Input(block level), Intermediate output, output(block level)

**Method 1: EnergyPlus equations**

**Step 1: Pad efficiency**

d is the depth(m) of the media and v is the air velocity(m/s) through the pad.

***Step 2 : Heat transfer module: Efficiency, outlet temperature(K/C)***

Where ε is the efficiency of the evaporative cooler.

**Step 3: Relative humidity using outlet DBT and WBT(in C), Patm (hPa)**

**Step 5: Water consumption module**

**Method 2: (Kachhwaha & Prabhakar, 2010)(Camargo & Ebinuma, 2002) (Bougleux, Saboya, Marques, & Parise, 2013) (Wu, Huang, & Zhang, 2009)– Numerical method**

**Heat transfer module**

1. Calculating Nusselt number to calculate hc (convective heat transfer coefficient)

(we have got hc and hm)

1. **Calculating humidity ratio using outlet air conditions (assuming outlet WBT to be same as evaporative cooling is an isenthalpic process)**
2. **Calculating the total heat transfer:**

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**Water consumption module**

**Pressure drop module: Cooling pads**

Where le is the medium length (occupied volume to surface area), V w and Va are the volumetric flow rates in water and air respectively(m3/s).

**Nomenclature**

|  |  |  |
| --- | --- | --- |
|  | **Units** | **Description** |
|  |  | Efficiency of the cooling pad |
|  | K | Inlet dry bulb temperature |
|  | K | outlet dry bulb temperature |
|  | K | Inlet wet bulb temperature |
|  | K | outlet wet bulb temperature |
|  | C | Outlet dew point temperature |
|  | m/s | Velocity of air over the cooling pad |
|  | m | Thickness of the cooling pad |
|  | mbar | Saturation Vapor Pressure at Dry Bulb (mb) |
|  | mbar | Saturation Vapor Pressure at wet Bulb (mb) |
|  | mbar | Actual vapour pressure (mb) |
|  | bar | Atmospheric pressure |
|  | % | Relative humidity (@outlet) |
|  | Pa | Partial vapour pressure |
|  | Kg/Kg | Humidity ratio |
|  | Kg/kg | Humidity ratio |
|  | m3/s | Volume of water evaporated per second |
|  | m3/s | Volume of water drifted per second |
|  | m3/s | Volume of water blown down per second |
|  | ratio | Drift factor |
|  | ratio | Ratio of solids in the water |
|  |  | Reynolds number |
|  | Kg/m3 | Density of air |
|  | Kg/m3 | Density of water |
|  | Pa/s | Dynamic viscosity of water |
|  | W/m K | Conductivity of air |
|  | J/(K kg) | Specific heat of air |
|  |  | Prandtl number |
|  | m | Characteristic length = Volume/Total surface area |
|  | W/(m2K) | Convective heat transfer coefficient |
|  |  | Nusselt number |
|  | W/(mK) | K value of the cooling pad |
|  | m/s | Mass transfer coefficient |
|  |  | Lewis relationship |
|  | 2/m3 | Contact factor = Total wetted surface area per unit volume |
|  | W | Sensible heat |
|  | W | Latent heat |
|  | KJ | Latent heat of vaporization |
|  | W | Total heat transfer |
|  | Kg/s | Mass flow rate in air |
|  | Kg/s | Mass flow rate in water |
|  | Pa | Pressure drop |