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Property Libraries

for Water and Steam, Humid Air, and other Working Fluids
for Calculating Heat Cycles, Turbines, Heat Pumps, and Refrigeration Processes

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

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 (2000)

and of the ideal Gases:
SO_2, CO, Ne (Bücker et al., 2003)

Consideration of:
- Condensation of steam
- Dissociation and poynting effect

Library **LibIDGAS**

Model: Ideal gas mixture from VDI-Guideline 4670

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 VDI-Guideline 4670 (2003)
- Poynting effect from ASHRAE RP-1485 (2009)

Ideal Gas Mixtures

Library **LibIdGasMix**

Model: Ideal mixture of the ideal gases:

Ar	SO_2	Methane
Ne	H_2	Ethane
N_2	H_2S	Ethylene
O_2	OH	Propylene
CO	He	Propane
CO_2	F_2	n-Butane
Air	NH_3	Isobutane
NO		Benzene
H_2O		Methanol

Consideration of:
Dissociation from VDI-Guideline 4670 (2003)

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-Formulation of Feistel (2008) and IAPWS-IF97

Ammonia

Library **LibNH3**

Formulation of Tillner-Roth (1995)

Hydrogen

Library **LibH2**

Formulation of Leachman et al. (2007)

Nitrogen

Library **LibN2**

Formulation of Span et al. (2000)

Siloxanes as ORC Working Fluids

$C_8H_{24}O_4Si_4$
Octamethylcyclotetrasiloxane
Library **LibD4**

$C_{10}H_{30}O_5Si_5$
Decamethylcyclopentasiloxane
Library **LibD5**

$C_{14}H_{42}O_5Si_6$
Tetradecamethylhexasiloxane
Library **LibMD4M**

$C_6H_{18}OSi_2$
Hexamethyldisiloxane
Library **LibMM**

Formulation of Colonna et al. (2006)

$C_{12}H_{36}O_6Si_6$
Dodecamethylcyclohexasiloxane
Library **LibD6**

$C_{10}H_{30}O_3Si_4$
Decamethyltetrasiloxane
Library **LibMD2M**

$C_{12}H_{36}O_4Si_5$
Dodecamethylpentasiloxane
Library **LibMD3M**

$C_8H_{24}O_2Si_3$
Octamethyltrisiloxane
Library **LibMDM**

Formulation of Colonna et al. (2008)

R134a

Library **LibR134a**

Formulation of Tillner-Roth and Baehr (1994)

Propane

Library **LibPropane**

Formulation of Lemmon et al. (2007)

Iso-Butane

Library **LibButane_Iso**

Formulation of Bücker et al. (2003)

n-Butane

Library **LibButane_n**

Formulation of Bücker et al. (2003)

Liquid Coolants

Library **LibSecRef**

Liquid solutions of water with:

$C_2H_6O_2$	Ethylene glycol
$C_3H_8O_2$	Propylene glycol
C_2H_5OH	Ethyl alcohol
CH_3OH	Methyl alcohol
$C_3H_8O_3$	Glycerol
K_2CO_3	Potassium carbonate
$CaCl_2$	Calcium chloride
$MgCl_2$	Magnesium chloride
NaCl	Sodium chloride
$C_2H_3KO_2$	Potassium acetate

Formulation of the International Institute of Refrigeration (1997)

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

$C_{10}H_{22}$ Dekane
Library **LibC10H22**

C_5H_{12} Isopentane
Library **LibC5H12_ISO**

C_5H_{12} Neopentane
Library **LibC5H12_NEO**

C_5H_{14} Isohexane
Library **LibC5H14**

C_7H_8 Toluene
Library **LibC7H8**

Formulation: 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**

C_3H_6O Acetone
Library **LibC3H6O**

Formulation: Lemmon and Span (2006)