

MORE ABOUT

In order to cope with the recent regulations, Arkema has developed a comprehensive range of new refrigerants based on HFCs (hydro-fluorocarbons) having no impact on the ozone layer.

HFC-134a, commercialised by Arkema under the trade name FORANE[®] 134a, has been chosen worldwide by most Original Equipment Manufacturers (OEMs) thanks to the excellence of its performance, as the long-term substitute of CFC-12 in applications such as:

- mobile air-conditioning,
- industrial A/C (centrifugal chillers),
- domestic refrigeration,
- transport and commercial refrigeration,
- industrial refrigeration.

In addition, R-134a is now being introduced in some commercial air conditioning applications (chillers fitted with scroll and screw compressors).

Like all HFCs, R-134a requires the use of synthetic oils, such as polyolester (POE) or polyalkylene-glycol (PAG) lubricants, to ensure the optimum oil return to the compressor.

CHARACTERISTICS

Like all refrigerants marketed by Arkema, FORANE[®] 134a complies with the most stringent criteria in terms of non-flammability and non-toxicity. Its use is not subject to any particular constraint, compared to CFC-12.

REFERENCES

FORANE[®] 134a is approved by all compressor manufacturers and other compatible components, such as heat exchangers, filter driers, etc., are available from major international suppliers.

Properties	Units	CFC-12	FORANE [®] 134a
Chemical formula	-	CCl ₂ F ₂	CF ₃ CH ₂ F
Molecular weight	g/mol	120.9	102.0
Boiling point (at 1.013 bar a)	°C	-29.8	-26.1
Liquid density (at 25 °C)	kg/dm ³	1.310	1.206
Saturated vapour density (at 1.013 bar a)	kg/m ³	6.32	5.28
Critical temperature	°C	112	101
Critical pressure	bar	41.1	40.7
Critical density	kg/m ³	0.558	0.512
Latent heat of vaporisation (at 1.013 bar a)	kJ/kg	165.3	215.9
Specific heat at 25°C			
• liquid	kJ/(kg.K)	1	1.46
• vapour (at 1.013 bar a)	kJ/(kg.K)	0,617	0.858
Flammability limits in air	% vol	none	none
ODP	-	1	0

FORANE® 134a

What is the meaning of FORANE® 134a?

FORANE® 134a is the Arkema commercial designation for the refrigerant R-134a. This last standard code given by ASHRAE standard 34

reflects the precise chemical structure of this molecule: $\text{CF}_3\text{CH}_2\text{F}$.

Is FORANE® 134a a long term refrigerant?

YES.

FORANE® 134a is an environmentally friendly refrigerant which does not deplete the ozone layer (ODP zero) and is therefore not subject to any phase-out regulation.

What are the main advantages of FORANE® 134a?

FORANE® 134a is a pure refrigerant, commercially available worldwide at industrial level. Rigorous specifications are warranted by Arkema. Furthermore, the product is non-toxic, non-

flammable and complies with the most severe safety standards, such as those established by ASHRAE and Underwriters Laboratories (UL) in the United States of America.

How does FORANE® 134a perform versus CFC-12?

Thermodynamic properties of CFC-12 and R-134a are very close. Both products offer equivalent level in terms of performance (cf. back page). Since the

CFC-12 phase out, technological improvements have enabled the nowadays FORANE® 134a equipments to outperform older R-12 types.

What kind of oil is to be used with FORANE® 134a?

For most applications, polyolester (POE) oils are the lubricant of choice. For automotive air-conditioning, polyalkyleneglycol (PAG) oils are preferred.

QUESTIONS AND ANSWERS

Can we service CFC-12 installations with FORANE® 134a?

NO.

When blending both fluids, CFC-12 and HFC-134a, an azeotropic composition can be reached resulting in a higher pressure blend (versus CFC-12).

It will imply serious discrepancies of the normal original operating conditions of CFC-12 installation.

Is any specific care required when handling FORANE® 134a?

NO.

There is no specific constraint with the manipulation of FORANE® 134a compared to that of CFC-12. Nevertheless special attention must be paid with the polyolester or polyalkyleneglycol lubricants that are more hygroscopic compared to the traditional mineral (or alkylbenzene) oil used with CFC-12.

As well, when looking for leaks on installations running with FORANE® 134a, like it has always been the case with installations running with CFCs or HCFCs, search must be conducted by using **dry nitrogen only**, to pressurize the system (after proper removal of the refrigerant).

Is FORANE® 134a a retrofit option for CFC-12 existing installations ?

YES.

The retrofit of existing systems from CFC-12 to FORANE® 134a is possible in many cases in terms of performance with small modifications (material compatibilities, filter drier change, etc.). Nevertheless, one has to remove the original mineral (or alkylbenzene) lubricant and replace it

by a polyolester or polyalkyleneglycol type of lubricant. Therefore, a flushing procedure of the system must be rigorously followed. Over the past years, many OEMs and contractors have already experienced this operation on the field with success.

GENERAL RETROFIT PROCEDURE FOR CFC-12 → FORANE® 134a?

- Ensure that the CFC-12 installation is in a good state of repair.
- Flush the installation to remove the mineral (or alkylbenzene) oil until intended residual level.
- Charge the polyolester (or polyalkyleneglycol) lubricant.
- Recover and estimate the CFC-12 charge.
- Replace filter drier and non-compatible components then vacuum pump the installation.
- Install FORANE® 134a at a rate of approximately 85-90% in weight of the CFC-12 charge.
- Gradually top up the charge until optimum performance is achieved.
- Affix the FORANE® 134a label.

What are the main advantages of FORANE® 134a?

FORANE® 134a is the best single fluid with zero ODP which replaces CFC-12.
FORANE® 134a has a high critical temperature

which ensures a very good coefficient of performance especially at high condensing temperatures in air-cooled systems.

SATURATION TABLE

Temperature (°C)	Absolute pressure (bar)
-40	0.512
-35	0.661
-30	0.844
-25	1.064
-20	1.327
-15	1.638
-10	2.004
-5	2.431
0	2.925
5	3.492
10	4.141
15	4.878
20	5.710
25	6.647
30	7.695
35	8.863
40	10.159
45	11.594
50	13.176
55	14.914
60	16.820
65	18.904
70	21.177
75	23.651
80	26.339
85	26.256
90	32.420

COMPARATIVE PERFORMANCE

Variations with CFC-12	FORANE® 134a
Δ Discharge pressure	~ 1.5 bar
Δ Discharge temperature	0 à – 10 K
Δ Refrigeration capacity	0 à – 10 %
Δ COP	Equivalent

(Data obtained from field tests).

These comparisons were realized on equivalent systems.

The real practical level of performance observed with FORANE® 134a when compared to R-12 depends on the type of equipment being considered.

Considering the constant improvements in technologies, new FORANE® 134a equipments now do outperform older R-12 types.

www.forane.com

The information contained in this document is based on trials carried out by our Research Centre and data selected from the literature, but shall in no event be held to constitute or imply any warranty, undertaking, express or implied commitment from our part. Our formal specifications define the limit of our commitment. No liability whatsoever can be accepted by Arkema with regard to the handling, processing or use of the product or products concerned which must in all cases be employed in accordance with all relevant laws and/or regulations in force in the country or countries concerned.



Arkema - 4/8, cours Michelet - 92800 Puteaux (France) - Tél. : (33) 1 49 00 76 50 - Fax : (33) 1 49 00 53 12
www.Arkema.com

DFL December 2004