TYPE 571: INFILTRATION TO A CONDITIONED ZONE

General Description

ASHRAE long recommended the use of a semi empirical model for the calculation of infiltration to a conditioned zone. The so called K1, K2, K3 method is considered to be less rigorous than the calculation of infiltration based upon dynamic wind pressure, buoyancy forces and envelope characteristics. However, the more rigorous model requires extensive knowledge of parameters whose values are difficult to measure without a blower door test and the K1, K2, K3 model remains an accurate method for obtaining quick computation of infiltration.

Nomenclature

ACH	[-]	Zone air changes per hour
K_1	[1/hr]	Constant coefficient of infiltration
K_2	[ach/ºC]	Temperature coefficient of infiltration
K_3	[ach.s/m]	Wind speed coefficient of infiltration
$T_{ambient}$	[ºC]	Ambient temperature
T_{zone}	[ºC]	Zone temperature
WindSpeed	[m/s]	Wind speed
$\dot{m}$	[kg/hr]	Mass flow rate of ventilation air
ρ_{air}	[kg/m^3]	Air density
Vol	[m^3]	Zone volume
Q_{inf}	[kJ/hr]	Infiltration energy to (positive) or from (negative) the zone.

Detailed Description

The ASHRAE Handbook of Fundamentals describes a simple, empirical method to provide infiltration values to conditioned spaces. The correlation is shown in Equation 571.1.

$$ACH = K_1 + K_2 * (T_{zone} - T_{ambient}) + K_3 * WindSpeed \qquad \text{(Eq. 571.1)}$$

Suggested values taken from the ASHRAE Handbook of Fundamentals are provided below in Table 1 for varying levels of construction.

Table 1: Suggested Infiltration Coefficient Values

Construction	K1	K2	K3	Description
	[ach]	[ach/C]	[ach.s/m]	
Tight	0.1	0.011	0.034	New building in which special precautions have been taken to prevent infiltration.
Medium	0.1	0.017	0.049	Building constructed using conventional construction procedures.
Loose	0.1	0.023	0.070	Evidence of poor construction on older

				buildings where joints have separated.

Type 571 also computes the amount of energy added to or subtracted from the space based on the calculated infiltration rate. The mass flow rate of infiltration is computed according to Equation 571.2

$$\dot{m} = ACH * \rho_{air} * Vol \qquad \text{(Eq. 571.2)}$$

Whereas the density of the air was assumed to be constant and 1 atmosphere in the first version of this component, the density of air is now calculated by the model through a call to the TRNSYS psychrometrics utility subroutine.

The associated energy is then calculated according to Equation 571.4.

$$Q_{\inf} = \dot{m} * C_p * \left(T_{ambient} - T_{zone}\right) \qquad \text{(Eq. 571.3)}$$

The specific heat of air is also considered to be constant by the model.

As a final output, Type571 reports the air changes of cooling and the air changes of heating. To arrive at these values for a given time step, the model assigns the air change rate to heating when the zone temperature is greater than the ambient temperature and to cooling if the ambient temperature is greater than the zone temperature.

References

[1] ASHRAE Handbook of Fundamentals (1989), chapter 22: Ventilation and Infiltration