SOLVAY FLUOR

SOLKANE® - INFORMATION SERVICE

Solkane® 410 Thermodynamics

SOLVAY FLUOR

Technical Service - Refrigerants -

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1 Units and Symbols

Symbol	Unit	Meaning/Definition
A, B	[-]	Parameters of the Wagner equation
C	[-]	Parameter of the equation for density of boiling liquid
D	[kJ/(kg K)]	Parameter of the equation for specific heat capacity in an ideal gas state
E, F, G	[-]	Parameter of the Martin-Hou equation
H	[Pa s/K]	Parameter of the equation for dynamic viscosity of vapour
J	[W/(m K)]	Parameter of the equation for thermal conductivity of the saturated liquid
K	[W/(m K)]	Parameter of the equation for thermal conductivity of the saturated vapour
L	[N/(m K)]	Parameter of the equation for surface tension
M	[kJ/(kg K)]	Parameter of the equation for specific heat capacity of the saturated liquid
R	[bar m^3/(kg K)]	Gas constant
T	[K]	Temperature
b	[m^3/kg)]	Parameter of the Martin-Hou equation
c	[kJ/(kg K)]	Specific heat capacity
e	[kJ/kg]	Specific exergy
h	[kJ/kg]	Specific enthalpy
k	[-]	Parameter of the Martin-Hou equation
p	[bar]	Pressure
r	[kJ/kg]	Enthalpy of vaporization
s	[kJ/(kg K)]	Specific entropy
t	[°C]	Temperature
v	[m^3/kg]	Specific volume
η	[Pa s]	Dynamic viscosity
λ	[W/(m K)]	Thermal conductivity
ρ	[kg/m^3]	Density
σ	[N/m]	Surface tension

Indices

´	Liquid
´´	Vapour
c	Critical value
r	Reduced value
i	Run index
u	Ambient conditions
p	Isobar
v	Isochor
0	Ideal gas

2 Introduction

The refrigerant Solkane®410 is a long-term replacement for applications, where a compact design and a high energy efficiency shall be realised. Solkane®410 replaces R22 and also R13B1.
The ozone depletion potential of the hydrochlorofluorocarbon (HCFC) R22 is reduced to a fraction of the ODPs of chlorofluorocarbons (CFCs). R22 is therefore regarded as an intermediate solution. The use of HCFCs will be gradually reduced and these products will finally be banned. By 2030 the production of HCFCs will be phased out in developed countries[1]. Accelerated phase out scenarios may apply in selected countries especially in Europe.
Solkane®410 is a near azeotropic blend of R32 and R125 (50 /50 weight-%). Both components are partly halogenated hydrofluorocarbons, containing only carbon, fluorine and hydrogen. They do not contribute to the depletion of the stratospheric ozone layer.
Due to the minimal temperature glide (<0.2K) Solkane®410 can be treated as a pure fluid for technical applications. Compared to R22 Solkane®410 has a significant higher volumetric capacity.
Solkane®410 is non-flammable. Its toxicity is low and comparable to the toxicity of R22.
The pressure level of Solkane®410 higher is than that of R22.
Solkane®410 is therefore unsuitable for the retrofit of existing R22-units. R13B1-units can be adapted to the use with Solkane®410.

[1] In the sence of Montreal Protocol (1995 Vienna meeting)

3 Thermophysical Properties

3.1 Physical Data

Chemical name	[-]	Difluoromethane/ Pentafluoroethane/
Chemical formula	[-]	CH_2F_2/CF_3CHF_2
CAS No.	[-]	75-10-5/354-33-6
Molecular weight	[kg/kmol]	72.6
Boiling point	[°C]	-51.5
Critical temperature	[°C]	70.2
Critical pressure	[bar]	47.7
Saturated liquid density[2]	[kg/m³]	1061
Saturated vapour density[2]	[kg/m³]	65.56
Vapour pressure[2]	[bar]	16.47
Enthalpy of vaporization[1]	[kJ/kg]	271.63
Liquid thermal conductivity[2]	[W/m K]	87.249E-3
Vapour thermal conductivity[2]	[W/m K]	16.532E-3
Surface tension of liquid[2]	[N/m]	5.158E-3
Specific heat capacity of liquid[2]	[kJ/(kg K)]	1.692
Specific heat capacity of vapour[1]	[kJ/(kg K)]	1.346
Liquid viscosity[2]	[Pa s]	0.1217E-3
Flammability limit in air[3]	[Vol.-%]	None[3]

[1] at 1.013 bar

[2] at 25°C and saturated conditions

[3] according to DIN 51649 and UL 2128

3.2 Basis of Thermodynamic Calculation

The thermodynamic calculation equations have been adapted to ISO/DIS 17584, as at 12/2003. They fulfil this standard with the exception of the thermal capacities in a saturated state of 0.59 < T_R < 0.94 and in an overheated state of 0.5MPa < p < 0.5MPa and T_{max} = 440K.

The Wagner equation

$$\ln p_R = \left(A_1(1-T_R) + A_2(1-T_R)^{B_1} + A_3(1-T_R)^{B_2} + A_4(1-T_R)^{B_3} + A_5(1-T_R)^{B_4} + A_6\right)/T_R \qquad (1)$$

where $T_R = \frac{T}{T_c}$ and $p_R = \frac{p}{p_c}$

was chosen to describe the vapour pressure. The constants and values for the critical pressure p_C and the critical pressure T_C are as follows:

		Bubble Pressure	Dew Pressure
A_1	[-]	-7.6368778	-7.70876155
A_2	[-]	3.020664659	3.293380929
A_3	[-]	-6.02265976	-6.477671
A_4	[-]	9.747548052	10.23405674
A_5	[-]	-8.74776593	-9.01987639
A_6	[-]	0.002434753	0.001688002
B_1	[-]	1.5	1.5
B_2	[-]	2	2
B_3	[-]	2.5	2.5
B_4	[-]	3	3
T_c	[K]	343.315	
p_c	[bar]	47.6985	

A slight difference between dew- and vapour pressure for Solkane®410 do exists. The difference is smaller than 0.02 bar and is therefore classified as insignificant for technical purposes.
The density of the boiling liquid is described by the equation

$$\rho'_R = 1 + C_1(1-T_R)^{1/3} + C_2(1-T_R)^{2/3} + C_3(1-T_R) + C_4(1-T_R)^{4/3} \qquad (2)$$

where $\rho'_R = \frac{\rho'}{\rho_c}$.

The constants and the value for the critical density are:

C_1	[-]	1.239281254	C_4	[-]	0.310613093
C_2	[-]	1.206550532	ρ_c	[kg/m³]	551.89
C_3	[-]	-0.31471863			

The specific heat capacity under ideal gas conditions is represented by the equation

$$c_p{}^0 = D_1 + D_2T + D_3T^2 + D_4T^3 + D_5/T \quad (3)$$

The coefficients are:

D_1	[kJ/(kg K)]	8.38141E-01	D_4	[kJ/(kg K³)]	-7.96710E-09
D_2	[kJ/(kg K²)]	-1.62958E-03	D_5	[kJ/kg]	-2.45256E+01
D_3	[kJ/kg]	8.40584E-06			

The equation of state according to Martin-Hou is

$$p = \frac{RT}{z} + \frac{E_1 + F_1T + G_1e^{-kT_R}}{z^2} + \frac{E_2 + F_2T + G_2e^{-kT_R}}{z^3} + \frac{E_3}{z^4} + \frac{E_4 + F_4T + G_4e^{-kT_R}}{z^5} \quad (4)$$

and is a good representation of the *pvT* relationship for Solkane®410. The coefficients of the equation are:

E_1	[-]	-1.89512E-03	F_2	[-]	9.56704E-10
E_2	[-]	2.15923E-07	F_4	[-]	3.61296E-14
E_3	[-]	-1.87075E-10	G_1	[-]	-4.25660E-02
E_4	[-]	-1.59054E-11	G_2	[-]	-3.20769E-06
F_1	[-]	3.22638E-06	G_4	[-]	1.23122E-09
b	[m³/kg]	-6.37801E-04	k	[-]	5.475
R	[bar m³/(kgK)]	1.14546E-03			

with $z = v - b$. The equation for specific heat capacity under ideal gas conditions (3) and the thermal equation of state (4) form the basis of the specific enthalpy and entropy calculation.

the equation for the specific enthalpy and entropy is transformed into

$$h = h_0 + (pv - RT) + D_1T + D_2\frac{T^2}{2} + D_3\frac{T^3}{3} + D_4\ln T + \frac{E_1}{z} + \frac{E_2}{2z^2} + \frac{E_3}{3z^3} + \frac{E_4}{4z^4} + e^{-k\cdot T_R}\cdot(1 + k\cdot T_R)\cdot\left(\frac{G_1}{z} + \frac{G_2}{2z^2} + \frac{G_4}{4z^4}\right) \quad (5)$$

and

$$s = s_0 + R\ln\left(\frac{zp_1}{RT}\right) + D_1\cdot\ln T + D_2T + D_3\frac{T^2}{2} - \frac{D_4}{T} - \left(\frac{F_1}{z} + \frac{F_2}{2z^2} + \frac{F_4}{4z^4}\right) + \frac{k}{T_c}e^{-k\cdot T_R}\left(\frac{G_1}{z} + \frac{G_2}{2z^2} + \frac{G_4}{4z^4}\right) \quad (6)$$

with $z = v - b$ and p_1=1,013bar.

The Clausius - Clapeyron equation was used to generate thermodynamic data in the wet vapour range.

$$\frac{dp}{dT} = \frac{1}{T} \cdot \frac{h''-h'}{v''-v'} \tag{7}$$

Rearranging equation (7) gives

$$h' = h'' - \frac{dp}{dT} \cdot T \cdot (v''-v') \tag{8}$$

The intergration constants h_0 und s_0 are found by letting

$h'_{(t = 0°C)}$ = 200.0 kJ/kg
$s'_{(t = 0°C)}$ = 1.000 kJ/(kg K)
to be

h_0 = 363.80 kJ/kg
s_0 = -2.5079 kJ/(kg K)

If neither the kinetic nor the potential energies are taken into account, the specific exergy may be found by the following equation:

$$e = h - h_u - T_u(s - s_u) \tag{9}$$

where the subscript u indicates ambient conditions.
The saturation pressure of the substance at T_u = 290 K serves as the reference pressure.
Applying the preconditions mentioned above, the constants h_u and s_u are found to be as follows:

h_u = 226.04 kJ/kg
s_u = 1.0908 kJ/(kg K),

for which specific exergy is set to e = 0 according to existing agreements.

3.3 Transport Properties

3.3.1 Dynamic Viscosity of Saturated Liquid

The viscosity of the saturated liquid of Solkane®410 was measured within the temperature range of -50 to 60 °C. The following regression equation is valid for the liquid phase:

$$\ln\left(\frac{\eta'}{10^{-3}}\right) = H_0 + H_1 t + H_2 t^2 + H_3 t^3 \qquad (10)$$

with t in °C and η' in 10^{-3} Pa s. The coefficients are:

H_0	=	-1.78743	[Pa s]	H_2 =	-2.0903e^{-5} [Pa s/K^2]
H_1	=	-0.012082	[Pa s/K]	H_3 =	-2.3930e^{-7} [Pa s/K^3]

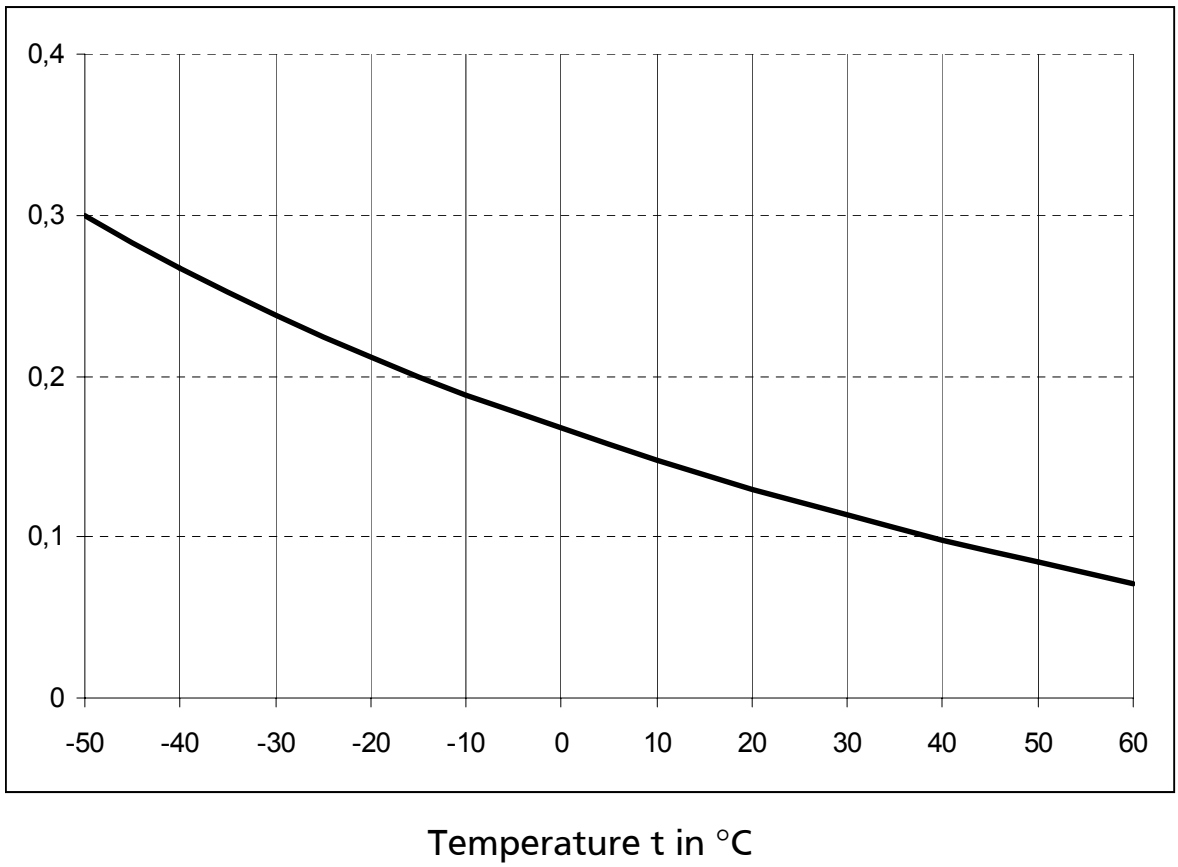

Figure 1: Dynamic viscosity of the saturated liquid

3.3.2 Dynamic Viscosity of Saturated and Superheated Vapour

The viscosity of the saturated and superheated vapour of Solkane®410 was measured in a temperature range of -50 to 50°C. The data can be represented by the following equations

$$\eta = \eta_0 + \Delta\eta \qquad (11)$$

with

$$\eta_0 = 2.6696\times10^{-2}\times\frac{(MT)^{\frac{1}{2}}}{\sigma^2\Omega_\eta T^*}, \qquad T^* = \frac{kT}{\varepsilon} \text{ and}$$

$$\Omega(T^*) = \exp[0.45667 - 0.53955(\ln(T^*) + 0.187265(\ln T^*)^2 - 0.03629(\ln T^*)^3 + 0.00241(\ln T^*)^4]$$

