"Constant Volume heat addition"

F$ = 'Steam_IAPWS'

"Initial State - part A: subcooled liquid"

P[1] = 101.325[kpa] "initial pressure"
T[1] = 25[c] "initial temperature"
vol1 = 1e-3[m3] "1 liter vessel - constant volume"

hA[1] = **enthalpy**(F$, ***T***=T[1], ***P***=P[1]) "specific enthalpy of subcooled liquid at state 1"
uA[1] = **intenergy**(F$, ***T***=T[1], ***P***=P[1]) "specific internal energy of subcooled liquid at state 1"
vA[1] = **volume**(F$, ***T***=T[1], ***P***=P[1]) "specific volume of subcooled liquid at state 1"
sA[1] = **entropy**(F$, ***T***=T[1], ***P***=P[1]) "specific entropy of subcooled liquid at state 1"

"Add heat - go to state 2: since the volume is constant, there is no work involved"

Q_12 = 1[kw] "rate of adding heat"
mass_A = vol1/vA[1] "mass contained in 1 liter volume"

"State 2"

uA[2] = uA[1] + Q_12*time/mass_A "specific internal energy at state 2"
hA[2] = **enthalpy**(F$, ***u***=uA[2], ***v***=vA[1]) "specific enthalpy at state 2"
sA[2] = **entropy**(F$, ***u***=uA[2], ***v***=vA[1]) "specific entropy at state 2"

vA[2] = vA[1] "no change of volume or mass"
PA[2] = **pressure**(F$, ***u***=uA[2], ***v***=vA[1]) "pressure at state 2"
TA[2] = **temperature**(F$, ***u***=uA[2], ***v***=vA[1]) "temperature at state 2"

"Initial State - part B: two phase"

xB[1] = 0.6 "initial quality"

hB[1] = **enthalpy**(F$, ***x***=xB[1], ***P***=P[1]) "specific enthalpy of two phase fluid at state 1"
uB[1] = **intenergy**(F$, ***x***=xB[1], ***P***=P[1]) "specific internal energy of two phase fluid at state 1"
vB[1] = **volume**(F$, ***x***=xB[1], ***P***=P[1]) "specific volume of two phase fluid at state 1"
sB[1] = **entropy**(F$, ***x***=xB[1], ***P***=P[1]) "specific entropy of two phase fluid at state 1"

"Add heat - go to state 2: since the volume is constant, there is no work involved"

mass_B = vol1/vB[1] "mass contained in 1 liter volume"

"State 2B"

uB[2] = uB[1] + Q_12*time/mass_B "specific internal energy at state 2"
hB[2] = **enthalpy**(F$, ***u***=uB[2], ***v***=vB[1]) "specific enthalpy at state 2"
sB[2] = **entropy**(F$, ***u***=uB[2], ***v***=vB[1]) "specific entropy at state 2"

vB[2] = vB[1] "no change of volume or mass"
PB[2] = **pressure**(F$, ***u***=uB[2], ***v***=vB[2]) "pressure at state 2"
TB[2] = **temperature**(F$, ***u***=uB[2], ***v***=vB[2]) "temperature at state 2"

"Initial state - Part C: superheated vapor"

PC[1] = 1[kpa] "initial pressure"

hC[1] = **enthalpy**(F$, ***T***=T[1], ***P***=PC[1]) "specific enthalpy of superheated vapor at state 1"
uC[1] = **intenergy**(F$, ***T***=T[1], ***P***=PC[1]) "specific internal energy of superheated vapor at state 1"
vC[1] = **volume**(F$, ***T***=T[1], ***P***=PC[1]) "specific volume of superheated vapor at state 1"
sC[1] = **entropy**(F$, ***T***=T[1], ***P***=PC[1]) "specific entropy of superheated vapor at state 1"

```
mass_C = vol1/vC[1]                                   "mass contained in 1 liter volume"

"State 2C"

uC[2] = uC[1] + Q_12*time/mass_C                      "specific internal energy at state 2"
hC[2] = enthalpy(F$, u=uC[2], v=vC[1])                "specific enthalpy at state 2"
sC[2] = entropy(F$, u=uC[2], v=vC[1])                 "specific entropy at state 2"

vC[2] = vC[1]                                         "no change of volume or mass"
PC[2] = pressure(F$, u=uC[2], v=vC[2])                "pressure at state 2"
TC[2] = temperature(F$, u=uC[2], v=vC[2])             "temperature at state 2"
```

SOLUTION

Unit Settings: SI C kPa kJ mass deg

(Case C, Run 100)

F$ = 'steam_iapws'

$mass_B$ = 0.0009956 [kg]

Q_{12} = 1 [kW]

vol1 = 0.001 [m^3]

$mass_A$ = 0.997 [kg]

$mass_C$ = 0.000007271 [kg]

time = 0.1 [s]

No unit problems were detected.