

## A/C Repair

Contributed by Administrator  
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This document is not intended as a step-by-step guide to repairing your A/C. Rather, it's a rundown of various legal, environmental, and practice considerations which are important in tackling the process. Between various laws, questionable marketing practices, and the "mystique" that surrounds modern A/C repair, I found it very difficult to get straight answers when it came time to rebuild my '90's system. I'm hoping that by producing this document, others don't have to spend all the time I did researching these concepts.

I first need to disclaim that I am neither a trained automotive technician, nor an automotive air conditioning specialist. Everything you're about to read is based on information I've gathered and experiences I've had, so take it for what you will. Just don't blame me when the EPA comes knocking, or your A/C doesn't work.

To get started, we need to understand why this discussion has to be had. Of course, the understood goal is that the A/C in your car either isn't working, or functioning at reduced capacity. But that's just the beginning of this confusing little journey. Here are the things you need to know: All early automotive A/C systems are based on a refrigerant called R12 (or CFC-12). Production of these gases was halted by the Clean Air Act on January 1, 1996 due to the deleterious effect they had on the ozone layer. The "official" replacement is a refrigerant known as R134a (or HFC 134a) and is used on all modern automotive A/C systems. Although they are employed in the same way, the two refrigerants are not compatible and must never be mixed. Although R12 production stopped over a decade ago, there is still a good supply of R12 available for direct installation into "legacy" air conditioning systems. Very little of this R12 (if any) is new, virgin refrigerant. By and large, most of the R12 is recycled and reclaimed from retired systems. It's relatively expensive (especially compared to how cheap it once was), and it is illegal for consumers to purchase or handle R12 anymore - only individuals carrying an EPA Section 609 certification may purchase R12. R12 must be handled in specific ways, and must never be allowed to escape into the atmosphere. R12 must be reclaimed and recycled. R134a is readily available, very inexpensive, and legal for anyone to purchase and handle. Although it too has negative effects on the atmosphere, its effects are less severe than R12 but more than likely more severe than they were originally believed to be. It is still absolutely illegal to vent R134a to the atmosphere, and used refrigerant must be reclaimed and recycled. It is believed that in the coming years, the EPA will restrict purchase and use of R134a to certified individuals. In addition to R12 and R134a, there is a virtually unlimited number of other refrigerants being marketed for motor vehicle air conditioning (MVAC) systems. These refrigerants come in dozens of varieties with a million interesting details and caveats, but it's important to know that the only refrigerant specified by the Federal Government for use in an MVAC system is R134a. Other refrigerants may be specifically outlawed or specifically overlooked by your local government, but none of them are endorsed by the EPA. What does that mean? Maybe nothing. But it's important to know. The single most common variety of "alternative refrigerants" are based on hydrocarbons, such as propane or butane. These types of refrigerants marketed by several different companies under dozens of different names. You will find all sorts of commentary about these refrigerants all over the web and it's often hard to distinguish fact from marketing propaganda. My research has left me with the following information, which you're free to heed or ignore:

- The Federal Government does not regulate the use of hydrocarbon based refrigerants in motor vehicles originally equipped with R134a
- The Federal Government specifically outlaws the use of hydrocarbon based refrigerants in motor vehicles originally equipped with R12
- States and municipalities may have specific legislation prohibiting or endorsing hydrocarbon-based refrigerants in MVACs
- It is always illegal to mix refrigerants of any type in the United States
- It is always illegal to vent any MVAC refrigerant to the atmosphere
- There are other alternative refrigerants available - legal ones are addressed on this EPA web page: <http://www.epa.gov/ozone/snap/refrigerants/lists/mvacs.html>

It should be noted that there is a "grey area" that exists between refrigerants that have failed EPA certification, received certification, and have never applied for certification. Be very careful of what you're buying if it isn't R12 or R134a - it's sometimes difficult to get a straight answer out of companies creating and marketing alternatives. That all said, the choice of which refrigerant you use is, of course, yours. My recommendation is to use R134a, for the following reasons:

- It's cheap and readily available. You can buy R134a at Wal-Mart or Pep Boys - no buying off Ebay or from questionable internet vendors.
- R134a is explicitly legal everywhere in the US. You don't need to check local laws, you don't need to worry about regulations when you travel.
- Anyone and everyone can work on an R134a system - since it is illegal to vent and mix refrigerants, it can be difficult to find a shop that will work on an MVAC system with an alternative refrigerant. Since they are responsible for reclaiming and recycling all used refrigerant, any shop will be required to have equipment specific to each type of refrigerant. This equipment is expensive, and it's unlikely they're going to invest tens of thousands of dollars in equipment for refrigerant used by you and your internet buddies. :) You should be aware that: R134a is not by any stretch of the imagination. It's potentially deadly and should be handled with care. R134a is not as efficient as R12, and probably not as efficient as most of the alternatives. It will not cool as well as R12 will in a given vehicle, but by the same token will more often than not be totally acceptable. R134a has smaller molecules than R12, and will be more likely to more quickly seep from your MVAC system's hoses and fittings. R134a is probably better than nothing.