(12 a-c)

$$\Delta\eta = T_R^{2.2}\left[\ln(1.65+\rho_{R0}^{0.8})\right]^{1.6}\left[e^{\left(1-\frac{0.78}{T_c}\right)\cdot\rho_{r0}} - 1\right](F\cdot z_c\cdot\zeta)^{-1}$$

$$z_c = \frac{p_c V_c}{RT_c} \quad \text{and} \quad \rho_{R0} = \frac{\rho-\rho_0}{\rho_c} \text{ and } F = 1 \text{ for Solkane®410 as a light polar agent.}$$

(12 d-f)

In equation (12) the constants are as follows .

R the universal gas constant	= 8314	[J kmol^{-1} K^{-1}]
ρ_c the critical density	= 487.37	[kg/m^3]
ρ_0 the density at 1.013bar and temperature as defined by T		[kg/m^3]
T_c the critical temperature	= 344.95	[K]

The constants of equation (11) where determined to be

ζ = 40990.75 [1/(Pa s)]
σ = 0.4324 [nm]
ε/k = 317.47 [K]

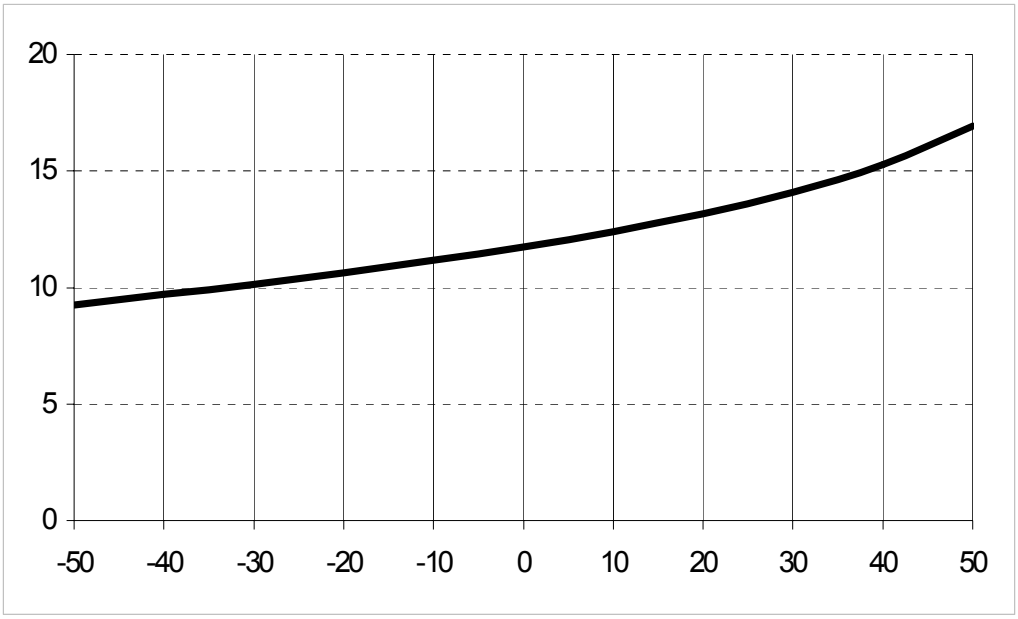

Figure 2: **Dynamic viscosity of saturated vapour**

3.3.3 Thermal Conductivity of Saturated Liquid

The thermal conductivity of saturated liquid can be expressed with the regression equation

$$\lambda' = J_0 + J_1 t \qquad (13)$$

where t is in °C and λ' in 10^{-3}W/(mK). The coefficients of the equation are:

J_0 = 99.926 [10^{-3}W/(mK)] J_1 = -0.5071 [10^{-3}W/(mK^2)]

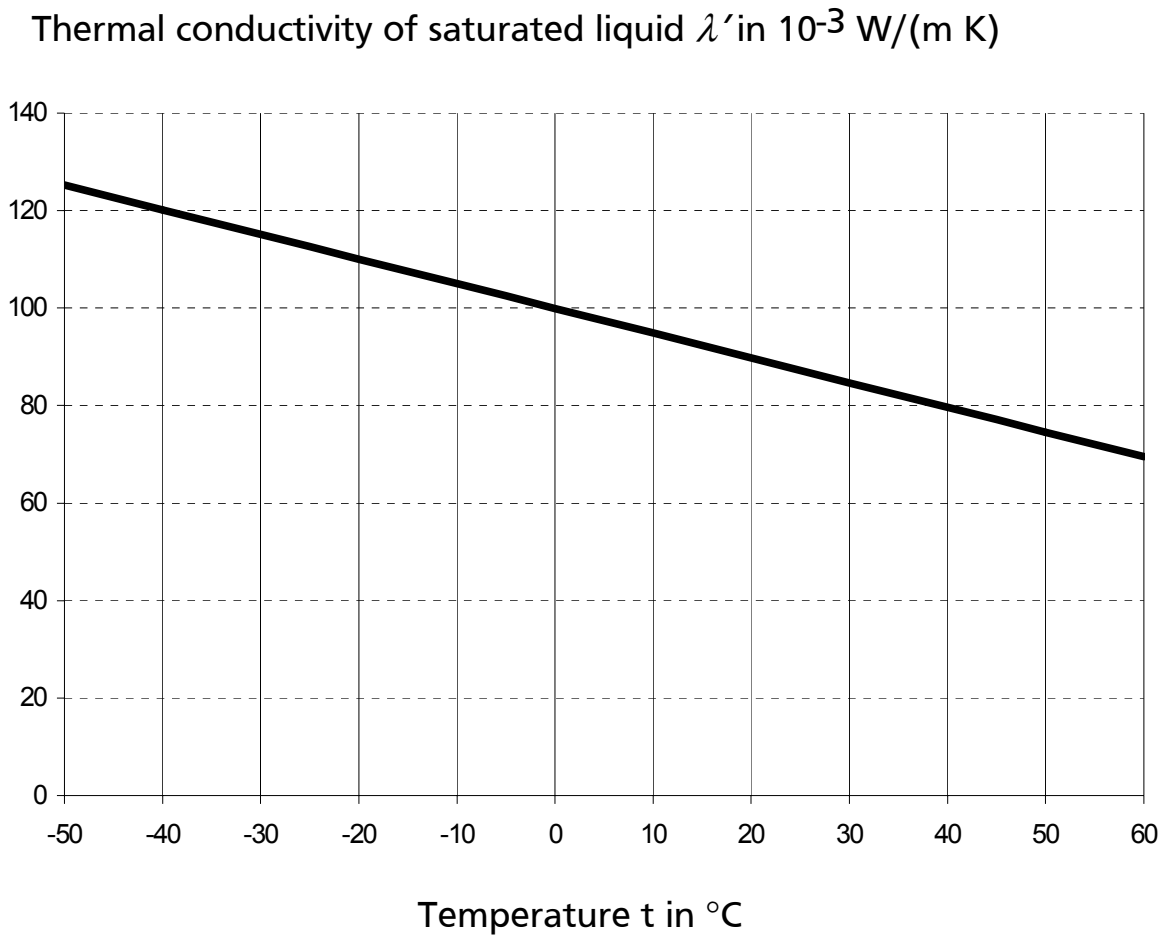

Figure 3: Thermal conductivity of saturated liquid

3.3.4 Thermal Conductivity of Saturated Vapour

The thermal conductivity of saturated vapour can be expressed using the regression equation

$$\lambda'' = K_0 + K_1 t + K_2 t^2 + K_3 t^3 + K_4 t^4 \qquad (14)$$

where t is in °C and λ'' in 10^{-3} W/(m K). The coefficients of the equation are as follows:

K_0 =	13.061	[10^{-3}W/(mK)]	K_3 =	3.3487e^{-6}	[10^{-3}W/(m K^4)]
K_1 =	0.10279	[10^{-3}W/(mK^2]	K_4 =	-2.5798e^{-8}	[10^{-3}W/(m K^5)]
K_2 =	1.3743e^{-3}	[10^{-3}W/(mK^3)]			

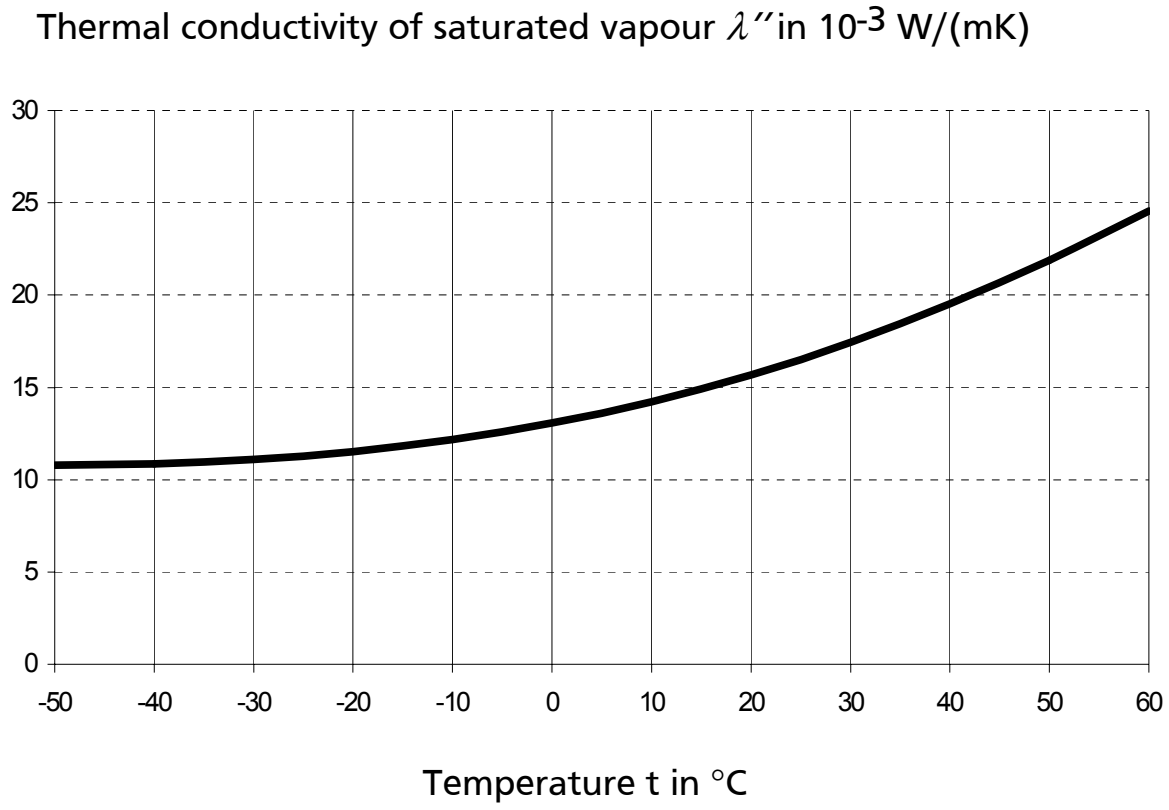

Figure 4: Thermal conductivity of saturated vapour

3.3.5 Surface Tension

The surface tension of the liquid can be expressed using the regression equation

$$\sigma = L_0 + L_1 t + L_2 t^2 + L_3 t^3 \qquad (15)$$

where t is in °C and σ in 10^{-3}N/m. The coefficients of the equation are:

L_0	=	8.7963	[10^{-3}N/m]	L_2 =	2.1740e^{-4} [10^{-3}N/(mK^2)]
L_1	=	-0.15227	[10^{-3}N/(mK)]	L_3 =	2.1147e^{-6} [10^{-3}N/(mK^3)]

