

MORE ABOUT

Manufacture of CFCs (ChloroFluoro-Carbons) such as CFC-12 ceased in many countries on December 31st, 1995 in accordance with the requirements of the Montreal Protocol and the use of CFCs for the maintenance and servicing of existing installations is forbidden since January 1st, 2001 in the European Union. Arkema has been developing a comprehensive range of refrigeration fluids for retrofitting existing installations which have hitherto run on CFCs, for all their applications.

One of these substitutes is FORANE® FX 56 (R-409A), a blend of HCFC fluids (HydroChloroFluoroCarbons), which Arkema has developed to replace CFC-12 in most of its applications, as described on the second page. Available from Arkema and its worldwide distribution network, FORANE® FX 56 (R-409A) allows users to retain existing CFC-12 installations.

The performance of this fluid is equivalent to that of CFC-12 in most applications. The compatibility and miscibility of FORANE® FX 56 (R-409A) with the mineral oils traditionally used with CFC-12 make it the ideal solution for retrofitting existing installations, particularly when an oil change is difficult e.g. in hermetic technology.

However, it must be pointed out that FORANE® FX 56 (R-409A) is not suitable to replace R-12 in vehicles air conditioning systems.

CHARACTERISTICS

FORANE® FX 56 (R-409A) 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® FX 56 (R-409A) is recognized by all major equipment manufacturers, whose recommended conversion procedures -when available- should be followed in the first instance.

The retrofit procedure summarised on page 4 of this document is given as an indication only.

Properties	Units	CFC-12	FORANE® FX 56 (R-409A)
Components	-	CCl ₂ F ₂	R-22, 124, 142b
Composition	% weight	100	60/25/15
Molecular weight	g/mol	120.9	97.4
Bubble temperature (at 1.013 bar a)	°C	- 29.8	-34.5
Temperature glide (at 1.013 bar a)	K	0	7.1
Liquid density (at 25°C)	kg/dm ³	1.31	1.22
Density of saturated vapour (at 1.013 bar a)	kg/m ³	6.33	4.97
Critical temperature	°C	112	106.8
Critical pressure	bar	41.1	46
Critical density	kg/m ³	0.558	0.514
Latent heat of vaporisation (at 1.013 bar a)	kJ/kg	165.1	220
Specific heat at 25°C			
• liquid	kJ/(kg.K)	1	1.25
• vapour (at 1.013 bar a)	kJ/(kg.K)	0.606	0.703
Flammability limits in air	-	none	none
ODP	-	1	0.05

FORANE® FX 56 (R-409A)

What are the application areas for FORANE® FX 56 (R-409A)?

FORANE® FX 56 (R-409A) is designed for use in the conversion of existing installations running with CFC-12 for domestic, commercial and transport refrigeration (refrigerated containers...). However, FORANE® FX 56 (R-409A) is not the adequate solution for industrial applications (centrifugal compressors, flooded evaporators) and mobile air

conditioning applications (cars, buses, truck cabins, agricultural vehicles...) where the recommended solution is FORANE® 134a. Indeed, FORANE® FX 56 (R-409A), a HCFC based blend containing HCFC-22, is generally not compatible with the flexible hoses, joints and other plastic materials used in these vehicle air conditioning systems.

What does R-409A mean?

This number has been allocated to the FORANE® FX 56 (R-409A) blend by the ASHRAE standard 34. It denotes very precise characteristics such as the

nature and percentage of the blend components (see front page), as well as the manufacturing specifications.

Why choose a blend?

FORANE® FX 56 (R-409A) was formulated to provide the same characteristics as CFC-12, thereby avoiding the need for modifications when

retrofitting existing installations. No pure fluid exists which features this property.

How should FORANE® FX 56 (R-409A) be installed?

- After recovering CFC-12, FORANE® FX 56 (R-409A) should be charged in liquid phase, as it is the case for all blends (see procedure on page 4).
- The optimum charge of FORANE® FX 56 (R-409A) is about 15% less by weight than the nominal charge of CFC-12. In this respect, do not rely solely on the equipment liquid sight-glass,

which may still be “bubbling” after the appropriate charge has been installed.

