ZEPHEX®

HFA 134a

Medical Propellant

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IUPAC Name:

1,1,1,2-Tetrafluoroethane

Other Names:

Norflurane
HFA 134a

Relied upon by leading Metered Dose Inhaler (MDI) manufacturers for over twenty years, Zephex® 134a is by far the most widely used medical propellant in the world. Present in over 70% of MDIs it is used in nearly all the major high-volume formulations including salbutamol sulphate, beclomethasone dipropionate, ipratropium bromide, fluticasone and their numerous combinations.

Zephex® 134a is miscible with ethanol in all proportions, and with a liquid density of around 1.22g/cm^3 (see table) it can effectively support a number of suspension formulations such as salbutamol sulphate and fluticasone. Such alcohol free suspension formulations often require the use of coated or plasma treated cans, which inhibits drug adhesion to the walls.

With the addition of a few percent of ethanol, it can also facilitate some solution formulations such as beclomethasone dipropionate.

It is also suitable for use with suspended drugs when used with ethanol as an excipient in levels up to 10%, such formulations normally requiring plain aluminium cans unless there is a corrosion concern.

Zephex® 134a is a colourless, odourless gas, boiling at -26.2°C, which can be liquefied under pressures of 4-5 bar(g) (see tables) at normal ambient temperatures.

It has no ozone depletion and a mid-range global warming potential of around 1420.

Property		Units	Value
Molecular Weight			102.03
Boiling Point	(1atm)	°C	-26.1
Melting Point		°C	-103.0
Critical Temperature		°C	101.0
Critical Pressure		bara	40.56
Critical Volume		m^3/kg	1.97×10^{-3}
Critical Density		kg/m^3	507.6
Saturated Vapour Density at nBPt		kg/m^3	5.26
Vapour Pressure	(25°C)	bara	6.652
Latent Heat of Evaporation at nBPt			216.8
Coefficient of Thermal Expansion	(LIQ, 0-20°C)	/°C	0.002766
Solubility of HFA 134a in Water	(20°C/1atm)	% w/w	0.0773
Solubility of Water in HFA 134a	(25°C/1atm)	% w/w	0.11
Flammability in Air	(1atm)		None
Autoignition temperature		°C	770
Liquid dielectric constant	(25°C)		9.51
Vapour dielectric constant	(25°C/1 atm)		1.014
Dielectric strength	(R12=1)		0.5
Dipole moment			2.06

Liquid Density	
$d_{liq} = A + Bx + Cx^2 + Dx^3 + Ex^4$ where $x = (1-(T/T_c))^{(1/3)}$	
A = 508	T = Temperature K
B = 967.57693	T_c = Critical Temperature K
C = 298.02172	d_{liq} kg/m^3
D = 79.877831	
E = 89.838713	

Liquid Viscosity	
$Ln(\mu_{liq}) = A + B/T + CT + DT^2$	
A = -9.707292	T = Temperature K
B = 1140.7291	μ_{liq} = cP
C = 0.0282451	
D = -4.6720×10^{-5}	

Saturated Vapour Density	
$d_{vap} = A + Bx + Cx^2 + Dx^3 + Ex^4$ where $x = (I-(T/T_c))^{(1/3)}$	
For T = -50 to 0°C	
A = -113.51	T = Temperature K
B = 3335.18	T_c = Critical Temperature K
C = -11368.8	d_{vap} kg/m^3
D = 13688.75	
E = -5583.8	
For T = 0°C to +80°C	
A = 388.752	T = Temperature K
B = 84.07428	T_c = Critical Temperature K
C = -3500.71	d_{vap} kg/m^3
D = 5252.284	
E = -2202.55	

Saturated Vapour Viscosity	
$\mu_{vap} = A + BT + CT^2 + DT^3$	
A = -0.32671694	T = Temperature K
B = 0.003456914	μ_{vap} = cP
C = -1.1836 x 10-5	
D = 1.3599 x 10-8	