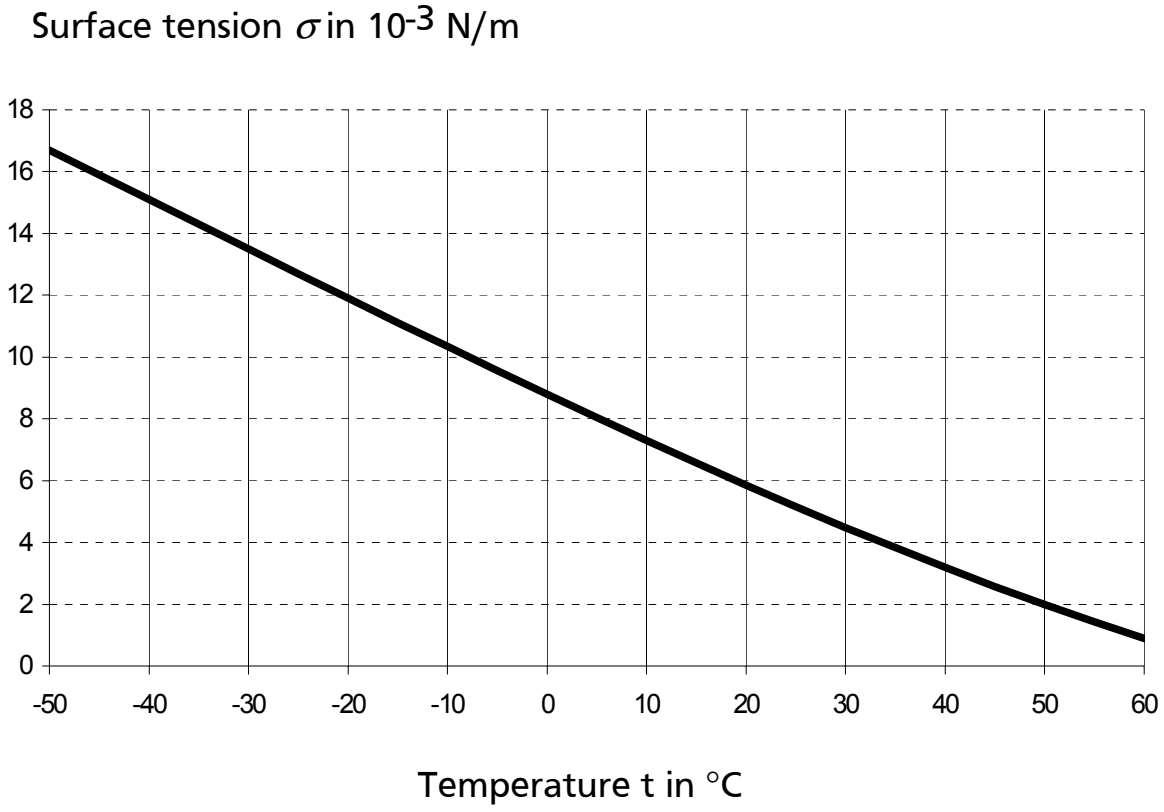

Figure 5: Surface tension

3.3.6 Specific Heat Capacity of Saturated Liquid

The specific heat capacity of saturated liquid can be expressed using the equation

$$c'_p = M_0 + M_1(1-T_R)^{1/9} + M_2(1-T_R)^{2/9} + M_3(1-T_R)^{3/9} + M_4(1-T_R)^{6/9} \quad (16)$$

where $T_R = \frac{T}{T_c}$, c'_p is in kJ/(kg K) and *T* is in K. The coefficients of the equation are as follows:

M_0 =	237.48544	[kJ/(kgK)]	M_3 =	-734.81854	[kJ/(kgK)]
M_1 =	-974.66894	[kJ/(kgK)]	M_4 =	60.886696	[kJ/(kgK)]
M_2 =	1412.81	[kJ/(kgK)]			

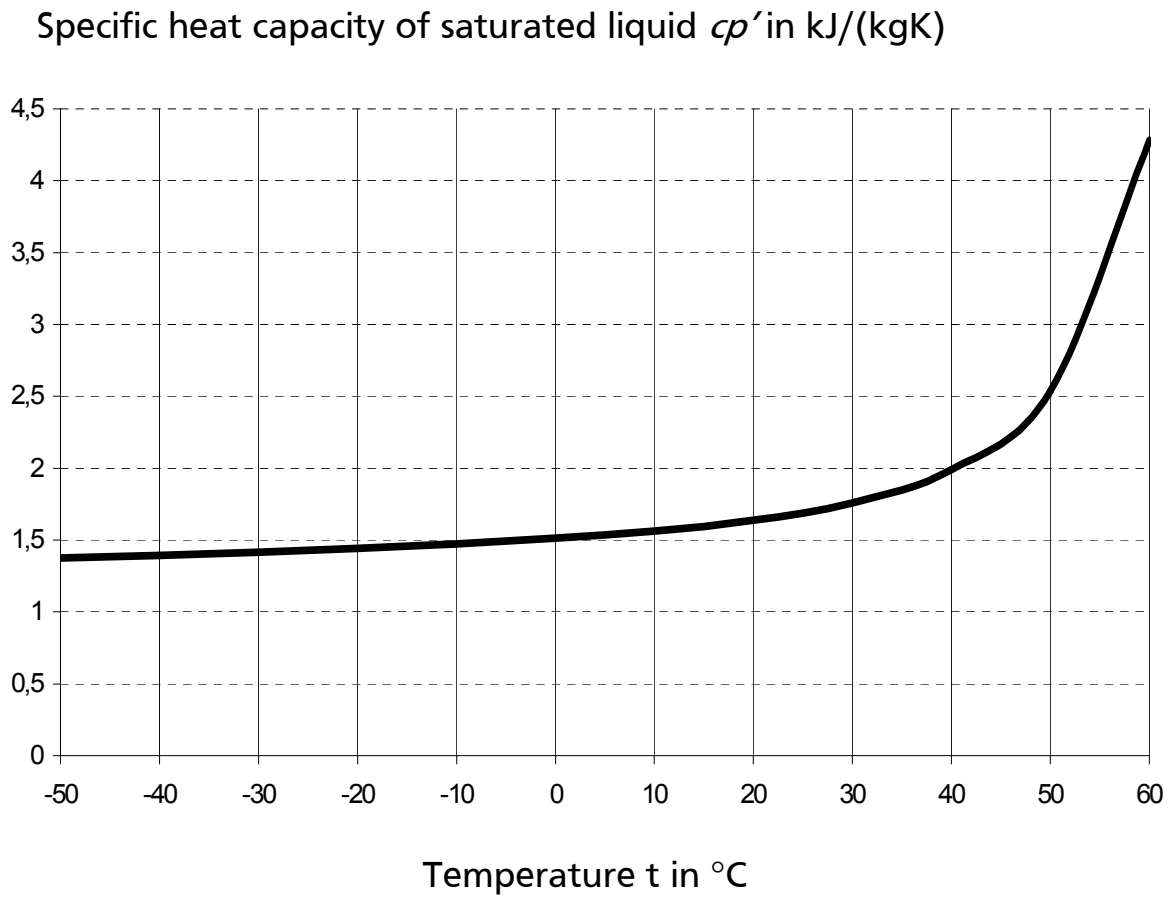

Figure 6: Specific heat capacity of saturated liquid

4 Compatibility of Materials

4.1 Elastomeres

The compatibility of the elastomeres that are normally used in refrigeration systems with Solkane®410 is generally good. Cold extraction tests that where carried out on CR (chlorbutadiene rubber or Neoprene®), NBR (acrylonitrilebutadienerubber) and HNBR (hydrated acrylnitrilbutadiene rubber) showed only slight swelling and yielded negligible amounts of extract. Fluorinated rubbers (FKM and FPM) are not recommended because of their considerable swelling and blistering when used with Solkane®410 or with other HFC refrigerants. Ethylenepropylenediene rubber is only to be recommended where the presence of mineral oil in the refrigeration cycle can be excluded.
The effect of the lubricant that is used must not be ignored. Recommendations made by the lubricant and compressor manufacturers must be followed.

4.2 Thermoplastics

Experience with CFC and HCFC has shown that only a limited number of plastics are resistant to fluorinated refrigerants. Polytetrafluoroethylene, polyacetale and polyamide might be taken into account for the use with Solkane®410. It is again vital to take the effect of the lubricant into account.

4.3 Metals

Solkane®410 is generally used in conjunction with lubricants (Ester oils, PAG-oils) in refrigeration technology. In combination both materials are compatible with the metals and alloys usually found in machines and apparatus. Only zinc, magnesium, lead and aluminium alloys with more than 2% magnesium by mass should be avoided. The water content of refrigeration oil depending on oil type should especially be taken into account. Values of not more than 50 ppm are to be aimed at.

5 Refrigerant Oils

Like all fluorinated hydrocarbons, Solkane®410 is immiscible with mineral oils. Ester oils (POE) are normally used as lubricants. The solubility of these oils in Solkane®410 is a function of temperature and composition. The following diagrams show the solubility properties of various lubricants with Solkane®410. Highly viscous lubricants tend to give large miscibility gaps.

The precise miscibility gaps of the individual oils can be obtained from the lubricant manufacturers.

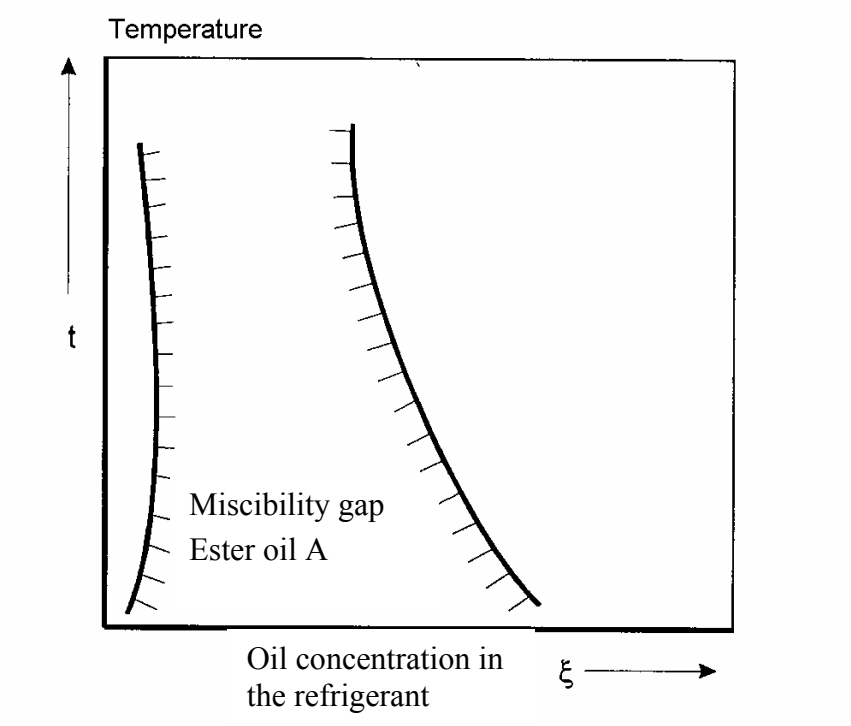

Figure 7: Miscibility behaviour of Solkane®410 and ester oil A

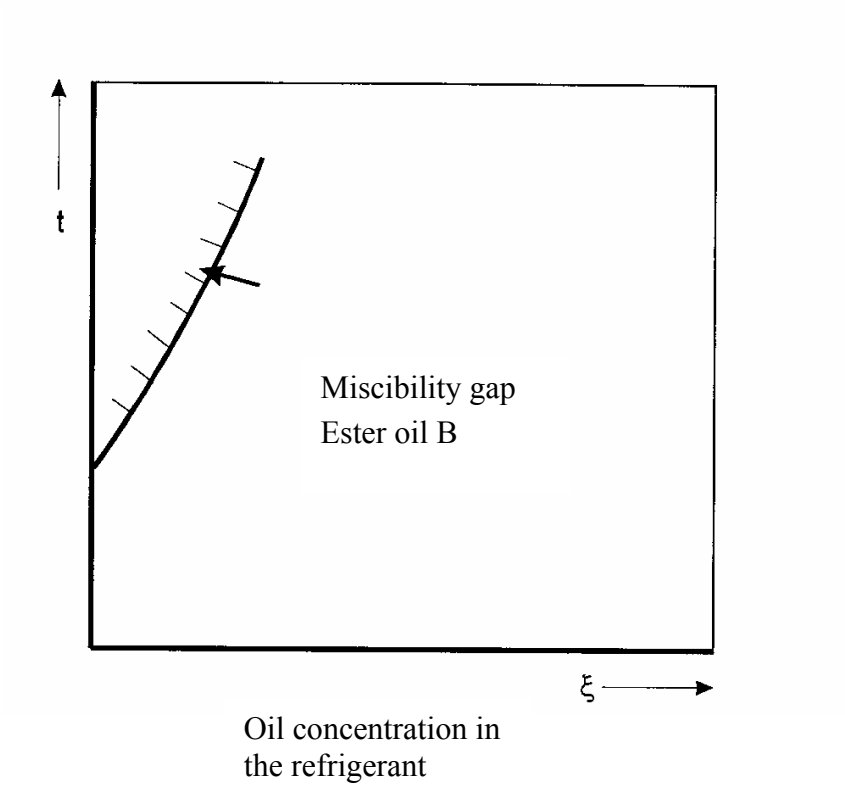

Figure 8: **Miscibility behaviour of Solkane®410 and ester oil B**

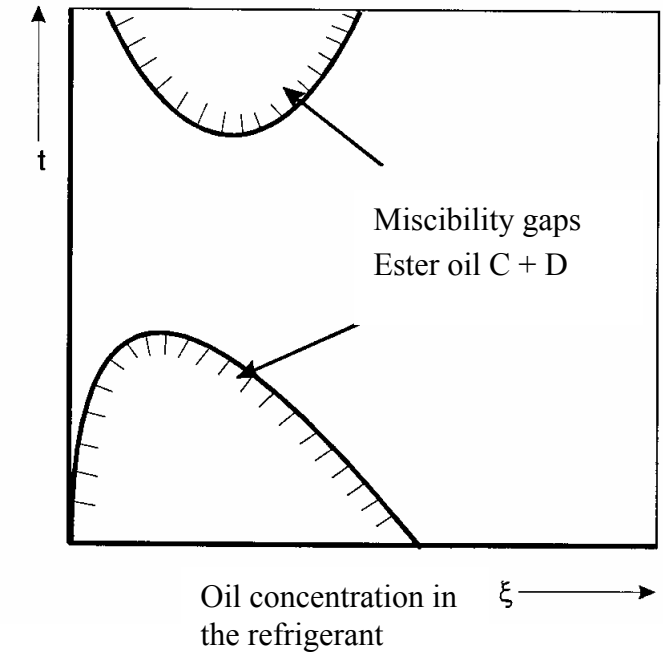

Figure 9: **Miscibility behaviour of Solkane®410 and ester oil C**

6 Flammability

R32 as a pure component is flammable, whereas R125 is not. According to DIN 51649 and UL 2182 Solkane®410 is not flammable.

