

REFRIGERANT CHART

R1234yf & R744 (CARBON DIOXIDE)

R1234yf and R744 (carbon dioxide) are two refrigerants that have been adopted by some global vehicle manufacturers as alternatives to R134a.

Both refrigerants and the systems designed for them will present significant changes to the tools, working practices, component standards and workplace safety considerations relating to repair, service and refrigerant recovery.

This wall chart has been designed to help ARCTick-licensed individuals and businesses to better understand these refrigerants.

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R1234yf

R1234yf is a hydrofluorolefin (HFO) refrigerant. HFO refrigerants are composed of hydrogen, fluorine and carbon atoms, but contain at least one double bond between the carbon atoms.

MAIN CHARACTERISTICS OF R1234yf

- Low toxicity.
- Low GWP; GWP = <1.
- Zero ozone-depletion potential.
- Low total contribution to climate change.
- Class A2L refrigerant - Mildly flammable.
- Same operating pressures as current R134a system.



PROPERTIES	R1234yf	R134a
Boiling Point	-29°C	-26°C
Critical Point	95°C	102°C
Saturation Pressure at 25°C	580 kPa gauge	567 kPa gauge
Saturation Pressure at 80°C	2400 kPa gauge	2490 kPa gauge
Global Warming Potential (100 ITH)	<1	1430
Flammability Rating	A2L Mildly Flammable	A1 Non Flammable

SAFETY ISSUES TO BE AWARE OF WHEN HANDLING R1234yf

R1234yf is classified as A2L mildly flammable. Technicians need to take the relevant safety measures for the correct transport, storage and handling of a flammable gas. This would include, but is not limited to, ensuring no open flames (including smoking) near the system. It is also worth noting that highly toxic substances are created when this gas is burnt. Asphyxiation and freeze burns are also a risk.

It is advised to check with your state-based Worksafe agency and refer to the relevant material safety data sheets available from your refrigerant wholesalers for specific safeguards when handling this refrigerant. Suitable Personal Protective Equipment (PPE) is to be worn when handling this refrigerant. Suitable trade training in flammable refrigerants is recommended prior to working on systems containing flammable refrigerants.

WHAT EQUIPMENT DO I NEED TO HANDLE R1234yf?

- A R1234yf calibrated gauge set with dedicated R1234yf couplers.
- Electronic refrigerant leak detector (A2L compliant).
- Vacuum pump (A2L compliant).
- Recovery/reclamation equipment (A2L compliant) - Although it is not mandatory to recover R1234yf, it is still good environmental practice and due to the cost of this refrigerant it would be advisable to do so, as long as it meets relevant specifications.
 - Dedicated cylinders for recovered or new R1234yf have a left-hand valve thread and require a suitable adaptor to connect to the gauge set charge hose. As R1234yf is a mildly flammable gas, cylinder storage and transport practices will differ to R134a cylinders. Check out the relevant dangerous goods handling and storage requirements for your State/Territory.
- A refrigerant identifier is also recommended to ensure you are handling pure R1234yf, free of contaminants.



Images used as examples only

IS R1234yf COMPATIBLE WITH EXISTING R134a EQUIPMENT?

No. R1234yf is classified as A2L mildly flammable refrigerant, and requires equipment that has been designed for its use.

The exception is an electronic leak detector. Several manufacturers are releasing detectors that are suited to both refrigerants. Check with your refrigerant wholesaler.

CAN I CONVERT R134a SYSTEMS TO R1234yf?

No. R134a systems are not designed to operate using a flammable refrigerant. R134a systems are unable to be converted to a safety level that satisfies the requirements of international standards set for systems that use R1234yf.

Aside from the safety aspects, although the two refrigerants have similar thermodynamic properties, they are not the same. Therefore, compressor damage or system performance limitations could be experienced by attempting to convert R134a systems to R1234yf.

WHERE CAN I BUY R1234yf?

R1234yf is available from most refrigerant wholesalers and automotive air conditioning component suppliers.

DO I NEED AN ARCTICK AUTHORISATION AND LICENCE TO BUY AND HANDLE R1234yf?

No. R1234yf is not controlled under Australia's Ozone Protection and Synthetic Greenhouse Gas legislation. However, a licence is required if it is part of a blend containing a controlled HFC refrigerant. R134a will also still be used in systems for years to come. It is a legal requirement that automotive workshops who provide air conditioning services (including recovery) continue to hold a refrigerant handling licence and refrigerant trading authorisation if R134a is being used.

