Property Library for Ethanol

LibC2H5OH

Prof. Hans-Joachim Kretzschmar
Dr. Sebastian Herrmann
Prof. Matthias Kunick
Ines Jaehne
Tobias Goepfert

Property Functions

Functional Dependence	Function Name	Call from Fortran Program	Property or Function	Unit of the Result
$a = f(p,t,x)$	a_ptx_C2H5OH	A_PTX_C2H5OH(P,T,X)	Thermal diffusivity	m²/s
c_p = f(p,t,x)	cp_ptx_C2H5OH	CP_PTX_C2H5OH(P,T,X)	Specific isobaric heat capacity	kJ/(kg K)
$\eta = f(p,t,x)$	eta_ptx_C2H5OH	ETA_PTX_C2H5OH(P,T,X)	Dynamic viscosity	Pa . s
h = f(p,t,x)	h_ptx_C2H5OH	H_PTX_C2H5OH(P,T,X)	Specific enthalpy	kJ/kg
κ = f(p,t,x)	ka_ptx_C2H5OH	KA_PTX_C2H5OH(P,T,X)	Isentropic exponent	-
λ = f(p,t,x)	lam_ptx_C2H5OH	LAM_PTX_C2H5OH(P,T,X)	Thermal conductivity	W/(m . K)
v = f(p,t,x)	ny_ptx_C2H5OH	NY_PTX_C2H5OH(P,T,X)	Kinematic viscosity	m²/s
$Pr = f(p,t,x)$	pr_ptx_C2H5OH	PR_PTX_C2H5OH(P,T,X)	*Prandtl*-number	-
p_S = f(t)	ps_t_C2H5OH	PST_C2H5OH(T)	Vapor pressure from temperature	bar
ρ = f(p,t,x)	rho_ptx_C2H5OH	RHO_PTX_C2H5OH(P,T,X)	Density	kg/m³
s = f(p,t,x)	s_ptx_C2H5OH	S_PTX_C2H5OH(P,T,X)	Specific entropy	kJ/(kg K)
σ = f(t)	sigma_t_C2H5OH	SIGMA_T_C2H5OH(T)	Surface tension from temperature	N/m
t = f(p,h)	t_ph_C2H5OH	T_PH_C2H5OH(P,H)	Backward function: Temperature from pressure and enthalpy	°C
t = f(p,s)	t_ps_C2H5OH	T_PS_C2H5OH(P,S)	Backward function: Temperature from pressure and entropy	°C
t_S = f(p)	ts_p_C2H5OH	TSP_C2H5OH(P)	Saturation temperature from pressure	°C
u = f(p,t,x)	u_ptx_C2H5OH	U_PTX_C2H5OH(P,T,X)	Specific internal energy	kJ/kg
v = f(p,t,x)	v_ptx_C2H5OH	V_PTX_C2H5OH(P,T,X)	Specific volume	m³/kg
w = f(p,t,x)	w_ptx_C2H5OH	W_PTX_C2H5OH(P,T,X)	Isentropic speed of sound	m/s

$x = f(p,h)$	x_ph_C2H5OH	X_PH_C2H5OH(P,H)	Backward function: Vapor fraction from pressure and enthalpy	kg/kg
$x = f(p,s)$	x_ps_C2H5OH	X_PS_C2H5OH(P,S)	Backward function: Vapor fraction from pressure and entropy	kg/kg

Units: t in °C

                                      p in bar

                                      x in (kg saturated steam)/(kg wet steam)

Range of validity

Temperature range: from - 114.15°C to 376.85 °C
Pressure range: from $p_t = 7.2 \times 10^{-9}$ bar to 2800 bar

Reference state

$h = 200$ kJ/kg   and $s = 1$ kJ/(kg K)   at $t = 0$ °C on the saturated liquid line (x = 0)

Details on the vapor fraction x

The wet steam region is calculated automatically by the subprograms. For this purpose the following fixed details on the vapor fraction x are to be considered:

<u>Single-phase region</u>

If the state point to be calculated is located in the single-phase region (liquid or superheated steam) x = –1 must be entered as a pro-forma value.

<u>Wet-steam region</u>

If the state point to be calculated is located in the wet steam region, a value for x between 0 and 1 (x = 0 for saturated liquid, x = 1 for saturated steam) must be entered. In this case, the backward functions result in the appropriate value between 0 and 1 for x. When calculating wet steam either the given value for t <u>and</u> p = -1000 or the given value for p <u>and</u> t = -1000 and in both cases the value for x between 0 and 1 must be entered.

If p <u>and</u> t <u>and</u> x are entered as given values, the program considers p and t to be appropriate to represent the vapor pressure curve. If this is not the case the calculation for the property of the chosen function results in –1.

Wet steam region: Temperature ranges from $t_{min} = $ - 114.15 °C to $t_c = 241.56$ °C

                  Pressure ranges from $p_{min} = 7.2 \times 10^{-9}$ bar to $p_c = 62.68$ bar

Note:

If the input values are located outside the range of validity, the calculated function will always result in –1000. Please find more exact details on every function and its corresponding range of validity in the enclosed software documentation in Chapter 3.