7 Toxicity

The toxicity of R32 and R125 was extensively tested within the scope of the PAFT programme (Programme for Alternative Fluorocarbon Toxicity Testing). PAFT recommended an occupational exposure limit of 1000 ppm for both products. The toxicity of Solkane®410 can therefore be regarded as low and comparable to the toxicity of R22.

8 Vapour Table, Wet Vapour Range Solkane®410

t	p´	p´´	v´	v´´	ρ'	ρ´´	h´	h´´	r	s´	s´´
[°C]	[bar]	[bar]	[dm³/kg]	[dm³/kg]	[kg/dm³]	[kg/m³]	[kJ/kg]	[kJ/kg]	[kJ/kg]	[kJ/kg K]	[kJ/kg K]
-70	0.36	0.36	0.711	631.36	1.407	1.58	102.05	388.31	286.26	0.5924	1.9981
-69	0.38	0.38	0.712	596.08	1.404	1.68	103.44	388.89	285.45	0.5986	1.9940
-68	0.41	0.41	0.714	563.13	1.401	1.78	104.82	389.46	284.64	0.6047	1.9900
-67	0.43	0.43	0.715	532.34	1.398	1.88	106.19	390.03	283.84	0.6109	1.9860
-66	0.46	0.46	0.717	503.54	1.395	1.99	107.56	390.60	283.04	0.6171	1.9821
-65	0.49	0.49	0.718	476.59	1.392	2.10	108.92	391.17	282.24	0.6232	1.9783
-64	0.52	0.52	0.720	451.35	1.389	2.22	110.28	391.73	281.45	0.6294	1.9745
-63	0.55	0.55	0.722	427.69	1.386	2.34	111.63	392.29	280.66	0.6356	1.9708
-62	0.58	0.58	0.723	405.50	1.383	2.47	112.98	392.85	279.87	0.6417	1.9671
-61	0.61	0.61	0.725	384.69	1.380	2.60	114.33	393.41	279.08	0.6479	1.9635
-60	0.65	0.65	0.726	365.15	1.377	2.74	115.67	393.96	278.29	0.6540	1.9599
-59	0.69	0.68	0.728	346.79	1.374	2.88	117.01	394.52	277.50	0.6601	1.9564
-58	0.72	0.72	0.729	329.53	1.371	3.03	118.35	395.07	276.71	0.6663	1.9529
-57	0.76	0.76	0.731	313.29	1.368	3.19	119.69	395.61	275.92	0.6724	1.9495
-56	0.81	0.80	0.733	298.01	1.365	3.36	121.03	396.16	275.13	0.6785	1.9461
-55	0.85	0.85	0.734	283.61	1.362	3.53	122.37	396.70	274.33	0.6846	1.9428
-54	0.90	0.89	0.736	270.05	1.359	3.70	123.70	397.24	273.54	0.6907	1.9395
-53	0.94	0.94	0.738	257.26	1.355	3.89	125.04	397.78	272.74	0.6968	1.9363
-52	0.99	0.99	0.739	245.19	1.352	4.08	126.38	398.31	271.93	0.7029	1.9331
-51	1.04	1.04	0.741	233.80	1.349	4.28	127.72	398.84	271.12	0.7089	1.9300
-50	1.10	1.10	0.743	223.04	1.346	4.48	129.06	399.37	270.31	0.7150	1.9268
-49	1.15	1.15	0.745	212.88	1.343	4.70	130.40	399.90	269.50	0.7210	1.9238
-48	1.21	1.21	0.746	203.27	1.340	4.92	131.74	400.42	268.68	0.7271	1.9207
-47	1.27	1.27	0.748	194.18	1.337	5.15	133.09	400.94	267.85	0.7331	1.9178
-46	1.33	1.33	0.750	185.57	1.333	5.39	134.44	401.46	267.02	0.7391	1.9148
-45	1.40	1.40	0.752	177.42	1.330	5.64	135.79	401.97	266.18	0.7451	1.9119
-44	1.47	1.46	0.754	169.70	1.327	5.89	137.14	402.48	265.34	0.7511	1.9090
-43	1.54	1.53	0.755	162.38	1.324	6.16	138.49	402.99	264.49	0.7570	1.9062
-42	1.61	1.61	0.757	155.44	1.321	6.43	139.85	403.49	263.64	0.7630	1.9034
-41	1.68	1.68	0.759	148.86	1.317	6.72	141.21	403.99	262.78	0.7689	1.9006
-40	1.76	1.76	0.761	142.61	1.314	7.01	142.58	404.49	261.91	0.7749	1.8979
-39	1.84	1.84	0.763	136.67	1.311	7.32	143.94	404.98	261.04	0.7808	1.8952
-38	1.93	1.92	0.765	131.03	1.308	7.63	145.31	405.47	260.16	0.7867	1.8925
-37	2.01	2.01	0.767	125.67	1.304	7.96	146.69	405.96	259.27	0.7925	1.8898
-36	2.10	2.10	0.769	120.57	1.301	8.29	148.07	406.44	258.37	0.7984	1.8872
-35	2.20	2.19	0.771	115.72	1.298	8.64	149.45	406.92	257.47	0.8043	1.8846
-34	2.29	2.29	0.773	111.10	1.294	9.00	150.83	407.39	256.56	0.8101	1.8821
-33	2.39	2.39	0.775	106.71	1.291	9.37	152.22	407.86	255.64	0.8159	1.8796
-32	2.49	2.49	0.777	102.52	1.288	9.75	153.61	408.33	254.72	0.8217	1.8771
-31	2.60	2.59	0.779	98.53	1.284	10.15	155.01	408.79	253.79	0.8275	1.8746

Vapour Table, Wet Vapour Range Solkane®410

t	p´	p´´	v´	v´´	ρ'	ρ´´	h´	h´´	r	s´	s´´
[°C]	[bar]	[bar]	[dm³/kg]	[dm³/kg]	[kg/dm³]	[kg/m³]	[kJ/kg]	[kJ/kg]	[kJ/kg]	[kJ/kg K]	[kJ/kg K]
-30	2.71	2.70	0.781	94.72	1.281	10.56	156.41	409.25	252.85	0.8333	1.8721
-29	2.82	2.81	0.783	91.09	1.278	10.98	157.81	409.71	251.90	0.8391	1.8697
-28	2.94	2.93	0.785	87.63	1.274	11.41	159.22	410.16	250.94	0.8448	1.8673
-27	3.06	3.05	0.787	84.32	1.271	11.86	160.63	410.61	249.98	0.8505	1.8650
-26	3.18	3.17	0.789	81.16	1.267	12.32	162.04	411.05	249.01	0.8562	1.8626
-25	3.31	3.30	0.791	78.15	1.264	12.80	163.46	411.49	248.03	0.8619	1.8603
-24	3.44	3.43	0.793	75.27	1.260	13.29	164.88	411.92	247.04	0.8676	1.8580
-23	3.58	3.57	0.796	72.51	1.257	13.79	166.31	412.35	246.04	0.8733	1.8557
-22	3.72	3.71	0.798	69.87	1.253	14.31	167.74	412.78	245.04	0.8789	1.8535
-21	3.86	3.85	0.800	67.35	1.250	14.85	169.18	413.20	244.03	0.8846	1.8512
-20	4.01	4.00	0.802	64.94	1.246	15.40	170.61	413.62	243.00	0.8902	1.8490
-19	4.16	4.15	0.805	62.63	1.243	15.97	172.06	414.03	241.97	0.8958	1.8468
-18	4.32	4.31	0.807	60.42	1.239	16.55	173.50	414.44	240.94	0.9014	1.8446
-17	4.48	4.47	0.809	58.30	1.235	17.15	174.95	414.84	239.89	0.9070	1.8425
-16	4.65	4.63	0.812	56.26	1.232	17.77	176.40	415.24	238.83	0.9125	1.8403
-15	4.82	4.80	0.814	54.32	1.228	18.41	177.86	415.63	237.77	0.9181	1.8382
-14	4.99	4.98	0.817	52.45	1.224	19.07	179.32	416.01	236.70	0.9236	1.8361
-13	5.17	5.16	0.819	50.65	1.221	19.74	180.78	416.40	235.61	0.9292	1.8340
-12	5.36	5.34	0.822	48.93	1.217	20.44	182.25	416.77	234.52	0.9347	1.8319
-11	5.55	5.53	0.824	47.28	1.213	21.15	183.72	417.14	233.42	0.9402	1.8299
-10	5.74	5.72	0.827	45.70	1.210	21.88	185.20	417.51	232.31	0.9457	1.8278
-9	5.94	5.92	0.829	44.17	1.206	22.64	186.67	417.87	231.20	0.9511	1.8258
-8	6.15	6.13	0.832	42.71	1.202	23.42	188.15	418.22	230.07	0.9566	1.8238
-7	6.36	6.34	0.835	41.30	1.198	24.21	189.64	418.57	228.93	0.9621	1.8218
-6	6.57	6.55	0.837	39.95	1.194	25.03	191.13	418.92	227.79	0.9675	1.8198
-5	6.80	6.78	0.840	38.64	1.191	25.88	192.62	419.25	226.63	0.9730	1.8178
-4	7.02	7.00	0.843	37.39	1.187	26.74	194.12	419.59	225.47	0.9784	1.8158
-3	7.26	7.23	0.845	36.19	1.183	27.63	195.62	419.91	224.29	0.9838	1.8138
-2	7.50	7.47	0.848	35.03	1.179	28.55	197.12	420.23	223.11	0.9892	1.8119
-1	7.74	7.72	0.851	33.91	1.175	29.49	198.62	420.54	221.92	0.9946	1.8099
0	7.99	7.97	0.854	32.83	1.171	30.46	200.00	420.85	220.85	1.0000	1.8080
1	8.25	8.22	0.857	31.80	1.167	31.45	201.65	421.15	219.50	1.0054	1.8061
2	8.51	8.49	0.860	30.80	1.163	32.47	203.17	421.44	218.27	1.0108	1.8041
3	8.78	8.75	0.863	29.83	1.159	33.52	204.69	421.72	217.03	1.0161	1.8022
4	9.06	9.03	0.866	28.90	1.155	34.60	206.21	422.00	215.79	1.0215	1.8003
5	9.34	9.31	0.869	28.01	1.151	35.70	207.74	422.27	214.53	1.0269	1.7984
6	9.63	9.60	0.872	27.14	1.146	36.84	209.28	422.53	213.26	1.0322	1.7965
7	9.92	9.89	0.875	26.31	1.142	38.01	210.81	422.79	211.98	1.0376	1.7946
8	10.23	10.20	0.879	25.50	1.138	39.21	212.36	423.04	210.68	1.0430	1.7927
9	10.54	10.50	0.882	24.73	1.134	40.44	213.90	423.28	209.37	1.0483	1.7908

