TYPE 646: AIR SUPPLY PLENUM WITH UP TO 100 PORTS

General Description

Type646 models a supply air plenum. One inlet flow of air is split up into as many as 100 individual streams whose mass flow rates are user specified fractions of the inlet air flow rate. The limit of 100 inlet flows can be modified in the Fortran source code.

Nomenclature

ω_{out}	[kgH_2O/kgAir]	Absolute humidity ratio of air exiting the plenum as calculated from mixing equations.
$\dot{m}_{in}$	[kg/hr]	Mass flow rate of air entering the plenum.
$\dot{m}_{cond}$	[kg/hr]	Mass flow rate of condensate exiting the plenum.
$\omega_{returned}$	[kgH_2O/kgAir]	Absolute humidity ratio of air exiting the plenum as returned from the TRNSYS psychrometrics subroutine.

Detailed Description

Type 646 takes, as inputs, air pressure, temperature, flow rate, relative humidity and absolute humidity ratio. Depending upon the mode in which Type646 is operating, the user specified value of either the relative humidity or the humidity ratio input is ignored allowing more flexibility in input data. The component takes a single value of pressure drop across the plenum as an input as well. Type646 passes pressure, temperature and either relative humidity or humidity ratio to the TRNSYS PSYCHROMETRICS routine, which returns values of temperature, humidity ratio, relative humidity, and enthalpy. If saturated conditions were passed to the PSYCHROMETRICS routine, PSYCHROMETRICS returns the saturated humidity ratio and relative humidity corresponding to the specified temperature. This means that the humidity ratio and relative humidity used in calculations may be slightly different than those passed to the model by the user. If the air condition is saturated at any point in the simulation, the PSYCHROMETRCS routine prints a warning in the TRNSYS list file.

The user is asked to provide (as parameters) the fraction of total inlet mass flow rate that exit the plenum through each given port. The number of ports is also supplied as a parameter and the model checks to make sure that the user specified fractions add up to 1. If they do not, then the last user specified fraction is calculated by the model and the user is warned that the value was reset. If the calculated value of the last fraction turns out to be less than zero, the model generates an error and stops the simulation. The outlet flow rate of air exiting a given port of the supply plenum is determined as the fraction for that port multiplied by the inlet air flow.

At each time step and whether or not there is flow through the plenum, the absolute pressure of air at the plenum outlet is set to the inlet air stream pressure minus the plenum pressure drop specified as an input to the model.

The humidity ratio and enthalpy of the supply air streams are set equal to the respective values of the air inlet stream.

With these three conditions known (pressure, humidity ratio and enthalpy), PSYCHROMETRICS is called to determine the remaining air outlet conditions, namely temperature and a modified humidity ratio. Again the humidity ratio is reduced to the saturation line value if PSYCHROMETRICS is called

with saturated conditions. The difference between the humidity ratio used in the call to PSYCHROMETRICS and the humidity ratio returned from PSYCHROMETRICS is used to calculate the flow rate of condensate that potentially results from applying the air pressure drop as shown in equation 646.1.

$$\dot{m}_{cond} = \dot{m}_{in}\left(\omega_{out} - \omega_{returned}\right) \qquad \text{(Eq. 646.1)}$$