Temp °C	Liquid Viscosity	Sat Vat Viscosity	Liq Therm Cond	Sat Vap Therm Cond	Surface Tension
	cP	cP	W/m.K	W/m.K	mN/m
-50	0.54	-	0.115	-	19.2
-40	0.46	-	0.110	-	17.6
-30	0.40	-	0.106	-	16.1
-20	0.35	0.0105	0.101	0.0101	14.5
-10	0.31	0.0112	0.097	0.0114	13.0
0	0.27	0.0116	0.093	0.0123	11.6
10	0.24	0.0119	0.089	0.0130	10.1
20	0.21	0.0121	0.084	0.0137	8.76
25	0.20	0.0122	0.082	0.0140	8.09
30	0.19	0.0124	0.080	0.0144	7.42
40	0.17	0.0127	0.076	0.0153	6.13
50	0.15	0.0133	0.072	0.0165	4.89
60	0.13	0.0141	0.068	0.0182	3.72
70	0.11	0.0153	0.064	0.0205	2.61
80	0.10	0.0169	0.060	0.0235	1.60

Temp °C	Relative pressure bar(g)	Density kg/m^3		Temp K
		Liquid	Vapour	
-26	0.016	1376.4	5.28	247.15
-25	0.064	1373.4	5.51	248.15
-24	0.113	1370.5	5.75	249.15
-23	0.164	1367.5	6	250.15
-22	0.216	1364.4	6.25	251.15
-21	0.271	1361.4	6.52	252.15
-20	0.327	1358.4	6.79	253.15
-19	0.386	1355.4	7.07	254.15
-18	0.446	1352.3	7.36	255.15
-17	0.508	1349.2	7.66	256.15
-16	0.573	1346.2	7.97	257.15
-15	0.639	1343.1	8.29	258.15
-14	0.708	1340	8.62	259.15
-13	0.779	1336.9	8.96	260.15
-12	0.852	1333.7	9.31	261.15
-11	0.928	1330.6	9.68	262.15
-10	1.006	1327.4	10.05	263.15
-9	1.086	1324.3	10.43	264.15
-8	1.169	1321.1	10.83	265.15
-7	1.254	1317.9	11.23	266.15
-6	1.342	1314.7	11.65	267.15
-5	1.433	1311.5	12.08	268.15
-4	1.526	1308.2	12.53	269.15
-3	1.623	1305.0	12.98	270.15
-2	1.721	1301.7	13.45	271.15
-1	1.823	1298.4	13.94	272.15
0	1.928	1295.1	14.43	273.15
1	2.035	1291.8	14.94	274.15
2	2.146	1288.5	15.47	275.15
3	2.260	1285.1	16.01	276.15
4	2.376	1281.8	16.56	277.15
5	2.496	1278.4	17.13	278.15
6	2.619	1275.0	17.72	279.15
7	2.746	1271.6	18.32	280.15
8	2.876	1268.2	18.94	281.15
9	3.009	1264.7	19.57	282.15
10	3.146	1261.2	20.23	283.15
11	3.286	1257.8	20.90	284.15
12	3.430	1254.3	21.58	285.15
13	3.577	1250.7	22.29	286.15
14	3.728	1247.2	23.01	287.15
15	3.883	1243.6	23.76	288.15
16	4.042	1240.0	24.52	289.15
17	4.205	1236.4	25.30	290.15
18	4.371	1232.8	26.10	291.15
19	4.452	1229.2	26.93	292.15
20	4.717	1225.5	27.77	293.15
21	4.895	1221.8	28.64	294.15
22	5.078	1218.1	29.53	295.15