There are six basic components of your Saab's A/C system, and they all must be in good shape to have functioning A/C:

1. The compressor itself - the compressor sits on top of your engine, has one pulley and a singular electrical connector
2. The compressor drive system - the compressor pulley is driven off a belt directly from the crankshaft, tensioned by a small idler pulley
3. The receiver-dryer - removes moisture from refrigerant, and to some degree acts as a filter to remove dirt and dust. It's located near the passenger side headlight.
4. The expansion valve - a device used to meter the flow of refrigerant entering the evaporator to match the amount of refrigerant being boiled off in

the evaporator. It separates the high pressure side of the system from the low pressure side. It is located under a plastic shield, near the evaporator. 5. The evaporator - exchanges heat from the cabin to the refrigerant. It is located under a plastic shield, accessed through the engine bay but inserted into the cabin. 6. The condenser - exchanges heat from the refrigerant to the airflow through the front of the car. The condenser works to oppose the evaporator. All of these components are linked together with rubber or metal hoses, and sealed with o-rings at connections. These hoses and o-rings are important but subject to the high heat of the engine bay and the extreme temperatures and pressure of the A/C system itself. Small leaks in these components become big leaks under the high pressure of a working A/C system. When servicing your A/C system, you should observe the following practice: Existing refrigerant must be vacuumed from the system using a vacuum pump. To ensure all old refrigerant, oil, and moisture is removed from the system, it should be evacuated to 30" of vacuum for 30 minutes. Every EPA-certified refrigerant includes fill/drain fittings specifically to help prevent cross-contamination of refrigerants. It is illegal to use the incorrect fittings with a refrigerant. Be sure you've acquired the correct set of fittings to match your chosen refrigerant. If you're using R134a, everyone from Pep Boys to Ebay sells adapter fittings. You should always replace the receiver-dryer when servicing the A/C system. Exposure to the atmosphere can quickly contaminate it which translates directly to less efficient A/C. If you are moving to R134a, you should replace all rubber A/C hoses with a specific type of rubber hose &ndash; called barrier hose &ndash; that is more resistant to R134a seepage. If you are switching to anything other than R12, you should replace all the black rubber o-rings with HNBR &ldquo;green&rdquo; o-rings, which are more resistant to high-temperature than standard NBR &ldquo;black&rdquo; o-rings. Ensure that you use the proper type of oil when refilling. Old R12 systems use mineral oil, but modern R134a and most alternative systems will use or require PAG or Ester oil. In general, oil types should not be mixed, but some PAG oil is compatible with both R12 and R134a, and will mix with remnants of mineral oil. Read labels and product descriptions carefully! In the early days of AC retrofitting, it was common practice to flush an A/C system using a dedicated MVAC system flush agent. Although many will still recommend it, there is growing belief that this may not be necessary and may in fact lead to shorter life of the fill or certain components. The primary reason for the flush was to remove traces of old oils, but with modern, highly-compatible PAG oils, the system flush is probably not necessary. Again, read labels and product descriptions carefully! Read the important facts about your chosen refrigerant: Most modern refrigerants are lighter than R12, and it will take less of them (by weight) to fill your system. The stock c900 A/C system will hold 2.2lbs of R12, which translates to 1.9-2.0lbs of R134a. Other refrigerants will have different fill ratios. Be sure you read the documentation or you&rsquo;ll risk blowing something up. Like you. Repairing or retrofitting the A/C system may include the following jobs: Evacuating the system &ndash; If your A/C is still somewhat working, you&rsquo;ll need to evacuate whatever is left of the current refrigerant. If it isn&rsquo;t, there&rsquo;s a good chance all the refrigerant has leaked out. Locating obvious leaks &ndash; Most leaks will be discovered during the evacuation process &ndash; high vacuum over an extended period of time will show you where the big ones are. Common leak points are the fittings at the condenser and the high-pressure side of the manifold hose attached to the compressor. Is it possible (if not likely) that additional leaks will be found during the refilling process &ndash; high pressure of a functioning A/C system will obviate leaks that vacuum may not. At this point, you may wish to use a flushing agent to clean the MVAC system. I personally recommend against the practice unless you have specific reason (such as switching from R12+mineral oil to R134a+ester oil), but if it&rsquo;s in your plan, do it now. Replacing key components &ndash; Any time the system is torn down, you are well-advised to replace the receiver-dryer and the expansion valve. Failure to do so will almost always result in poor system performance, and these items are so inexpensive there is no reason not to. The receiver dryer MUST be changed if you&rsquo;re moving from R12 to R134a (you need the XH7 or XH9 desiccant instead of the R12-specific XH5). You&rsquo;ll also want to replace o-rings at every connection to ensure there are no leaks. I also recommend replacing the manifold hose that attaches to the compressor &ndash; yours may not be leaking now, but this is a fragile component in the system and starting fresh with a new one will give the best chances of a long-lasting A/C rebuild. You may also find yourself replacing the compressor, the A/C idler pulley, and the A/C belt. Add oil. Different refrigerants require different types of oil to lubricate the compressor and help the receiver dryer function properly. You should never mix oils unless the new oil specifically addresses such a condition. Recharge the system with your chosen refrigerant. You may find upon charging new leaks on the high pressure side of the system. Sometimes, leaks will be obvious, but sometimes they&rsquo;ll prove much harder to find. Special dyes can be added to the refrigerant charge which is visible under UV light and through special glasses - this will very often help locate leaks. More often than not, refrigerant can be purchased with dye already in it to facilitate the process. Generally speaking, it is important to remember that only rarely will leaks be cured by tightening things more. A/C o-rings do not seal by crushing them to death &ndash; they seal by the nature of their materials and the connection itself. If you have a leak at a connection, ensure the o-ring is intact and properly seated before tightening the connection even more. There are three basic approaches to servicing the A/C in your Saab: Leave the whole thing to someone else. There is no argument that A/C systems are touchy, and having someone else fight the battle with leaks and ensuring all the old refrigerant is properly dealt with is a huge load off of you. There are a number of specialized tools you&rsquo;ll need to finish the job, and if you&rsquo;ve got one car that needs new refrigerant or a retrofit it may not be economical to buy everything you&rsquo;ll need. Install new parts, but leave the removal and refilling of refrigerant up to a pro. Replacing most of the components is not terribly difficult and does not require much in the way of extended effort or special tools. Replacing the condenser is a slight pain and replacing the evaporator is a fairly large pain, but it&rsquo;s relatively unusual that either of these components need attention anyway. A standard &ldquo;A/C Refresh&rdquo; will consist of the appropriate new compressor fittings, new hoses (likely only the big manifold hose directly off the compressor), a new receiver dryer, a new expansion valve (you&rsquo;re foolish if you don&rsquo;t replace them both), and new o-rings. You&rsquo;ll need a couple big wrenches, a couple small wrenches, and a

