KCE
ThermoFluidProperties

# Property Library for Octamethyltrisiloxane (MDM) $C_8H_{24}Si_3O_2$

# LibMDM

Prof. Hans-Joachim Kretzschmar
Dr. Sebastian Herrmann
Prof. Matthias Kunick
Ines Jaehne
F. Elschner
G. Doleisch von Dolsperg

# Property Functions

## Calculation Programs

"MDM" means Octamethyltrisiloxane **($C_8H_{24}Si_3O_2$)**

| Functional Dependence | Function Name | Call from Fortran program | Property or Function | Unit of the result |
|---|---|---|---|---|
| $a = f(p,t,x)$ | a_ptx_MDM | APTXMDM(P,T,X) | Thermal diffusivity | $m^2/s$ |
| $c_p = f(p,t,x)$ | cp_ptx_MDM | CPPTXMDM(P,T,X) | Specific isobaric heat capacity | kJ/(kg K) |
| $c_v = f(p,t,x)$ | cv_ptx_MDM | CVPTXMDM(P,T,X) | Specific isochoric heat capacity | kJ/(kg K) |
| $\left(\frac{\partial p}{\partial T}\right)_v = f(p,t,x)$ | dpdtv_ptx_MDM | DPDTVPTXMDM(P,T,X) | Derivative of pressure with respect to temperature (at constant specific volume) | kPa/K |
| $\left(\frac{\partial p}{\partial v}\right)_T = f(p,t,x)$ | dpdvt_ptx_MDM | DPDVTPTXMDM(P,T,X) | Derivative of pressure with respect to specific volume (at constant temperature) | $kPa/(m^3/kg)$ |
| $\eta = f(p,t,x)$ | eta_ptx_MDM | ETAPTXMDM(P,T,X) | Dynamic viscosity | Pa·s |
| $h = f(p,t,x)$ | h_ptx_MDM | HPTXMDM(P,T,X) | Specific enthalpy | kJ/kg |
| $\kappa = f(p,t,x)$ | kappa_ptx_MDM | KAPPAPTXMDM(P,T,X) | Isentropic exponent | - |
| $\lambda = f(p,t,x)$ | lamda_ptx_MDM | LAMPTXMDM(P,T,X) | Thermal conductivity | W/(m·K) |
| $\nu = f(p,t,x)$ | nu_ptx_MDM | NUPTXMDM(P,T,X) | Kinematic viscosity | $m^2/s$ |
| $Pr = f(p,t,x)$ | Pr_ptx_MDM | PRPTXMDM(P,T,X) | *Prandtl* number | - |
| $p_s = f(t)$ | ps_t_MDM | PSTMDM(T) | Vapor pressure from temperature | bar |
| $\rho = f(p,t,x)$ | rho_ptx_MDM | RHOPTXMDM(P,T,X) | Density | $kg/m^3$ |
| $s = f(p,t,x)$ | s_ptx_MDM | SPTXMDM(P,T,X) | Specific entropy | kJ/(kg K) |
| $t = f(p,h)$ | t_ph_MDM | TPHMDM(P,H) | Backward function: Temperature from pressure and enthalpy | °C |
| $t = f(p,s)$ | t_ps_MDM | TPSMDM(P,S) | Backward function: Temperature from pressure and entropy | °C |
| $t_s = f(p)$ | ts_p_MDM | TSPMDM(P) | Saturation temperature from pressure | °C |
| $u = f(p,t,x)$ | u_ptx_MDM | UPTXMDM(P,T,X) | Specific internal energy | kJ/kg |

| Functional Dependence | Function Name | Call from Fortran program | Property or Function | Unit of the result |
|---|---|---|---|---|
| $v = f(p,t,x)$ | v_ptx_MDM | VPTXMDM(P,T,X) | Specific volume | $m^3/kg$ |
| $w = f(p,t,x)$ | w_ptx_MDM | WPTXMDM(P,T,X) | Isentropic speed of sound | m/s |
| $x = f(p,h)$ | x_ph_MDM | XPHMDM(P,H) | Backward function: Vapor fraction from pressure and enthalpy | kg/kg |
| $x = f(p,s)$ | x_ps_MDM | XPSMDM(P,S) | Backward function: Vapor fraction from pressure and entropy | kg/kg |
| $Z = f(p,t,x)$ | Z_ptx_MDM | ZPTXMDM(P,T,X) | Compression factor | - |

**Units:** $t$ in °C
$p$ in bar
$x$ in (kg of saturated steam)/(kg wet steam)

## Range of validity

Temperature range: from $t$ = 0°C to 400 °C
Pressure range: from $p$ = 0.00078994 bar to 300 bar

## Reference state

$h$ = 0 kJ/kg and $s$ = 0 kJ/(kg K) at $t_B$ = 152.53 °C on the boiling curve ($x$ = 0; $p_s = p_N$ = 1.01325 bar)

## Details on the vapor fraction *x* and on the calculation of wet steam

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:

Single-phase region

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.