Vapour Table, Wet Vapour Range Solkane®410

t	p´	p´´	v´	v´´	ρ'	ρ´´	h´	h´´	r	s´	s´´
[°C]	[bar]	[bar]	[dm³/kg]	[dm³/kg]	[kg/dm³]	[kg/m³]	[kJ/kg]	[kJ/kg]	[kJ/kg]	[kJ/kg K]	[kJ/kg K]
10	10.85	10.82	0.885	23.97	1.130	41.71	215.45	423.51	208.05	1.0537	1.7889
11	11.18	11.14	0.889	23.25	1.125	43.01	217.01	423.73	206.72	1.0590	1.7870
12	11.51	11.47	0.892	22.55	1.121	44.35	218.57	423.95	205.38	1.0644	1.7851
13	11.85	11.81	0.896	21.87	1.116	45.73	220.14	424.15	204.02	1.0698	1.7832
14	12.19	12.15	0.899	21.21	1.112	47.14	221.71	424.35	202.64	1.0751	1.7813
15	12.54	12.51	0.903	20.58	1.108	48.59	223.29	424.54	201.25	1.0805	1.7794
16	12.90	12.87	0.907	19.97	1.103	50.09	224.87	424.71	199.85	1.0859	1.7775
17	13.27	13.23	0.910	19.37	1.099	51.62	226.46	424.88	198.43	1.0912	1.7756
18	13.65	13.61	0.914	18.80	1.094	53.20	228.05	425.04	196.99	1.0966	1.7736
19	14.03	13.99	0.918	18.24	1.089	54.82	229.65	425.19	195.53	1.1020	1.7717
20	14.43	14.38	0.922	17.70	1.085	56.49	231.26	425.32	194.06	1.1074	1.7698
21	14.83	14.78	0.926	17.18	1.080	58.20	232.88	425.45	192.57	1.1128	1.7678
22	15.24	15.19	0.930	16.68	1.075	59.96	234.50	425.57	191.06	1.1183	1.7659
23	15.65	15.61	0.934	16.19	1.070	61.78	236.13	425.67	189.54	1.1237	1.7639
24	16.08	16.03	0.939	15.71	1.066	63.64	237.77	425.76	187.99	1.1291	1.7619
25	16.52	16.47	0.943	15.25	1.061	65.56	239.42	425.84	186.42	1.1346	1.7599
26	16.96	16.91	0.947	14.81	1.056	67.54	241.08	425.91	184.82	1.1401	1.7579
27	17.41	17.36	0.952	14.37	1.051	69.57	242.75	425.96	183.21	1.1455	1.7559
28	17.87	17.82	0.956	13.95	1.046	71.67	244.43	426.00	181.57	1.1510	1.7539
29	18.34	18.29	0.961	13.55	1.040	73.83	246.11	426.02	179.91	1.1566	1.7518
30	18.82	18.77	0.966	13.15	1.035	76.05	247.81	426.03	178.22	1.1621	1.7497
31	19.31	19.26	0.971	12.77	1.030	78.34	249.53	426.03	176.50	1.1677	1.7476
32	19.81	19.76	0.976	12.39	1.025	80.70	251.25	426.01	174.76	1.1733	1.7455
33	20.32	20.26	0.981	12.03	1.019	83.13	252.99	425.97	172.99	1.1789	1.7434
34	20.84	20.78	0.987	11.68	1.014	85.64	254.73	425.92	171.18	1.1845	1.7412
35	21.37	21.31	0.992	11.33	1.008	88.23	256.50	425.85	169.35	1.1901	1.7390
36	21.91	21.85	0.998	11.00	1.002	90.90	258.28	425.76	167.48	1.1958	1.7367
37	22.46	22.40	1.003	10.68	0.997	93.65	260.07	425.65	165.58	1.2015	1.7345
38	23.02	22.95	1.009	10.36	0.991	96.50	261.88	425.52	163.64	1.2073	1.7322
39	23.59	23.52	1.015	10.06	0.985	99.45	263.71	425.37	161.66	1.2130	1.7298
40	24.17	24.10	1.021	9.76	0.979	102.49	265.56	425.20	159.64	1.2188	1.7274
41	24.76	24.69	1.028	9.47	0.973	105.64	267.42	425.00	157.59	1.2247	1.7250
42	25.37	25.30	1.034	9.18	0.967	108.90	269.30	424.79	155.48	1.2306	1.7225
43	25.98	25.91	1.041	8.91	0.960	112.28	271.21	424.54	153.34	1.2365	1.7200
44	26.61	26.54	1.048	8.64	0.954	115.78	273.13	424.27	151.14	1.2424	1.7174
45	27.24	27.17	1.056	8.37	0.947	119.41	275.08	423.98	148.90	1.2484	1.7148
46	27.89	27.82	1.063	8.12	0.941	123.17	277.05	423.65	146.60	1.2544	1.7121
47	28.55	28.48	1.071	7.87	0.934	127.09	279.04	423.29	144.25	1.2605	1.7093
48	29.23	29.15	1.079	7.62	0.927	131.16	281.06	422.90	141.84	1.2666	1.7065
49	29.91	29.84	1.088	7.39	0.919	135.39	283.11	422.47	139.37	1.2727	1.7035

Vapour Table, Wet Vapour Range Solkane®410

t	p´	p´´	v´	v´´	ρ'	ρ´´	h´	h´´	r	s´	s´´
[°C]	[bar]	[bar]	[dm³/kg]	[dm³/kg]	[kg/dm³]	[kg/m³]	[kJ/kg]	[kJ/kg]	[kJ/kg]	[kJ/kg K]	[kJ/kg K]
50	30.61	30.53	1.096	7.15	0.912	139.81	285.18	422.01	136.83	1.2789	1.7005
51	31.32	31.24	1.106	6.92	0.905	144.41	287.28	421.51	134.23	1.2852	1.6974
52	32.04	31.97	1.115	6.70	0.897	149.23	289.41	420.96	131.55	1.2915	1.6942
53	32.78	32.70	1.125	6.48	0.889	154.26	291.57	420.37	128.79	1.2978	1.6909
54	33.53	33.45	1.136	6.27	0.880	159.54	293.77	419.72	125.96	1.3042	1.6875
55	34.29	34.22	1.147	6.06	0.872	165.08	296.00	419.03	123.03	1.3107	1.6839
56	35.07	35.00	1.159	5.85	0.863	170.91	298.26	418.27	120.01	1.3172	1.6802
57	35.86	35.79	1.171	5.65	0.854	177.06	300.56	417.45	116.89	1.3238	1.6763
58	36.67	36.59	1.185	5.45	0.844	183.56	302.89	416.55	113.66	1.3304	1.6723
59	37.49	37.42	1.199	5.25	0.834	190.46	305.27	415.58	110.31	1.3371	1.6680
60	38.32	38.25	1.214	5.06	0.824	197.81	307.68	414.51	106.83	1.3439	1.6635
61	39.18	39.11	1.231	4.86	0.813	205.68	310.14	413.35	103.21	1.3507	1.6588
62	40.04	39.97	1.249	4.67	0.801	214.13	312.64	412.06	99.42	1.3576	1.6537
63	40.93	40.86	1.269	4.48	0.788	223.29	315.18	410.63	95.45	1.3645	1.6482
64	41.83	41.76	1.291	4.29	0.774	233.28	317.77	409.04	91.27	1.3716	1.6423
65	42.74	42.68	1.317	4.09	0.759	244.30	320.41	407.24	86.83	1.3787	1.6358
66	43.68	43.62	1.347	3.90	0.743	256.65	323.10	405.19	82.09	1.3858	1.6287

9 Vapour Table, Superheated Range Solkane®410

0.36 bar -70.00 °C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-70	631.36	388.31	1.9981
-65	648.17	391.80	2.0150
-60	664.89	395.31	2.0317
-55	681.54	398.84	2.0480
-50	698.11	402.40	2.0642
-45	714.62	405.98	2.0801
-40	731.07	409.60	2.0957
-35	747.47	413.24	2.1112
-30	763.83	416.91	2.1264
-25	780.14	420.62	2.1415
-20	796.42	424.35	2.1564
-15	812.67	428.12	2.1711
-10	828.89	431.91	2.1857
-5	845.08	435.75	2.2001
0	861.24	439.61	2.2144
5	877.38	443.51	2.2286
10	893.51	447.45	2.2426
15	909.61	451.42	2.2565

0.41 bar -68.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-68	563.13	389.46	1.9900
-65	572.11	391.57	2.0002
-60	587.01	395.09	2.0169
-55	601.83	398.64	2.0333
-50	616.58	402.21	2.0495
-45	631.27	405.81	2.0655
-40	645.89	409.43	2.0812
-35	660.47	413.09	2.0967
-30	675.00	416.77	2.1120
-25	689.49	420.48	2.1271
-20	703.95	424.22	2.1420
-15	718.37	428.00	2.1568
-10	732.76	431.80	2.1714
-5	747.12	435.64	2.1859
0	761.46	439.51	2.2002
5	775.78	443.42	2.2143
10	790.08	447.36	2.2284
15	804.36	451.33	2.2423

0.46 bar -66.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-66	503.54	390.60	1.9821
-65	506.21	391.31	1.9855
-60	519.54	394.85	2.0024
-55	532.78	398.41	2.0189
-50	545.95	402.00	2.0351
-45	559.05	405.61	2.0512
-40	572.10	409.25	2.0669
-35	585.10	412.92	2.0825
-30	598.05	416.61	2.0978
-25	610.96	420.33	2.1130
-20	623.83	424.08	2.1279
-15	636.67	427.86	2.1427
-10	649.48	431.68	2.1574
-5	662.26	435.52	2.1718
0	675.02	439.40	2.1862
5	687.76	443.31	2.2004
10	700.47	447.26	2.2144
15	713.17	451.24	2.2284

0.52 bar -64.00 °C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-64	451.35	391.73	1.9745
-60	460.90	394.58	1.9880
-55	472.77	398.17	2.0046
-50	484.57	401.77	2.0210
-45	496.31	405.40	2.0371
-40	507.98	409.05	2.0529
-35	519.61	412.73	2.0685
-30	531.18	416.43	2.0839
-25	542.72	420.17	2.0991
-20	554.22	423.93	2.1141
-15	565.69	427.72	2.1289
-10	577.12	431.54	2.1436
-5	588.53	435.39	2.1581
0	599.91	439.28	2.1724
5	611.28	443.20	2.1867
10	622.62	447.15	2.2007
15	633.94	451.14	2.2147
20	645.25	455.16	2.2285

0.58 bar -62.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-62	405.50	392.85	1.9671
-60	409.80	394.29	1.9739
-55	420.49	397.89	1.9906
-50	431.09	401.52	2.0070
-45	441.63	405.16	2.0232
-40	452.11	408.83	2.0391
-35	462.54	412.52	2.0548
-30	472.92	416.24	2.0702
-25	483.26	419.99	2.0854
-20	493.57	423.76	2.1005
-15	503.83	427.56	2.1154
-10	514.07	431.39	2.1301
-5	524.29	435.25	2.1446
0	534.47	439.15	2.1590
5	544.64	443.07	2.1732
10	554.78	447.03	2.1873
15	564.91	451.02	2.2013
20	575.02	455.05	2.2152

0.65 bar -60.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-60	365.15	393.96	1.9599
-55	374.79	397.59	1.9767
-50	384.35	401.24	1.9933
-45	393.86	404.90	2.0095
-40	403.29	408.59	2.0255
-35	412.68	412.30	2.0412
-30	422.02	416.03	2.0567
-25	431.31	419.79	2.0720
-20	440.57	423.57	2.0871
-15	449.79	427.38	2.1020
-10	458.99	431.23	2.1168
-5	468.15	435.10	2.1314
0	477.29	439.00	2.1458
5	486.41	442.93	2.1600
10	495.51	446.90	2.1742
15	504.59	450.90	2.1882
20	513.65	454.93	2.2021
25	522.70	459.00	2.2158

0.72 bar -58.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-58	329.53	395.07	1.9529
-55	334.75	397.26	1.9631
-50	343.41	400.93	1.9797
-45	351.99	404.62	1.9960
-40	360.52	408.32	2.0121
-35	368.99	412.05	2.0279
-30	377.42	415.80	2.0435
-25	385.80	419.57	2.0588
-20	394.14	423.37	2.0740
-15	402.45	427.19	2.0890
-10	410.73	431.04	2.1037
-5	418.98	434.93	2.1184
0	427.20	438.84	2.1328
5	435.40	442.78	2.1471
10	443.59	446.75	2.1613
15	451.75	450.76	2.1753
20	459.90	454.80	2.1892
25	468.03	458.87	2.2030

0.81 bar -56.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-56	298.01	396.16	1.9461
-55	299.59	396.90	1.9495
-50	307.44	400.59	1.9663
-45	315.22	404.30	1.9827
-40	322.95	408.03	1.9989
-35	330.62	411.77	2.0148
-30	338.24	415.54	2.0304
-25	345.82	419.33	2.0458
-20	353.36	423.14	2.0611
-15	360.87	426.98	2.0761
-10	368.34	430.85	2.0909
-5	375.79	434.74	2.1056
0	383.21	438.66	2.1201
5	390.60	442.61	2.1344
10	397.98	446.60	2.1486
15	405.34	450.61	2.1626
20	412.68	454.66	2.1766
25	420.01	458.74	2.1904

0.89 bar -54.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-54	270.05	397.24	1.9395
-50	275.76	400.22	1.9530
-45	282.84	403.96	1.9696
-40	289.86	407.71	1.9858
-35	296.83	411.47	2.0018
-30	303.74	415.26	2.0175
-25	310.61	419.07	2.0330
-20	317.45	422.90	2.0483
-15	324.25	426.75	2.0634
-10	331.01	430.63	2.0783
-5	337.75	434.54	2.0930
0	344.47	438.47	2.1075
5	351.16	442.43	2.1219
10	357.83	446.43	2.1361
15	364.48	450.45	2.1502
20	371.11	454.50	2.1642
25	377.73	458.59	2.1780
30	384.33	462.71	2.1917

0.99 bar -52.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-52	245.19	398.31	1.9331
-50	247.80	399.82	1.9399
-45	254.26	403.58	1.9566
-40	260.66	407.36	1.9729
-35	267.00	411.15	1.9890
-30	273.29	414.96	2.0048
-25	279.54	418.78	2.0204
-20	285.75	422.63	2.0358
-15	291.92	426.50	2.0509
-10	298.07	430.39	2.0658
-5	304.18	434.31	2.0806
0	310.27	438.26	2.0952
5	316.34	442.24	2.1096
10	322.38	446.24	2.1239
15	328.41	450.27	2.1380
20	334.41	454.34	2.1520
25	340.41	458.43	2.1658
30	346.39	462.56	2.1796

1.10 bar -50.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-50	223.04	399.37	1.9268
-45	228.96	403.17	1.9437
-40	234.81	406.97	1.9602
-35	240.60	410.79	1.9764
-30	246.35	414.62	1.9923
-25	252.04	418.47	2.0080
-20	257.70	422.34	2.0234
-15	263.32	426.23	2.0386
-10	268.92	430.14	2.0536
-5	274.48	434.07	2.0684
0	280.02	438.03	2.0830
5	285.53	442.02	2.0975
10	291.02	446.04	2.1118
15	296.49	450.08	2.1260
20	301.95	454.15	2.1400
25	307.39	458.26	2.1539
30	312.81	462.40	2.1676
35	318.23	466.56	2.1813

