set of contacts that make or break depending upon the location of the bellow with respect to the switch, thus turning on the compressor or shutting it off.

How the AC Vent Temperature is Regulated

As you turn the knob on the switch you are increasing or decreasing the distance between the bellow thus changing the min or max temperature of the evaporator coil which in turn changes the a/c vent air temperature coming into the cockpit. The cockpit temperature is lowered or raised based upon the temperature of the ac air produced by the evaporator.

Switch Temperature Ranges

The switch/bellow design “usually” has a max. cold setting of 26F (the tolerance is +/- 2) ; all numbers are in “F”. At maximum cold position, fully CW – clockwise, in theory what should happen is the contacts would break and the compressor would turn off when the capillary tube sees 26F nominal. As the evaporator coil temperature rises to 33F (with a tolerance of +/- 2) the contacts would make and the compressor would turn on. As you turn the switch knob CCW – counter clock wise, you are raising the temperature at which the contacts will make and break. In the maximum cold, fully CW knob position, you can see you have potential of 24F. In that same knob position (fully CW) the compressor would then turn on when at the cap tube sees 35F. The low of 24F and the high of 35F include the tolerance noted above.

The original thermostat design (no longer available) as compared to the current model, had a maximum ‘cold’ (CW, fully clockwise, right) of 30F +/- 3F. And, when turned to fully CCW (left), had a minimum ‘on’ of 65F. Most current models have a max cold of 26F and minimum on of 55F.

As a side note altitude can affect the point at which the switch makes and breaks, meaning if you set the position of the knob at one point at a given altitude at sea level and then drove up to a higher elevation the make and break point in switch/below would change. And depending upon the year your capillary tube (or thermostatic tube) was built, it may have R12 refrigerant or it may have R134a refrigerant as its gas.

Capillary Tube Position and Contact

The end of the aluminum capillary tube, inserted into the evaporator, is sealed and crimped to form a closed gas circuit to the bellow. This is where most failures (breakage) occur from handling of the tube. The OEM incorporated into the design two protective items to help protect the aluminum capillary tube. The first is plastic like sleeve (white in appearance) which extends from the switch in the center console to near the end of the tube in the evaporator box location. The plastic sleeve protects against abrasion. And, a brass tube to help protect the aluminum tube. The brass tube, which is crimped closed at one end and has a flare opening at the entrance, is inserted into an existing hole near the front support bracket on the top case half of the evaporator box. The brass tube is inserted at a diagonal through OEM stock tube and fin design evaporator coils or vertically through serpentine design coils. The insertion depth should be to “near bottom” of the coil, however not clearly through the entire coil such as to expose the tubing to incoming “warm air”. The aluminum capillary tube is then inserted into this brass tube to its bottom. The aluminum capillary tube excess coil is then secured to the top of the evaporator box using a tie wrap and positioned such that the steering shaft connecting to the steering rack will not make contact.

Capillary Tube Function Failure

There are two modes of failure typically found with the The AC Temperature Switch.

1. Failure of the capillary tube (loss of refrigerant). This typically occurs when the tube has been handled in such a way that a fracture or break occurs in the tube, which releases the refrigerant gas from the tube preventing the bellow in the switch from contracting or expanding. This failure leaves the switch in a permanent “open” position preventing the electrical current to flow between the switch contacts; the compressor clutch will not engage in the circuit. Capillary tubes do not usually fail on their own as once installed they are a “static” device (they do not move nor are they subject to contact by other moving components). Failures of this type can be avoided by handling the aluminum capillary tube with care. Should you need to work on the vehicle near the tube, be aware of its limitations. Should you need to remove the tube when

R&Ring of the evaporator box: carefully remove any tie wraps and tape securing the tubing. Carefully extract the tube, with the brass tube if possible, from the evaporator slowly. If you need to "bend" or reshape the excess coil or the aluminum capillary tube end, first warm the tube with your hands as a "cold" tube does not bend as easily as a "warm" tube. Do not attempt to bend the tubing at sharp angles, rather form a gentle radius. Note: There are instances where you may find the brass protective sleeve, mentioned above, is missing from the box. The aluminum capillary tube will fully function without the brass sleeve however be aware of the potential for damaging the aluminum tube as discussed above.

