

Libraries for Calculating the Properties

of Working Fluids in Heat Cycles, Turbines, Heat Pumps, and Refrigeration Plants

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Steam, Water, and Ice

Library **LibIF97**

- Industrial Formulation IAPWS-IF97 (Revision 2007)
- Supplementary Standards IAPWS-IF97-S01 IAPWS-IF97-S03ref IAPWS-IF97-S04 IAPWS-IF97-S05
- IAPWS Revised Advisory Note No. 3 on Thermodynamic Derivatives (2008)

Library **LibICE**

- Ice from IAPWS-06
- Melting line and sublimation line from IAPWS-08
- Water from IAPWS-IF97
- Steam from IAPWS-95 and IAPWS-IF97

Library **LibSBTL_IF97** Library **LibSBTL_95**

Extremely fast property calculations according to the IAPWS Guideline 2015 Spline-based Table Look-up Method (SBTL) applied to the Industrial Formulation IAPWS-IF97 and to the Scientific Formulation IAPWS-95 for Computational Fluid Dynamics (CFD) and the simulation of non-stationary processes

Humid Combustion Gas Mixtures

Library **LibHuGas**

Model: Ideal mixture of the real fluids:
 CO_2 - Span and Wagner (1994)
 O_2 - Schmidt and Wagner (1995)
 H_2O - IAPWS-95
 Ar - Tegeler et al. (1999)
 N_2 - Span et al. (2000)
 and of the ideal gases:
 SO_2 , CO , Ne (Bücker et al., 2003)
 Consideration of:
 • Condensation of steam
 • Dissociation and Poynting effect

Library **LibIdGasMix**

Model: Ideal gas mixture of 25 ideal gases from VDI Guideline 4670 (2003)

Humid Air

Library **LibHuAir**

- Model: Ideal mixture of the real fluids:
- Dry air from Lemmon et al. (2000)
 - Steam, water, and ice from IAPWS-IF97 and IAPWS-06
- Consideration of:
- Condensation and freezing of steam
 - Dissociation from the VDI Guideline 4670 (2003)
 - Poynting effect from ASHRAE RP-1485

Library **ASHRAE LibHuAirProp**

Model: Virial equation from ASHRAE Report RP-1485 for real mixture of the real fluids dry air and steam.

Carbon Dioxide Including Dry Ice

Library **LibCO2**

Formulation of Span and Wagner (1994)

Ammonia/Water Mixtures

Library **LibAmWa**

IAPWS Guideline 2001 of Tillner-Roth and Friend (1998)

Water/Lithium Bromide Mixtures

Library **LibWaLi**

Formulation of Kim and Infante Ferreira (2004)

Dry Air Including Liquid Air

Library **LibRealAir**

Formulation of Lemmon et al. (2000)

Seawater

Library **LibSeaWa**

IAPWS Industrial Formulation (2013)

Ammonia

Library **LibNH3**

Formulation of Tillner-Roth (1993)

Hydrogen

Library **LibH2**

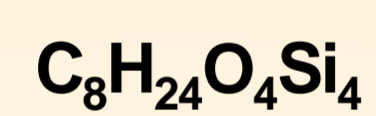
Formulation of Leachman et al. (2009)

Nitrogen

Library **LibN2**

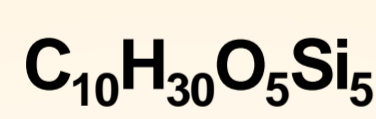
Formulation of Span et al. (2000)

Siloxanes as ORC Working Fluids



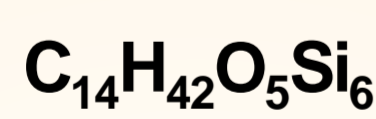
Octamethylcyclotetrasiloxane

Library **LibD4**



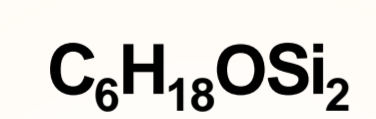
Decamethylcyclopentasiloxane

Library **LibD5**



Tetradecamethylhexasiloxane

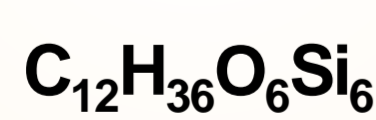
Library **LibMD4M**



Hexamethyldisiloxane

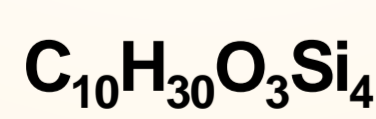
Library **LibMM**

Formulation of Colonna et al. (2006)



