928 Air Conditioning Miscellaneous Ramblings

Just as different 928s have unique personalities, different 928s seem to have different AC systems. Some owners report their AC blows ice cubes while many more report struggles with AC performance. The heat load of the huge glass area of the car and a system designed for European conditions often combine to disappoint. It isn't a system as strong as GM would have built but Porsche had different priorities in designing the 928 and there is not a lot of room for a bigger AC system. Also, moisture, air and contaminants seriously impair AC performance and with most cars having had multiple owners, what is in the AC systems in our cars can be anybody's guess.

The number of AC threads on Rennlist is testament to how vexing and mysterious the AC system is as well as illustrating the challenges posed by maintaining 35-year-old cars. However, the 928 AC system is simply a device that uses a mechanical valve (the expansion valve) to control refrigerant temperatures and pressures such that the refrigerant changes from a liquid to a gas by boiling inside the evaporator and sucking the heat out of the moving air being forced through the evaporator inside your dashboard.

Here is an excellent guide to the 928 HVAC system in Michael Benno's treasure trove of 928 stuff on a google drive:
https://drive.google.com/file/d/1GYbUN_5f6IG9tsmNHfhW0NoFueldAbiC/view?usp=sharing

A totally awesome explanation of how AC actually works:
https://drive.google.com/file/d/1tUsyaDju-G-Z9gwdjqThHBGqerkBOBps/view?usp=sharing

Porsche AC service docs from Michael Benno's collection:

https://drive.google.com/file/d/1UVUAnCeIOPpNHDSOWzw5w-rgPYH89jDO/view?usp=sharing

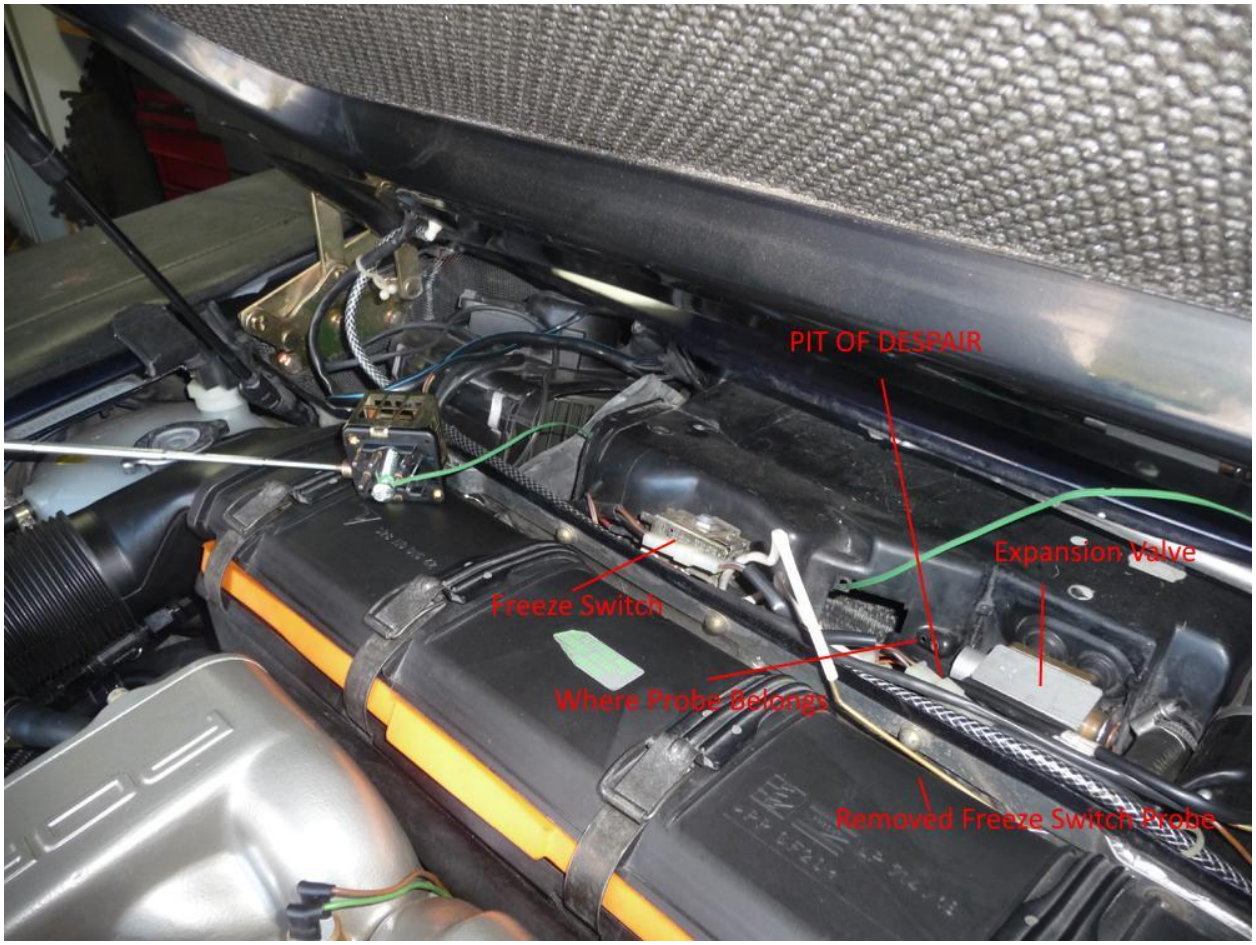
https://drive.google.com/file/d/1NOrloDOgWALsJoN63Vh0a7oTxGBhSLYP/view?usp=sharing