1.21 bar -48.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-48	203.27	400.42	1.9207
-45	206.52	402.72	1.9309
-40	211.88	406.56	1.9475
-35	217.19	410.40	1.9639
-30	222.45	414.26	1.9799
-25	227.66	418.13	1.9956
-20	232.83	422.02	2.0112
-15	237.96	425.93	2.0264
-10	243.06	429.86	2.0415
-5	248.14	433.81	2.0564
0	253.18	437.79	2.0711
5	258.21	441.79	2.0856
10	263.21	445.81	2.1000
15	268.19	449.87	2.1142
20	273.16	453.96	2.1282
25	278.11	458.07	2.1421
30	283.04	462.22	2.1559
35	287.96	466.39	2.1696

Vapour Table, Superheated Range Solkane®410

1.33 bar -46.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-46	185.57	401.46	1.9148
-45	186.56	402.23	1.9182
-40	191.50	406.10	1.9350
-35	196.38	409.98	1.9515
-30	201.20	413.87	1.9676
-25	205.98	417.76	1.9835
-20	210.72	421.68	1.9991
-15	215.42	425.61	2.0145
-10	220.08	429.56	2.0296
-5	224.72	433.52	2.0445
0	229.33	437.52	2.0593
5	233.92	441.53	2.0739
10	238.49	445.58	2.0883
15	243.04	449.64	2.1025
20	247.57	453.74	2.1166
25	252.08	457.87	2.1306
30	256.58	462.02	2.1444
35	261.07	466.21	2.1581

1.46 bar -44.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-44	169.70	402.48	1.9090
-40	173.34	405.61	1.9226
-35	177.83	409.52	1.9392
-30	182.27	413.44	1.9554
-25	186.67	417.37	1.9714
-20	191.02	421.30	1.9871
-15	195.33	425.26	2.0026
-10	199.62	429.23	2.0178
-5	203.87	433.22	2.0328
0	208.09	437.23	2.0477
5	212.29	441.26	2.0623
10	216.47	445.32	2.0768
15	220.63	449.40	2.0910
20	224.77	453.51	2.1052
25	228.90	457.65	2.1192
30	233.01	461.81	2.1330
35	237.11	466.01	2.1468
40	241.20	470.24	2.1604

1.61 bar -42.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-42	155.44	403.49	1.9034
-40	157.12	405.07	1.9102
-35	161.27	409.02	1.9269
-30	165.38	412.97	1.9434
-25	169.43	416.93	1.9595
-20	173.44	420.90	1.9753
-15	177.41	424.88	1.9909
-10	181.34	428.87	2.0062
-5	185.25	432.88	2.0213
0	189.13	436.91	2.0362
5	192.99	440.96	2.0509
10	196.82	445.04	2.0654
15	200.63	449.13	2.0797
20	204.43	453.26	2.0939
25	208.21	457.41	2.1080
30	211.97	461.59	2.1219
35	215.73	465.80	2.1356
40	219.47	470.03	2.1493

1.76 bar -40.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-40	142.61	404.49	1.8979
-35	146.46	408.48	1.9148
-30	150.25	412.47	1.9314
-25	154.00	416.46	1.9476
-20	157.70	420.46	1.9636
-15	161.37	424.47	1.9793
-10	165.00	428.49	1.9947
-5	168.60	432.52	2.0099
0	172.17	436.57	2.0248
5	175.71	440.64	2.0396
10	179.24	444.73	2.0542
15	182.74	448.85	2.0686
20	186.23	452.99	2.0828
25	189.70	457.15	2.0969
30	193.16	461.34	2.1109
35	196.60	465.56	2.1247
40	200.03	469.81	2.1383
45	203.45	474.09	2.1519

1.92 bar -38.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-38	131.03	405.47	1.8925
-35	133.17	407.89	1.9027
-30	136.70	411.93	1.9195
-25	140.17	415.96	1.9359
-20	143.60	419.99	1.9520
-15	146.99	424.03	1.9678
-10	150.35	428.07	1.9833
-5	153.67	432.13	1.9986
0	156.96	436.21	2.0136
5	160.24	440.30	2.0285
10	163.48	444.41	2.0431
15	166.71	448.54	2.0576
20	169.92	452.70	2.0719
25	173.12	456.88	2.0860
30	176.29	461.08	2.1000
35	179.46	465.31	2.1139
40	182.61	469.58	2.1276
45	185.75	473.86	2.1412

2.10 bar -36.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-36	120.57	406.44	1.8872
-35	121.23	407.26	1.8907
-30	124.52	411.33	1.9076
-25	127.75	415.41	1.9242
-20	130.93	419.48	1.9404
-15	134.08	423.55	1.9563
-10	137.19	427.62	1.9720
-5	140.26	431.71	1.9874
0	143.31	435.81	2.0025
5	146.33	439.93	2.0175
10	149.33	444.06	2.0322
15	152.31	448.21	2.0467
20	155.28	452.38	2.0611
25	158.22	456.58	2.0753
30	161.15	460.80	2.0893
35	164.07	465.05	2.1032
40	166.97	469.32	2.1170
45	169.86	473.62	2.1306

2.29 bar -34.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-34	111.10	407.39	1.8821
-30	113.55	410.70	1.8958
-25	116.56	414.81	1.9125
-20	119.53	418.92	1.9289
-15	122.45	423.03	1.9450
-10	125.34	427.14	1.9608
-5	128.20	431.26	1.9763
0	131.03	435.39	1.9915
5	133.83	439.53	2.0066
10	136.60	443.68	2.0214
15	139.36	447.85	2.0360
20	142.10	452.05	2.0504
25	144.82	456.26	2.0646
30	147.53	460.50	2.0787
35	150.22	464.76	2.0927
40	152.90	469.05	2.1065
45	155.57	473.36	2.1201
50	158.23	477.70	2.1337

2.49 bar -32.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-32	102.52	408.33	1.8771
-30	103.66	410.00	1.8840
-25	106.48	414.17	1.9009
-20	109.25	418.33	1.9175
-15	111.98	422.47	1.9337
-10	114.67	426.62	1.9496
-5	117.32	430.77	1.9653
0	119.95	434.93	1.9806
5	122.55	439.10	1.9958
10	125.13	443.28	2.0106
15	127.68	447.47	2.0253
20	130.22	451.68	2.0398
25	132.74	455.92	2.0541
30	135.25	460.17	2.0683
35	137.74	464.45	2.0823
40	140.22	468.75	2.0961
45	142.68	473.08	2.1099
50	145.14	477.44	2.1234

2.70 bar -30.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-30	94.72	409.25	1.8721
-25	97.37	413.48	1.8893
-20	99.96	417.68	1.9061
-15	102.51	421.87	1.9225
-10	105.02	426.06	1.9386
-5	107.50	430.25	1.9543
0	109.95	434.44	1.9698
5	112.37	438.63	1.9850
10	114.76	442.84	2.0000
15	117.14	447.06	2.0148
20	119.50	451.30	2.0294
25	121.84	455.55	2.0438
30	124.16	459.82	2.0580
35	126.47	464.12	2.0720
40	128.76	468.44	2.0859
45	131.05	472.78	2.0997
50	133.32	477.15	2.1133
55	135.59	481.54	2.1268

2.93 bar -28.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-28	87.63	410.16	1.8673
-25	89.11	412.73	1.8777
-20	91.55	416.99	1.8947
-15	93.94	421.23	1.9113
-10	96.29	425.46	1.9276
-5	98.61	429.68	1.9435
0	100.89	433.91	1.9591
5	103.15	438.14	1.9744
10	105.39	442.37	1.9895
15	107.60	446.62	2.0044
20	109.79	450.88	2.0190
25	111.97	455.16	2.0335
30	114.13	459.45	2.0478
35	116.27	463.77	2.0619
40	118.41	468.10	2.0759
45	120.53	472.46	2.0897
50	122.64	476.84	2.1033
55	124.74	481.25	2.1169

3.17 bar -26.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-26	81.16	411.05	1.8626
-25	81.63	411.92	1.8661
-20	83.92	416.24	1.8834
-15	86.17	420.53	1.9002
-10	88.38	424.81	1.9166
-5	90.55	429.08	1.9326
0	92.69	433.34	1.9484
5	94.80	437.61	1.9639
10	96.89	441.87	1.9791
15	98.96	446.15	1.9940
20	101.00	450.44	2.0088
25	103.03	454.74	2.0233
30	105.04	459.05	2.0377
35	107.04	463.39	2.0519
40	109.02	467.74	2.0659
45	110.99	472.12	2.0797
50	112.95	476.52	2.0935
55	114.90	480.94	2.1071

3.43 bar -24.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
-24	75.27	411.92	1.8580
-20	77.00	415.43	1.8720
-15	79.12	419.78	1.8890
-10	81.19	424.11	1.9056
-5	83.23	428.43	1.9218
0	85.24	432.73	1.9377
5	87.22	437.03	1.9534
10	89.18	441.34	1.9687
15	91.11	445.64	1.9838
20	93.02	449.96	1.9986
25	94.91	454.29	2.0132
30	96.79	458.63	2.0277
35	98.65	462.98	2.0419
40	100.50	467.36	2.0560
45	102.34	471.75	2.0699
50	104.16	476.17	2.0837
55	105.98	480.61	2.0973
60	107.79	485.07	2.1108

Vapour Table, Superheated Range Solkane®410

3.71 bar	-22.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	kJ/kgK
-22	69.87	412.78	1.8535
-20	70.69	414.56	1.8605
-15	72.69	418.98	1.8778
-10	74.66	423.36	1.8946
-5	76.58	427.73	1.9111
0	78.47	432.08	1.9271
5	80.33	436.42	1.9429
10	82.16	440.76	1.9584
15	83.97	445.10	1.9736
20	85.76	449.45	1.9885
25	87.53	453.80	2.0032
30	89.29	458.17	2.0178
35	91.03	462.55	2.0321
40	92.76	466.95	2.0462
45	94.47	471.36	2.0602
50	96.17	475.80	2.0741
55	97.87	480.25	2.0878
60	99.55	484.73	2.1013

4.63 bar	-16.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	kJ/kgK
-16	56.26	415.24	1.8403
-15	56.60	416.16	1.8439
-10	58.28	420.76	1.8616
-5	59.92	425.31	1.8787
0	61.52	429.83	1.8954
5	63.08	434.32	1.9117
10	64.62	438.79	1.9276
15	66.13	443.25	1.9432
20	67.62	447.70	1.9586
25	69.09	452.16	1.9736
30	70.54	456.61	1.9885
35	71.98	461.08	2.0031
40	73.40	465.55	2.0174
45	74.81	470.03	2.0317
50	76.21	474.53	2.0457
55	77.59	479.05	2.0596
60	78.97	483.58	2.0733
65	80.34	488.14	2.0868

5.72 bar	-10.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	kJ/kgK
-10	45.70	417.51	1.8278
-5	47.12	422.31	1.8459
0	48.51	427.05	1.8634
5	49.86	431.73	1.8804
10	51.17	436.38	1.8969
15	52.46	440.99	1.9131
20	53.72	445.58	1.9289
25	54.97	450.16	1.9444
30	56.19	454.73	1.9596
35	57.40	459.30	1.9745
40	58.59	463.86	1.9892
45	59.77	468.43	2.0037
50	60.93	473.01	2.0180
55	62.09	477.60	2.0321
60	63.23	482.20	2.0460
65	64.37	486.82	2.0598
70	65.50	491.45	2.0734
75	66.62	496.11	2.0868

7.00 bar	-4.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	kJ/kgK
-4	37.39	419.59	1.8158
0	38.38	423.60	1.8306
5	39.57	428.55	1.8486
10	40.72	433.42	1.8659
15	41.84	438.24	1.8828
20	42.94	443.01	1.8992
25	44.01	447.75	1.9152
30	45.06	452.46	1.9309
35	46.09	457.16	1.9463
40	47.11	461.84	1.9614
45	48.11	466.52	1.9762
50	49.10	471.20	1.9908
55	50.08	475.87	2.0051
60	51.04	480.56	2.0193
65	52.00	485.25	2.0333
70	52.95	489.96	2.0471
75	53.89	494.67	2.0607
80	54.82	499.41	2.0742

4.00 bar	-20.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	kJ/kgK
-20	64.94	413.62	1.8490
-15	66.84	418.11	1.8666
-10	68.70	422.56	1.8836
-5	70.51	426.98	1.9003
0	72.30	431.38	1.9166
5	74.05	435.77	1.9325
10	75.77	440.15	1.9481
15	77.47	444.53	1.9634
20	79.15	448.91	1.9785
25	80.81	453.29	1.9933
30	82.46	457.68	2.0079
35	84.09	462.09	2.0223
40	85.70	466.51	2.0366
45	87.31	470.95	2.0506
50	88.90	475.40	2.0645
55	90.48	479.88	2.0783
60	92.05	484.37	2.0919
65	93.62	488.89	2.1053

4.98 bar	-14.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	kJ/kgK
-14	52.45	416.01	1.8361
-10	53.72	419.76	1.8504
-5	55.28	424.38	1.8678
0	56.80	428.96	1.8848
5	58.29	433.51	1.9013
10	59.74	438.04	1.9174
15	61.17	442.55	1.9332
20	62.58	447.04	1.9487
25	63.97	451.53	1.9639
30	65.34	456.03	1.9788
35	66.69	460.52	1.9935
40	68.03	465.02	2.0080
45	69.35	469.53	2.0223
50	70.66	474.06	2.0364
55	71.97	478.59	2.0503
60	73.26	483.15	2.0641
65	74.54	487.72	2.0777
70	75.82	492.32	2.0912