2. Failure of the capillary tube's function is related to its position (contact) with the evaporator coil. This type of functional failure will result in "icing" of the evaporator coil; whereas moisture entering the evaporator box, drawn in from the cockpit, turns to ice on evaporator coils and insulates the capillary tube from seeing the air temperatures. As ice builds up on the evaporator coil it too will insulate the coil from the incoming cockpit air which prevents the coil from cooling the air. Typically this can be noticed when the a/c vent temperatures drastically rise from cool to warm though the compressor clutch is engaged, the refrigerant cycling and pressure ranges are normal. Though this mode of failure happens more often on more humid days.

Capillary Tube Function Failure – Testing

If Compressor Does NOT work

Assuming you have already checked the a/c fuse and relay, and tested the compressor clutch coil and you have determined the system has an adequate charge of refrigerant for systems that may have an aftermarket refrigerant low pressure switch attached).

Failure of the capillary tube (loss of refrigerant). Testing for capillary tube gas refrigerant loss first starts with a visual examination of the tube section near and inside evaporator box. Examine the circular bend in the excess tubing adjacent to the box, looking for sharp bends. Carefully remove the aluminum capillary tube from and its brass sleeve (if present) from the evaporator box and examine with a magnifying glass the crimped sealed end of the tube looking for sharp bends, breaks or fractures. Consider if any repairs or work had been recently done on the vehicle in the evaporator box area or near the center console or behind the console which might suggest a kink or break in the aluminum tube potenially occurred.

With the ignition off, remove the knob attached to the thermostat switch. Obtain access to the switch behind the center consoles fascia or front cover. Locate the two wires attached to the back of the switch, solid green and green with a white stripe. Be careful when handling the switch so you don't bend or or break the capillary tube on the switch. Carefully remove the two wires. With the ignition off and evaporator fan switch off, connect an ohm meter or continuity meter between the two male spade terminals on the back of the thermostat switch. When the thermostat switch is turned fully off, CCW (counter clockwise), the circuit should be "open", no continuity. Carefully remove the aluminum capillary tube from the evaporator and warm the end with your hands (this test should not be done in freezing weather naturally).

Turn the thermostat knob from the off position (fully left CCW) to the right CW (clockwise) approximately 1/4 turn (this should put the switch in its on position and set to a warm to cool cockpit temperature). The ohm or continuity meter should now show a "make" contact, you have continuity. If not try turning the knob slightly CCW a few degrees closer to the off position. You can also try placing the end (approximately 3" thereof) of the aluminum capillary tube in warm water (say up to 120 F hot tap water). If you fail to make or break contact then most likely the thermostatic switch needs to be replaced.

If Compressor DOES work

(You do not have remove the thermostat's knob, the green and green/white wire are attached to the back of the thermostat; mentioned above). Turn on the ignition switch to the "accessory" position". Turn on the evaporator fan motor to either of its three fan speeds. Turn thermostat knob fully CW (clockwise to the right). At this point the compressor clutch should be engaged. Carefully remove the aluminum capillary tube from the evaporator and insert it into ice cold water so the water covers the end of the tube and upward approximately 3 inches. Alternately you can use common common electrical component aerosol used to freeze circuit components. When the end of the aluminum capillary tube chills enough (24-28 F) it should "break" the contacts so the compressor clutch disengages. If your chilling method cannot get down that low, try repeating the procedure with the thermostat set at progressively lower temps (turning the knob in the CCW position). If your chill test does not cause the compressor clutch to disengage then most likely the thermostatic switch needs to be replaced. However if the chill test works and you have an icing problem the icing is related to the position or contact of the end of aluminum capillary in the evaporator's coils. If possible, visually inspect the path in the evaporator core where brass sleeve (if it is there) inserted. Try making a new path or "seat" in the coil's fins by VERY carefully inserting a phillips head screw driver down through the hole in the top of the evaporator box at a slight angle, carefully twisting the tool and gently pressing downward; you do not want to puncture the coils tubing. The depth of placement should not put the capillary tube below the bottom of the coil. In general terms 3" to 3.5" straight vertical from the top of the evaporator box, is a good depth (allow for the length in a diagonal placement). If new placement does not improve on the thermostats function of turning on and off the compressor a more thorough test of contact and placement may be achieved by using an digital thermometer probe inserted adjacent to and of the same depth as the capillary tube. There are accurate and rather inexpensive digital thermometer probes available with rather long wire leads that will allow you to view the actual evaporator core temperature while you are test driving the vehicle; here is just one manufacturer’s example: We used this digital probe device in a similar trouble shooting secession on a four condenser 911 running R134a where vent temperatures where rising drastically; the evaporator core was actually getting down to -9 F ! That is real ice.

