IdealGasMixtureProps

IdealGasMixtureProps is an EES Procedure that will determine the specific enthalpy, entropy, viscosity, thermal conductivity, specific heat capacity and Prandtl number for a mixture of ideal gases.

Inputs:

F$ a string constant or string variable that contains the names of 1 or more (up to 20) names of ideal gases that are contained in the EES property library. The names of the gases are separated with a + sign, e.g., 'CH4+C3H8'

T the temperature in the units EES is configured to work in.

P the pressure in the units EES is configured to work in. (Pressure is used only for calculation of specific entropy)

f[1..N] the mass or mole fractions of the gases represented by string F$. The sum of the values of f must add to 1.0. Supply mass fractions if EES is configured to work with specific properties on a mass basis. Otherwise, supply mole fractions.

Outputs:

MW The molar mass of the mixture in kg/kmol or lb_m/lbmol

h the specific enthalpy of the mixture determined as the mole fraction-weighted average of the specific enthalpy of the gases in the mixture. The units of h will be returned on a per unit mass basis if EES is configured to provide properties on a mass basis. Otherwise the units of h will be returned on a molar basis.

s the specific entropy of the mixture determined as the mole fraction-weighted average of the specific entrop gases in the mixture plus the entropy change of mixing the gases. The units of s will be returned on a per unit mass basis if EES is configured to provide properties on a mass basis. Otherwise the units of s will be returned on a molar basis.

mu The viscosity of the gas mixture determined using the Wilke Approximation as described in Eq. 9-5.2 of Reid, Prausnitz, and Sherwood.

k The thermal conductivity of the gas mixture determined using the Mason and Saxena modification, as described in Eq. 10-6.2. of Reid, Prausnitz, and Sherwood.

cp The specific heat capacity of the gas mixture determined as the mole fraction-weighted average of the specific heat capacity of the gases in the mixture.

Pr The Prandtl number for the gas mixture.

Reference:

Reid, Prausnitz, and Sherwood, 3rd edition, McGraw-Hill, (1977).

Example:

```
$UnitSystem SI C kPa molar kJ
$Varinfo MW Units ='kg/kmol'
$VarInfo h Units='kJ/kmol'
$VarInfo s Units='kJ/kmol-K'
$VarInfo cp Units='kJ/kmol-K'
$VarInfo mu Units='Pa-s'
```

```
$VarInfo k Units='W/m-K'
F$='CH4+C4H10'
T=20 [C]
P=101.3 [kPa]
N=2
y[1..N]=[0.697,0.303]
Call idealgasmixtureprops(F$,T,P,y[1..N]: MW, h, s, mu, k, cp, Pr)
```

Unit Settings: SI C kPa kJ molar deg

cp = 54.17 [kJ/kmol-K]	F$ = 'CH4+C4H10'	h = -90377 [kJ/kmol]
k = 0.02466 [W/m-K]	μ = 0.000009313 [Pa-s]	MW = 28.79 [kg/kmol]
N = 2	P = 101.3 [kPa]	Pr = 0.7106
s = 227.9 [kJ/kmol-K]	T = 20 [C]	

It is not necessary to have the procedure return all of the outputs. For example, if your calculation does not require the viscosity and thermal conductivity, modify the Call statement as follows.

```
Call idealgasmixtureprops(F$,T,P,y[1..N]: MW, h, s, , , cp, Pr)
```