Wet-steam region

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 $t$ and p = -1000 or the given value for $p$ and t = -1000 and in both cases the value for $x$ between 0 and 1 must be entered.

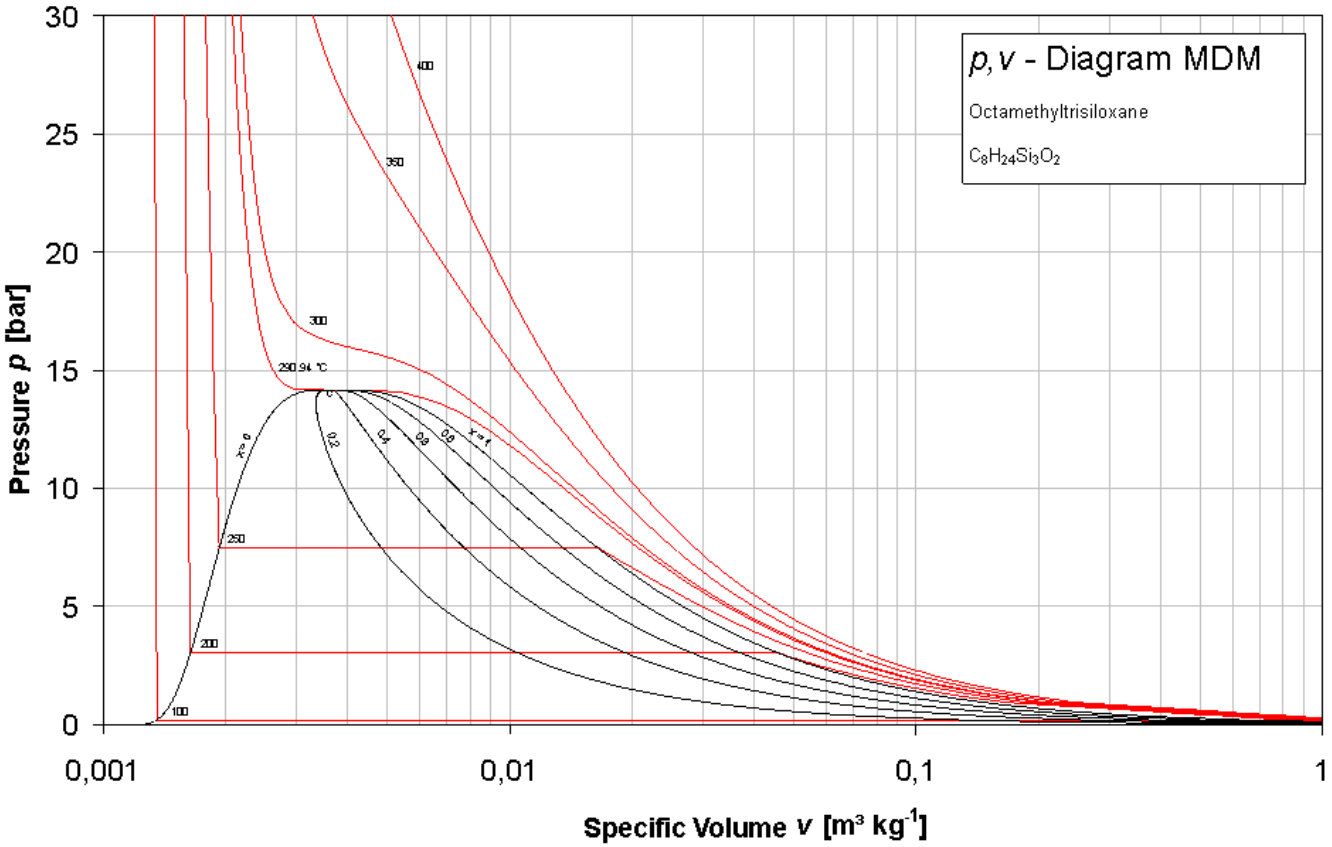
If $p$ and $t$ and $x$ are entered as given values, the program considers $p$ and $t$ to be appropriate to represent the vapor pressure curve. If this is not the case the calculation for the property of the chosen function results in –1000.

