KLEA® 407C

Physical Property Data Sheet
SI Units

Mexichem FLUOR

PHYSICAL PROPERTY DATA FOR KLEA®407C			
PROPERTY		**UNITS**	**VALUE**
Bubble Point	(1 atm)	°C	-44.0
Dew Point	(1atm)	°C	-36.8
Bubble Point Pressure	(25°C)	bara	11.9
Estimated Critical Temperature		°C	86
Latent Heat of Vaporisation	(Tm=25°C)	kJ/kg	193.9
Trouton's constant		kJ/kg.K	1.08
Coeff.Vol.Therm.Exp.	(LIQ,0-20°C)	K^{-1}	0.0037
Density (SAT VAPOUR) at 1 atm		kg/m^3	4.57

EQUATION OF STATE (MARTIN-HOU)

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

Where :

T_r = T/T_c, $P_r = P/P_c$, $V_r = V/V_c = V \times RHO_c$
X = 3.649216
B = 0.0
K = 5.475

T_c, P_c, RHO_c = 359.2(K), 46.52(bara), 490(kg/m^3)

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:- 0-30 bara, 0-100K superheat.

SATURATION ENVELOPE – BUBBLE POINT TEMPERATURES	
Bubble Point Temperature (T_b) = $A + BX + CX^2 + DX^3$	
A = 228.9073 B = 20.99838 C = 1.855389 D = 0.37783	T_b = Bubble point temperature in K X = Ln(P) P = pressure in bara

The correlations in this data sheet should not be used outside the applicable ranges quoted. Contact Mexichem Fluor for further advice.

SATURATION ENVELOPE – DEW POINT TEMPERATURES

Dew Point Temperature (T_d) = $A + BX + CX^2 + DX^3$

A = 236.0528	T_d = Dew point temperature in K
B = 20.37606	X = Ln(P)
C = 2.17732	
D = 0.250429	P = pressure in bara

SATURATION ENVELOPE – MID POINT TEMPERATURES

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

A = 232.4902	T_m = Average of Dew & Bubble point temperatures in K
B = 20.64264	X = Ln(P)
C = 2.047962	
D = 0.3082967	P = pressure in bara

LATENT HEAT OF VAPORISATION

$DH_{vap} = A + Bx + Cx^2 + Dx^3 + Ex^4$

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

A = 218.8494	T_m = Mid point temperature K
B = -1683.2244	T_c = Critical Temperature K
C = 6325.3877	T_c = 359.2K
D = -8231.939	DH_{vap} = kJ/kg
E = 3884.46	

IDEAL GAS HEAT CAPACITY

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

A = -0.083843	T = Temperature K
B = 0.00321516	
C = -1.94062E-06	C_p (ideal) kJ/kg.K
D = 36.35655	

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SATURATED LIQUID ENTHALPY

$$H_{liq} = A + Bx + Cx^2 + Dx^3 + Ex^4$$
where $x = (1- (T_b/T_c))^{(1/3)}$

A = 131.7716	T_b = Bubble point temperature K
B = 1224.77	T_c = Critical Temperature K
C = -4212.446	T_c = 359.2 K
D = 5045.1332	H_{liq} kJ/kg
E = -2528.57	

LIQUID DENSITY

$$d_{liq} = A + Bx + Cx^2 + Dx^3 + Ex^4$$
where $x = (1- (T_b/T_c))^{(1/3)}$

A = -650.4582	T_b = Bubble point temperature K
B = 7861.656	T_c = Critical Temperature K
C = -15312.36	T_c = 359.2 K
D = 15705.71	d_{liq} kg/m^3
E = -5734.191	

LIQUID VISCOSITY

$$\text{Ln}(\mu_{liq}) = A + B/T_m + CT_m + DT^2_m$$

A = 15.66442	T_m = Mid point temperature K
B = -1283.053	μ_{liq} cP
C = -0.061504	
D = 5.81907E-5	

LIQUID THERMAL CONDUCTIVITY

$$K_{liq} = A + BT_m + CT_m^2 + DT_m$$

A = 0.11898	T = Mid point temperature K
B = 0.0	K_{liq} W/m K
C = -6.71955E-7	
D = 9.039943	

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SATURATED VAPOUR DENSITY

$$d_{vap} = A + Bx + Cx^2 + Dx^3 + Ex^4$$
where $x = (1- (T_d/T_c))^{(1/3)}$

A = 315.4088
B = 343.5035
C = -3883.4765
D = 5587.518
E = -2353.113

T_d = Dew point temperature K
T_c = Critical Temperature K
T_c = 359.2 K
d_{vap} kg/m^3

VAPOUR VISCOSITY (IDEAL VAPOUR)

