1. Theory for Liquid Thermal Conductivity

I) Polynomial equation (HC_THLEQN)

Polynomial equation is used for gas viscosity for low pressure.

$$THL = \sum_{i=0}^{3} A_i T^i$$

(1)

where, T is Kelvin and THL is W/(m·K).

II) Latini et al. Method (HC_THLLATINI)

Latini et al. proposed the following expression for liquid thermal conductivity.

$$\lambda_L = \frac{A(1-T_r)^{0.38}}{T_r^{1/6}}$$

(2)

where

λ_L	= thermal conductivity of the liquid, W/(m·K)
T_b	= normal boiling point temperature (at 1 atm), K
T_c	= critical temperature, K
M	= molecular weight, g/mol
$T_r = T/T_c$	

And

$$A = \frac{A^* T_b^a}{M^b T_c^g}$$

(3)

and the parameters $A^*, a, b,$ and g are shown in Table 1.

Table 1. Latini et al. Correlation Parameters for Eq. (3)

Family	ICLASS	A^*	a	b	g
Saturated hydrocarbons	1 ~ 2	0.00350	1.2	0.5	0.167
Olefins	3 ~ 5	0.00361	1.2	1.0	0.167
Cycloparaffins	6 ~ 7	0.0310	1.2	1.0	0.167
Aromatics	8 ~ 10	0.0346	1.2	1.0	0.167
Alcohols	11 ~ 14	0.00339	1.2	0.5	0.167
Acids (organic)	15 ~ 19	0.00319	1.2	0.5	0.167
Ketones	28 ~ 30	0.00383	1.2	0.5	0.167
Esters	25 ~ 27	0.0415	1.2	1.0	0.167
Ethers	20 ~ 24	0.0385	1.2	1.0	0.167
Refrigerants	48				
R20,R21,R22,R23		0.562	0.0	0.5	-0.167
others		0.494	0.0	0.5	-0.167

References :

Latini, G., and M. Pacetti, *Therm. Conduct.*, **15**, 245, 1977

Poling et al., "Properties of Gases and Liquids", 5th ed. McGraw-Hill, New York

2. KDB Routines for Liquid Thermal Conductivity Calculation

KDB liquid thermal conductivity calculation subroutines contain one KDB correlation equation and one estimation method, which is Latini method.

Subroutine Name	Description	Required Common Blocks
HC_THLEQN	KDB correlation equation	HC_KTHL
HC_THLLATINI	Latini method	HC_NAME, HC_PROP

I) HC_THLEQN

1. USAGE : CALL HC_THLEQN(ICN,T,THL,IST)

2. ARGUMENTS

    ICN   : COMPONENT NUMBER (1-50) TO CALCULATE LIQUID THERMAL CONDUCTIVITY

                                      (INTEGER, INPUT)

    T   : TEMPERATURE IN KELVIN (REAL*8, INPUT)

    THL   : LIQUID THERMAL CONDUCTIVITY IN W/m.K (REAL*8, OUTPUT)

    IST   : STATUS OF CALCULATION (INTEGER, OUTPUT)

           = 0   : NORMAL TERMINATION

           = 801   : LIQUID THERMAL CONDUCTIVITY COEFFICIENT NOT AVAILABLE

           = 802   : OUT OF RANGE FOR THE APPLICATION

II) HC_THLLATINI

1. USAGE : CALL HC_THLLATINI(ICN,T,THL,IST)

2. ARGUMENTS

    ICN   : COMPONENT NUMBER (1-50) TO CALCULATE LIQUID THERMAL CONDUCTIVITY

                                        (INTEGER, INPUT)

    T   : TEMPERATURE IN KELVIN (REAL*8, INPUT)

    THL   : LIQUID THERMAL CONDUCTIVITY IN W/m.K (REAL*8, OUTPUT)

    IST   : STATUS OF CALCULATION (INTEGER, OUTPUT)

           = 0   : NORMAL TERMINATION

           = 811   : CRITICAL TEMPERATURE DATA NOT AVAILABLE

           = 812   : NORMAL BOILING POINT DATA NOT AVAILABLE

           = 813   : MOLECULAR WEIGHT DATA NOT AVAILABLE

           = 814   : GIVEN T EXCEEDS CRITICAL TEMPERATURE

$= 815$: OUT OF APPLICATION

3. Required Properties

Critical temperature in K, normal boiling point in K, and molecular weight in g/mol ICLASS(ICN) must be specified according to Table 1 for each component.