

R-134a

Introduction

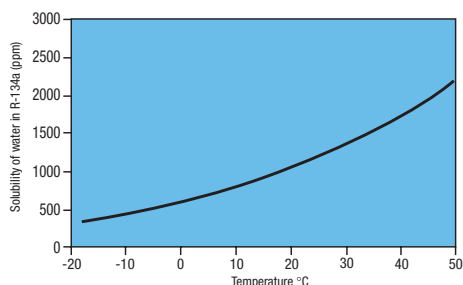
R-134a (HFC-134a) has been developed by Honeywell to serve as one of the key substitutes for CFCs and HCFCs. R-134a is a longterm, environmentally safer, non-ozonedepleting substitute. As a refrigerant, it possesses similar energy efficiency and capacity characteristics as R-12 and has an intrinsically low toxicity. R-134a is the alternative refrigerant of choice in automobile air-conditioning. It may be used in residential and commercial refrigeration, as well as commercial, and industrial air-conditioning.

Pressure/Temperature table

Temperature (°C)	Pressure (kPa)
-40.0	51
-35.0	66
-30.0	84
-25.0	106
-20.0	133
-15.0	164
-10.0	201
-5.0	243
0.0	293
5.0	350
10.0	415
15.0	488
20.0	572
25.0	665
30.0	770
35.0	887
40.0	1017
45.0	1160
50.0	1318

Solubility of water in R-134a

The solubility of water in R-134a is shown in the graph below. This solubility is comparable to that of water in R-22.



Applications

Refrigeration and air-conditioning

In the automotive industry, manufacturers are now using R-134a in the air-conditioning systems in their new vehicles. Retrofit kits are being developed to permit conversion of existing auto air-conditioning systems from CFC-12 to R-134a.

R-134a has been developed for a number of refrigeration applications including supermarket cases, walk-in coolers and home refrigerators. R-134a is also being used in some centrifugal chillers.

R-134a is suitable for both new equipment and for retrofitting existing R-12 commercial refrigeration systems. Generally, there will be few equipment design changes necessary to optimise the performance of R-134a in these applications. For retrofitting commercial refrigeration systems, refer to R-134a retrofitting guidelines.

Physical properties

Chemical name	1,1,1,2 Tetrafluoroethane
Molecular formula	CH ₂ FCF ₃
Molecular weight	102.03
Boiling point (°C)	at 101.3 kPa -25.9
Freezing Point (°C)	at 101.3 kPa -96.6
Critical temperature* (°C)	101.06
Critical pressure (kPa)	4059
Critical volume* (kg/m ³)	0.002
Critical density* (kg/m ³)	511.9
Vapour density at boiling point (kg/m ³)	5.26
Liquid density † (kg/m ³)	1207.0
Liquid heat capacity † (kJ/kg·°K)	1.425
Vapour heat capacity (at constant pressure) (kJ/kg·°K)	at 101.3 kPa 0.851
Heat of vaporization at boiling point (kJ/kg)	216.98
Vapour pressure † (kPa)	665.0
Liquid thermal conductivity † (W/m·°K)	0.081
Vapour thermal conductivity † (W/m·°K)	0.0138
Liquid viscosity † (µPa·sec)	197.9
Vapour viscosity † (µPa·sec)	11.8
% Volatiles by volume	100
Solubility of R-134a in water (wt.%)	0.15
Solubility of water in R-134a (wt.%)	0.11
Flammability limits in air (vol.%)	None
Auto ignition temperature (°C)	770
Ozone Depletion Potential (ODP – R11=1)	0

* Relprop v6.01 (NIST)

† All data are at 25°C unless noted otherwise.

Lubricants

R-134a is being used with polyalkylene glycol (PAG) and with polyol ester lubricants.

Most automotive original equipment manufacturers have chosen specific PAG lubricants for their systems. For non-automotive applications, most compressor manufacturers are recommending specific polyol ester lubricants. Users should check with the equipment manufacturer for the recommended lubricants for their system.

Safety

Honeywell recommends reading the Material Safety Data Sheet (MSDS) before using R-134a.