Wet steam region: Temperature range from $t$ = 0 °C to $t_c$ = 290.94 °C
Pressure range from $p_s$ (0 °C) = 0.00078994 bar to $p_c$ = 14.1510555 bar

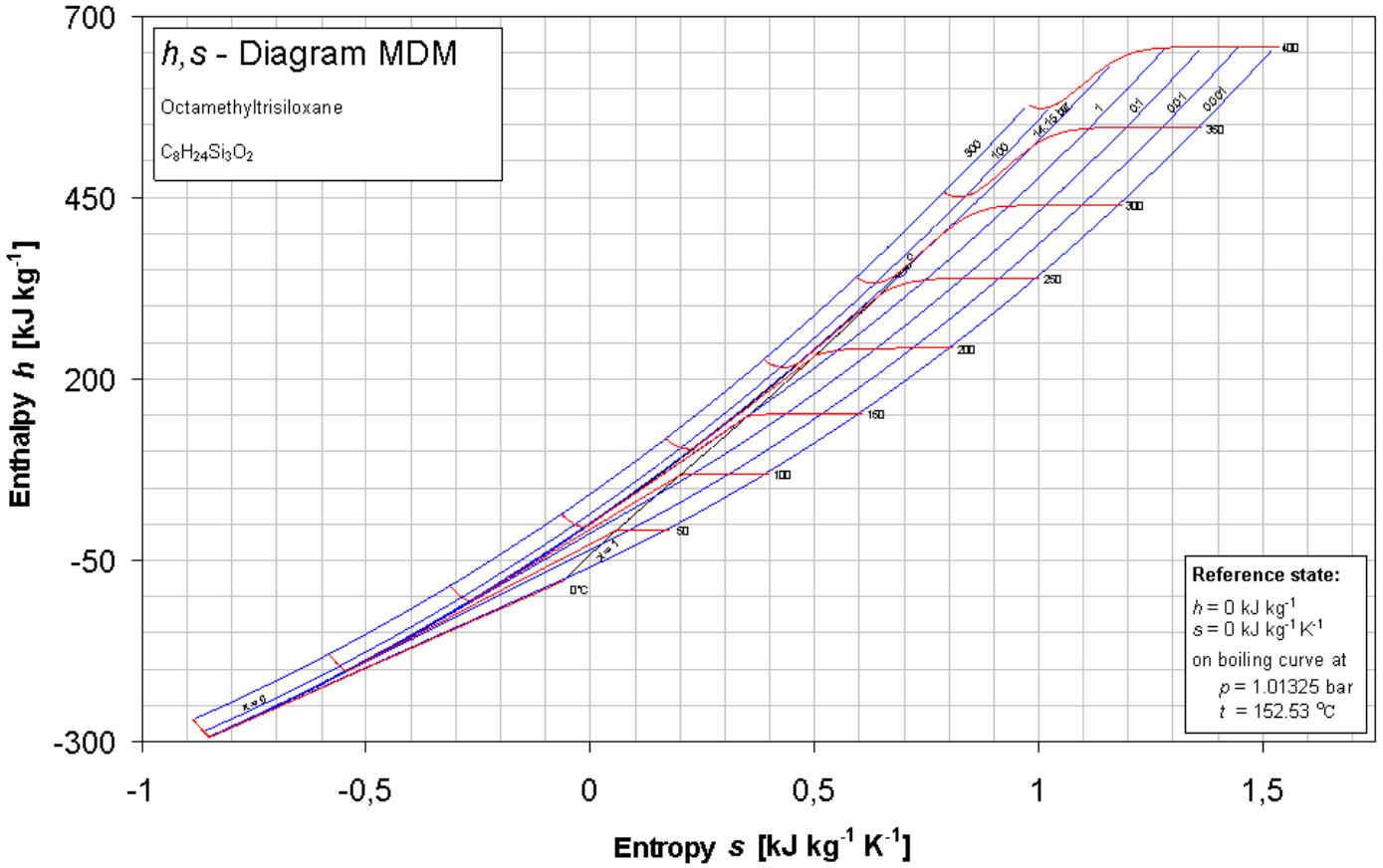
**Note:**

*If the calculation results in –1000, the values entered represent a state point beyond the range of validity of MDM. For further information on each function and its range of validity see Chapter 3. The same information may also be accessed via the online help pages.*