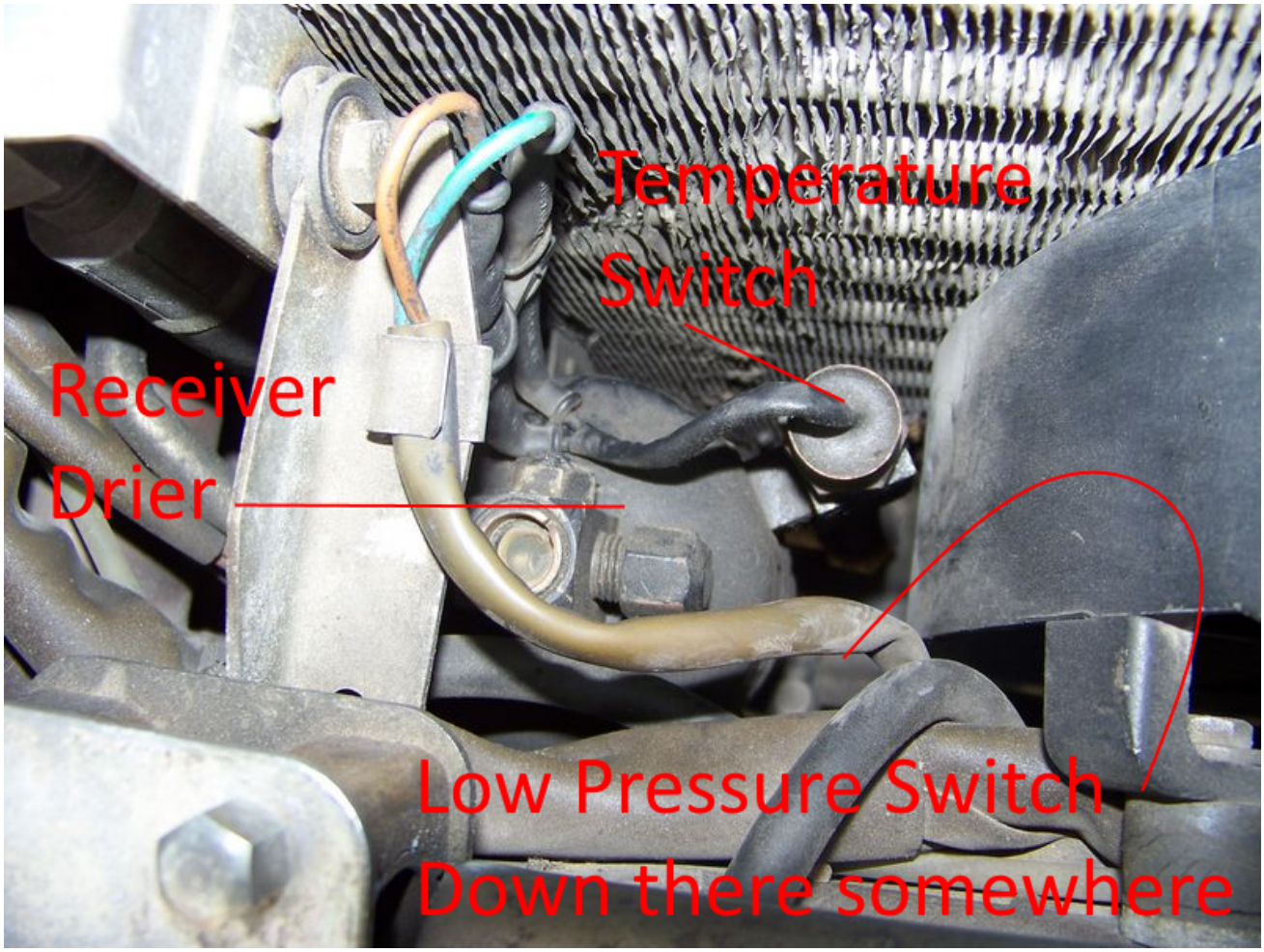
https://drive.google.com/file/d/1j2voWuya2ErxjaX_kUUHO2acCyarMqqv/view?usp=sharing

BTW: Releasing Refrigerant into the atmosphere violates Federal regulations.

https://www.epa.gov/mvac/epa-regulatory-requirements-mvac-system-servicing

Where some of the important parts are:





Tools you will need (depending on how far down the rabbit hole you want to go)

Voltmeter-Continuity Tester

R134a or R12 gauge set (or both)

Vacuum gauge

Mityvac or similar hand vacuum pump

Mechanical dial thermometer for vent temps

Infrared thermometer for reading temps on high- and low-pressure lines

Full collection of Metric wrenches including 27 and 32 mm

Vacuum pump

MAPP gas torch

Hydraulic hose crimper or EZ-Clip pliers.

Troubleshooting Basics

ZERO cold air:

1. Is your compressor working? Check to see if the center portion of the pulley assembly is turning. If not, check for 12v at the wire to the compressor. If there is 12V your compressor clutch is fried, or your compressor is locked (which should cause a lot more drama).

2. If 12v is not present, check:
   a. Relay

   b. AC system pressure – if refrigerant is low and pressure is less than 20-30 psi, low pressure switch will open to protect the compressor.

   c. Relay in HVAC control head.

   d. Low pressure switch on the side of the receiver dryer.

   e. Freeze switch under the cowl near the center.

   f. Under hood 14 pin connector continuity and wiring.

A HINT OF COOL BREEZE TO NOT ENOUGH COLD:

1. The Dreaded Heat Control Valve: In its infinite wisdom, Porsche decided to control hot water flow into the cabin heater core with a vacuum actuated valve whose default position is open and will only close when vacuum is applied. A leaky or disconnected hose or a failed valve will result in heat being on no matter how the climate control is set.

2. Low, contaminated, of too much refrigerant: If you have never serviced the AC do you know what is in there? R12, R134a, an R12 substitute, propane, or a mix of some or all? Is there moisture in the system? Is your receiver dryer old enough to have a graduate degree? Is there enough refrigerant? Too much oil in the system? Check:

   a. Static AC pressure system off engine off at 70 degrees should be around 70 psi.

   b. Check for oil level/contaminants with ENVIRO-SAFE Pittstop R134A Oil Checker - https://www.amazon.com/ENVIRO-SAFE-Pittstop-R134A-Checker-Pack/dp/B0821PJPJT

   c. Use a manifold and gauges to check high and low side pressures with engine at 1200 to 2000 RPM, AC on, fan at 2. Compare results to Porsche pressure temperature chart. Low refrigerant is one of the most common causes of poor cooling performance. On the other hand, DO NOT OVERCHARGE to try to gain additional performance because you will not get it and you can blow up your compressor.

3. Are all the required flaps and doors in the HVAC system working as they should? With the exception of one motor driven flap, all the doors and flaps are vacuum actuated and as one wise woman once said: “Never trust a diaphragm.” The diaphragms in these actuators have all exceeded their service lives. Check:

    a. Recirculation door flap by wedging your head way under the passenger side dash and looking up to see if the door is fully closed and keeping outside air out of the cabin.

    b. If the recirc door doesn’t close, does the flap actuator system hold vacuum when tested with a Mityvac or equivalent.

    c. Is the flap actuator system GETTING vacuum?

    d. Is your heater core setting motor working? Remove the left side knee bolster/shelf or the dreaded console side panel from the central console and with the ignition switch on, move the temperature lever all the way to the highest setting. Find the setting motor and observe the linkage coming out of the top of the control unit. Move the temperature control lever to the lowest temperature setting - the linkage should retract.

4. Are your cooling fans and/or AC pusher fans working as they should? For the pusher fan on up through 1986 you can test the fan by jumpering the two terminals coming out of the refrigerant temperature switch on the top of the receiver dryer. For 87 on, are your electric fans running at full speed when they are supposed to?

