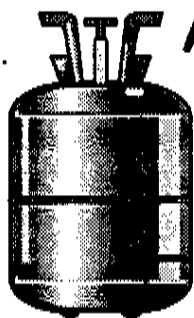


Elf Atochem
ATO



TECH DIGEST

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Forane® 404A

Forane® 404A is a zero ozone depletion potential (ODP), near azeotropic blend of HFC refrigerants R-125, R-143a, and R-134a. Forane® 404A is formulated to closely match the properties of R-502, which make it useful for a variety of medium and low temperature refrigeration applications.

New Systems

Forane® 404A has been approved by many refrigeration compressor and system manufacturers for use in new refrigeration equipment. Applications where R-404A equipment is available include food display and storage cases, cold storage rooms, ice machines, transportation, and process refrigeration.

Retrofit

Forane® 404A can be used to retrofit many existing R-502 systems. The physical and refrigeration properties of the blend cause it to behave much like R-502 when used in a retrofit; however it is not intended to be a direct, "drop-in" service fluid for

R-502 systems. (See the RETROFIT section).

This brochure provides a broad background of properties and technical information to help apply Forane® 404A to your refrigeration needs.

NOTE: R-404A is the ASHRAE Standard 34 Number Designation for the blend of R-125/143a/134a (44/52/4 wt %). Prior to the assignment of an ASHRAE number designation, Elf Atochem referred to this blend under the research label Forane® FX 70.

Forane® 404A: Basic Property Data

Chemical Formula:	R-125	(CF ₃ CHF ₂) - 44 wt %
	R-143a	(CF ₃ CH ₃) - 52 wt %
	R-134a	(CF ₃ CH ₂ F) - 4 wt %
Average Molecular Weight:		97.6
Bolling Point @ 1 atm:		- 50.4°F
Density of Saturated Vapor @ b.p.:		0.336 lb./cu. ft. ³
Density of Saturated Liquid @ 77°F:		64.86 lb./cu. ft. ³
Critical Temperature:		162°F
Critical Pressure:		542 psia
Latent Heat of Vaporization @ b.p.:		88.8 BTU/lb.
Specific Heat of Liquid @ 77°F:		0.359 BTU/lb. °F
Specific Heat of Vapor @ 1 atm, 77°F:		0.208 BTU/lb. °F
Maximum Temperature Glide:		1.5°F
Flammability Limits in Air:		non-flammable*
Ozone Depletion Potential (ODP):		0
Halocarbon Greenhouse Warming Potential (HGWP):		0.94

* Forane 404A does not propagate flame in ASTM E-681-95 at test temperatures up to 100°C

Pressure - Temperature Chart

for Forane® 404A and R-502

Temp (°F)	404A (psig) ^a	502 (psig)
-60	* 8.1	* 7.2
-50	* 1.0	* 0.2
-40	3.8	4.1
-30	9.1	9.2
-25	12.2	12.1
-20	15.5	15.3
-15	19.1	18.8
-10	23.1	22.6
-5	27.4	26.7
0	32.1	31.1
5	37.2	35.9
10	42.7	41.0
15	48.6	46.5
20	54.9	52.4
25	61.7	58.8
30	69.1	65.6
35	77.0	72.8
40	85.3	80.5
45	94.4	88.7
50	104.0	97.4
55	114.1	106.6
60	124.9	116.4
65	136.3	126.7
70	148.4	137.6
75	161.4	149.1
80	174.8	161.2
85	189.1	174.0
90	204.1	187.4
95	220.1	201.4
100	236.7	216.2
105	254.3	231.7
110	273.0	247.9
115	334.1	264.9
120	313.4	282.7
125	334.1	301.4
130	356.9	320.8

* Pressures provided in Inches Mercury Vacuum.

a. The pressure of Saturated Vapor (Dew Point pressure) has been provided for Forane 404A in this chart. This pressure is from 1 to 2 psi lower than the pressure generated by a cylinder of liquid refrigerant at the same temperature. The Dew Point pressure is more meaningful when using a Pressure - Temperature chart for purposes such as checking system operation during charging.