Air Conditioning Q & A’s

What causes compressor failure?

There are various forms of failure, and 9 times out of 10 the failure is related a system related problem, a system component, poor system maintenance or improper procedures. An air conditioning compressor is designed to move “gas” and not liquids or solids.

Failure usually is seen as one of two symptoms:

1. Lockup or binding (both referred to as mechanical “freezing”) is caused by lack of oil flow. Compressors need constant oil flow and it is the refrigerant that moves the oil through the compressor.
2. Leaks caused by high system pressures or damaged shaft surfaces.

Lock up, binding or freezing is caused by lack of oil flow. Lack of oil flow is related to:

- Losses over the years through refrigerant leaks since refrigerant pushes the oil out of the system.
- Failure to replenish the oil supply when re-charging a system.
- A low refrigerant charge. It is the refrigerant that moves the oil through the system.

- Evaporator system or expansion valve malfunctions, such as a “starved” evaporator (not receiving adequate refrigerant) results in poor oil flow, or a “flooded” evaporator (too much refrigerant) which results in liquid “slugging” of the compressor, either will have a severe effect on compressor life expectancy.
- High system pressures create heat levels beyond what the compressor was designed to handle.
- An “oil trap” in the system prevents adequate oil flow.
- System contamination as result of either: moisture, metal particles from a previous compressor’s disintegration or hose break down.

Compressor leaks are caused by:

- High system pressures.
- Pitted or rusted shaft surfaces as a result of moisture in the system.
- Not often, but it happens: improper refrigerant type.

What causes compressor clutch failure?

In most instances we hear symptom expressed as either a “burnt” clutch or frozen clutch.

A clutch assembly consists of:

1. a front hub or disk which is attached to the compressor shaft
2. a drive pulley
3. a bearing mounted in the pulley and slipped on to the compressor nose, and (d) a coil that creates a magnetic field to pull the front hub into the drive pulley.

Front hubs can be either rubber vulcanized or spring mounted assemblies. Failure of the rubber mount can be related to either compressor lockup, excessive heat, ozone or simple aging. Spring mounted designs do fail as often. There is an “air gap” required between the front hub and pulley surfaces. A gap is required to prevent the clutch surfaces from contacting when the compressor is not turned on. Too little of a gap will cause unwanted contact and friction resulting in a burnt or polished surface which leads to poor contact when the clutch attempts to engage. Too large of a gap will result in inadequate surface contact or a slipping clutch. The gap varies with manufacturer, though it is typically .020" to .030".

Drive pulleys can be either “V” belt or “serpentine” (multi-rib) designs and seldom fail. Pulleys should be inspected kept free of grease, contaminants or mechanical damage (burr’s, dings, scores, cracks).

Clutch bearings usually last a very long time. Bearing failure is usually caused by high temperatures which break down the grease.

Clutch coils consist of a insulated (thinly coated) wire wound in a circular fashion which is designed to create an electromagnetic when current is allowed to flow through the winding. The winding is set in a metal can and encapsulated with an epoxy. One end of the winding is grounded to the compressor body and the other is connected to the a/c electrical system. When current is passed through the winding the clutch's front hub is pulled into the pulley and allows the compressor shaft to turn. Coil failure is, in most cases, caused by excessive heat melting the coil winding insulation which results in a ground or short within the assembly. Seldom if ever is coil failure (internal shorting) related to the a/c systems electrical circuits. Evidence of coil failure can be check with an ohm meter. Though resistance varies with manufacturer it is typically between 2.8 and 3.2 ohms. Signs of burnt or cracked epoxy are clear evidence of coil failure. Whether the clutch coil is new or old, coil failure is usually caused by a system problem rather than the component itself.

What causes a "new compressor" to fail?

99% of the time new compressor failure is caused by the system, the installation or poor maintenance.

Compressors today are manufactured with tighter controls on component tolerances and with greater accuracy than years ago. If you hear that a "new" compressor failed it is more than likely caused by "the system, the installation or poor maintenance and not the result of the compressor manufacturer's material or workmanship. Regardless of how much you want to blame the compressor manufacturer, the manufacturer's today know their product and are reluctant to review warranty requests because of extensive reviews documenting failure analysis.

Cores

The word "core" refers to your old compressor.