5. Is there crud or leaves between the radiator and the condenser? Is the condenser damaged? Is your evaporator airflow blocked with leaves, dead mice etc.? (Accessible by removing the blower motor and pulling a rubber boot.)

    Cruddy Evap:

6. Is your blower motor working as it should? (Roger's replacement motor is the BOMB!)

7. Is your system blowing cold for a while and then blowing warm for 15-20 minutes and then blowing cold again? Does it go from cold to warm and then blow cold like a champ after you stop for 15-20 minutes? If this is your symptom, your freeze switch may be out of calibration or, depending on local humidity, may be doing exactly what it should. The freeze switch is near the center of the cowl and has a probe extending from it that passes through the firewall near the expansion valve. The probe end is stuck into the evaporator coils. Its function is to prevent ice from building up on the evaporator to where it blocks airflow or, worse yet, breaks the evaporator open. Ideally, the freeze switch opens when temperature at the probe tip is near freezing. A bad freeze switch will turn off your compressor above the point where ice will form. Early ones are adjustable but later ones are not. Test the switch by pulling the probe and sticking it into crushed ice and water and then seeing if it opens at higher temperatures.
   Ice will form on your evaporator under high temperature/high humidity conditions but can also be the result of a failed expansion valve as described below.

8. Cold and hot air cycling as above, including evaporator freezing, can be caused by a failed expansion valve, and undercharged system or contaminated refrigerant. The 928 expansion

valve is a block type valve and the flying saucer at the top is a temperature sensor exposed to the low pressure or suction side of the evaporator. When the temperature sensor detects warmer gas from the suction side it opens the valve controlling flow through the smaller high-pressure port. Conversely, if the gas exiting the evaporator is too cold, the valve restricts or stops the high-pressure flow. A bad expansion valve will cause out of range disparities between the high and low side pressures or can cause high pressure to go high enough to shut off the system or kill your compressor. A bad valve can also fail to modulate properly so your evaporator keeps freezing up when it shouldn't.

9. Out of range high and low pressures can also be caused by a clogged condenser or crud in your system. Too much oil in the system will impede heat transfer at both the evaporator and condenser.

10. An infrared thermometer is very useful for reading temperatures off of the hard lines going into and out of the evaporator, expansion valve and condenser. This data, combined with pressure information can be helpful when you post to Rennlist.

Topping off, Converting, Rebuilding, Replacing and Refilling (High and Low Pressure/Temperature Charts are provided at the end of this document).

1. **Topping off** - Refrigerant will find its way out of your system over time even if your system is tight. As owners of cars with the rear air option know, every additional connection in the system presents a leak path. If your system is underperforming and the compressor is turning on, your heat control valve is not sending hot water to the heater core and your recirc flap is closing, then it is time to see if adding replacement refrigerant will help. Do the following:

    a. With the AC on full blast, look in the sight glass at the top of the receiver dryer for gas bubbles. The presence of these bubbles is a sure sign that your refrigerant is low. R12 is better at bubble making than R134, which explains why sight glasses went away in newer cars.

    b. If you don't have a gauge set and don't want to buy one, you have the option of purchasing a can of R134 at your FLAPS with an integrated gauge and fill hose that snaps on a R134 low side fill port. This is a quick and dirty one-shot option and will enable putting some refrigerant in based only on the low side pressure. At best, you are getting only half the story and will have no idea what your high side pressure is. At worst, you can be overcharging because you are not seeing the high side pressure. A gauge set good enough for occasional use can be had for a modest sum and is a useful diagnostic tool. If you do go with one of these integrated can and gauge products, do not buy one with a "sealant" in with the refrigerant. A UV dye additive is ok, oil with the refrigerant is probably ok but likely not needed. Sealants are a bad idea as the material gunks up your system and coats your evaporator and condenser with crud you may not be able to remove with flushing. Frankly, filling up with these is dumb and I have seen use of these lead to high side pressures high enough to damage the compressor and high pressure hoses.

c. If you have a gauge set, hook it up after making sure both valves on the set are closed and all connections are tight (ask me how I know). The blue line goes to the low-pressure port hidden under the radiator hose at the front passenger side. The red line goes to the high-pressure port sticking up out of the receiver dryer. If you haven't had the AC on immediately before hooking up the gauges, the high side and low side pressures should be equal. With a fully charged system, you should see about 70 psi at 70 degrees ambient temperature. If you are down below 50 psi, you should add refrigerant, if you are below 30 psi, you are at or near the pressure at which the low-pressure switch will cut off power to your compressor clutch – a point at which you may wish to consider how and why you have so little refrigerant.

d. Get your engine up to "thermostat open" operating temperature, make sure all valves on your gauge set are closed. Turn the AC full on and attach your can tap or screw on valve on the refrigerant can to the yellow line on your gauge set. Open the valve at the connector to your low pressure port if using an R134 gauge set. Next crack open the valve near the BLUE line on your gauge set. If you have a schrader valve above the yellow line, push it open until refrigerant spurts out. If there is no schrader valve, loosen the connector where the yellow line joins the manifold until refrigerant spurts out. The preceding steps purge air from the low pressure line and manifold. Next, crack the valve on the can and then loosen the connector for the yellow line where it connects to your gauge set. Let a little refrigerant spritz out and then retighten. This purges any air out of the yellow line. Have a helper or use some other means to get the engine above 1200-1500 rpm and after making sure the can is right side up – so the refrigerant enters the low side as a gas and not a liquid – and open the valve above the blue hose on your gauge set because **YOU CHARGE ONLY THROUGH THE LOW SIDE.** Do not open the high side valve on your gauge set but monitor the high side and low side pressures. Refrigerant should flow into the low side. Shaking the can will encourage more flow as will heating the can in hot water or using a heat gun. DO NOT INVERT THE CAN as your compressor is built to compress gas and not liquids. Stop charging when the high and low side pressures are within spec for the temperature and humidity. If you don't get there, wait until can stops getting cold and get ready for can #2. Be careful not to keep adding refrigerant if your high side pressure is near the maximum specified for the temperature and humidity.

2. Converting – R12 to R134a

a. Does sticking with R12 make sense? Opinions on whether R12 works that much better in a 928 vary widely and like the endless "Which oil?" threads there are many steadfast adherents and very little data. R134 is not as efficient at heat transfer as R12. It will find its way out of the system a little faster over time. Switching requires new GREEN HNBR O-rings, new R134 barrier rubber hose sections, flushing out the old mineral oil, installing a new receiver drier, vacuuming the system down, putting adapters on the ports, filling with PAG or Ester oil and getting a new gauge set. Most converts say 134 works just fine and the O-rings and hoses that had to be redone had reached the end of their service lives anyway.

