Klea®

Mexichem Refrigerants

Klea® 407C Physical Property Data Sheet – British Units

Klea® 407C is a blend of HFCs 32, 125 and 134a designed to replace HCFC-22 in new air conditioning and low temperature refrigeration equipment and also for retrofit in many existing systems. Klea® 407C offers the optimal combination of minimal environmental impact with favorable technical performance. For information on the properties and safe handling of Klea® 407C, please refer to the Material Safety Data Sheet supplied with the product or available upon request.

The data presented here represents a combination of measurements and estimation. Mexichem does not guarantee its accuracy and reserves the right to update the information in the future, in light of the best available knowledge at the time.

Physical Property Data for Klea® 407C

Property		Units	Value
Bubble Point	(1atm)	°F	-47.2
Dew Point	(1atm)	°F	-34.2
Bubble Point Pressure	(70°F)	psia	156
Estimated Critical Temperature		°F	187
Latent Heat Vaporization	(Tm=70°F)	Btu/lb	85.3
Trouton's Constant		Btu/lb R	0.265
Coeff. Vol. Therm. Exp.	(liquid, 60°F)	$°R^{-1}$	0.0019
Density		lb/ft^3	0.285

Equation of State (Martin-Hou)

$$P_r = \frac{XT_r}{V_r - B} + \sum_{i=1,4} \frac{(A_i + B_i T_r + C_i \exp(-KT_r))}{(V_r - B)^{(i+1)}}$$

$T_r = T/T_c$, $P_r = P/P_c$, $V_r = V/V_c$

X = 3.649216
B = 0.0
K = 5.475
T_c, P_c, V_c = 646.6, R 674.7 psia, 0.0327 cu. Mb

A_1,B_1,C_1 = -11.576411672, 6.9516394791,-12.992106787
A_2,B_2,C_2 = 9.108927853, -5.8551996466, -101.85219827
A_3,B_3,C_3 = -4.2674117378, 0.0, 0.0
A_4,B_4,C_4 = 17.976354749, 0.0, -1992.5643203

Applicable Range: 0-400 psia, 0-180 R superheat

Saturation Envelope — Bubble Point Temperatures

Bubble Point Temperature (T_b) = $A + BX + CX^2 + DX^3 + EX^4$

T_b = Bubble Point Temperature in °F
X = Ln(P)
P = Pressure in psia

A = -123.1417
B = 19.59164
C = 3.35685
D = -0.181209
E = 0.049304

Saturation Envelope — Dew Point Temperatures

Bubble Point Temperature (T_d) = $A + BX + CX^2 + DX^3 + EX^4$

T_d = Dew Point Temperature in °F
X = Ln(P)
P = Pressure in psia

A = -119.0841
B = 31.31686
C = -1.91995
D = 0.804863
E = -0.020383

Saturation Envelope — Mid Point Temperatures

Mid Point Temperature (T_m) = $A + BX + CX^2 + DX^3 + EX^4$

T_m = Mid Point Temperature in °F
X = Ln(P)
P = Pressure in psia

A = -121.1129
B = 25.45425
C = 0.718449
0 = 0.311827
E = 0.0144605

Latent Heat Vaporization

$dh_{latent} = A + BX + CX^2 + DX^3 + EX^4$

A = 94.0883061	T_m = Mid Point Temperature R
B = -723.65623	T_c = Critical Temperature R
C = 2719.42721	T^c = Critical Temperature R
D = -3539.0967	T_c = 646.6 R
E = 1670.0172	dh_{latent} = Btu/lb

Ideal Gas Heat Capacity

C_p (ideal) = $A + BT + CT^2 + D/T^3 + D/T$

A = -2.002556E-2
B = 4.26626E-4
C = -1.430584E-7
D = 15.630503

T = Temperature R
C_p(ideal) = Btu/lb R

Saturated Liquid Enthalpy

$h_{liquid} = A + BX + CX^2 + DX^3 + EX^4$

where $x = (1- (T_b/T_c))^{(1/3)}$

A = 37.5396507
B = 526.55632
C = -1811.0258
0 = 2169.01685
E = -1087.0894

T_b = Bubble Point Temperature R
T_c = Critical Temperature R
T_c = 646.6 R
h_{liquid}= Btu/lb

Liquid Density

$P_{liquid} = A + BX + CX^2 + DX^3 + EX^4$

where $x = (1- (T_b/T_c))^{(1/3)}$

A = -40.606805
B = 490.787461
C = -955.92001
D = 980.476064
E = -357.97408

T_b = Bubble Point Temperature R
T_c = Critical Temperature R
T_c = 640.6 R
P_{liquid} = lb/ft3

