Honeywell

Genetron® 407C

Introduction

Genetron® 407C (a ternary blend of HFC-32/HFC-125/ HFC-134a, assigned Genetron® 407C by ASHRAE) serves as a non-ozone-depleting replacement for Genetron® 22 (HCFC-22) in various air-conditioning applications, as well as in other refrigeration systems.

Since Genetron® 407C is a close match to Genetron® 22, it also serves as a retrofit fluid in applications where Genetron® 22 is generally used.

Physical properties

Components:	Chemical name:	Molecular formula:	Weight %:
HFC-32	Difluoromethane	CH_2F_2	23%
HFC-125	Pentafluoroethane	CHF_2CF_3	25%
HFC-134a	1,1,1,2 Tetrafluoroethane	CH_2FCF_3	52%
Molecular weight			86.2
Bubble point temperature [IV] (°C)			-43.7
Bubble point pressure [I] (kPa)			1193
Dew point temperature [IV] (°C)			-36.7
Dew point pressure [I] (kPa)			1019
Critical temperature (°C)			87.3
Critical pressure (kPa)			4819
Critical volume (m^3/kg)			0.0019
Critical density (kg/m^3)			515.8
Vapour density [IV] (kg/m^3)			4.585
Liquid density [I] (kg/m^3)			1153
Liquid heat capacity [I, III] (kJ/kg·°K)			1.481
Vapour heat capacity [III] (kJ/kg·°K)			0.963
Heat of vaporization at boiling point (kJ/kg)			249.73
Vapour pressure [III] (kPa)			1287.01
Liquid thermal conductivity [I, III] (W/m·°K)			0.08626
Vapour thermal conductivity [I, III] (W/m·°K)			0.01314
Liquid viscosity [I, III] (µPa·sec)			164.3
Vapour viscosity [III] (µPa·sec)			12.83
Flammability limits in air (vol.%)			None [II]
Ozone Depletion Potential (ODP-R11=1)			0
ASHRAE Safety Group Classification			A1/A1

Pressure/Temperature table

Temperature (°C)	Bubble pressure (liquid) (kPa)	Dew pressure (vapour) (kPa)
-30.0	188	139
-25.0	231	174
-20.0	281	215
-15.0	339	264
-10.0	405	320
-5.0	481	386
0.0	568	461
5.0	666	547
10.0	776	645
15.0	899	755
20.0	1036	880
25.0	1188	1019
30.0	1356	1175
35.0	1541	1348
40.0	1745	1539
45.0	1967	1751
50.0	2210	1985
55.0	2475	2242
60.0	2763	2524

[I] Information based on estimated properties

[II] Flame limits measured using ASTM E681 with electrically activated kitchen ignition source per ASHRAE Standard 34.

[III] All Measurements are at 25°C and 101.3 kPa unless otherwise noted.

[IV] at 101.3 kPa

Compatibility with plastics and elastomers

The table below is a summary of materials compatibility data resulting from tests performed by Honeywell and other worldwide industry organisations.
Since there are many different grades and formulations of these materials, we recommend that compatibility testing be performed on the specific grade of materials under consideration when designing new systems. This data should be used only as a guide to the compatibility of materials with Genetron® 407C.
The rankings in the table should be used with caution since they are judgements based on limited samplings. Customers should consult with the manufacturer or conduct further independent testing.

Applications

Unitary Air conditioning

Genetron® 407C can serve as a non-ozone depleting replacement for Genetron® 22 in residential and light commercial air-conditioning systems. Relative to Genetron® 22 there is little to no capacity decrease with Genetron® 407C, making it easier to use in existing equipment designs. However, some loss of efficiency will occur and some equipment modifications will be required when retrofitting these systems to Genetron® 407C. In designing for new equipment, some design changes are needed if retention of efficiency ratings are required.

Chillers

Genetron® 407C serves as a replacement for Genetron® 22 in positive displacement chillers without flooded heat-exchangers. Because Genetron® 407C is a blend with a temperature glide, it is not recommended for use in chillers with a flooded evaporator.

Commercial refrigeration

Genetron® 407C may be used to replace Genetron® 22 in existing medium-temperature commercial refrigeration systems, including supermarket displays cases and reach-in coolers.

Compatibility with plastics and elastomers

Material	Genetron® 407C
Ethylene-Propylene Diene Terpolymer	S
Ethylene-Propylene Copolymer	S
Chlorosulfonated Polyethylene	S
Chlorinated Polyethylene	Su
Neoprene (Chloroprene)	S
Epichlorohydrin	Su
Fluorinated Rubbers	U
Silicone	Su
Polyurethane	Su
Nitriles	Su
H-NBR	Su
Butyl Rubber	Su
Polysulfide	S
Nylon	S
Polytetrafluoroethylene	S
PEEK	S
ABS	U
Polypropylene	Su
Polyphenyl Sulfide	U
Polyethylene Terephthalate	Su
Polysulfone	Su
Polyimide	S
Polyetherimide	S
Polyphthalamide	Su
Polyamideimide	S
Acetal	Su
Phenolic	S

S: Suitable
Su: Suitable with some exceptions
U: Unsuitable

Servicing considerations

Genetron® 407C is a ternary blend of HCF-32/HFC-125/HFC-134a. This product can generally be used to successfully retrofit existing Genetron® 22 systems. Unlike pure fluids and azeotropes, blends boil and condense at varying temperatures for a given pressure. The range over which the temperature varies is referred to as temperature glide. Genetron® 407C has moderately high temperature glides between about 5°C and 7°C, depending upon pressure.
Technicians should use a throttling device to avoid slugging the compressor with liquid and causing damage to the compressor.