When you buy a component on a remanufactured "core exchange" basis it means you are purchasing the remanufacturer's compressor and the remanufacturing work they accomplished. When you return your old compressor to them they inspect the core to determine if it's "economically rebuildable", at least the reputable remanufacturers do this. So if you received a compressor with clutch on a core exchange basis you must return a rebuildable compressor with clutch back to them (usually compressors that have leaks are considered potentially rebuidable subject to inspection). If your core is sent back missing parts, disassembled or it has a cracked case, broken mounting ears or is locked up, you may not receive back your core payment (most reputable remanufacturers won't take back a bad core). You should discuss their core return policy before you buy. What should you do with your old locked up or partially frozen compressor? Dispose of it. If a rebuilder is willing to take it from you on a core exchange I wonder who will end up with it; the majority of piston compressors lack sleeves in the bore and lack rings on pistons so once the wear they are not economically "rebored" nor can they then be matched with new pistons, cannot be economically repaired when excessively damaged.

Refrigerants

Is R134a refrigerant less efficient than R12?

The answer is NO.

R134a is actually more efficient that R12.

Pound for pound R134 a greater propensity (capacity) to remove BTU's from the car.

What is most important to remember when using R134a is:

1. the amount needed
2. the capability of the condenser and evaporator

You can get a retrofitted system with R134a to come pretty close to matching the performance of R12 provided there is sufficient condenser function and the system correctly evacuated and charged. Matching the charge weight to the system is critical and more easily accomplished. In some cases additional condenser area or greater air flow across the condenser is required, such as with the Porsche 911 or 930. The Porsche 924, 928, 944 and 968 have no problem achieving cold results with R134a. If the system had a poor design to start with you can not blame R134a. Years ago we assumed that the expansion valve needed to be adjusted to either increase or decrease the flow rate into the evaporator for R134a however we have found that in many cases a stock R12 valve will perform close enough to that of an R134a valve.

With respect to comparison of pressures between the two refrigerants, they are nearly identical under normal temperatures (R134a will run 10 to 15 psi or higher as get into the 90 F+ outside temps.) R134a should only be installed using a weighted charge scale, monitored with gauges during the process and never rely on the site glass to determine the system charge.

WE DO NOT RECOMMEND ATTEMPTING TO CHARGE THE CAR YOURSELF WITH SMALL CAN'S OF REFRIGERANT.

Checking the evaporator discharge (superheat – "starved or flooding") should be addressed to insure system performance and compressor life.

What about these "drop in" refrigerants we hear about?

The first issue here is *refrigerant identification*.

If technician "A" puts in a not so commonly used refrigerant, such as "Super Stuff", and another technician "B" works on the vehicle, "B" most likely will not be aware of what "A" put in the system. Mixing refrigerants will cause system problems.

The second issue is *dedicated equipment for each type of refrigerant.*

You cannot recover and recharge refrigerants with equipment unless it has been certified for that particular type of refrigerant. A typical starting price for a good refrigerant recovery and charging station starts at $2,500.00 Your average repair shop is not going to invest in additional equipment if the majority of the market is directed toward R134a. So you might as well focus R134a components and systems.

AC Oil

What kind and how much?

Compressors today are typically designed with aluminum pistons and cylinders. Rotary vane or scroll types may have steel components. The most common design you will encounter is a piston compressor. A few piston compressors may have steel cylinders with a teflon type sealing ring on the piston, though more commonly you will have aluminum pistons riding in aluminum cylinders, so good lubrication is important.

R12 refrigerants require the use of a "mineral" type compressor oil.

R134a refrigerant requires either PAG or Ester type oils.

The PAG types come in various viscosities which are chosen by the compressor manufacturer. It is preferred with PAG types to remove or flush out as much of the residual R12 mineral oil prior to installing the PAG. Texaco and Castrol offer an Ester type that can mix with residual mineral oil, and this Ester type can be used with either R12 or R134a refrigerants.

Vehicle designers typically will note the total ac system oil requirement on a vehicle or compressor sticker or in a manual, and measured in fluid ounces or cc's. Too little oil will cause a compressor to lock up while too much oil will coat the evaporator and condenser walls reducing heat transfer. If you had to guess how much oil to use it would be wiser to have too much.

The exact amount of oil to replenish will vary from vehicle to vehicle.

- With your typical replacement of a piston compressor the *minimum oil replenishment averages 4 to 6 ounces*.
- If you are replacing a drier, evaporator or condenser you should figure an *additional ounce for each item replaced*.

In most cases a compressor supplier or the OEM vehicle mfg. will advise you how much of what type of oil is or is not in the replacement compressor. It is smarter to assume there is no oil in the compressor, and therefore you would attempt to empty the compressor and measure the oil (if any) that comes out of it before you install it in the car.