Although you can still find R12 with a little work, R134 is readily available and at worst 1/3rd the price of R12. Additionally, good luck finding anybody who still has an R12 recovery machine. So, unless you have one yourself, be prepared to vent out 2.5 pounds of R12 if you need to crack the system open to fix something. If you are filling from cans, that's 90 bucks gone at current pricing, and you won't feel so good about what you are doing to the environment.

b. What if I don't like 134a after I convert? R12 uses mineral oil as a lubricant. R134a uses PAG oil. YOU MUST FLUSH ALL MINERAL OIL OUT when going from R12 to R134a and PAG oil is not compatible with R12. ESTER OIL is compatible with both R12 and R134a. If you use Ester Oil you can try R134 and go back to R12. The expansion valve works equally well with either refrigerant and need not be changed. NOTE: ESTER OIL LOVES ATMOSPHERIC MOISTURE LIKE BRAKE FLUID. DO NOT USE FROM A BOTTLE YOU OPENED A WEEK AGO.

c. DISASSEMBLY - Porsche 928 – designed to make servicing the car a living hell. You will need 17mm, 19 mm, 22mm, 27mm and 32mm wrenches for the fittings. Flare wrenches are not needed. Drain the radiator so the upper radiator hose can come off to give better access to the high- and low-pressure hose connections. On cars up to 87, the grill has to come out so you can take out the pusher fan so you can take out the condenser so you can change the receiver dryer. The expansion valve – located conveniently above the "pit of despair" in the cowl – uses finger-defying socket head screws clamping the lines to the valve. Be sure to stuff the void under the valve with rags before taking it apart. For maneuvering the lines into the valve, it is far easier to undo the driver's side fuel line into the fuel cooler and loosen or remove the bracket holding the fuel cooler to the firewall AFTER breaking the 32mm nuts loose. It is also better to crack the line nuts on top of the compressor before removing it.

   FLUSHING – We are working with cars that have had long lives and previous owners. Unless your car is one where you know the AC hasn't been touched since it left the factory, you don't know who put what in the system before you got it. An evaporator coated with old oil, super-jiffy leak fix, or some other substance will not transfer heat well and lead to high low side pressures that will have you tearing your hair out. Painful experience leads me to conclude that evaporators and condensers need to flushed multiple times (newer design parallel flow condensers are considered to be so difficult to flush that it is now a common practice to just replace them). There is thread on Rennlist started by Worf that documents a saga involving a system that had way too much oil in it that required a special oil purge procedure to get the system working right:

   https://rennlist.com/forums/928-forum/462098-r134-a-c-diagnosis-high-low-side-pressure-opinions-5.html

   Compressors, receiver driers and expansion valves do not get flushed.

d. Older and "less green" AC solvents will eat O-rings and new "greener" solvents supposedly do not. Neither is cheap. Depending on whether you are flushing after a compressor failure

that has blown metal fragments into your system or you are just purging mineral oil you can collect your solvent in a clean container and re-use it. I will also admit to using mineral spirits to flush at different times, a practice that inspires abject horror in purists, without ill effects. Using mineral spirits and then following up with a quality AC flushing solvent is, in my mind, a legitimate cost saving strategy.

e. Tools, Flushing Tips and Tricks – A hardware store or home center with a robust selection of clear vinyl hose can supply short lengths in various internal diameters. Judicious use of a heat gun will soften the end of this hose enough so you can screw it onto threaded fittings or slide it over the "collar" O-rings slide against. Put rags around these junctions to be on the safe side. Coffee filters can be used to filter solvent for re-use if you feel the need. An AC solvent flushing gun using shop air is not expensive and can be had on Amazon for $30 to $40.

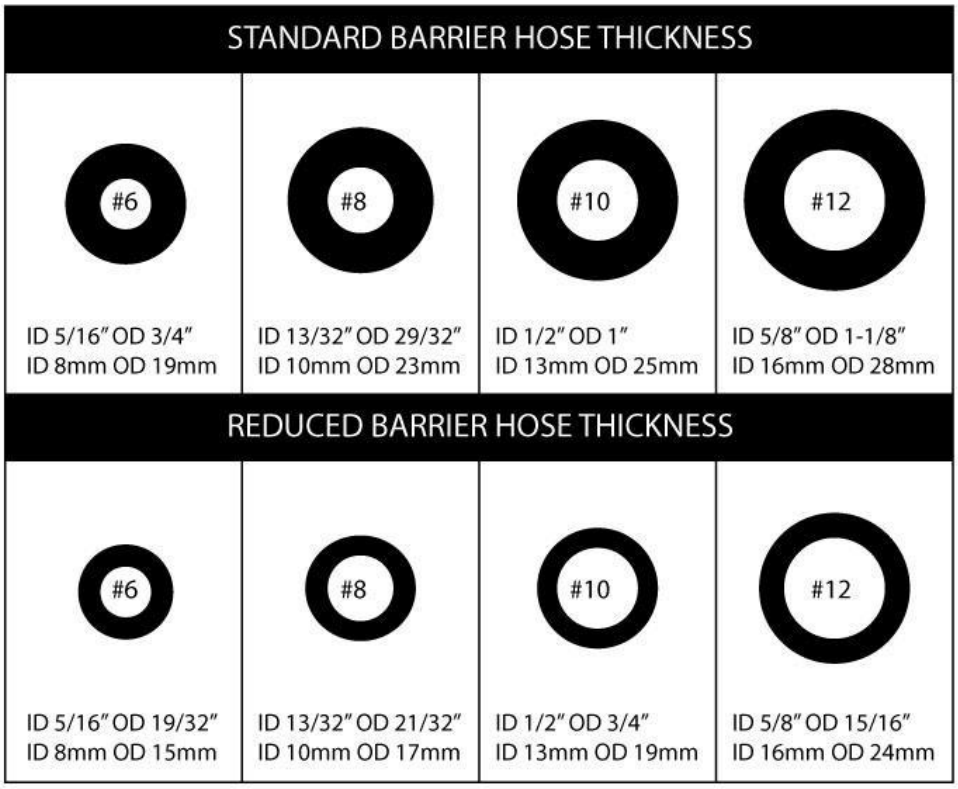
f. 928 expansion valves for R12 and R134 are identical. Most people put in new ones due to price an WYAIT, but you don't have to change.