6.13 bar	-8.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	kJ/kgK
-8	42.71	418.22	1.8238
-5	43.53	421.16	1.8348
0	44.85	425.98	1.8526
5	46.14	430.74	1.8699
10	47.40	435.46	1.8867
15	48.63	440.13	1.9030
20	49.83	444.78	1.9190
25	51.01	449.41	1.9347
30	52.17	454.02	1.9500
35	53.31	458.63	1.9651
40	54.44	463.23	1.9799
45	55.55	467.83	1.9945
50	56.66	472.44	2.0089
55	57.75	477.06	2.0230
60	58.83	481.69	2.0370
65	59.90	486.33	2.0509
70	60.96	490.98	2.0645
75	62.01	495.66	2.0781

7.47 bar	-2.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	KJ/kgK
-2	35.03	420.23	1.8119
0	35.50	422.28	1.8194
5	36.65	427.33	1.8377
10	37.76	432.29	1.8554
15	38.84	437.19	1.8726
20	39.89	442.04	1.8892
25	40.91	446.84	1.9055
30	41.92	451.61	1.9214
35	42.90	456.35	1.9369
40	43.87	461.08	1.9521
45	44.82	465.80	1.9671
50	45.76	470.52	1.9818
55	46.68	475.23	1.9962
60	47.60	479.95	2.0105
65	48.51	484.67	2.0246
70	49.40	489.40	2.0385
75	50.29	494.14	2.0522
80	51.17	498.90	2.0657

4.31 bar	-18.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	kJ/kgK
-18	60.42	414.44	1.8446
-15	61.50	417.17	1.8553
-10	63.26	421.69	1.8726
-5	64.98	426.17	1.8895
0	66.66	430.63	1.9060
5	68.32	435.07	1.9221
10	69.94	439.49	1.9378
15	71.55	443.91	1.9533
20	73.13	448.33	1.9685
25	74.69	452.74	1.9834
30	76.23	457.17	1.9982
35	77.76	461.60	2.0127
40	79.27	466.04	2.0270
45	80.77	470.50	2.0411
50	82.26	474.98	2.0551
55	83.74	479.47	2.0689

5.34 bar	-12.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	kJ/kgK
-12	48.93	416.77	1.8319
-10	49.54	418.67	1.8392
-5	51.03	423.38	1.8569
0	52.48	428.04	1.8741
5	53.89	432.65	1.8909
10	55.27	437.23	1.9072
15	56.63	441.79	1.9231
20	57.96	446.34	1.9388
25	59.27	450.87	1.9541
30	60.57	455.40	1.9692
35	61.84	459.93	1.9840
40	63.10	464.46	1.9986
45	64.35	469.00	2.0130
50	65.59	473.55	2.0272
55	66.81	478.11	2.0412
60	68.03	482.69	2.0550

6.55 bar	-6.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	kJ/kgK
-6	39.95	418.92	1.8198
-5	40.21	419.91	1.8235
0	41.49	424.84	1.8417
5	42.72	429.68	1.8593
10	43.93	434.47	1.8763
15	45.10	439.22	1.8929
20	46.24	443.92	1.9091
25	47.37	448.61	1.9250
30	48.47	453.27	1.9405
35	49.56	457.92	1.9557
40	50.63	462.56	1.9706
45	51.68	467.20	1.9853
50	52.72	471.84	1.9998
55	53.75	476.48	2.0141
60	54.77	481.14	2.0281
65	55.78	485.80	2.0420

7.97 bar	0.00°C		
t	*v*	*h*	*s*
°C	dm³/kg	kJ/kg	kJ/kgK
0	32.83	420.85	1.8080
5	33.95	426.02	1.8268
10	35.02	431.09	1.8448
15	36.06	436.07	1.8623
20	37.07	440.99	1.8792
25	38.05	445.87	1.8957
30	39.01	450.70	1.9118
35	39.95	455.50	1.9275
40	40.87	460.28	1.9429
45	41.78	465.04	1.9580
50	42.67	469.80	1.9728
55	43.55	474.55	1.9874
60	44.42	479.30	2.0017
65	45.28	484.05	2.0159
70	46.13	488.81	2.0299
75	46.98	493.58	2.0437

Vapour Table, Superheated Range Solkane®410

8.47bar 2.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	KJ/kgK
2	30.80	421.44	1.8041
5	31.44	424.60	1.8156
10	32.48	429.79	1.8341
15	33.49	434.87	1.8519
20	34.46	439.88	1.8691
25	35.40	444.83	1.8858
30	36.32	449.73	1.9021
35	37.22	454.59	1.9180
40	38.10	459.42	1.9336
45	38.97	464.24	1.9488
50	39.82	469.03	1.9638
55	40.66	473.82	1.9785
60	41.49	478.61	1.9930
65	42.30	483.40	2.0072
70	43.11	488.19	2.0213
75	43.91	492.98	2.0352
80	44.70	497.79	2.0489
85	45.49	502.61	2.0624

10.20 bar 8.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
8	25.50	423.04	1.7927
10	25.89	425.27	1.8006
15	26.81	430.73	1.8197
20	27.69	436.06	1.8380
25	28.55	441.28	1.8557
30	29.37	446.43	1.8728
35	30.17	451.50	1.8894
40	30.95	456.53	1.9056
45	31.71	461.51	1.9214
50	32.46	466.46	1.9368
55	33.19	471.39	1.9520
60	33.91	476.30	1.9668
65	34.62	481.20	1.9814
70	35.32	486.10	1.9958
75	36.01	490.99	2.0100
80	36.69	495.89	2.0239
85	37.36	500.79	2.0377
90	38.03	505.70	2.0513

12.15 bar 14.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
14	21.21	424.35	1.7813
15	21.39	425.53	1.7854
20	22.22	431.32	1.8053
25	23.01	436.94	1.8243
30	23.77	442.41	1.8425
35	24.50	447.78	1.8601
40	25.20	453.05	1.8771
45	25.88	458.26	1.8935
50	26.55	463.40	1.9096
55	27.20	468.51	1.9253
60	27.84	473.58	1.9406
65	28.46	478.62	1.9556
70	29.08	483.65	1.9704
75	29.68	488.66	1.9849
80	30.28	493.66	1.9992
85	30.86	498.66	2.0132
90	31.44	503.66	2.0271
95	32.02	508.66	2.0408

14.38 bar 20.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
20	17.70	425.32	1.7698
25	18.47	431.52	1.7907
30	19.19	437.47	1.8105
35	19.87	443.23	1.8294
40	20.52	448.85	1.8474
45	21.15	454.35	1.8649
50	21.76	459.75	1.8817
55	22.35	465.08	1.8981
60	22.92	470.35	1.9140
65	23.48	475.58	1.9296
70	24.03	480.77	1.9448
75	24.56	485.92	1.9598
80	25.09	491.06	1.9744
85	25.61	496.18	1.9888
90	26.12	501.29	2.0030
95	26.62	506.40	2.0169
100	27.12	511.50	2.0307
105	27.61	516.61	2.0443

9.03 bar 4.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
4	28.90	422.00	1.8003
5	29.11	423.08	1.8042
10	30.13	428.39	1.8231
15	31.10	433.59	1.8413
20	32.04	438.69	1.8589
25	32.94	443.73	1.8759
30	33.83	448.70	1.8924
35	34.69	453.62	1.9086
40	35.54	458.52	1.9243
45	36.36	463.38	1.9397
50	37.18	468.23	1.9548
55	37.98	473.06	1.9697
60	38.77	477.88	1.9843
65	39.54	482.70	1.9986
70	40.31	487.53	2.0128
75	41.07	492.35	2.0267
80	41.83	497.19	2.0405
85	42.57	502.03	2.0542

10.82 bar 10.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
10	23.97	423.51	1.7889
15	24.88	429.13	1.8086
20	25.74	434.60	1.8274
25	26.57	439.94	1.8454
30	27.37	445.18	1.8629
35	28.14	450.34	1.8798
40	28.90	455.44	1.8962
45	29.63	460.49	1.9122
50	30.35	465.50	1.9278
55	31.05	470.49	1.9431
60	31.74	475.45	1.9581
65	32.42	480.39	1.9728
70	33.08	485.33	1.9873
75	33.74	490.26	2.0016
80	34.39	495.18	2.0157
85	35.04	500.12	2.0295
90	35.67	505.05	2.0432
95	36.31	510.00	2.0567

12.87 bar 16.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
16	19.97	424.71	1.7775
20	20.62	429.49	1.7939
25	21.40	435.27	1.8134
30	22.14	440.88	1.8321
35	22.85	446.36	1.8500
40	23.54	451.74	1.8673
45	24.20	457.03	1.8841
50	24.84	462.26	1.9004
55	25.47	467.43	1.9163
60	26.08	472.56	1.9318
65	26.68	477.66	1.9470
70	27.27	482.74	1.9619
75	27.85	487.80	1.9765
80	28.43	492.84	1.9909
85	28.99	497.88	2.0051
90	29.54	502.91	2.0190
95	30.09	507.95	2.0328
100	30.64	512.99	2.0464

15.19 bar 22.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
22	16.68	425.57	1.7659
25	17.13	429.40	1.7788
30	17.84	435.56	1.7993
35	18.52	441.49	1.8187
40	19.16	447.25	1.8372
45	19.77	452.87	1.8550
50	20.36	458.38	1.8722
55	20.93	463.80	1.8889
60	21.49	469.15	1.9051
65	22.03	474.45	1.9208
70	22.56	479.70	1.9362
75	23.08	484.91	1.9513
80	23.58	490.10	1.9661
85	24.08	495.27	1.9807
90	24.57	500.42	1.9949
95	25.06	505.57	2.0090
100	25.54	510.71	2.0229
105	26.01	515.84	2.0366

9.60 bar 6.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
6	27.14	422.53	1.7965
10	27.93	426.89	1.8120
15	28.88	432.21	1.8306
20	29.79	437.42	1.8485
25	30.66	442.55	1.8659
30	31.52	447.60	1.8827
35	32.35	452.60	1.8990
40	33.16	457.55	1.9150
45	33.95	462.47	1.9306
50	34.73	467.37	1.9458
55	35.49	472.25	1.9608
60	36.25	477.12	1.9755
65	36.99	481.98	1.9900
70	37.72	486.83	2.0043
75	38.45	491.69	2.0183
80	39.16	496.55	2.0322
85	39.87	501.43	2.0459
90	40.57	506.31	2.0594

11.47 bar 12.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
12	22.55	423.95	1.7851
15	23.08	427.40	1.7972
20	23.92	433.02	1.8165
25	24.73	438.49	1.8350
30	25.51	443.84	1.8528
35	26.26	449.10	1.8700
40	26.98	454.28	1.8867
45	27.69	459.41	1.9029
50	28.38	464.48	1.9187
55	29.06	469.53	1.9342
60	29.72	474.54	1.9494
65	30.37	479.53	1.9643
70	31.01	484.51	1.9789
75	31.64	489.48	1.9932
80	32.26	494.44	2.0074
85	32.88	499.41	2.0214
90	33.48	504.37	2.0351
95	34.08	509.35	2.0487

13.61 bar 18.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
18	18.80	425.04	1.7736
20	19.12	427.50	1.7820
25	19.89	433.47	1.8022
30	20.62	439.24	1.8214
35	21.31	444.85	1.8398
40	21.98	450.34	1.8575
45	22.62	455.73	1.8746
50	23.25	461.04	1.8911
55	23.86	466.29	1.9072
60	24.45	471.49	1.9230
65	25.03	476.65	1.9383
70	25.59	481.78	1.9534
75	26.15	486.88	1.9682
80	26.70	491.97	1.9827
85	27.24	497.05	1.9969
90	27.77	502.12	2.0110
95	28.30	507.19	2.0249
100	28.82	512.26	2.0386

16.03 bar 24.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
24	15.71	425.76	1.7619
25	15.86	427.08	1.7664
30	16.57	433.49	1.7877
35	17.24	439.62	1.8077
40	17.87	445.53	1.8268
45	18.47	451.29	1.8450
50	19.05	456.92	1.8626
55	19.61	462.44	1.8795
60	20.15	467.88	1.8960
65	20.67	473.25	1.9120
70	21.19	478.57	1.9276
75	21.69	483.84	1.9429
80	22.18	489.09	1.9578
85	22.66	494.31	1.9725
90	23.13	499.50	1.9869
95	23.60	504.69	2.0011
100	24.05	509.87	2.0151
105	24.51	515.04	2.0288

Vapour Table, Superheated Range Solkane®410

16.91 bar 26.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
26	14.81	425.91	1.7579
30	15.37	431.23	1.7756
35	16.04	437.59	1.7964
40	16.66	443.69	1.8161
45	17.26	449.60	1.8348
50	17.82	455.36	1.8527
55	18.37	460.99	1.8700
60	18.89	466.52	1.8868
65	19.40	471.98	1.9030
70	19.90	477.37	1.9189
75	20.38	482.72	1.9343
80	20.86	488.02	1.9495
85	21.32	493.29	1.9643
90	21.78	498.54	1.9788
95	22.23	503.77	1.9931
100	22.67	508.99	2.0072
105	23.10	514.20	2.0211
110	23.53	519.41	2.0348

17.82 bar 28.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
28	13.95	426.00	1.7539
30	14.24	428.76	1.7630
35	14.90	435.39	1.7847
40	15.52	441.71	1.8051
45	16.11	447.79	1.8243
50	16.67	453.69	1.8427
55	17.20	459.45	1.8604
60	17.71	465.09	1.8775
65	18.21	470.64	1.8940
70	18.69	476.11	1.9101
75	19.16	481.53	1.9257
80	19.62	486.90	1.9410
85	20.07	492.23	1.9560
90	20.51	497.53	1.9707
95	20.94	502.80	1.9852
100	21.37	508.07	1.9994
105	21.79	513.32	2.0133
110	22.20	518.56	2.0271

