TYPE 649: FLOW MIXER WITH UP TO 100 PORTS

General Description

Type649 models a mixing valve that combines up to 100 individual liquid streams into a single outlet mass flows. The limit of 100 inlet flows can be modified in the Fortran source code.

Nomenclature

$T_{in,i}$	[ºC]	The temperature of fluid at inlet port i.
$\dot{m}_{in,i}$	[kg/hr]	The mass flow rate of fluid at inlet port i.
Cp	[kJ/kg.K]	The specific heat of the fluid
T_{out}	[ºC]	The temperature of fluid exiting the mixing valve.
$\dot{m}_{out}$	[kg/hr]	The mass flow rate of fluid exiting the mixing valve
T_{mix}	[ºC]	The temperature of mixed inlet fluid.
$nPorts$	[-]	Number of inlet air ports.

Detailed Description

Type649 models a mixing valve by performing an energy balance on the system shown in Figure 1 in which there can be as many as 100 inlet flows but only one outlet flow.

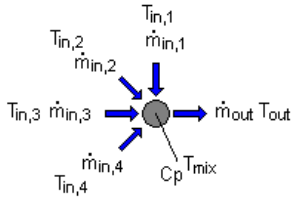


Figure 1: Mixing Valve Schematic

The energy balance can be written as shown in equation 649.1

$$\dot{m}_{in,1}Cp\left(T_{in,1}-T_{mix}\right)+\dot{m}_{in,2}Cp\left(T_{in,2}-T_{mix}\right)+\dot{m}_{in,3}Cp\left(T_{in,3}-T_{mix}\right)+\dot{m}_{in,4}Cp\left(T_{in,4}-T_{mix}\right)=\dot{m}_{out}Cp\left(T_{out}-T_{mix}\right) \quad \text{(Eq. 649.1)}$$

In fact since T_{mix} and T_{out} are the same, the energy balance could be written more simply still. It has been written with T_{mix} and T_{out} separated for clarity sake. Since Cp is assumed to be the same for all inlet flows to the mixing valve and since the outlet flow is the sum of the inlet flows, the energy balance can be simplified and solved for the outlet temperature as shown in equation 649.2

$$T_{out}=\frac{\sum_{i=1}^{nPorts}\dot{m}_i T_{in,i}}{\sum_{j=1}^{nPorts}\dot{m}_j} \quad \text{(Eq. 649.2)}$$