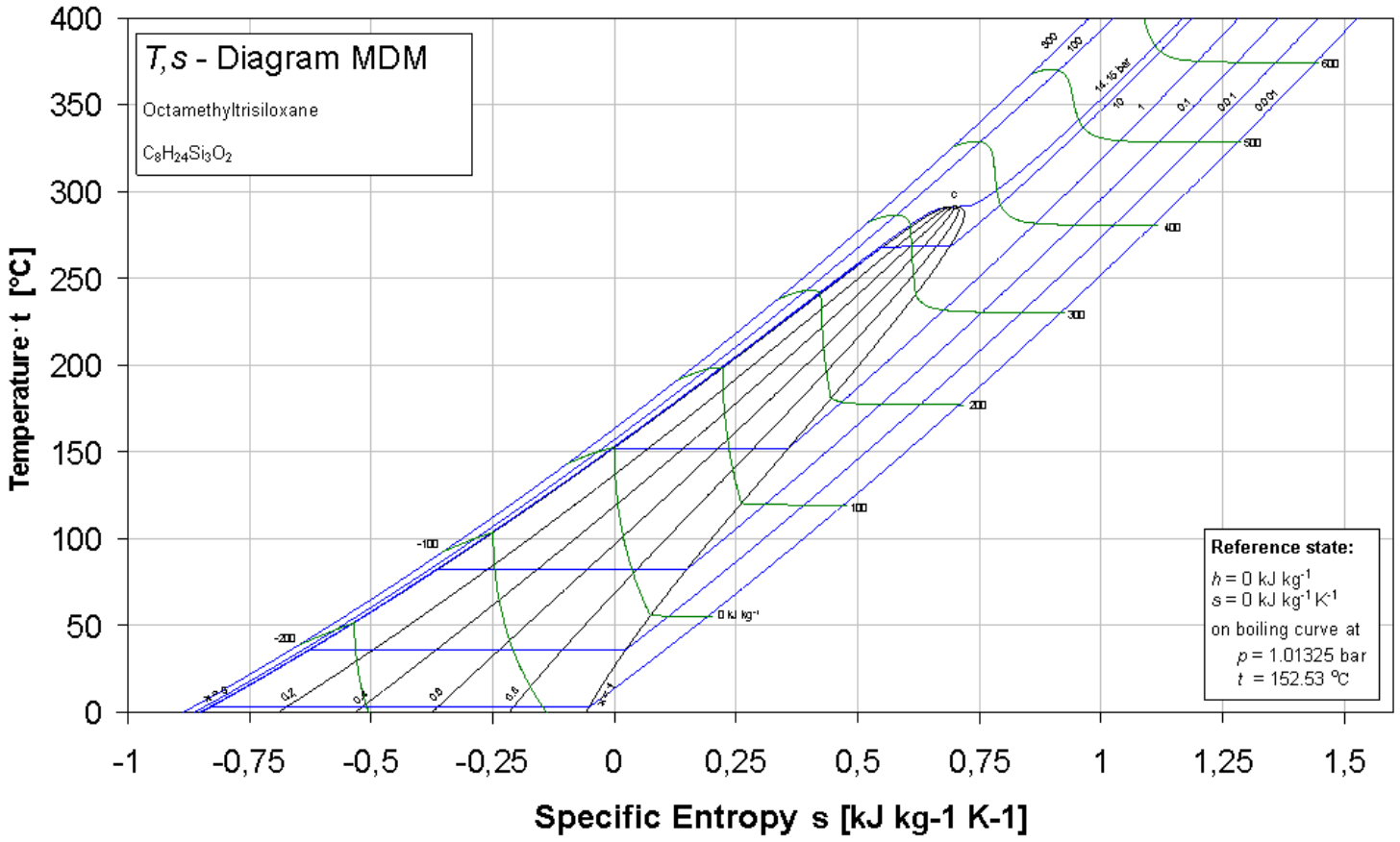
## p,v-Diagram


p,v - Diagram MDM
Octamethyltrisiloxane
C8H24Si3O2
Pressure p [bar]
Specific Volume v [m³ kg-1]
30
25
20
15
10
5
0
0,001
0,01
0,1
1
400
350
300
290,94 °C
250
200
100
x = 0
0,2
0,4
0,6
0,8
x = 1

## h,s-Diagram


h,s - Diagram MDM
Octamethyltrisiloxane
C8H24Si3O2
Reference state:
h = 0 kJ kg-1
s = 0 kJ kg-1 K-1
on boiling curve at
p = 1.01325 bar
t = 152.53 °C
Enthalpy h [kJ kg-1]
Entropy s [kJ kg-1 K-1]
700
450
200
-50
-300
-1
-0,5
0
0,5
1
1,5
400
350
300
250
200
150
100
50
0°C
x = 0
x = 1
900
1000
1 bar
0,1
0,01
0,001

## T,s-Diagram


T,s - Diagram MDM
Octamethyltrisiloxane
C8H24Si3O2
Reference state:
h = 0 kJ kg-1
s = 0 kJ kg-1 K-1
on boiling curve at
p = 1.01325 bar
t = 152.53 °C
Temperature t [°C]
Specific Entropy s [kJ kg-1 K-1]
400
350
300
250
200
150
100
50
0
-1
-0,75
-0,5
-0,25
0
0,25
0,5
0,75
1
1,25
1,5
14.45 bar
0 kJ kg-1