AC Hose Lines

What are Barrier hoses?

Imagine a hose within a hose.

Barrier hose has an additional liner that greatly reduces refrigerant loss through the hose walls.

And if you are wondering about those little pin holes you see evenly spaced on the outside of the hose, they are there for a reason: in the event that the inner lining fails the refrigerant will be safely released through the outer wall as opposed to building up pressure and exploding the case. Barrier was introduced as OEM equipment in the early to mid 90’s with the mandate to use R134a refrigerant.

All Griffiths hose assemblies use certified barrier hose.

Receiver Driers

What does a drier do and why must it be replaced?

Drier’s are typically used with a/c systems that have expansion valve systems. Systems that use orifice tubes, rather than expansion valves, typically have accumulators.

- The drier is located in the refrigerant line circuit after the condenser and before the evaporator.
- The drier contains a desiccant which removes moisture from the system.

Driers for use with R134a should have XH-7 or XH-9 type desiccant, both types are compatible with R12 a well. Some studies suggest the use of R134a with a drier containing the older R12 desiccant can result in the break down of the desiccant which would lead to system contamination.

The driers performs three functions:

1. Driers remove moisture from the system. Moisture (water) when mixed with R12 refrigerant creates a corrosive acid that will etch holes through the compressor’s reed valves, the condenser and evaporator tubing. Moisture lowers a/c system performance, and moisture will freeze up the expansion valve (internally) causing refrigerant flow and system pressure problems.
2. Driers help filter contaminants from the system that damage the expansion valve and compressor.
3. Driers act a reservoir, holding the liquid refrigerant which in reserve for the system.

Driers should be replaced when:

1. a system has been opened, recovered or is in need of charging and the condition of the drier cannot be determined,
2. when ever a system shows signs of contamination, moisture, etching or when a compressor locks up,
3. when changing refrigerant types or oil types. Regardless of the time to replace or part cost, investment in a new drier is a smart idea. Many compressor suppliers will not warranty a compressor unless a new drier has been installed.

Expansion Valves

What is an expansion valve or “TXV”:

The valve is a thermostatic device that controls the flow of liquid refrigerant entering the evaporator.

Proper control or metering of the refrigerant volume entering the evaporator insures the evaporator does not run to lean (starving) or too rich (flooding). Besides poor system performance, starving or flooding will result in compressor failure. There are several expansion valve designs. The basic valve consists of a liquid side inlet, a thermostatic valve spring, diaphragm, a circuit to sense the difference in the valve inlet vs. evaporator outlet temperatures. One common design, called a peanut valve or “L” shape (found on the 911 and 944), has an external thermal sensing bulb or pigtail attached to a capillary tube running from the top of the valve. The thermal sensing bulb or end is attached to the topside of the outlet port or tube of the evaporator and is covered with insulating material. This tube/ bulb is filled with a temperature sensitive gas and should be handled with care to insure the tubing does not break and release the gas thereby making the valve inoperable. The 911 valve may have another capillary tube for equalizing or smoothing out refrigerant flow demands. Some valve designs, called the "H" (as found on the 928 and later C2/C4), lack an external sensing bulb as the function is incorporated inside the valve. Regardless of design the function is the same for all valves. Valves are factory set in terms of their "superheat" which is the difference between the evaporator's inlet and outlet temperatures. The superheat setting ensures complete vaporization of refrigerant so liquid refrigerant will not damage the compressor.

Superheat

The proper superheat setting provided by the expansion valve (we are not addressing orifice tube systems here) insures that there is no liquid refrigerant leaving the evaporator which could end up in the compressor.

Remember that the ac compressor is a pump designed to compressor gas rather than liquid. Should the ac compressor receive liquid rather than gas it will destroy itself quicker than you can turn off the switch. So what is needed is enough extra heat or residual heat to vaporize all the liquid refrigerant before it leaves the evaporator.

A rather simple or basic procedure for determining the current superheat of a charged system requires an ac gauge set, thermal probe and an R134a "PT" (pressures and temperatures chart). You measure the average low pressure on the low side of the system. You then measure the average temperature of the low pressure gas at the evaporator's outlet next to the external thermal sensing bulb. Using an R134a PT chart you locate the corresponding saturation temperature associated with the low pressure reading you observed. Subtract the saturation temperature from the low side temperature you noted and you arrive at the superheat of the low pressure for the evaporator.