Safety

Honeywell recommends reading the Material Safety Data Sheet (MSDS) before using Genetron® 407C.

Toxicity

Genetron® 407C can be safely used in all of its intended applications, based on data developed by the Program for Alternative Fluorocarbon Toxicity Testing (PAFT 1,3,5).

Leaks

If a large release of Genetron® 407C 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, Genetron® 407C is classified in safety group A1/A1, i.e., it is non-flammable at 1 atm. pressure (101.3 kPa) and 18°C.

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.

Retrofitting existing systems

As the industry moves away from the use of CFCs and HCFCs, refrigerant service personnel will play a key role in the transition to HFC alternatives through retrofitting. Honeywell has prepared the following guidelines to help service technicians better understand the various technical and operational aspects of performing retrofits on air conditioning or refrigeration systems using Honeywell's Genetron® 407C. Although the information can be helpful as a general guide, it should not be used as a substitute for the equipment manufacturers specific recommendations. For this reason, Honeywell recommends contacting the equipment manufacturer for detailed information on retrofitting the specific equipment under consideration. And, always refer to the MSDS for safety information on the use of Genetron® 407C.

Applications

Since Genetron® 407C is a close match to Genetron® 22, it also serves as a retrofit fluid in many applications where Genetron® 22 is generally used, including unitary air conditioning, positive displacement chillers and commercial refrigeration.

Retrofit

Genetron® 407C can be used successfully as a retrofit fluid, but may require some system modifications such as changing the lubricant. Mineral oils and alkylbenzene lubricants, which have been used traditionally with Genetron® 22 are immiscible with Genetron® 407C and must therefore be replaced with new lubricants. Consult the original equipment manufacturer for the recommended lubricants.

Storage and handling

Genetron® 407C must be only liquid charged into a system to ensure proper refrigerant composition and system performance.

Bulk and cylinder

Some special handling and storage procedures are required for Genetron® 407C to minimise or prevent liquid compositional changes, particularly those occurring during liquid level depletion or vapour leaks from the storage container. Because these procedures and/or systems are sometimes site specific for designed leak storage systems, contact a Honeywell Technical Service Representative to discuss each application.

Among the most important handling practices that must be followed for Genetron® 407C is to ensure that all transfers be executed by using liquid flow instead of vapour. This practice will help minimise compositional changes in the liquid phase and, as a result, provide a more consistent product. Genetron® 407C 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 Genetron® 407C should be kept out of direct sunlight, especially in warm weather. Liquid Genetron® 407C 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 Genetron® 407C 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 Genetron® 407C. 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.

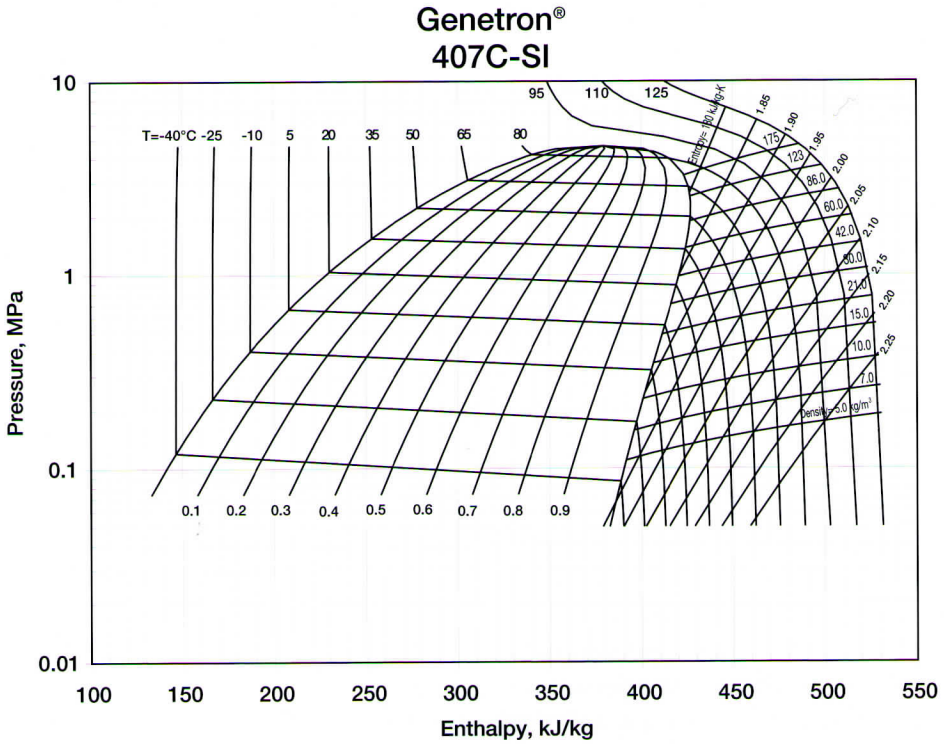
Available literature

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

Please ask for Honeywell's software package containing Refrigerant Properties, Cycle Analysis and Pipe Sizing.

All literature and information can be found at: www.honeywellrefrigerants.com

Pressure-Enthalpy Diagram



Honeywell Fluorine Products Europe B.V.
Laarderhoogtweg 18
1101 EA Amsterdam
The Netherlands

Honeywell Belgium N.V.
Haasrode Research Park,
Grauwmeer 1
B-3001 Heverlee
Belgium
Tel: +32 16-391 278
Fax: +32 16-391 277

www.honeywellrefrigerants.com

Honeywell

DS407C-UK-HRE 0705-1
September 2007