**Generalized Balance Equations - thermofluids.net**

**Mass:**

; (1)



**Energy:**

 (2)



**Entropy:**

 (3)

**Customized Balance Equations - thermofluids.net**

**Closed Steady Systems (Wall, Light bulb, Laptop adapter, Gear box, closed cycles)**

Mass Equation:  (1)

Energy Equation:  (2)

Entropy Equation:  (3)

**Single-Flow Open-Steady Systems (pumps, turbines, nozzles, valves, pipes, etc.)**

Mass:  (1)

 (2)

Entropy:  (3)

**Closed Processes (Heating water in a tank, piston-cylinder compression)**

Mass:  (1)

 (2)

Entropy:  (3)

**Open Processes (Filling an evacuated tank, filling a propane cylinder, discharge from a tank)**

Mass:  (1)

 (2)

Entropy:   (3)

**Manual State Evaluation**

**thermofluids.net>Tables**

**General State Related Equations: ( applies to any substance)**

; ; ; ; ; ;  (1)

;; ; ;  (2)

; ; ; ; (3)

; ;  (4)

**SL Model:** (Assumptions: =constant: see Tables>Table-A)

;  (5)

 (6)

 (7)

**PG Model:** (Assumptions: ; =constant: see Tables>Table-C)

, where  (8)

, , where  (9)

; ; also, ,  (10)

 process: (11)

For polytropic process replace  with 

**IG Model**: (Assumptions: ;  is function of : see Tables>Table-D)

 (12)

,   (use ideal gas tables);  (13)

The temperature dependent part of entropy is separated from the pressure dependent part:

, where  is tabulated against. (14)

**PC Model:** (see Tables>Table-B) Determine the phase, L, V or M, of the fluid. For vapor use superheated Table. For mixture, use saturation table (if the quality is not known, your goal should be to evaluate the quality first which is the key to finding all specific properties of a mixture). For liquid use the **CL sub-model**.

**CL Sub-Model:** , and depend on  only. Therefore, use the temperature-sorted saturation table to obtain ,  or . To find , use .

**RG Model:** (see Tables>Table-E)  where Z, the compressibility factor, is obtained from a chart.  are pressure and temperature normalized by the corresponding critical properties. Just like entropy in the PG or IG model, and  also have two parts, one temperature dependent and another pressure dependent, in the RG model. The departure of these values from the corresponding IG values are tabulated in the enthalpy and entropy departure charts as functions of . Therefore, the complete state can be evaluated if  are given.