Toxicity

R-134a can be safely used in all of its intended applications, based on data developed by the Program for Alternative Fluorocarbon Toxicity Testing (PAFT 1).

Leaks

If a large release of R-134a vapour occurs, the area should be evacuated immediately. Vapours may concentrate near the floor, displacing available oxygen. Once the area is evacuated, it must be ventilated using blowers or fans to circulate the air at floor-level.

Flammability

According to ASHRAE Standard 34, R-134a is classified in safety group A1, i.e., it is non-flammable at 1 atm. pressure (101.3 kPa) and 18°C.

Storage and handling

Bulk and cylinder

R-134a cylinders must be clearly marked and kept in a cool, dry and properly ventilated storage area away from heat, flames, corrosive chemicals, fumes, explosives -- and be otherwise protected from damage. Under no circumstances should an empty cylinder be refilled with **anything other than virgin product**. Once empty, properly close the cylinder valve and replace the valve cap. Return empty cylinders to your Honeywell distributor.

Cylinders of R-134a should be kept out of direct sunlight, especially in warm weather. Liquid R-134a expands significantly when heated, reducing the amount of vapour space left in the cylinder. Once the cylinder becomes liquid-full, any further rise in temperature can cause it to burst, potentially resulting in severe personal injury. **Never allow a cylinder to get warmer than 52°C.**

Vessels, containers, transfer lines, pumps and other equipment used with R-134a should not be exposed to high-temperature sources (such as welding, brazing and open flames) until they have been thoroughly cleaned and found free of vapours or liquid. Cylinders must never be exposed to welding, brazing or open flames. Exposure to high temperatures can cause fire, explosion and decomposition of R-134a. This may result in the formation of toxic or corrosive compounds.

When possible, maintenance or cleaning of equipment should be performed without entering the vessel. If a tank or any confined space must be entered, then formal confined space entry procedures must be followed. These procedures require that a fully qualified work team be used and a confined space entry form be completed and placed at the job site.

Materials compatibility

Compatibility: plastics and elastomers

Material	R-134a	R-134a/PAG	R-134a/Polyol esters
Ethylene Propylene Diene Terpolymer	S	S	S
Ethylene-Propylene copolymer	S	S	S
Chlorosulfonated Polyethylene	S	Us	Us
Polyisoprene	S	Su	U
Chlorinated Polyethylene	Su	Su	Us
Neoprene (Chloroprene)	S	S	Su
Epichlorohydrin	S	Su	Us
Polyvinylidene Fluoride and copolymer of Vinylidene Fluoride and Hexafluoropropylene	U	S	Us
Silicone	Us	S	Su
Polyurethane	S	U	Su
Nitrile	Su	Su	Su
H-NBR	S	Su	S
Butyl rubber	S	S	Su
Natural rubber	Su	U	U
Polysulfide	S	U	U
Nylon	S	Su	Su
Polytetrafluoroethylene	S	S	S
PEEK	S	S	S
ABS	S	U	U
Polypropylene	Su	Su	S
Polyphenylene Sulfide	Su	U	Su
Polyethylene Terephthalate	S	U	S
Polysulfone	S	Us	S
Polyimide	S	Su	Su
Polyetherimide	S	Su	S
Polyphthalamide	S	U	U
Polyamideimide	S	S	S
Acetal	S	U	U
Phenolic	S	S	Su
Epoxy resin	S	S	S

S: Suitable

Su: Suitable with some exceptions

U: unsuitable

Us: Unsuitable with some exceptions

Note: In either case, rankings should be used with caution since they are judgements based on limited sampling. Customers should consult the manufacturer or do further independent testing.

Leak detection

Use leak detectors for pinpointing leaks or for monitoring an entire room on a continual basis. Leak detection is important for refrigerant conservation, equipment protection and performance, reduction of emission and protection of those coming in contact with the system. Never use air to perform leak detection.

Available literature

Honeywell has a wide range of literature available on topics including: retrofitting procedures, product specifications and product descriptions.

Please ask for the CD-rom containing Refrigerant Properties, Cycle Analysis and Pipe Sizing.

For further information and/or technical assistance on refrigerants, please contact us at our sales & technical offices:

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