Many expansion valve designs can be 'adjusted' for more or less superheat however the amount of adjustment is limited (you can't get many degrees in either direction). In case you wondered this adjustment is accomplished by turning the allen hex inside the valve's outlet port (in older style L shaped valves) outward for greater flow or inward for less flow. One complete turn typically corresponds to 3 degrees F of superheat however this does not mean you can turn it 4 times to get 12 degrees, the adjustment is limited. We have found over the years with most Porsches that adjustment of the superheat setting is not necessary as there is little to gain and any gain reported by a DIY tends to be more attributed to unknowingly accomplishing a better evacuation and charge the second time around.

WARNING: do not attempt to make this adjustment unless you are experienced with the procedure and willing to accept the consequences.

Vacuum

There are 2 reasons to pull a vacuum on the system:

1. The first reason is to test for a “gross” leak. A gross leak is a ‘major’ leak that can be easily found. Pulling a vacuum on a system will not guarantee you will not have any leaks. When you pull a vacuum on a system you are inverting or changing which side the “pressure” is on. In a charged or running system the greater pressure is in the system (inside the components; hence the refrigerant gas is trying to move outward). When you pull a vacuum on a system the greater pressure is the outside world or atmosphere (outside the components; hence the outside world gases are trying to move inward). So you have 2 different scenarios or 2 different pressures. A properly charged AC system, when not running, can have a static inside pressure ranging from, say for example, 75 psi to 100 psi (depending upon the ambient air temperature). And, while it is running anywhere from 350 psi down to 35 psi depending upon where the pressure is measured (compressor outlet vs. compressor inlet). At standard atmospheric pressure all the values are equal, for example 29.92 HgA = 14.7 PSIA. So your vacuum gauge reading (in inches of mercury) of -25 in/Hg is equal to only -12.27885 PSI in simple terms; hence a vacuum does not create as much pressure as the system will normally see when it is operating. In summary….. pulling a vacuum on a system to test for potential leaks will not validate the potential for leaks because the “pressure” is no where near that of an operating system; your 12.27 psi static (or vacuum) vs. the real world operating pressure up to 350 psi.
2. The second reason for pulling a vacuum on a system is to remove the atmospheric gases (as well as outgasing of component and residual refrigerant and oils) in the system so the refrigerant you will later inject can operate in the purest state as it was designed to do.

R134a vs. R12

What is R134a?

R134a is the most widely accepted alternative automotive refrigerant used to replace R12.

There are other refrigerants: some of which may work, some of which don't work, some of which will destroy your a/c system and some of which are dangerous. The problem with these so called "drop in replacements" is that to properly handle them you may need dedicated equipment to identify the gas and evacuate it for proper disposal. This can be very very expensive. We are addressing only R134a and not other suggested "drop in" replacements. So to keep things simple and to avoid controversy and politics we have R134a. At this time you can still find R12, but, because it is no longer produced, availability is limited to current inventories and the price per pound is greater than R134a.

Should I use R12 or R134a?

The choice is up to you.

R134a vs R12 refrigerant? Hopefully after you have read this entire page you will have enough information to determine which type of refrigerant is best for you. If your a/c system is empty/low on refrigerant, if your system has a leak or if you need to open the system, then now is the time to decide which refrigerant you want to use. Your decision could be made based on economics, environmental concerns, or both. If you have a perfectly operating system using R12 you do not have to drop what you are doing and convert to R134a. Just leave it alone for now.

Is R134a less efficient than R12?

R134a is NOT less efficient than R12 – Actually R134a is more efficient.

Pound for pound R134a is a more efficient refrigerant than R12, however it runs at higher pressures in some aspects and therefore requires more effective condensing. Whether R134a performs as well as R12 in any given a/c system depends upon system components and the amount of R134a used.

Given two identical vehicles, each with the same weighted amount of refrigerant, the vehicle with the R134a has the "capability" to remove more heat (measured in btu's) from the vehicle than the same type of vehicle using the same amount of R12.

The most common influences which effect the capability of R134a to perform well are the condenser, in some cases the the superheat setting of the expansion valve or the amount of R134a. Condensers designed to release greater amounts of heat help to expel the greater amount of heat which R134a removes from the car's interior. And by "matching" the correct amount of R134a to use in a given vehicle, correcting the superheat of the expansion valve (if necessary), you can in some manner nearly balance or match the amount of heat drawn out by the evaporator and released by the condenser.

