

MORE ABOUT

The replacement of CFCs in the fields of refrigeration and air conditioning is already effective on the field. The regulation on ozone depleting substances will also lead to the replacement of HCFCs including R-22. Moreover, more severe restrictions on the use of HCFCs for new installations already apply in the European Union (regulation # 2037/2000).

Arkema is now offering a complete range of HFC substitutes with no effect on the ozone layer. FORANE® 410A is one of these products, mostly dedicated to small and medium size air-conditioning applications as a R-22 replacement.

CHARACTERISTICS

FORANE® 410A is a two component blend based on HFC-32 and HFC-125. It is classified A1/A1 by ASHRAE Standard 34 (i.e. non flammable and non toxic).

Rigorous specifications are also warranted by Arkema (composition, water content).

Properties	Unit	FORANE® 22	FORANE® 410A
Components	-	CHClF ₂	HFC-32 HFC-125
Composition	% weight	-	50/50
Molecular weight	g/mol	86.5	72.6
Bubble temperature (at 1,013 bar a)	°C	-40.7	-52.2
Temperature glide (at 1,013 bar a)	K	-	0.1
Liquid density (at 25 °C)	kg/dm ³	1.194	1.061
Density of saturated vapour (at boiling point)	kg/m ³	4.70	4.12
Vapour pressure at :			
• 25°C	Bar a	10.4	16.4
• 50°C	Bar a	19.4	30.5
Critical temperature	°C	96	72.2
Critical pressure	Bar a	49.8	49.5
Critical density	kg/dm ³	0.525	0.491
Latent heat of vaporisation (at 1,013 bar a)	kJ/kg	233.7	271.5
Specific heat at 25 °C			
• liquid	kJ/(kg.K)	1.26	1.86
• vapour (at 1,013 bar a)	kJ/(kg.K)	0.662	0.819
Ratio of specific heat Cp/Cv (at 25°C and 1.013 bar a)		1.185	1.172
Flammability limits in air		None	None
ODP		0.055	0

FORANE[®] 410A

What are the main fields of application of FORANE[®] 410A?

FORANE[®] 410A has been mainly developed for new comfort air conditioning systems up to a few tens of kW and for reversible cycle heat pumps, where R-22 has been traditionally used.

Some larger power systems (water cooled, screw type) are also available for maritime or industrial applications.

What are the main characteristics of FORANE[®] 410A?

FORANE[®] 410A is a near azeotropic blend (temperature glide is 0.1 K) of HFC-32 and HFC-125, and therefore its behaviour is very close to that of a single component fluid such as R-22. FORANE[®] 410A offers attractive thermodynamic properties. It has a higher volumetric cooling capacity compared to R-22 and better thermal exchange properties.

However, pressures generated by FORANE[®] 410A are higher (+ 50 % versus R-22) and the critical temperature is relatively low (72.2°C). It is therefore necessary for OEMs to re-design equipment to take into account these characteristics. The performance in heating mode is another asset of FORANE[®] 410A that can explain the choice made by Japanese heat pump manufacturers.

How should FORANE[®] 410A be handled?

As for any blend, FORANE[®] 410A should be charged into a system in the liquid phase. In the event of a leak, since FORANE[®] 410A is a near

azeotropic blend, it is possible to top up the fluid charge and there is no requirement to remove the remaining refrigerant charge.

What kind of lubricant is used with FORANE[®] 410A?

FORANE[®] 410A is a HFC based blend, so polyolester (POE) or polyvinylether (PVE) oils are used to ensure satisfactory lubrication and

miscibility which allows good oil return to the compressor.

When to replace R-22?

Montreal Protocol calls for a progressive reduction of quantities of HCFCs being introduced on the market in Europe and based on the EC Regulation # 2037/2000, restrictions already apply to its use in new systems.

In this case, the use of a HFC type refrigerant such as FORANE[®] 410A is recommended.

QUESTIONS AND ANSWERS

Can FORANE® 410A be used as a R-22 retrofit refrigerant?

NO

Due to the pressure increase compared to R-22 and the higher cooling capacity (+ 40 %), it is not possible to use FORANE® 410A in equipment originally designed for R-22.

In such systems, Arkema recommends to use two other fluids :

- FORANE® 407C, which has properties that are close to that of R-22. The conversion will follow a rigorous retrofit procedure that includes a careful oil change from mineral or alkylbenzene to polyolester,

- FORANE® FX 100, a simplified retrofit option as it only requires one mineral or alkylbenzene oil draining and its replacement by a polyolester oil to ensure optimal performances of the system. No long and costly rinsing process of the circuit is necessary.

Is FORANE® 410A the only R-22 substitute?

NO

For air-conditioning applications, several fluids have a role to play. FORANE® 134a, a common R-12 substitute (mobile air-conditioning, centrifugal systems), is also used to replace R-22 in large systems with over 100 kW cooling capacity (with screw and centrifugal compressors). For small and medium size applications (hermetic and semi-hermetic systems up to 300 kW), FORANE® 407C has already been adopted by major equipment

manufacturers to comply with the regulations that ban the use of HCFCs in new systems in Europe. Besides, FORANE® 410A is already widely used by Japanese OEMs in small air conditioning systems (less than 30 kW with hermetic rotating or scroll compressors). Its use for other applications may still depend on the availability of the dedicated components and equipments.

SATURATION TABLE

PRESSURE (bar a)	TEMPERATURE (°C)		PRESSURE (bar a)	TEMPERATURE (°C)	
	saturated liquid	saturated vapour		saturated liquid	saturated vapour
2	- 37.2	- 37.1	9.2	5	5.1
2.5	- 31.8	- 31.7	9.4	5.7	5.8
3	- 27.2	- 27.2	9.6	6.3	6.4
3.5	- 23.3	- 23.2	9.8	7	7.1
4	- 19.7	- 19.6	10	7.7	7.8
4.5	- 16.5	- 16.4	10.2	8.3	8.4
5	- 13.5	- 13.4	10.4	9	9.1
5.2	- 12.4	- 12.3	10.6	9.6	9.7
5.4	- 11.3	- 11.2	10.8	10.3	10.4
5.6	- 10.3	- 10.2	11	10.9	11
5.8	- 9.2	- 9.2	11.5	12.4	12.5
6	- 8.2	- 8.2	12	13.8	13.9
6.2	- 7.3	- 7.2	14	19.2	19.3
6.4	- 6.3	- 6.2	16	24.1	24.2
6.6	- 5.4	- 5.3	18	28.5	28.6
6.8	- 4.5	- 4.4	20	32.5	32.6
7	- 3.6	- 3.5	22	36.3	36.4
7.2	- 2.8	- 2.7	24	39.8	39.9
7.4	- 1.9	- 1.8	26	43.1	43.2
7.6	- 1.1	- 1	28	46.2	46.3
7.8	- 0.3	- 0.2	30	49.2	49.2
8	0.5	0.6	32	52	52
8.2	1.3	1.4	34	54.6	54.7
8.4	2	2.1	36	57.2	57.3
8.6	2.8	2.9	38	59.7	59.7
8.8	3.5	3.6	40	62	62.1
9	4.3	4.3	42	64.3	64.3

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