socket set to do this work, but you'll take a big bite out of the bill. Have a local shop vacuum out the out refrigerant, swap all the parts, and take it back for a test and recharge. Going this route can be problematic &ndash; if a leak is found you're either taking the car home to fix it (and do it right this time!) or paying the shop to replicate all your effort. If you decide to DIY the hardware side of the equation, I strongly recommend you put the money you saved on labor into ensuring as many components are new as possible to minimize the chances of leaks. DIY the whole task! To even go down this road you're going to invest in a UV light and UV glasses for leak detection, an air temperature gauge to check the in cabin air temp, a good manifold gauge set with fittings/adapters for both R12 and whatever it you plan on installing, and a vacuum pump to evacuate the system. It is highly recommend you buy an electric vacuum pump instead of relying on a Venturi-type air-driven pump. Air-driven pumps cannot generally &ldquo;pull&rdquo; enough vacuum for a long enough period of time to properly evacuate the system. Good-enough electric pumps are inexpensive and better suited to the task. The downside of an entire DIY job is the cost of entry &ndash; figure about \$250 just to buy the tools. The nice thing about owning all the tools is that they'll work on any car, and down the road you're ready to deal with any leaks or other issues that may develop. There is nothing complex about the operation, just a lot of little details that must be accounted for, and a number of decisions that must be made. By virtue of the fact you've read this much of my diatribe on the subject, chances are you can handle an A/C job, too. Now that you've gotten here, you may be ready to start wrenching on your Saab. For that, I'd like to point you to the excellent FAQ on Twinsaabs's website which will walk you through rebuilding the system: [http://www.twinsaabs.com/900\\_repair/diyac/step1.html](http://www.twinsaabs.com/900_repair/diyac/step1.html) As always, if you have any other questions please don't hesitate to contact me!