Rebuilding Hoses and Compressors – Thirty-year-old AC hoses have every right to leak. Any hose that can be rotated while the crimp section stays stationary is definitely leaking. Compressors can simply wear out, grenade from under-lubrication or hydro lock from oil or liquid refrigerant, eat a bearing or leak. All can either be rebuilt or replaced, although replacing the high-pressure line from the receiver drier to the expansion valve requires incredible gymnastics or removing the engine.

a. Compressor - For the majority of 928's, the compressor is a Denso 6E171 and careful anecdotal regression analysis suggests that home shop people like us have about a 50% success rate in rebuilding these. The rebuild kits available are really resealing kits with O-rings and seals although bearings and clutch parts are also available separately from some vendors if needed. Most failed rebuilds involve a leaking shaft seal which has a component that must be handled with gloved hands as skin oil ruins the surface. Additionally, the seal depends in part on oil to seal and should be put clutch side down for a bit after oil is put in. If the main bearing has failed, there are sources for that part as well.

b. Hoses - There are three rubber hoses – one is for low-pressure that attaches between the fat hard line from the fuel cooler to the compressor. Another carries high pressure from the compressor to a hard line that attaches to the top of the condenser on the passenger side. The third hose is a high-pressure line that runs from the receiver drier to where it is crimped onto a bronze hard line that runs to the expansion valve. This is the "Hose of Dread" because Porsche made it impossible to remove and crimped a rubber line on the end. (Photo by Greg Brown)

c. Hose Nomenclature - AC hoses and fittings



Reduced barrier hose is just as good as standard but thinner. Fittings for standard will not work with reduced and vice versa.
The hose from the receiver drier to the bronze hard line is #6
From compressor to condenser is #8
From low pressure hard line to compressor is #12
The end fittings are not metric and follow the hose sizing convention shown above.

End fittings known as beadlock fittings that are crimped onto the hose with a hydraulic crimping tool.

d. Hose replacement/rebuild options – Buy new assemblies for the lines to and from the compressor. Wrestle the rubber/bronze line from the receiver dryer out of car and replace it if you can find one.

e. *Partial DIY option:* Ask your local gearhead buddies to refer you to a good AC hose rebuilder. Remove lines attached to the compressor and take them to your referred shop or a hydraulic hose shop to have them cut off the old hose and replace it with new hose. For the dreaded third line, cut off the hard line below the crimp, present it to the rebuilder and ask them to replace the cut off end with a female O-ring fitting. A (NOTE: As described below, Eaton/Aeroquip dealers/hose shops may use EZ-Clip fittings unless you specifically specify beadlock. If you care, crimped beadlock ends look more like the OE ends your car came with.) Once you get your hoses back, check for fit and lay out your hose from the receiver drier to the bronze hard line to determine where to install a #6 male compression O-ring compression fitting, a splice kit like this (https://www.autocoolingsolutions.com/ac-lines/ac-line-repair-kits/a-c-line-repair-kit-3-8-tr6) or find a shop to braze a #6 male in the right location. A #6 male braze or weld on fitting is available here: https://coldhose.com/collections/weld-on-nuts. I have never used compression fittings for AC lines but other rennlisters report doing so with success.

f. *Total DIY option 1.* Buy the required beadlock fittings or ferrules from a source like https://coldhose.com/ or Summit Racing, Jeg's, etc. and a chinesium alloy hydraulic hose crimper from Amazon - https://www.amazon.com/REDLOONG-hydraulic-Hydra-Krimp-71500-Conditioning/dp/B09W8HT3NJ/ref=sr_1_1_sspa?crid=DQLDF7QBVEM7&keywords=hydraulic+hose+crimping+tool&qid=1663877795&sprefix=hydraulic+hose%2Caps%2C228&sr=8-1-spons&psc=1 along with the required lengths of appropriately sized barrier hose and go to town. Mark up the old hose and tubing so you can make sure that your new fittings are correctly oriented or "clocked" before crimping. As with other things, there are many you tube videos on how to do this.

For the dreaded receiver drier to expansion valve line, remove the two retaining clips on the inner fender and the two retaining clips on the firewall and disconnect the line from the expansion valve. Finagle the front end of the line as far forward and upward as you can and cut below the factory crimp and get ready for the real fun.

Contact Greg Brown and purchase his kit for brazing a steel #6 male onto the hard line (see https://rennlist.com/forums/928-forum/873241-a-c-hose-repair.html) or, alternatively, buy a steel or aluminum #6 male from this source: https://coldhose.com/collections/weld-on-nuts. You will need a MAPP gas or acetylene torch and an appropriate brazing rod. Steel to bronze requires more heat but can still be done with a MAPP torch with this rod: https://www.muggyweld.com/product/ssf-6-silver-solder/ and aluminum to bronze requires less heat and this rod: https://www.amazon.com/Lucas-Milhaupt-Aluminum-Soldering-Copper/dp/B01MTSURG2/r

ef=pd_lpo_1?pd_rd_i=B01MTSURG2&psc=1 (Lucas Milhaupt Al822). You don't need to buy flux for either, but your parts have to be CLEAN before you braze. You know you have made a good joint when the rod melts and flows easily between the two parts. If you go the aluminum route apply a little more heat to the bronze tube and be mindful that aluminum has a low melting point. The rod will melt and flow well before the fitting is in danger as long as you are paying attention. Once the joint is cool, inspect for pits or voids that may leak. Leftover flux can be removed by wrapping a rag soaked in a vinegar and water solution around the part and letting it sit overnight.

Total DIY Option 2. This is essentially the same as Option 1 but employs hose and hose ends from Eaton/Aeroquip sold under the EZ-CLIP trade name. EZ-CLIP hoses look like this when assembled and the hose end parts are below:

- The fittings and the dedicated EZ-CLIP hose are more expensive but offer a significant advantage – you can remove and re-attach or replace the hose by undoing two locking clips with $20 specialty pliers from Amazon. Going the full EZ-Clip route on a 928 requires one each of #6, #8 and #12 EZ-CLIP Lifesaver Braze Kit as well as #6, #8 and #12 cages and clips. A good source for these parts is www.hosewarehouse.com. You will have to braze the EZ clip nipple onto the dreaded bronze hardline inside the engine

compartment as described above as well as the hard line sections of the two lines that run from the compressor to the low-pressure suction line and the condenser. The EZ-Clip nipples are available in steel or aluminum, and a MAPP gas torch is more than sufficient. Use a magnet to see what your hard lines are made of. Steel will attract a magnet and aluminum and bronze will not. The Lucas Milhaupt Al822 brazing rod mentioned above works just fine for aluminum to bronze and the Muggyweld will work with bronze to steel and steel to steel. You should still pay attention to orientation or "clocking" so you don't have to repeat that same task, but if you do screw it up, you can just release the clips, rotate the hose, and refasten the clips with your $20 pliers. If you have enough access, you can do this with the hoses in the car.

