

# R-404A

## Introduction

R-404A (HFC-404A) is a non-ozone depleting compound designed to serve as a long-term alternative to R-502 (CFC-502) and R-22 (HCFC-22) in low- and medium-temperature commercial refrigeration applications. Applications where R-404A is a suitable retrofit refrigerant include supermarket freezer cases, reach-in coolers, display cases, transport refrigeration and ice machines.

R-404A has been designed as a substitute for R-502, but it is not a drop-in replacement. Mineral oils and alkylbenzene lubricants, which have been used traditionally with R-502, are immiscible with R-404A. Service technicians should consult the original equipment manufacturer for the recommended lubricants.

R-404A is a blend. For this reason it is essential that systems be charged only with liquid from the cylinder, not vapour. Vapour-charging R-404A may result in the wrong refrigerant composition and could damage the system.

## Physical properties

Components:	Chemical name:	Molecular formula:	Weight %:
HFC-125	Pentafluoroethane	CHF <sub>2</sub> CF <sub>3</sub>	44%
HFC-143a	1,1,1 Trifluoroethane	CH <sub>3</sub> CF <sub>3</sub>	52%
HFC-134a	1,1,1,2 Tetrafluoroethane	CH <sub>2</sub> FCF <sub>3</sub>	4%
Chemical name	Pentafluoroethane/1,1,1, Trifluoroethane/1,1,1,2, Tetrafluoroethane		
Molecular formula	CHF <sub>2</sub> CF <sub>3</sub> /CH <sub>3</sub> CF <sub>3</sub> /CH <sub>2</sub> FCF <sub>3</sub>		
Molecular weight	97.6		
Boiling point (Bubble point) (°C)	at 101.3 kPa		- 46.2
Critical temperature (°C)	72.2		
Critical pressure (kPa)	3668.6		
Critical density (kg/m <sup>3</sup> )	483.7		
Saturated liquid density at 26.7°C (kg/m <sup>3</sup> )	1034.7		
Heat of vaporization at boiling point (kJ/kg)(*)	35.8		
Specific heat of vapour at constant pressure, Cp at 1 atm and 26.7°C (kJ/kg.°C)(*)	0.09		
Flammable range, % volume in air	(**)None		
Ozone Depletion Potential (ODP – R11=1)	0		
ASHRAE/ANSI Standard 34-1992 Safety Group Classification	A1/A1		

(\*) Refprop v 4.0 (NIST)

(\*\*) Flame limits measured using ASTM E681 with electrically activated kitchen ignition source per ASHRAE Standard 34.

## Retrofitting

### Lubricant

A lubricant miscible with HFC refrigerants must be used with R-404A. Honeywell recommends using a lubricant such as polyol ester (POE) that has been approved by the compressor manufacturer. Differences among polyol ester-based lubricants make it difficult to assume that they are interchangeable. Check with the compressor manufacturer for the correct viscosity grade and brand for the compressor in the system being retrofitted.

### Expansion device

Most R-502 systems with any common expansion device will operate satisfactorily with R-404A, however, it may be necessary to adjust the superheat. For R-502 equipped with a capillary tube, in most cases the unit can be operated satisfactorily with the original capillary tube by undercharging the unit (as long as ambient conditions are relatively constant).

## 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.

## Pressure/Temperature table

Temperature (°C)	Bubble pressure (liquid) (kPa)	Dew pressure (vapour) (kPa)
-60	51	48
-56	63	60
-52	78	74
-48	95	91
-44	114	110
-40	137	133
-36	164	159
-32	194	188
-28	228	222
-24	267	260
-20	310	303
-16	359	351
-12	414	405
-8	474	465
-4	541	531
0	615	604
4	696	685
8	785	773
12	882	869
16	987	974
20	1102	1089
24	1227	1213
28	1362	1347
32	1507	1493
36	1664	1649
40	1834	1818
44	2015	2000
48	2210	2195
52	2420	2405
56	2645	2630
60	2886	2871

## Storage and handling

### Bulk and cylinder

R-404A 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-404A should be kept out of direct sunlight, especially in warm weather. Liquid R-404A 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-404A 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-404A. 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.

### 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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