

Modelling R and S series e-stacks in IES

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Introduction

This document is to allow IES users to model the e-stack ventilation system.

The main advantage of the e-stack system over other natural ventilation systems is that in the winter, we do not bring in air via opening windows, as this requires a large amount of preheating energy. Instead we operate in 'mixing mode' where we bring in air at high level and mix it with warm room air to create a tempered air stream which is comfortable for occupants.

To accurately model conventional natural ventilation systems, preheating at the low level openings would have to be incorporated. However as IES and building regulations do not take account of thermal comfort in relation to draughts; therefore any energy input to mitigate cold draughts does not need to be included. So the e-stack system will look the same as any other natural ventilation system in terms of heating energy consumption, because the need for preheating is disregarded by IES which just takes into account the bulk air temperature.

Downloads

The easiest way to model the e-stack ventilation strategy accurately is to download the relevant files from our website <http://breathingbuildings.com/products/modelling-e-stacks-in-ies>. Two files are required;

1. The stack geometry as a .gem file
2. The profiles database from the .cab file

Summary of the Strategy

External Temperature	Internal Temperature	Strategy
< 16 degC	-	Winter Mixing Mode Minimum ventilation on CO ₂
> 16 degC	<24 degC	Upwards Displacement Mode No Fans
> 16 degC	>24 degC	Upwards Displacement Mode Fan Assistance
>25degC	-	Nightcooling operates that night

Geometry

The geometry of the e-stack R-Series and S-Series units can be downloaded as a .gem file from our website. These should then be placed level with the roofline and then merged or connected with your building geometry with partitions removed. The louvres are indicated as doors and to accurately reflect the aerodynamic free area of the e-stack units, these should achieve an equivalent orifice area of approximately 10% in MacroFlo.

Air Exchanges

Three auxiliary ventilation rates are required to effectively simulate the operation of the e-stack unit;

1. **Winter** - In winter the system aims to control CO₂ to meet a daily average of 1500ppm. This means providing 5l/s/p of fresh air. This should be assigned as an Auxiliary Ventilation and should use the variation profile *"e-stack Winter Mode (Y)"*. Any specific fan power assigned to this Auxiliary ventilation should be set at 0.6 W/l/s for the R-Series and S-1200 unit and 0.41 W/l/s for the S-1500 unit.
2. **Summer Boost** - Summer boost mode occurs when the space temperature exceeds 24°C during occupied hours. It should be assigned as an Auxiliary Ventilation and should use the variation profile *"e-stack R;S & F Summer Fan Boost (Y)"*. Any specific fan power assigned to this Auxiliary ventilation should be set to 0.3 W/l/s for the R-Series and S-1200 unit.
3. **Nightcool Boost** - Nightcool boost mode occurs during the summer months when the temperature in the space overnight is still above target temperature at 3am. It should be assigned as an Auxiliary Ventilation and should use the variation profile *"e-stack R;S & F Nightcool Fan Boost (Y)"*. Any specific fan power assigned to this Auxiliary ventilation should be set to 0.3 W/l/s for the R-Series and S-1200 unit.

MacroFlo

This mode relies on natural buoyancy and wind to drive air through the space and the fans are not required. In this mode, the unit consumes minimal power. It is important that all the windows and other openings are positioned correctly in the space as this will affect the natural ventilation flow.

Two profiles should be created separately for the low level openings and the e-stack. The low level openings should only open for daytime operation and therefore should be assigned the Degree of Opening Profile *"Low Level Openings"*. The e-stack unit will open for both daytime and nightcool operation and therefore should be assigned the Degree of Opening Profile *"e-stack Louvres (Y)"*.