Putting it All Back Together – Expect this to go more slowly than taking it apart. Some parts, like the condenser, are easy to remove and not so easy to put back in. If you did not drain the old oil out of your compressor before, do it before you put it back in. If you are just replacing a compressor, measure the amount of oil that drained out and replace with the same quantity.

a. If you went whole hog and brazed a new end on the dreaded bronze high pressure line, getting it back into position and fastening the inner fender retaining clips will be hard and the rearmost one will require a palm ratchet and 10m socket.

b. Be sure to lubricate your new o rings with new clean oil before assembling connections.

c. REPLACE THE SCHRADER VALVE IN THE LOW-PRESSURE PORT.

d. PUTTING THE SPECIFIED AMOUNTS OF OIL IN THE COMPRESSOR, EVAPORATOR, CONDENSER and RECEIVER DRIER BEFORE CONNECTING LINES STAVES OFF REGRET.

e. When reconnecting the low-pressure line connections for the fuel cooler and expansion valve it pays to leave both fuel cooler and the expansion valve joints just loose enough to allow some movement to aid in aligning everything. Don't forget that the fuel line you disconnected also has to line up with the fuel cooler fitting it mates with.

f. Your replacement receiver drier will have caps sealing off the connections and plug in the hole for the low-pressure sensor switch and will either have vacuum or a dry inert gas inside. Plan your work to minimize the amount of time the desiccant inside the receiver drier is exposed to ambient moist air. If I have removed the condenser, I think it is easier to mount the new receiver drier, make the connection to the lower port on the condenser, install the low-pressure switch and temperature switch before putting the condenser back in the car.

g. There are torque specs for the different size fittings, but I go with my internal torque sensor and aim for "snug" to "snug plus." Too much force can damage O-rings, distort fittings, and split your knuckles.

h. Once you get the system all back together, use a 12mm socket on an impact gun, cordless drill or other tool that will spin the compressor clockwise (looking at it from the front). This will pump some of the oil out of it to minimize the possibility of having a big slug of oil damaging it.
i. Now it is all assembled, it is time for the awful moment of truth – leak testing and pulling a vacuum. I have a two stage Harbor Freight pump like this one - https://www.harborfreight.com/automotive/auto-shop-tools/air-conditioning/vacuum-pumps/3-cfm-two-stage-vacuum-pump-61176.html and it has far outlasted my expectations.

j. You want to run your pump for at least 30 minutes to boil off any residual moisture in the system.

k. If you pump the system down and it holds vacuum overnight, you are probably good leak-wise, but a pressure test is also a good idea.

l. A pressure test is good insurance and professionals usually insist on doing one because sucking ain't the same as blowing and the entire point is to keep high pressure stuff in. Dry inert gas like nitrogen is preferred. I have used nitrogen, dry CO2, and argon I have for my mig welder. An adapter to use those tanks is needed - https://www.amazon.com/NIGO-Brass-Fitting-Half-Union-Flare/dp/B079M6H3S4/ref=sr_1_13?crid=1GXIRWK2YSY0V&dchild=1&keywords=1%2F4+sae+to+1%2F4+npt&qid=1591810185&sprefix=1%2F4+npt+sae+%2Caps%2C164&sr=8-13 – and make sure your pressure regulator is set to a safe pressure. I would only use shop air to pressure test if I had a serious air drier (like car painters use) to keep moisture away from the receiver drier.

m. If you have a leak, pressure testing is the way to find anything except a small one. A piece of garden hose held against your ear and a suspect area allows detection of a telltale hiss. A mix of water and dish soap in a spray bottle also works as bubbles will form at the leak source.

n. If your leak is more elusive you can partially charge the system with R134 (another good reason to use ester oil) and use a sniffer. A sniffer ain't cheap, but they are a lot cheaper than they used to be. The Mastercool 56100 Blue Raptor is a quality sniffer you can get for less than $150.

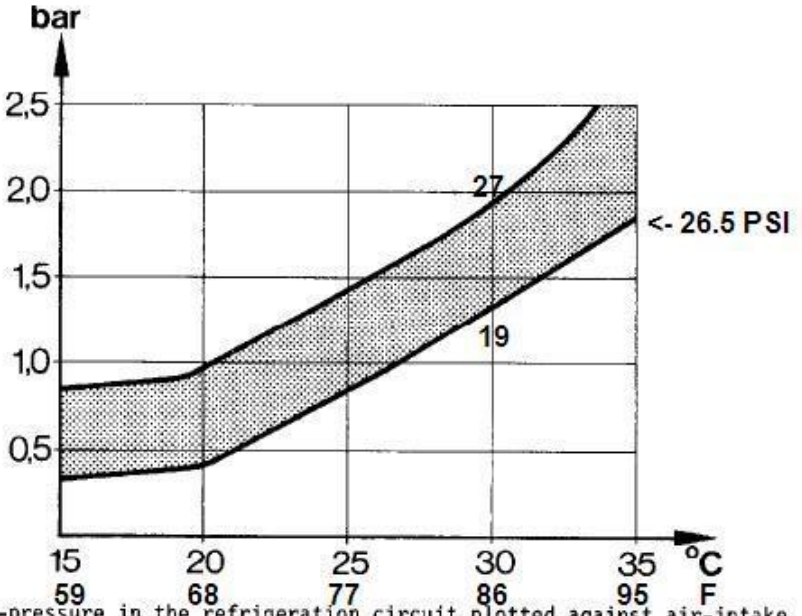
o. UV dye can also be helpful if added carefully to the system once it is all together. My experience with oil with dye in it is that enough gets spread around when reassembling the plumbing to make everything glow under UV light. If you are careful, it can work and is much cheaper than a sniffer.

CONCLUSION:

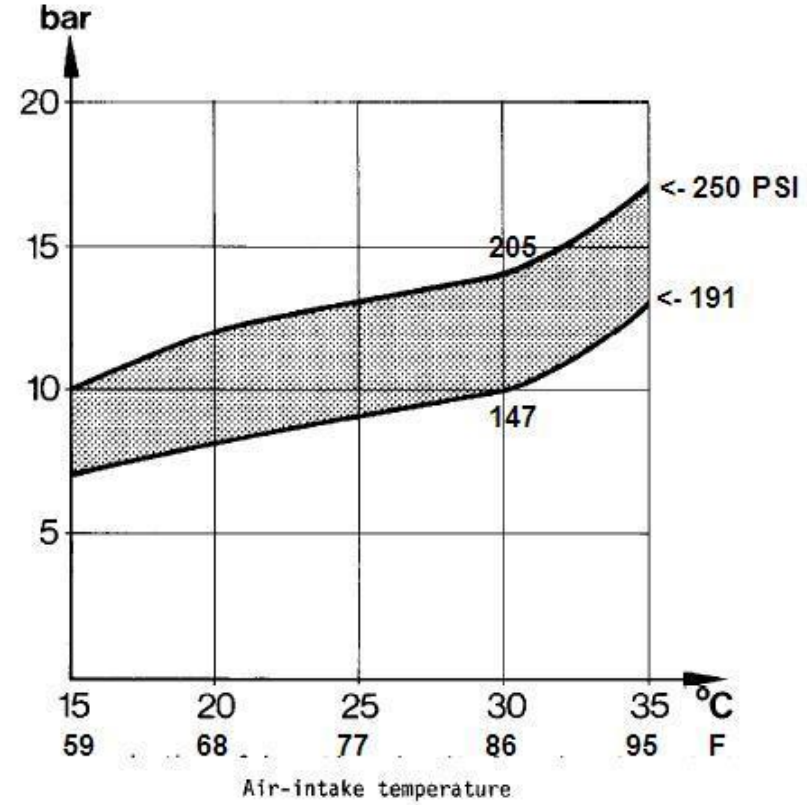
While the control system for the AC is very complex and there are 928 specific issues like the idiot heat control valve that defaults to open, the under-hood parts of the AC system are pretty simple. You have a pump, an expansion valve that controls pressure and flow into the evaporator, a little radiator the sucks heat out of the cabin by boiling refrigerant, a big radiator in the front of the car to dump heat and condense a gas to liquid, a collection can and moisture scrubber we call the receiver drier, switches that activate cooling fans and two switches that stop the system from self-destructing.

Many 928 AC problems are caused by crap that got in the system before you got the car. Sealants, moisture, air and too much oil may have been introduced when the system was last “topped off.” Other problems are caused by components reaching the end of their service lives. Expansion valves may start to stick etc. Nonetheless, a system that has been properly flushed, filled with the right amount of oil and a known refrigerant should work and, to the extent it doesn’t, will be much easier to diagnose and fix.

R12 Chart



Low-pressure in the refrigeration circuit plotted against air-intake temperature.



High-pressure in the refrigeration circuit plotted against air-intake temperature

R134 Chart

Pressure and temperature specifications

Refrigerant R 134 a

General Testing Requirements:

– V-belt tightened properly.

– Vacuum system o.k.

– Solenoid clutch energized.

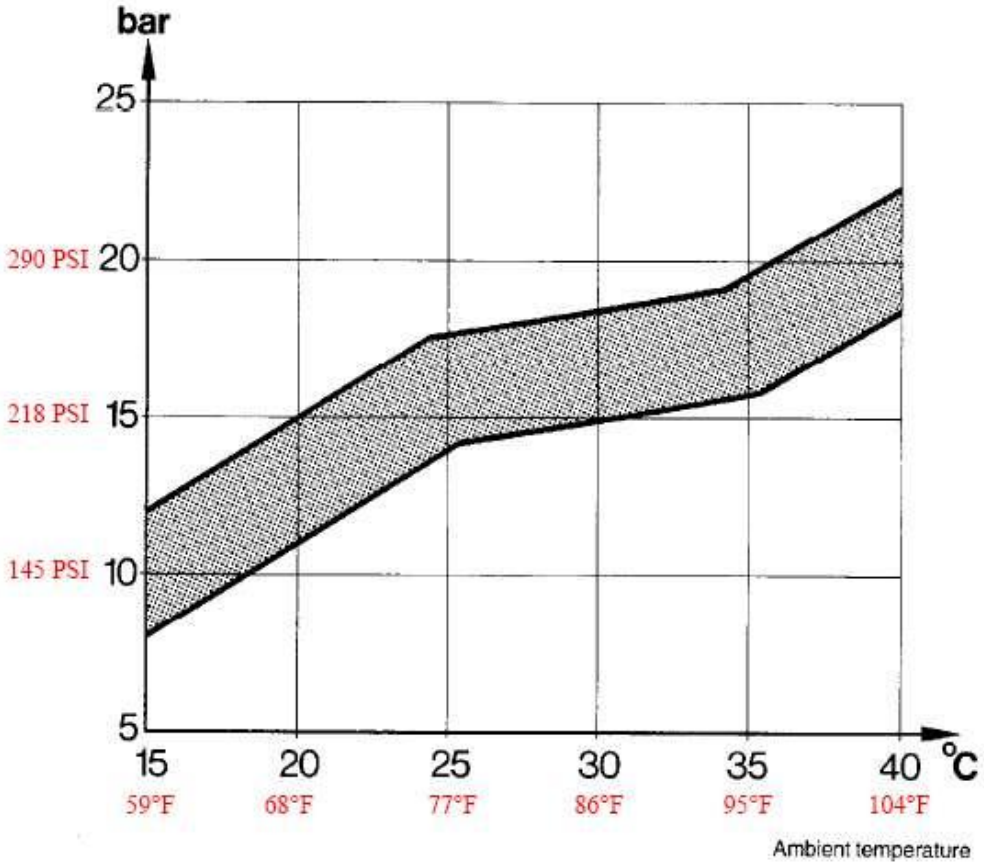
– Clean condenser.

1. Turn on air conditioning.

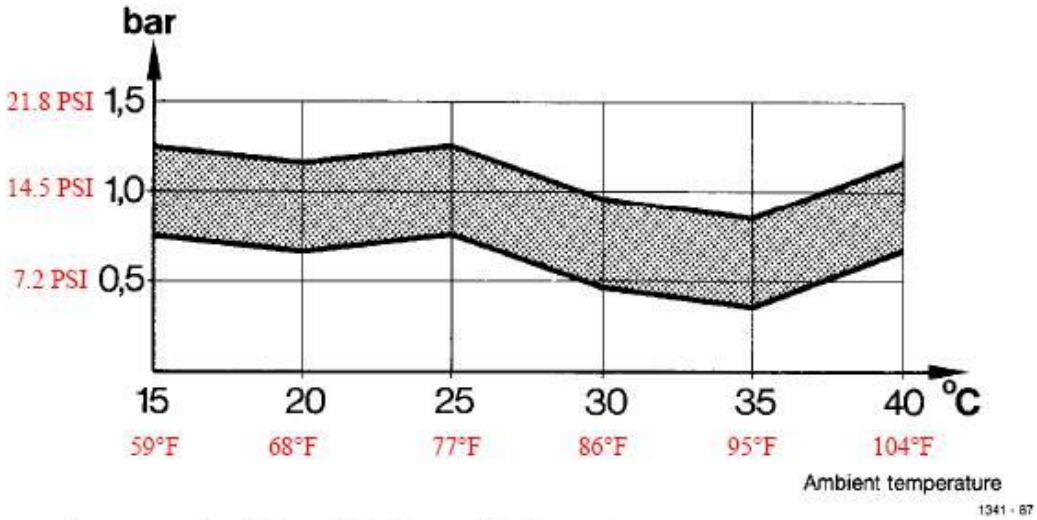
2. Set temperature control to max. cooling position.