Liquid Viscosity

$\ln (\mu)_{liquid} = A + B/T_m + CT_m + D/T_m$

A = 15.66442
B = -2309.4954
C = -0.0341689
D = 0.00001796

μ_{liquid} = cP
T_m = Mid Point Temperature R

Liquid Thermal Conductivity

$K_{(liquid)}$ = = $A + BT_m + CT_m^2 + D/T_m^3$

where $x = (1- (T_m/T_c))^{(1/3)}$

A = 0.06874537
B = 0
C = -1.198298E-7
D = 9.40172848

T_m = Mid Point Temperature R
$K_{(liquid)}$ = Btu/hr.ft.R

Saturated Vapor Density

$P_{vapor} = A + BX + CX^2 + DX^3 + EX^4$

Where $x = (1-(T_d/T_c))^{(1/3)}$

A = 19.6903406
B = 21.4442365
C = -242.43767
D = 348.817574
E = -146.90014

T_d = Dew Point Temperature R
T_c = Critical Temperature R
T_c = 646.6 R
Pvapor = lb/ft3

Vapor Viscosity (Ideal Vapor)

$\mu_{vapor} = A + BT + CT^2$

A = -0.0013724
B = 0.00002977
C = -4.726E-09

T = Temperature R
μ_{vapor} = cP

Vapor Viscosity (Sat Vapor)

$\mu_{vapor} = A + BT_d + CT_d^2 + DT_d$

A = 0.375554
B = -0.0007599
C = 5.489E-07
D = -60.07482

μvapor = cP
TD = Dew Point Temperature R

Vapor Thermal Conductivity (Ideal Vapor)

$K_{vapor} = A + BT + CT^2$

A = -2.054908E-3
B = 1.1506995E-5
C=1.3817671E-8

T = Temperature R
K(vapor) = Btu/hr.ft.R

Vapor Thermal Conductivity (Sat Vapor)

$K_{vapor} = A + BT_d + CT_d^2 + D/T_d$

A = 0.24578002
B = -5.0217916E-4
C = 3.7181456E-7
D = -40.089109

K(vapor) = Btu/hr.ft.R
T_d = Dew Point Temperature R

Speed of Sound (Sat Vapor)

$\mu_{(vapor)} = A + BT_d + CT_d^2 + D/T_d$

A = -2854.0469
B = 8.98147237
C = -7.595246E-3
D = 406179.685

$\mu_{(vapor)}$ = ft/s
Td = Dew Point Temperature R

Liquid Properties

Temp °F	Liquid Density lb/ft^3	Liquid Enthalpy Btu/lb	Latent Heat Btu/lb	Liquid Viscosity cP	Liq Therm Cond Btu/hr.ft.R
-60	87.55	-6.58	111.70	0.41	0.073
-40	85.45	0.00	108.00	0.36	0.070
-20	83.27	6.56	104.40	0.32	0.067
0	80.99	13.15	100.70	0.28	0.064
20	78.61	19.81	96.74	0.24	0.061
40	76.08	26.61	92.51	21.00	0.058
60	73.38	33.62	87.84	0.19	0.054
68	71.94	37.24	85.28	0.18	0.053
80	70.43	40.95	82.52	0.16	0.051
100	67.11	48.74	76.26	0.14	0.048
120	63.18	57.20	68.66	0.12	0.045

The temperatures used for liquid density and liquid enthalpy are bubble point temperatures. The restare mid point temperatures.

Ideal Gas Properties

Temp °F	ID. Gas Heat Cap. Btu/lb R	ID. Gas Viscosity cP	ID. Gas Therm Cond Btu/hr.ft.R
-60	0.167	0.0098	0.0048
-40	0.171	0.0103	0.0052
-20	0.175	0.0108	0.0057
0	0.180	0.0113	0.0062
20	0.184	0.0118	0.0066
40	0.189	0.0123	0.0071
60	0.193	0.0128	0.0077
68	0.195	0.0130	0.0079
80	0.198	0.0133	0.0082
100	0.202	0.0138	0.0087
120	0.206	0.0143	0.0093

Saturated Vapor Properties				
Temp °F	Sat Vap Density lb/ft^3	Sat Vap Viscosity cP	Sat Vap Therm. Cond Btu/hr.ft.R	Speed of Sound ft/s
-60	0.145	0.0092	0.0042	539
-40	0.246	0.0102	0.0050	545
-20	0.404	0.0109	0.0057	550
0	0.633	0.0115	0.0063	553
20	0.954	0.0121	0.0069	553
40	1.39	0.0127	0.0075	550
60	1.98	0.0133	0.0081	544
68	2.35	0.0135	0.0084	539
80	2.77	0.0140	0.0088	534
100	3.83	0.0148	0.0096	519
120	5.28	0.0158	0.0105	501

The temperatures used are dew point temperatures.

Standard States

Enthalpy (-40 °F, liquid = 0)

Entropy (-40 °F, liquid=0)

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Mexichem Fluor Inc, 4990 B ICI Road, PO Box 30, St. Gabriel, LA 70776, USA

Tel TOLL FREE: 800-ASK-KLEA, Tel: +(225) 642-0094, Fax: +(225) 642-8629

Email: kleaUSwebmail@mexichem.com