Forane® 404A: Engineering Data

Absolute Pressure psia	Bubble Pt. Temp. (°F) (liq)	Dew Pt. Temp. (°F) (vap)	Density (lb./cu. ft.)		Enthalpy (BTU/lb.)	
			Liquid	Vapor	Liquid	Vapor
5	-86.85	-84.90	85.29	0.123	-13.73	80.10
10	-64.10	-62.30	82.93	0.235	-7.19	83.60
15	-49.65	-48.00	81.37	0.344	-2.91	85.82
20	-38.50	-36.90	80.15	0.449	0.46	87.52
30	-21.60	-20.20	78.26	0.659	5.67	90.05
40	-8.70	-7.30	76.74	0.867	9.77	91.96
50	1.9	3.3	75.46	1.074	13.23	93.50
60	11.1	12.3	74.34	1.282	16.25	94.78
70	19.1	20.3	73.32	1.490	18.96	95.89
80	26.3	27.5	72.39	1.708	21.44	96.96
90	32.9	34.0	71.62	1.911	23.73	97.72
100	38.9	40.0	70.70	2.124	25.97	98.49
110	44.5	45.5	69.92	2.340	27.88	99.18
120	49.7	50.7	69.18	2.588	29.79	99.80
130	54.6	55.6	68.47	2.778	31.61	100.4
140	59.3	60.2	67.79	3.001	33.36	100.9
150	63.7	64.6	67.12	3.227	35.04	101.4
160	67.9	68.3	66.47	3.456	36.55	101.8
170	71.9	72.7	65.84	3.689	38.22	102.2
180	75.7	76.5	65.22	3.925	39.74	102.6
190	79.4	80.2	64.62	4.165	41.22	102.9
200	82.8	83.7	64.02	4.409	42.66	103.2
210	86.3	87.1	63.43	4.657	44.07	103.5
220	89.6	90.4	62.86	4.909	45.45	103.8
230	92.8	93.5	62.28	5.166	46.80	104.0
240	95.9	96.6	61.71	5.428	48.13	104.2
250	98.9	99.6	61.14	5.696	49.43	104.4
260	101.8	102.4	60.58	5.968	50.72	104.5
270	104.6	105.3	60.01	6.247	51.99	104.7
280	107.3	108.0	59.45	6.531	53.24	104.8
290	110.0	110.6	58.89	6.822	54.48	104.9
300	112.6	113.2	59.32	7.120	55.71	105.0
350	124.8	125.3	55.43	8.732	61.74	105.1
400	135.3	136.2	49.79	10.610	67.73	104.7

To calculate the Latent Heat of Vaporization, subtract the liquid enthalpy from the vapor enthalpy at the desired temperature.

Temperature Conversion: $^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9$

Pressure Conversion: $\text{psig} = \text{psia} - 14.7$ ($P > 14.7$)
 $\text{in. Hg Vacuum} = (14.7 - \text{psia}) \times 2.036$

Density Conversion: $\text{lb./cu. ft.} \quad \{\text{water} = 62.43 \text{ lb./cu. ft.}\}$
 $\text{lb./gal.} = \text{lb./cu. ft.} \div 7.48$
 $\{\text{water} = 8.35 \text{ lb./gal.}\}$
 $\text{g/ml} = \text{lb./cu. ft.} \times 0.016$
 $\{\text{water} = 1 \text{ g/ml}\}$

Elf Atochem Cylinder Identification

TYPE	COLOR CODE	SIZES NET LBS.
R-404A	Orange	24 (B), 100 (D)

Other Forane® Alternative Refrigerants

TYPE	COLOR CODE	SIZES NET LBS.
R-22 (CHClF_2)	Green	30 (B), 50 (C), 125 (D)
R-123 (CHCl_2CF_3)	Lt. Blue Grey	100 (E), 200 (E)
R-134a ($\text{CF}_3\text{CH}_2\text{F}$)	Light Blue	30 (B), 125 (D)
FX 56	Tan	30 (B)

Container Style

24/30 lb.
(B)



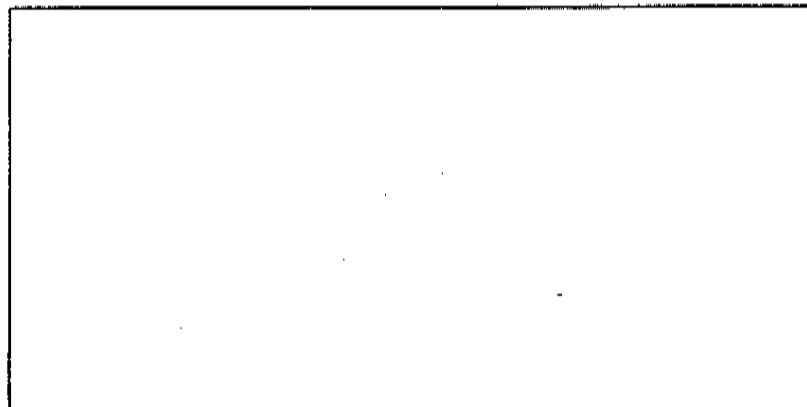
50 lb.
(C)



100/125 lb.
(D)



100/200 lb.
Drum
(E)



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