3. Set fresh-air blower to stage 2.

After an operating time of approx. 10 mins., at an engine speed of 2,000 rpm and with the compressor switched on, the pressures and temperatures from the below diagrams must be reached.

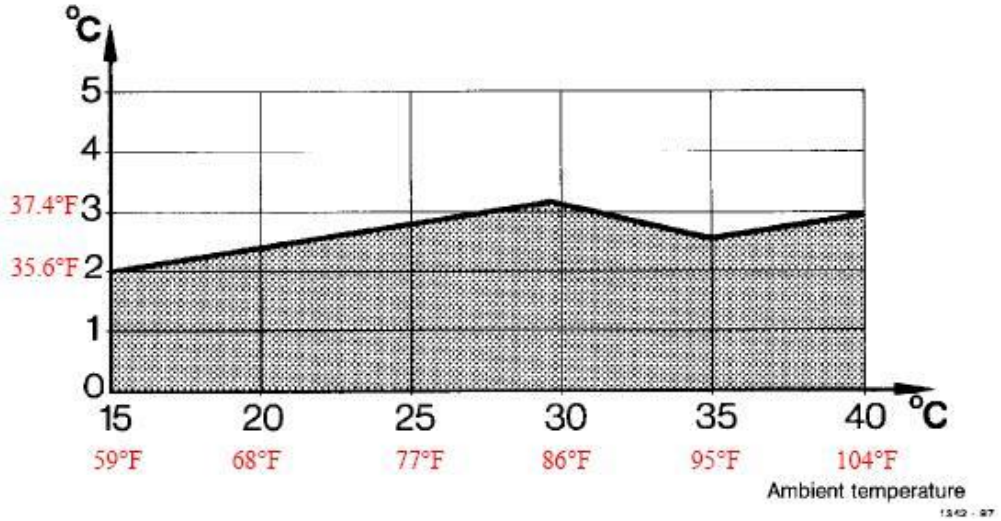


High pressure in refrigerant circuit vs. ambient temperature



Low pressure in refrigerant circuit vs. ambient temperature

Temperature at center nozzle



Air temperature at center nozzle vs. ambient temperature

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PORSCHE

Technical Information

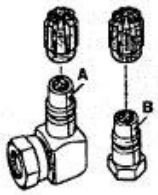
8-cyl 1/95 | 8E

Retrofitting air conditioning system to refrigerant R 134a

928 / 928 S - Model Years '83 (D) to '86 (G)

Designation	Qty.	Porsche Part No.	Notes
Fluid tank with drier insert	1	**928.573.941.03**	May also be retrofitted to A/C systems using refrigerant R 12.
O-ring 7.5 x 2 mm	2	**999.707.247.40**	- Coat with fresh PAG refrigerant oil
Charging valve (Refer to Note)			Tightening torque: **10 - 12 Nm** (= 7,5 - 9 ftlb)
High-pressure valve	1	**928.573.965.01**	- Straight adapter
Low-pressure valve	1	**928.573.965.00**	- Straight adapter
PAG refrigerant oil		**000.043.200.04** (Available from Porsche Parts Service - container size 250 ml.)	Capacity: **300 ± 20 ml.** (270 ml.) Value in ( ) = capacity for R 12
Refrigerant R 134a		– (Available from specialist suppliers only)	Capacity: **860 g** **1030 g** *
Self-adhesive label	2	**964.701.141.02**	Attach the self-adhesive labels in the following places: - On the bodywork near the compressor. - In the maintenance booklet.

* with additional A/C system in the rear



Assembly notes:

- When fitting angle valves (A), remove the formerly used valve inserts.
- When fitting straight valves (adapter - B), the former valve inserts remain fitted.

- Fit the straight adapter (B, 928.573.965.01) to the new fluid tank (arrow). Use a second wrench to lock when tightening the bolts!
- Installed compressor 928.126.010.03 - with drain plug.

Reference: Repair Manual 928, Vol. IV from page 87 - 01.

Flat Rates: **350 TU** - Covering: Retrofitting A/C system to refrigerant R 134a (Replacing fluid tank) Without removal of compressor.

928 Freon Capacity.

R12

1978-1979
R12, 950 grams or 33.5 ounces

1980 June 1988
Revised Factory recommendation,

Single evaporator systems R12, 1050 grams or 37 ounces
Dual evaporator systems R12, 1200 grams or 42.3 ounces

July 1988 1992
Single evaporator systems R12, 950 grams or 37 ounces
Dual evaporator systems R12, 1150 grams or 40.5 ounces

*before you attempt to charge using refrigerant weights stated above, always check in the engine compartment for the factory R12 sticker, and verify the charge using an R12 Pressures and Temperatures Chart

R134a

1978-1982
R134a, estimated 807 grams or 28.5 ounces

1983-1992
as per TB, 9501, 12/19/1995

Single evaporator systems R134a, 860 grams or 30 ounces
Dual evaporator systems R134a, 1030 grams or 36 ounces

1993 onward
Original Factory recommendation

Single evaporator systems R134a, 860 grams or 30 ounces
Dual evaporator systems R134a, 1050 grams or 37 ounces

Charging quantities of refrigerant R12 and refrigeration oil

Vehicle type	Compressor type	Refrigerating oil qty in cm3	Refrigerant R12 in grams
911	2 cyl.	300	1000
911 SC	2 cyl.	300	1100
911 SC 1981 to 1983	2 cyl.	300	1250
911 Carrera as from 1984	10 cyl.	120	1350
911 Carrera 4 as from 1989	10 cyl.	80	930
930 Turbo 1975 to 1979	2 cyl.	250	1100
930 Turbo 1980 to 1983	6 cyl.	170	1300
930 Turbo 1984 to	10 cyl.	120	1300
924	5 cyl.	175	850
1976 to 1978 swash plate on one side			
924 1979 to 1985	6 cyl.	230	850
924 S 1986 to 1988	10 cyl.	120	850
944 1982 to 1984	6 cyl.	280	1150
944 85/2 and turbo	10 cyl.	80	950
928	6 cyl.	350	1000
1978 to 1979 with damper line	6 cyl.	350	1050
928 S	6 cyl.	280	1050
with additional evaporator in rear compartment as from 1980		280	1200
928 S 4	6 cyl.	280	950
with addit. evaporator in rear compartment		280	1150
as from Mod. 89	10 cyl.	120	950
with addit. evaporator in rear compartment		120	1150
928 GT as from Mod. 90	10 cyl.	120	950
with addit. evaporator in rear compartment		120	1150