These efforts to "balance" the system can not be realized if there are problems within the a/c system, such as: poor performing compressor, dirty condenser or poor air flow through the condenser, malfunctioning expansion valve, water or air in the system, improperly operating fresh air or heat input in the climate-air mixing system.

The common problem when converting from R12 to R134a is lack of knowledge or equipment.

The typical scenario here is when the car owner buys an inexpensive "retro-fit" kit from the local auto parts store. These cheap kits usually have a few cans of R134a (either 12 ounce or 16 ounce), maybe an extra can of refrigerant oil, a few generic R134a charge port adapters and maybe some o-rings. And, unfortunately a small high side pressure gauge on a short hose.

What is missing from the package?

A vacuum pump, a refrigerant recover system, quality service gauge set with both low and high side gagues, and much more besides the lessons to learn what to do and what not to do. This is not to say that one of these small retro-fit kits can't be used, however to be used wisely.

Steps to convert to R134a

It's not that difficult but the procedures of evacuation, charging and testing should be done by a licensed a/c technician that is experienced with R134a and your particular car.

Here are the basics for converting a system that does not have a charge of R12, it's empty

1. Unplug the a/c's clutch wire
2. Loosen the a/c belt
3. Disconnect the two hose lines to the compressor, protect the ends from getting dirty.
4. Remove the compressor.

5. Remove the old mineral oil from the compressor by turning it upside down, side to side, and turn the front hub on the clutch assembly. We suggest dumping the old refrigerant oil in a clean container and inspect the oil for ‘sludge or waxing’ (old oil that has gelled) and contamination (metal particles). If you find any of these conditions you will want to ‘liquid flush’ (with dedicated AC flush solution) all the lines, condensers, evaporator (remove the expansion valve) before you proceed further.
6. Recharge the compressor with a/c ester oil and a “tracer dye”. Typically 5 to 6 ounces of a/c oil is adequate but this may vary depending upon the car.
7. Put the compressor back on the car.
8. Reattach the hose lines using new R134a compatible o-rings, lightly lubricate with compressor oil.
9. Reattach and tighten the a/c belt.
10. Plug in the a/c clutch wire.
11. Attach the R134a charge port adaptors, there are two types.. one of which you need to remove the old R12 valve cores.
12. Replace the drier with a drier that has a desiccant that is R134a compatible, use new R134a o-rings.
13. If your car does not have a high pressure cut-out switch in the AC system then you’ll need to have one installed.

At this point it is time to make an appointment with the a/c shop.

The shop will:

1. Do a pre-inspection and then Evacuate (vacuum down) the system, the longer the evacuation the better but there is a point of diminishing return, 2-3 hours is generally very good.
2. The system will be checked for “gross” leaks while under vacuum.
3. Generally the system will be “initially” charged with approximately 80% to 85% of the original amount of R12, using R134a. For example, if your system originally had 36 ounces of R12 then you multiply that by .80 and you have 29 ounce of R134a. The exact amount will vary with each car.
4. After the “initial” charge the system is then “tweeked” : you determine the optimum amount of refrigerant to match your system by monitoring the a/c outlet vent temperature and the high side pressure as you add or remove refrigerant. When the ambient air temps get above 80F the gauge readings can run a bit higher on the high side and lower on the low side when using R134a. You do not want to exceed the system’s high side recommendations. The safe

high side pressures are determined with a “PT” (pressures and temperatures) chart. This chart has a column of “ambient” (outside) air temperatures on one side and a corresponding range of high side pressures on the other side. The higher the ambient temperature the higher the high side pressure. By noting the ambient temperature you can look up what the preferred high side pressure should be.

5. Since you will be using less R134a than R12 you do not want to rely on the drier’s site glass to determine if the system is full. With R12 you use to check to see if the site glass was “full”, if it had bubbles it meant you had a low charge. With R134a you do not rely on the site glass.
6. After the optimum refrigerant charge is determined the car should be test driven to check for performance of the system.
7. After the system has been tested out it should be checked for leaks. When you add fluorescent “tracer dye” to with the refrigerant oil it helps to track down leaks that push oil out of the system. By using a “black light” the dye will glow in areas where oil leaks are visible. The next piece of equipment to track down leaks is a “leak sniffer”. This is an electronic tool that sucks in air through a tube and across a sensor. When the sensor detects the refrigerant leak the sniffers lights glow and the sniffer makes a noise. What is usually “sniffed” are all the connections in the system: hoses and compressor, condenser, drier, expansion valve and evaporator fittings. Generally you follow the refrigerant flow moving from connection to connection, component to component, and you sniff the a/c vents to check for evaporator leaks as well.
8. To “bless” the system the technician should attach a R134a sticker somewhere in the engine compartment to note the car is using R134a. The sticker typically has a place to note the amount of refrigerant used, the type of oil and amount of oil, the technicians sign off or name and the date of the conversion. When ever possible you should ask the technician to note the same information on your repair bill and keep a copy in your glove box for future reference.