Standard State: At 0°C, Liquid Enthalpy = 100kJ/Kg, Liquid Entropy = 1kJ/kg.K

Temp °C	Relative pressure bar(g)	Density kg/m^3		Temp K
		Liquid	Vapour	
23	5.266	1214.3	30.44	296.15
24	5.457	1210.6	31.38	297.15
25	5.653	1206.8	32.34	298.15
26	5.854	1203.0	33.32	299.15
27	6.059	1199.2	34.33	300.15
28	6.268	1195.3	35.37	301.15
29	6.482	1191.4	36.43	302.15
30	6.701	1187.5	37.52	303.15
31	6.925	1183.5	38.63	304.15
32	7.154	1179.6	39.78	305.15
33	7.387	1175.6	40.95	306.15
34	7.625	1171.5	42.16	307.15
35	7.869	1167.5	43.39	308.15
36	8.118	1163.4	44.66	309.15
37	8.371	1159.2	45.96	310.15
38	8.631	1155.1	47.29	311.15
39	8.895	1150.9	48.65	312.15
40	9.165	1146.7	50.06	313.15
41	9.440	1142.4	51.49	314.15
42	9.721	1138.1	52.97	315.15
43	10.008	1133.7	54.48	316.15
44	10.300	1129.4	56.03	317.15
45	10.598	1124.9	57.62	318.15
46	10.902	1120.5	59.26	319.15
47	11.212	1116.0	60.93	320.15
48	11.527	1111.4	62.65	321.15
49	11.849	1106.8	64.42	322.15
50	12.177	1102.2	66.23	323.15
51	12.512	1097.5	68.10	324.15
52	12.852	1092.8	70.01	325.15
53	13.199	1088.0	71.97	326.15
54	13.553	1083.1	73.99	327.15
55	13.913	1078.3	76.07	328.15
56	14.280	1073.3	78.20	329.15
57	14.654	1068.3	80.39	330.15
58	15.034	1063.2	82.64	331.15
59	15.421	1058.1	84.96	332.15
60	15.816	1052.9	87.35	333.15
61	16.217	1047.6	89.80	334.15
62	16.626	1042.2	92.33	335.15
63	17.042	1036.8	94.93	336.15
64	17.465	1031.3	97.61	337.15
65	17.896	1025.8	100.37	338.15
66	18.335	1020.1	103.22	339.15
67	18.781	1014.3	106.16	340.15
68	19.235	1008.5	109.20	341.15
69	19.697	1002.5	112.33	342.15
70	20.167	996.49	115.56	343.15
71	20.645	990.33	118.91	344.15

Standard State: At 0°C, Liquid Enthalpy = 100kJ/Kg, Liquid Entropy = 1kJ/kg.K

Temp °C	Relative pressure bar(g)	Density kg/m^3		Temp K
		Liquid	Vapour	
72	21.131	984.06	122.37	345.15
73	21.626	977.66	125.95	346.15
74	22.129	971.14	129.66	347.15
75	22.641	964.48	133.51	348.15
76	23.161	957.67	137.50	349.15
77	23.691	950.71	141.65	350.15
78	24.229	943.58	145.96	351.15
79	24.777	936.28	150.45	352.15
80	25.334	928.78	155.13	353.15
81	25.900	921.08	160.01	354.15
82	26.476	913.15	165.12	355.15
83	27.061	904.98	170.46	356.15
84	27.657	896.54	176.06	357.15
85	28.263	887.82	181.96	358.15
86	28.878	878.77	188.16	359.15
87	29.505	869.36	194.72	360.15
88	30.142	859.55	201.67	361.15
89	30.790	849.29	209.05	362.15
90	31.449	838.51	216.94	363.15
91	32.119	827.13	225.39	364.15
92	32.802	815.05	234.52	365.15
93	33.496	802.15	244.43	366.15
94	34.202	788.23	255.29	367.15
95	34.921	773.06	267.32	368.15
96	35.653	756.27	280.84	369.15
97	36.399	737.29	296.33	370.15
98	37.159	715.11	314.58	371.15
99	37.934	687.74	337.07	372.15
100	38.725	649.71	367.06	373.15

Standard State: At 0°C, Liquid Enthalpy = 100kJ/Kg, Liquid Entropy = 1kJ/kg.K

Zephex®
Pure quality

We are the world leader in the manufacture and supply of high purity HFA medical propellants. Zephex® is produced to the most demanding industry standards at dedicated facilities, and this commitment to the highest levels of propellant gas quality is supported by staff with a detailed understanding of customer requirements and many years of technical expertise.

Our highly experienced team provide a comprehensive range of support services as an integral part of our offering. This includes skilled formulation, analytical, engineering and technical services to help with many aspects of our customer's business, always compliant with ICH guidelines.

We tailor support services to suit individual requirements, please contact us for further information.

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