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

A = -0.0013724
B = 5.359E-5
C = -1.53122E-8

T_m = Temperature K
μ_{vap} cP

VAPOUR VISCOSITY (SATURATED VAPOUR)

$$\mu_{vap} = A + BT_d + CT_d^2 + D/T_d$$

A = 0.375554
B = -1.36789E-3
C = 1.77845E-6
D = -33.3749

T_d = Dew point temperature K
μ_{vap} cP

VAPOUR THERMAL CONDUCTIVITY (IDEAL VAPOUR)

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

A = -3.5565E-3
B = 3.5848E-5
C = 7.74837E-8

T_d = Temperature K
K_{gas} W/m.K

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SATURATED VAPOUR THERMAL CONDUCTIVITY

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

A = 0.42538
B = -1.56445E-3
C = 2.08498E-6
D = -38.54645

T_d = Dew point temperature K
K_{gas} W/m.K

SPEED OF SOUND (SATURATED VAPOUR)

$$\mu_{vap} = A + BT_d + CT_d^2 + D/T_d$$

A = -869.9
B = 4.927595
C = -7.5007E-3
D = 68779.76

T_d = Dew point temperature K
μ_{vap} = m/s

SATURATION ENVELOPE

PRESSURE	TEMPERATURES (°C)		
Bara	BUB pnt	MID pnt	DEW pnt
1.0	-44.2	-40.7	-37.1
2.0	-28.7	-25.3	-21.8
3.0	-18.4	-15.1	-11.8
4.0	-10.6	-7.3	-4.0
6.0	1.5	4.7	7.8
8.0	10.8	13.9	16.9
10.0	18.6	21.5	24.4
12.0	25.2	28.0	30.8
15.0	33.7	36.4	39.0
20.0	45.5	47.8	50.2
25.0	55.2	57.3	59.4
30.0	63.5	65.4	67.2

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LIQUID PROPERTIES					
TEMP	LIQUID DENSITY	LIQUID ENTH	LATENT HEAT	LIQUID VISCOSITY	LIQ.THERM COND
°C	kg/m^3	kJ/kg	kJ/kg	cP	W/m.K
-50.0	1399	30.7	258.9	0.40	0.126
-40.0	1369	44.5	251.3	0.36	0.121
-30.0	1337	58.2	243.7	0.32	0.116
-20.0	1305	72.0	235.9	0.29	0.112
-10.0	1271	85.9	227.8	0.25	0.107
0.0	1235	100.0	219.2	0.23	0.102
10.0	1197	114.0	209.9	0.20	0.097
20.0	1157	129.0	199.6	0.18	0.092
25.0	1135	137.0	193.9	0.16	0.090
30.0	1113	145.0	187.8	0.15	0.087
40.0	1063	162.0	174.1	0.14	0.082
50.0	1005	180.0	157.7	0.12	0.077

For Liquid Density and Liquid Enthalpy the bubble point temperatures are used. For Latent Heat, Liquid Viscosity and Liquid Thermal Conductivity mid point temperatures are used.

IDEAL GAS PROPERTIES			
TEMP	ID. GAS Cp	ID. GAS VISCOSITY	ID. GAS THERM COND
°C	kJ/kg.K	cP	W/m.K
-50.0	0.700	0.0098	0.0083
-40.0	0.716	0.0103	0.0090
-30.0	0.733	0.0108	0.0097
-20.0	0.749	0.0112	0.0105
-10.0	0.766	0.0117	0.0112
0.0	0.783	0.0121	0.0120
10.0	0.799	0.0126	0.0128
20.0	0.816	0.0130	0.0136
25.0	0.824	0.0132	0.0140
30.0	0.832	0.0135	0.0144
40.0	0.849	0.0139	0.0153
50.0	0.865	0.0143	0.0161

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SATURATED VAPOUR PROPERTIES				
TEMP	SAT VAP DENSITY	SAT VAP VISCOSITY	SAT VAP THERM COND	SPEED OF SOUND
°C	kg/m^3	cP	W/m.K	m/s
-50.0	-	0.0093	0.0074	164.0
-40.0	3.94	0.0102	0.0086	166.0
-30.0	6.17	0.0108	0.0097	168.0
-20.0	9.31	0.0114	0.0107	169.0
-10.0	13.57	0.0119	0.0116	169.0
0.0	19.24	0.0124	0.0125	168.0
10.0	26.67	0.0130	0.0134	167.0
20.0	36.35	0.0135	0.0144	165.0
25.0	42.24	0.0139	0.0150	163.0
30.0	48.95	0.0142	0.0156	161.0
40.0	65.45	0.0150	0.0168	157.0
50.0	87.38	0.0160	0.0183	152.0

The temperatures used are Dew Point Temperatures.

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