NOTES:

- Though you can purchase 12 or 16 ounce cans of R134a from local retailers it is very difficult to measure out the correct amount into your system. By using a qualified a/c shop with the proper equipment you odd’s are in your favor of having the job done correctly the first time. You may have heard of a friend that did the job himself with borrowed equipment and 12 or 16 ounce cans of refrigerant. Statisicaly your friend was lucky. If you you don't have the free time to "play" then you are better off to pay a technician.

- If you are replacing other system components, such as condensers, driers or hoses, you may need to add more a/c refrigerant oil to the system. Before we mentioned that you can add approximately 5-6 ounces of ester oil to the compressor. Generally this works well for the whole system. We say "generally" because the vehicle manufacturer may have a formula already worked out for the R134a conversion process. They might say for instance, add 3-4 oz of oil to the compressor, 1 oz of oil for when you replace a drier, 2 oz oil for the evaporator and so on. We chose to use 5-6 ounces of oil to be on the safe side: 3-4 ounces for the compressor, 1 oz of oil for the drier and another ounce of oil for "system losses". You do not have to split up the 5-6 oz of oil and add it to each component, just simply put it all in the compressor as it will move throughout the whole system once the system is operational.
- If your compressor requires replacement or its seals and o-rings need to be replaced due to leakage, it would be wise at this time to either obtain a compressor that has o-rings and seals that are compatible with R134a or have your unit re-manufactured with compatible components. You do not however "need" to replace all the o-rings or seals for a simple conversion, it is simply a logical thing to do when and if the time comes to work or replace certain components because of age issues.
- You do not need to replace every o-ring in the system, but if you happen to open a connection that has an o-ring you should replace the old o-ring with one that is compatible with R134a and lubricate the o-ring with ac oil.
- We mention using "ester" type refrigerant oil. Some compressor manufacturer's or OEM's suggest PAG type oil for R134a. But some types of PAG do not mix well with the old residual R12 mineral oil left in the system components whereas "ester" does mix very well.
- You do not need to replace the expansion valve in most cases. The original expansion valves work very well with R134a. But, if your old compressor has lock-up or if your current expansion valve is not functional it would wise to replace the expansion valve with a valve designed for R134a.
- The original rubber a/c hose lines in your car will leak out R12 through the hose's lining. R134a has a smaller molecule than R12 so R134a will leak out sooner than R12. So if you car has a large amount of rubber hose, such as a 40 feet with the 911, then you will be re-charging the system often and that is

expensive no matter which refrigerant you use. To prevent refrigerant loss you should consider replacing your old hose lines with “barrier” type hose.

So should I use R12 or R134a?

If your car’s system has a sufficient condenser design and air flow to expel the greater amount of heat extracted by R134a, then by all means you should convert over when the time comes.

But, if your car lacks enough condenser and you have many 100+ degree days then you may want to stick either increase air flow, add another condenser as we mentioned in The Mr. Ice Project or stick with R12. For those of you who are considering what the cost is for R12 you can think of it this way:

> “Don’t go out to dinner this weekend. Stay home and grill your own steaks and stir your own martini. The money you will save by will pay for the R12”.

Other refrigerants

Besides R134a there are some other refrigerants that are “approved” to replace R12 and there is a long list of refrigerants that are “not approved”. The approval is very legal one, governed by the U.S. EPA. Failure to abide by the EPA regulations can result in expensive fines for either you or your service technician.

Approved list

The problem with using an approved alternative refrigerants other than R134a is that when the system is serviced it requires certain types of fittings, labels and dedicated equipment. For instance you can evacuate FRIGC FR-12 into a refrigerant recovery bottle that has R134a in it or visa versa. This would become an expensive investment for a repair or service station to have unique dedicated equipment for every type of alternative refrigerant.

Non approved list

We consider the the various types alternative refrigerants that are illegal or not approved to be in two sectors: non-flammables and flammables. The non-flammables can have R22 type gas which is not compatible with most rubber hoses or they have gases that contribute to global warming. The flammables have hydrocarbons.