



AIR CONDITIONING INFORMATION SHEET

Car air conditioning – What does it do?

Well apart from the obvious function of cooling the car's interior, air conditioning also dehumidifies the air helping to demist the windows in winter.

Car air conditioning – How does it work?

Whilst every vehicle manufacturer uses different variations of in-car air conditioning systems, in broad terms all use the same basic types of component and work in a very similar way. Some of the key components of the system are:

The Evaporator

As a fan moves air over the evaporator, heat is transferred to the refrigerant within it. As the refrigerant absorbs heat it causes the liquid refrigerant to become a gas. The evaporator is a heat exchanger, and can be thought of as a sort of radiator working in reverse.

The Compressor

The function of the compressor is to pump refrigerant around the system between the low pressure and high pressure sides. The compressor is lubricated by special oil suspended in the refrigerant. The compressor is usually engine driven and is connected by a belt.

The Condenser

This is a radiator normally fitted at the front of the vehicle. Its function is to dissipate the heat from the refrigerant by transferring it to the outside air passing over it.

The Expansion Valve (or in some systems - Orifice Tube)

The purpose of this valve is to control the rate of flow (and thus pressure) of the refrigerant through the evaporator.

The Service Ports

There are two service ports on the system, one on the high pressure side and one on the low pressure side. These ports allow a technician to connect test gauges, filling and recovery equipment and vacuum pumps to the system. These ports usually have self-sealing valves, but should always be protected by a plastic cap to prevent contamination by the ingress of dirt or moisture. Missing caps should always be replaced without delay.

Compressor oil & refrigerant

The compressor oil is used to lubricate the compressor and its seals. We recommend you run your air conditioning system at least once a month to redistribute this oil as, if the air conditioning system is not used for a long time, the seals dry out and may become damaged. In R134a systems Poly Alkaline Glycol (PAG oil) is used. This oil requires very careful handling as it is easily absorbed through the skin and is rather poisonous. PAG must also not be exposed to the open air for too long as it is very hygroscopic (it absorbs water from the air).

For cars made since around 1992 until very recently the refrigerant used is R134a (very new cars might use R1234yf). Unfortunately R134a is a greenhouse gas and thought to be implicated in climate change so its use is controlled by law. The system is at high pressure when running and if any refrigerant is accidentally splashed on the skin it can cause severe frostbite and if splashed in the eye blindness. An air conditioning technician will always use special protective equipment such as splash proof goggles and fluoroelastomer gloves, as normal chemical handling gloves and safety specs don't offer sufficient protection from the oil and refrigerant.

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Legal considerations

It is an offence to allow refrigerant to escape into the atmosphere.

The law requires that all persons who recover refrigerant from vehicles hold a recognised qualification. It does not matter whether the process is carried out using individual items of equipment, manual air conditioning service machines or fully automatic units, what does matter is that the operator of the equipment is competent and holds a recognised qualification.

What about the DIY 'top-up' kits?

You may have seen DIY air conditioning top-up kits sold online or at your local car accessories shop. The trouble with these is that the system must be filled with the correct weight, specified in grams, by the vehicle manufacturer. Add too little and it will not work efficiently, add too much and you risk permanent damage to the air conditioning system. These kits do not provide any means of recovering the refrigerant to determine how much is already in the system, so you have no way of knowing how much to add.

As pressure changes with temperature, the pressure gauge on these top-up kits will leave uncertainty as to whether the appropriate amount of refrigerant has been added or not. When you combine this with the hazards of handling the refrigerant and compressor oil (and it is unlikely that a DIYer will have the correct personal protective equipment or a means of confirming the system is not leaking - as to allow refrigerant to escape into the atmosphere is against the law), we would strongly recommend that all work on the car's air conditioning system is left to a suitably qualified professional.

Testing the system

There are 4 common tests that can be performed on the air conditioning system:

1. Temperature measurement

A very accurate digital air conditioning thermometer is used to measure the temperature of the air coming out of the car's air vents. By comparing this with the ambient temperature it is possible to determine how effectively the system is working.

2. Leakage detection – on a system with refrigerant in it

Before we do any work on an air conditioning system we use a sensitive electronic leakage detection probe. The probe 'sniffs' the air and shows the concentration of any refrigerant present. By passing a probe slowly over the relevant parts of the system whilst it is working, leaks can be quickly identified and located.

A second method of leak detection involves introducing a dye into the system that fluoresces under ultra violet light. A UV lamp and special safety specs are used to identify any areas where it is leaking out.

3. Leakage detection – on a system with no refrigerant in it

An empty system can be pressure tested using oxygen-free nitrogen; however this test will not show leaks that occur only when the system is running.

Once all the refrigerant has been recovered from the system a vacuum pump is connected to pull a vacuum on the system. Provided the vacuum is maintained for some minutes it demonstrates that air is not leaking into the system.

4. Pressure measurement

By comparing the readings on the high and low pressure gauges it is possible to determine whether the system is working correctly or, in the case of a problem, to infer what component may be at fault.



Recovery of the refrigerant and oil

A recovery pump (either separately or as part of a service machine) is used to draw all the used refrigerant and oil out of the system. The oil and refrigerant are separated, the refrigerant going into a recovery cylinder and the oil into a separate sealed container. These are then weighed and the amount that should be added to comply with the vehicle manufacturers specification calculated.

Some machines such as ours also dry, filter and clean the oil and refrigerant before it is reintroduced into the vehicle

Pulling a vacuum on the system

Once all the refrigerant is removed, a powerful vacuum pump is connected to the system for around 30 minutes. This causes any water that has become trapped in the system to boil off and be removed also, providing a good vacuum is maintained, it shows that no air is leaking into the system.

Have you noticed a musty or unpleasant smell coming from your car's air vents?

If so, then mould, fungus or bacteria growing in the ducts and on the evaporator are almost certainly the cause.

Don't just try and disguise the smell with an air freshener! What you need to do is tackle the root cause of the problem.

The best way is to have your car's air conditioning and ventilation system professionally treated with a powerful broad spectrum antimicrobial fluid that is drawn through the whole system to eliminate the unpleasant smells and the potential for adverse health effects.

The usual benefits of the treatment are:

- Eliminating unpleasant odours emitted from air conditioning systems
- Deodorising the car interior
- Destroying bacteria on the evaporator
- Providing a healthier environment for driver and passengers

Regular air conditioner sanitising can make your car a healthier and more pleasant place.

Note: This information sheet applies to systems using R134a refrigerant, excluding electric and hybrid vehicles. Whilst this information is offered in good faith, no liability can be accepted by its authors for any loss, damage or injury caused by errors in or omissions from the information given. We recommend that all work on your air conditioning system is undertaken by a suitably qualified professional.