18.77 bar 30.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
30	13.15	426.03	1.7497
35	13.82	432.99	1.7725
40	14.45	439.56	1.7937
45	15.03	445.84	1.8136
50	15.58	451.91	1.8325
55	16.10	457.80	1.8506
60	16.60	463.56	1.8680
65	17.09	469.21	1.8848
70	17.56	474.78	1.9012
75	18.01	480.27	1.9171
80	18.46	485.71	1.9326
85	18.89	491.10	1.9477
90	19.32	496.46	1.9626
95	19.74	501.79	1.9772
100	20.15	507.10	1.9915
105	20.55	512.39	2.0056
110	20.95	517.67	2.0195
115	21.34	522.95	2.0331

19.76 bar 32.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
32	12.39	426.01	1.7455
35	12.80	430.36	1.7597
40	13.42	437.23	1.7818
45	14.00	443.74	1.8025
50	14.55	450.00	1.8220
55	15.07	456.05	1.8405
60	15.56	461.94	1.8584
65	16.03	467.70	1.8755
70	16.49	473.36	1.8922
75	16.94	478.94	1.9083
80	17.37	484.46	1.9240
85	17.79	489.92	1.9394
90	18.20	495.34	1.9544
95	18.61	500.72	1.9691
100	19.00	506.08	1.9836
105	19.39	511.42	1.9978
110	19.78	516.74	2.0118
115	20.16	522.06	2.0256

20.78 bar 34.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
34	11.68	425.92	1.7412
35	11.81	427.43	1.7461
40	12.45	434.67	1.7694
45	13.03	441.47	1.7909
50	13.58	447.94	1.8111
55	14.09	454.17	1.8303
60	14.57	460.20	1.8485
65	15.04	466.09	1.8661
70	15.49	471.87	1.8830
75	15.92	477.54	1.8994
80	16.34	483.14	1.9154
85	16.75	488.67	1.9310
90	17.15	494.16	1.9462
95	17.55	499.60	1.9611
100	17.93	505.01	1.9757
105	18.31	510.40	1.9900
110	18.68	515.77	2.0041
115	19.04	521.13	2.0180

21.85 bar 36.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
36	11.00	425.76	1.7367
40	11.52	431.86	1.7564
45	12.11	438.99	1.7790
50	12.65	445.71	1.7999
55	13.16	452.15	1.8197
60	13.64	458.35	1.8385
65	14.10	464.38	1.8564
70	14.54	470.28	1.8737
75	14.97	476.05	1.8904
80	15.38	481.74	1.9067
85	15.78	487.36	1.9225
90	16.17	492.91	1.9379
95	16.55	498.42	1.9529
100	16.92	503.89	1.9677
105	17.28	509.33	1.9822
110	17.64	514.75	1.9964
115	18.00	520.15	2.0104
120	18.34	525.53	2.0242

22.95 bar 38.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
38	10.36	425.52	1.7322
40	10.62	428.73	1.7425
45	11.23	436.27	1.7664
50	11.78	443.30	1.7883
55	12.29	449.97	1.8088
60	12.76	456.37	1.8281
65	13.22	462.56	1.8466
70	13.65	468.59	1.8643
75	14.07	474.48	1.8813
80	14.47	480.27	1.8978
85	14.86	485.97	1.9138
90	15.24	491.60	1.9295
95	15.61	497.18	1.9447
100	15.97	502.71	1.9596
105	16.32	508.21	1.9743
110	16.67	513.68	1.9886
115	17.01	519.12	2.0028
120	17.35	524.55	2.0167

24.10 bar 40.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
40	9.76	425.20	1.7274
45	10.38	433.27	1.7530
50	10.94	440.67	1.7761
55	11.45	447.62	1.7975
60	11.93	454.24	1.8175
65	12.38	460.61	1.8365
70	12.81	466.79	1.8546
75	13.22	472.81	1.8720
80	13.61	478.71	1.8888
85	13.99	484.51	1.9051
90	14.36	490.22	1.9210
95	14.72	495.88	1.9364
100	15.07	501.48	1.9515
105	15.41	507.03	1.9663
110	15.75	512.55	1.9808
115	16.08	518.05	1.9951
120	16.41	523.53	2.0091
125	16.73	528.99	2.0229

25.29 bar 42.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
42	9.18	424.79	1.7225
45	9.57	429.91	1.7387
50	10.14	437.78	1.7633
55	10.66	445.07	1.7857
60	11.14	451.95	1.8065
65	11.59	458.52	1.8261
70	12.01	464.87	1.8447
75	12.41	471.03	1.8625
80	12.80	477.05	1.8797
85	13.17	482.96	1.8963
90	13.53	488.77	1.9124
95	13.88	494.50	1.9281
100	14.23	500.17	1.9434
105	14.56	505.80	1.9583
110	14.89	511.38	1.9730
115	15.21	516.93	1.9874
120	15.52	522.45	2.0015
125	15.83	527.96	2.0155

26.54 bar 44.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
44	8.64	424.27	1.7174
45	8.77	426.10	1.7232
50	9.37	434.58	1.7496
55	9.90	442.28	1.7733
60	10.38	449.46	1.7950
65	10.83	456.28	1.8153
70	11.25	462.82	1.8345
75	11.65	469.14	1.8528
80	12.03	475.30	1.8704
85	12.40	481.32	1.8873
90	12.75	487.23	1.9037
95	13.09	493.05	1.9196
100	13.43	498.80	1.9351
105	13.75	504.50	1.9503
110	14.07	510.14	1.9651
115	14.38	515.75	1.9796
120	14.69	521.33	1.9939
125	14.99	526.88	2.0080

27.82 bar 46.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
46	8.12	423.65	1.7121
50	8.62	430.98	1.7349
55	9.17	439.21	1.7602
60	9.66	446.76	1.7830
65	10.11	453.86	1.8042
70	10.53	460.62	1.8240
75	10.93	467.13	1.8429
80	11.30	473.43	1.8608
85	11.66	479.58	1.8781
90	12.01	485.61	1.8948
95	12.35	491.53	1.9110
100	12.67	497.36	1.9268
105	12.99	503.13	1.9421
110	13.30	508.85	1.9571
115	13.60	514.51	1.9718
120	13.90	520.15	1.9863
125	14.19	525.75	2.0004
130	14.48	531.33	2.0144

29.15 bar 48.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
48	7.62	422.90	1.7065
50	7.89	426.86	1.7188
55	8.46	435.78	1.7462
60	8.97	443.80	1.7704
65	9.43	451.24	1.7926
70	9.85	458.26	1.8132
75	10.24	464.97	1.8326
80	10.61	471.45	1.8511
85	10.97	477.74	1.8688
90	11.31	483.89	1.8858
95	11.64	489.92	1.9023
100	11.96	495.85	1.9183
105	12.27	501.70	1.9339
110	12.57	507.49	1.9491
115	12.87	513.22	1.9640
120	13.15	518.91	1.9785
125	13.44	524.57	1.9928
130	13.72	530.20	2.0069

Vapour Table, Superheated Range Solkane®410

30.53 bar 50.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
50	7.15	422.01	1.7005
55	7.78	431.92	1.7310
60	8.30	440.53	1.7570
65	8.77	448.38	1.7804
70	9.19	455.71	1.8019
75	9.59	462.66	1.8220
80	9.96	469.33	1.8411
85	10.31	475.79	1.8592
90	10.65	482.07	1.8766
95	10.97	488.21	1.8934
100	11.29	494.25	1.9097
105	11.59	500.19	1.9255
110	11.88	506.06	1.9410
115	12.17	511.86	1.9560
120	12.45	517.62	1.9707
125	12.73	523.34	1.9852
130	13.00	529.02	1.9994
135	13.26	534.68	2.0133

31.97 bar 52.00 °C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
52	6.70	420.96	1.6942
55	7.10	427.46	1.7141
60	7.65	436.88	1.7426
65	8.14	445.24	1.7675
70	8.57	452.94	1.7901
75	8.97	460.17	1.8111
80	9.34	467.07	1.8307
85	9.69	473.70	1.8494
90	10.02	480.14	1.8672
95	10.34	486.41	1.8844
100	10.65	492.56	1.9010
105	10.94	498.60	1.9171
110	11.23	504.56	1.9327
115	11.51	510.44	1.9480
120	11.79	516.26	1.9629
125	12.05	522.04	1.9775
130	12.32	527.78	1.9918
135	12.57	533.49	2.0059

33.74 bar 54.00°C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
54	6.27	419.72	1.6875
55	6.41	422.15	1.6949
60	7.02	432.73	1.7269
65	7.52	441.77	1.7538
70	7.97	449.92	1.7778
75	8.37	457.48	1.7997
80	8.74	464.64	1.8201
85	9.09	471.48	1.8393
90	9.42	478.09	1.8576
95	9.74	484.51	1.8752
100	10.04	490.78	1.8921
105	10.33	496.93	1.9085
110	10.61	502.98	1.9244
115	10.89	508.94	1.9398
120	11.15	514.84	1.9549
125	11.42	520.69	1.9697
130	11.67	526.49	1.9842
135	11.92	532.26	1.9984

35.00 bar 56.00°C

t	v	h	S
°C	dm³/kg	kJ/kg	kJ/kgK
56	5.85	418.27	1.6802
60	6.39	427.91	1.7093
65	6.93	437.87	1.7390
70	7.39	446.59	1.7646
75	7.80	454.56	1.7877
80	8.17	462.02	1.8090
85	8.52	469.10	1.8289
90	8.85	475.90	1.8477
95	9.16	482.49	1.8657
100	9.46	488.89	1.8830
105	9.75	495.16	1.8997
110	10.03	501.31	1.9159
115	10.29	507.37	1.9316
120	10.56	513.35	1.9469
125	10.81	519.27	1.9618
130	11.06	525.14	1.9765
135	11.30	530.96	1.9909
140	11.54	536.75	2.0050

36.59 bar 58.00 °C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
58	5.45	416.55	1.6723
60	5.75	422.09	1.6890
65	6.34	433.42	1.7227
70	6.83	442.90	1.7506
75	7.25	451.37	1.7751
80	7.63	459.19	1.7974
85	7.98	466.55	1.8181
90	8.31	473.57	1.8375
95	8.62	480.34	1.8560
100	8.91	486.90	1.8737
105	9.20	493.29	1.8908
110	9.47	499.56	1.9072
115	9.73	505.72	1.9232
120	9.99	511.79	1.9387
125	10.24	517.78	1.9539
130	10.48	523.72	1.9687
135	10.72	529.61	1.9832
140	10.95	535.46	1.9975

38.49 bar 60.00 °C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
60	5.06	414.51	1.6635
65	5.75	428.21	1.7043
70	6.28	438.75	1.7353
75	6.72	447.86	1.7616
80	7.11	456.11	1.7852
85	7.46	463.80	1.8068
90	7.79	471.08	1.8270
95	8.10	478.05	1.8460
100	8.39	484.78	1.8642
105	8.67	491.32	1.8816
110	8.94	497.71	1.8984
115	9.20	503.98	1.9147
120	9.45	510.14	1.9304
125	9.69	516.22	1.9458
130	9.93	522.24	1.9608
135	10.16	528.19	1.9755
140	10.39	534.10	1.9899
145	10.61	539.97	2.0040

39.97 bar 62.00 °C

t	v	h	S
°C	dm³/kg	kJ/kg	kJ/kgK
62	4.67	412.06	1.6537
65	5.15	421.83	1.6827
70	5.73	433.98	1.7184
75	6.20	443.94	1.7472
80	6.60	452.74	1.7723
85	6.96	460.82	1.7950
90	7.29	468.39	1.8160
95	7.60	475.60	1.8357
100	7.89	482.52	1.8544
105	8.17	489.23	1.8723
110	8.44	495.75	1.8894
115	8.69	502.14	1.9060
120	8.94	508.41	1.9220
125	9.18	514.58	1.9376
130	9.41	520.68	1.9528
135	9.63	526.71	1.9677
140	9.86	532.68	1.9823
145	10.07	538.62	1.9965

41.76 bar 64.00 °C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
64	4.29	409.04	1.6423
65	4.49	413.28	1.6549
70	5.19	428.35	1.6991
75	5.69	439.51	1.7314
80	6.11	449.02	1.7585
85	6.48	457.57	1.7826
90	6.82	465.50	1.8046
95	7.13	472.97	1.8250
100	7.42	480.12	1.8443
105	7.69	487.00	1.8626
110	7.95	493.68	1.8802
115	8.21	500.20	1.8971
120	8.45	506.58	1.9134
125	8.68	512.86	1.9293
130	8.91	519.04	1.9447
135	9.13	525.15	1.9598
140	9.35	531.20	1.9745
145	9.56	537.19	1.9889

43.67 bar 66.00 °C

t	v	h	s
°C	dm³/kg	kJ/kg	kJ/kgK
66	3.90	405.19	1.6287
70	4.61	421.36	1.6761
75	5.19	434.40	1.7138
80	5.63	444.85	1.7437
85	6.02	454.00	1.7694
90	6.36	462.35	1.7925
95	6.67	470.15	1.8139
100	6.96	477.54	1.8338
105	7.23	484.63	1.8527
110	7.49	491.48	1.8707
115	7.74	498.14	1.8880
120	7.98	504.65	1.9046
125	8.21	511.04	1.9208
130	8.44	517.32	1.9364
135	8.65	523.51	1.9517
140	8.86	529.64	1.9666
145	9.07	535.70	1.9812
150	9.27	541.72	1.9955

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