For additional licensing requirements, check with your relevant state-based licensing authorities.

IMPORTANT

R1234yf FLAMMABILITY RATING = A2L MILDLY FLAMMABLE

Only use equipment that meets the following Society of Automotive Engineers (SAE) Standards for use with R1234yf:

- Refrigerant Recovery equipment:
 - SAE J 2843:2013, R1234yf recovery/recycling/recharging equipment for flammable refrigerants for mobile air-conditioning systems
 - SAE J 2851:2015, recovery equipment for contaminated R134a or R1234yf refrigerant from mobile automotive air conditioning systems
 - SAE J 3030:2015, automotive refrigerant recovery/recycling/recharging equipment intended for use with both R1234yf and R134a
- Hose sets and gauges: SAE J 2196:1997 service hose for automotive air conditioning
- Leak detectors: SAE J 2913:2016, R1234yf refrigerant electronic leak detectors, minimum performance criteria

R744 (CO₂ CARBON DIOXIDE)

MAIN CHARACTERISTICS OF R744

- R744 is pure carbon dioxide and is non-flammable.
- Low GWP; GWP = 1.
- The extremely high operating pressures of R744 and hazards associated with potentially high concentrations of carbon dioxide in vehicle cabins or working environments means this refrigerant must be used with care.
- R744 can exist in all 3 states at one time, vapour, liquid and solid (dry ice) and, as such, the skills of the technician are critical.

NOTE

- Dry ice changes from a solid to a vapour (sublimates) at -78°C and the boiling point of liquid carbon dioxide at atmospheric pressure is also -78°C.
- Be aware that R744 can cause serious burns.



PROPERTIES	R744	R134a
Boiling Point	-78°C	-26°C
Critical Point	31°C	102°C
Saturation Pressure at 25°C	6370 kPa gauge	567 kPa gauge
Saturation Pressure at 80°C	Not Applicable	2490 kPa gauge
Global Warming Potential (100 ITH)	1	1430
Flammability Rating	A1 Non Flammable	A1 Non Flammable

SAFETY ISSUES TO BE AWARE OF WHEN HANDLING R744

R744 systems operate at extremely high and dynamic pressures. Even when equipment is turned off, static pressure is still very high. Do not handle this refrigerant in a confined space and take all precautions to prevent its release. Oxygen will be displaced with carbon dioxide if R744 is released in excessive amounts (it is heavier than air and can congregate). Symptoms from overexposure to carbon dioxide range from drowsiness to asphyxiation, and in extreme cases, death.

R744 systems must also be charged and degassed in a specific manner to avoid the formation of dry ice inside the refrigerant pipework. Frost burns can occur if contact is made with liquid or solid carbon dioxide (R744). Appropriate Personal Protective Equipment (PPE) must be used. Refer to the relevant material safety data sheets, and ensure system-specific safety procedures are followed. If dry ice is allowed to form it can cause severe skin burns and block parts of the system for long periods of time until it has evaporated.

WHAT EQUIPMENT DO I NEED TO HANDLE R744?

Equipment to work on R744 systems is not yet commonly available in Australia. However, if you come across a system with R744 refrigerant we encourage you to contact the vehicle manufacturer for guidelines on handling the refrigerant and servicing the system.

IS R744 COMPATIBLE WITH EXISTING R134a EQUIPMENT?

No. R744 operates under pressures up to ten times higher than R134a. Although it has been used for some time in stationary equipment, developing R744 systems for automotive air conditioning requires significant engineering development, with unique components and system layouts required.

CAN I CONVERT R134a SYSTEMS TO R744?

No. R134a systems were not designed to operate using a high pressure refrigerant.

WHERE CAN I BUY R744?

R744 is available from most refrigerant wholesalers and automotive air conditioning component suppliers.

DO I NEED AN ARCTICK AUTHORISATION AND LICENCE TO BUY AND HANDLE R744?

No. R744 is not controlled under Australia's Ozone Protection and Synthetic Greenhouse Gas legislation. However, a licence is required if it is part of a blend containing a controlled HFC refrigerant. R134a will also still be used in systems for years to come. It is a legal requirement that automotive workshops who provide air conditioning services (including recovery) continue to hold a refrigerant handling licence and refrigerant trading authorisation if R134a is being used.

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This initiative was developed by:



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