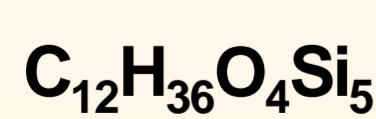
Dodecamethylcyclohexasiloxane

Library **LibD6**



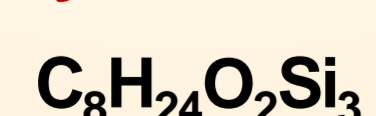
Decamethyltetrasiloxane

Library **LibMD2M**



Dodecamethylpentasiloxane

Library **LibMD3M**



Octamethyltrisiloxane

Library **LibMDM**

Formulation of Colonna et al. (2008)

R134a

Library **LibR134a**

Formulation of Tillner-Roth and Baehr (1994)

Iso-Butane

Library **LibButane_Iso**

Formulation of Bücker and Wagner (2006)

Liquid Coolants

Library **LibSecRef**

Liquid solutions of water with

$\text{C}_2\text{H}_6\text{O}_2$	Ethylene glycol
$\text{C}_3\text{H}_8\text{O}_2$	Propylene glycol
$\text{C}_2\text{H}_5\text{OH}$	Ethanol
CH_3OH	Methanol
$\text{C}_3\text{H}_8\text{O}_3$	Glycerol
K_2CO_3	Potassium carbonate
CaCl_2	Calcium chloride
MgCl_2	Magnesium chloride
NaCl	Sodium chloride
$\text{C}_2\text{H}_3\text{KO}_2$	Potassium acetate
CHKO_2	Potassium formate
LiCl	Lithium chloride
NH_3	Ammonia

Formulation of the International Institute of Refrigeration (IIR 2010)

Propane

Library **LibPropane**

Formulation of Lemmon et al. (2009)

n-Butane

Library **LibButane_n**

Formulation of Bücker and Wagner (2006)

Ethanol

Library **LibC2H5OH**

Formulation of Schroeder et al. (2012)

Methanol

Library **LibCH3OH**

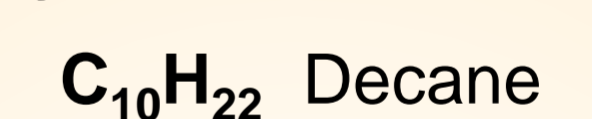
Formulation of de Reuck and Craven (1993)

Helium

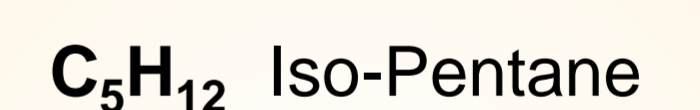
Library **LibHe**

Formulation of Arp et al. (1998)

Hydrocarbons



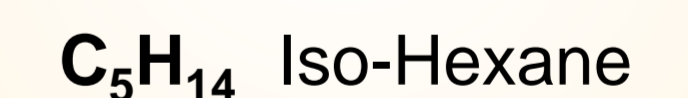
Library **LibC10H22**



Library **LibC5H12_ISO**



Library **LibC5H12_NEO**



Library **LibC5H14**



Library **LibC7H8**

Formulation of Lemmon and Span (2006)

Other Fluids

CO Carbon monoxide

Library **LibCO**

COS Carbonyl sulfide

Library **LibCOS**

H_2S Hydrogen sulfide

Library **LibH2S**

N_2O Dinitrogen monoxide

Library **LibN2O**

SO_2 Sulfur dioxide

Library **LibSO2**



Library **LibC3H6O**

Formulation of Lemmon and Span (2006)