- Use the pressure-temperature ruler rather than the CFC-12 references shown on the equipment manometers.

What “tools” should be used to install FORANE® FX 56 (R-409A)?

- a) Saturation table (see page 4): relative pressure of saturated vapour (adjustment of superheating) and saturated liquid (adjustment of high pressure line) at given temperatures.
- b) Mollier diagram.
- c) Pressure-temperature ruler for FX 56 - R-12 comparison.

- d) FORANE® FX 56 labels (red colour code) to feature on equipment.

A FORANE® calculation software programme is also available, free of charge from our website www.forane.com.

QUESTIONS AND ANSWERS

Does the installation require any modification?

NO

Except for the filter drier which must be compatible with FORANE® FX 56 (R-409A) (R-22 or HFC

type). Expansion valves (thermostatic or capillary) do not need to be changed.

Should the oil be changed?

NO

FORANE® FX 56 (R-409A) is compatible and miscible with the oils traditionally used with CFC-12

(mineral or alkylbenzene), and allows a good oil return to the compressor.

Should any adjustments be made to the installation?

YES

Ensure superheating at the evaporator is adequate. To adjust, use the pressure-temperature rulers. The saturated vapour (or “dew”) temperature of

FORANE® FX 56 (R-409A) should be used as a reference for the setting.

Can further quantities of FORANE® FX 56 be added in case of leaks?

YES

- In cases of malfunction or emergency stops caused by undersupply to the installation exchangers, the FORANE® FX 56 (R-409A) charge may be topped up.

- In cases of significant accidental loss of refrigerant, a full new charge of refrigerant fluid should be installed again, after the installation has been repaired.

Is FORANE® FX 56 (R-409A) toxic or flammable?

NO

FORANE® FX 56 (R-409A) offers excellent safety of use, like CFC-12. It is classified A1/A1 as per

ASHRAE standard 34 (non-flammable and non-toxic).

Can FORANE® FX 56 (R-409A) be blended with other refrigerants?

NO

Blending FORANE® FX 56 (R-409A) with another refrigerant fluid generally results in a loss of equipment performance as well as non conformity of the fluid commercial specification.

In addition, this is not recommended by equipment manufacturers, and it impairs the recovery and recycling of FORANE® FX 56 (R-409A).

Retrofit procedure for CFC-12 → FORANE® FX 56

- Ensure that the CFC-12 installation is in a good state of repair.
- Recover and weigh the CFC-12 charge.
- Replace the filter drier, and vacuum pump the installation.
- Install FORANE® FX 56 (R-409A), in the liquid phase, at a rate of approximately 80% of the weight of the CFC-12 charge.
- Gradually top up the charge until optimum performance is achieved.
- Adjust the superheating, and affix the FORANE® FX 56 (R-409A) label.

SATURATION TABLE

Temperature (°C)	PRESSURE (absolute bar)	
	Saturated liquid Bubble pressure	Saturated vapour Dew pressure
- 40	0.78	0.57
- 35	0.99	0.72
- 30	1.23	0.90
- 25	1.53	1.12
- 20	1.87	1.38
- 15	2.26	1.68
- 10	2.71	2.03
- 5	3.23	2.44
0	3.82	2.91
0	4.48	3.45
+ 5	5.22	4.07
+ 15	6.05	4.76
+ 20	6.97	5.55
+ 25	7.98	6.44
+ 30	9.11	7.44
+ 35	10.34	8.55
+ 40	11.69	9.80
+ 45	13.17	11.18
+ 50	14.78	12.72
+ 55	16.54	14.42
+ 60	18.44	16.30
+ 65	20.52	18.38
+ 70	22.76	20.67
+ 75	25.19	23.18
+ 80	27.82	25.95

COMPARATIVE PERFORMANCE

Variation with CFC-12	FORANE® FX 56 R-409A
Δ Discharge pressure	~ + 1.5 bar a
Δ Discharge temperature	0 to 10 K
Δ Refrigeration capacity	+ 1 to 15 %
Δ COP	0 to + 5 %

(Data obtained from field tests)

www.forane.com

The information contained in this document is based on trials carried out by our Research Centres 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