

MORE ABOUT

According to the Montreal Protocol and its various amendments, Ozone depleting substances, among them CFCs (ChloroFluoroCarbons) such as R-502 and HCFCs (HydroChloro-FluoroCarbons) such as R-22, will finally be phased out.

Consequently, Arkema is now offering a complete range of HFC substitutes with no effect on the ozone layer. These solutions allow the construction of energy efficient refrigeration or air-conditioning installations, thus more respectful to the environment.

FORANE[®] 404A (FX 70) is one of these products, mostly dedicated to commercial, transport and industrial refrigeration. Used in new refrigeration installations from -45°C to +15°C (evaporation temperature) FORANE[®] 404A (FX 70) offers similar to better performance compared to R-502 and R-22 without any specific handling concern.

CHARACTERISTICS

FORANE[®] 404A (FX 70) is a three component blend based on HFC-125, 143a and 134a. It is classified A1/A1 by ASHRAE Standard 34 (i.e. non-flammable and non-toxic). Its use is not subject to any particular constraint, compared to R-502.

REFERENCES

FORANE[®] 404A (FX 70) is recognised by all major equipment manufacturers, offering a complete range of commercial equipment (compressors, display cases, reefer containers...), as well as **by many supermarket chains all over the world.**

Properties	Units	R-502	FORANE [®] 404A (FX 70)
Components	-	R-22, R-115	R-125, R-134a, R-143a
Composition	% weight	48.8/51.2	44/4/52
Molecular weight	g/mol	111.6	97.6
Bubble temperature (at 1,013 bar a)	°C	-45.4	-46.4
Temperature glide (at 1,013 bar a)	K	0	0.9
Saturated liquid density (25 °C)	kg/dm ³	1.217	1.04
Saturated vapour density (at 1,013 bar a)	kg/m ³	6.22	5.41
Critical temperature	°C	82.1	72
Critical pressure	bar	40.7	37.2
Latent heat of vaporisation (at 1,013 bar a)	kJ/kg	172.5	200
Specific heat at 25 °C			
• Liquid	kJ/(kg.K)	1.25	1.64
• Vapour (at 1,013 bar a)	kJ/(kg.K)	0.70	0.88
Flammability limits in air		none	none
ODP		0.34	0

FORANE® 404A (FX 70)

What are the application fields for FORANE® 404A (FX 70) ?

FORANE® 404A (FX 70) is formulated for use in low temperature single stage applications (evaporation temperature $\geq -45^{\circ}\text{C}$) and is commonly used in commercial, transport and industrial refrigeration. Moreover, this refrigerant

can be used in cascade, multistage or liquid injection systems with good results. FORANE® 404A (FX 70) is also efficient at higher temperatures (up to $+15^{\circ}\text{C}$ evaporation) and allows the use of small displacement compressors.

When to use FORANE® 404A (FX 70)?

Now.

In article 2 countries (according to the Montreal Protocol), R-502 is no longer produced and R-22 is or will be phased out in the future depending on the

local regulations. An installation designed with FORANE® 404A (FX 70) will reach the end of its life without needing a refrigerant change.

What does R-404A mean?

The number has been allocated to the FORANE® 404A (FX 70) blend by the ASHRAE standard 34. It lists 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?

None single available component satisfies the equipment manufacturers' technical requirements.

Are there other replacements for R-22 in refrigeration and A/C?

In low and medium temperature refrigeration applications, R-22 has been successfully replaced by FORANE® 404A (FX 70) since 1994-1995 with specific technical benefits.

In air-conditioning, FORANE® 134a serves as a R-22 alternative for equipment with relatively large refrigerating power (from 100 kW).

FORANE® 407C and FORANE® 410A replace R-22 for direct expansion air-conditioning systems. FORANE® 404A (FX 70) can also be applied in this kind of application where a water-cooled condenser is used (or when the outside temperature is moderate).

QUESTIONS AND ANSWERS

Is FORANE® 404A (FX 70) toxic or flammable?

NO

FORANE® 404A (FX70) offers excellent safety of use, like R-502. It is classified A1/A1 as per ASHRAE standard 34 (non-flammable and non-

toxic), and is also UL approved as practically non flammable (the most severe flammability test applied in the industry).

What kind of oil is to be used with FORANE® 404A (FX 70)?

As FORANE® 404A (FX70) is based on HFCs, polyolester (POE) oils are used to ensure miscibility

and good oil return to the compressor.

Is it possible to top-up the fluid during servicing?

YES

After several years of extensive use in the field, it is confirmed that the impact of a leak on the composition of FORANE® 404A (FX 70) is not

detectable. Therefore, maintenance practices are the same as with R-502.

Can FORANE® 404A (FX 70) be used in any type of equipment?

YES

FORANE® 404A (FX70) can be used in any kind of systems with evaporation temperature ranging from -45°C to +15°C. Field experience has shown that

FORANE® 404A (FX 70) can be successfully used in systems fitted with flooded evaporators or low-pressure liquid receivers.

Can FORANE® 404A (FX 70) be used as a R-502 retrofit refrigerant?

FORANE® 404A (FX70) can be used in recent R-502 systems with some modifications, including the change to a POE type oil. However, Arkema

developed FORANE® FX 10 (R-408A) as a specific drop-in refrigerant with properties that exactly match those of R-502.

SATURATION TABLE

PRESSURE (bar a)	TEMPERATURE (°C) saturated vapour
1	-45.8
1.1	-43.8
1.2	-41.9
1.3	-40.1
1.4	-38.5
1.6	-35.5
1.8	-32.7
2	-30.2
2.2	-27.8
2.4	-25.7
2.6	-23.6
2.8	-21.7
3.2	-18.1
3.6	-14.9
4.0	-12.0
5.0	-5.4
6.0	0.2
7.0	5.1
8.0	9.5
9.0	13.5
10	17.2
12	23.9
14	29.7
16	35.0
18	39.8
20	44.2
22	48.3
24	52.1
26	55.7
28	59.1
30	62.3

PERFORMANCE COMPARISON

This performance comparison corresponds to a thermodynamic model, calculated using FORANE® software available free of charge on FORANE® pages (www.forane.com) of our web site.

Standard cycle : -40°C/+43°C, suction 18°C, sub cooling 10K.

Variation with R-502	R-22	FORANE® 404A (FX 70)
Δ Discharge temperature	+ 52 K	- 10 K
Refrigeration capacity	91 %	103 %
COP	100 %	99 %

The technical practical performance observed with FORANE® 404A (FX 70) depends on the type of equipment used, the refrigeration cycle and the ambient conditions.

Generally, the performance of FORANE® 404A (FX 70) is similar or better than that of R-502 and R-22 one in an optimised system and there is no doubt, as technology improves, that FORANE® 404A (FX 70) equipments will soon be much more efficient than old CFC and HCFC ones.

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DFL December 2004