Breathing Buildings

Assigning profiles to an e-stack or Passive Stack
(S1500, S1200 & R-Series)

This document provides a comprehensive step-by-step guide to assigning opening profiles for an e-stack to an existing IES VE model. Should you have any questions please contact **Joe Clawley or Matthew Waterson** at joe.clawley@breathingbuildings.com / matthew.waterson@breathingbuildings.com, or call the office on **01223 450 060**.

Table of Contents

Modelling natural hybrid ventilation in IES VE

One of the big advantages 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 potentially large amount of preheating energy. This would of course make for a less energy efficient and environmentally friendly solution to keeping temperatures and CO2 levels comfortable.

Instead we operate in 'mixing mode' where we bring air at high-level and mix it with the warm room air to create a tempered air stream which is comfortable for occupants. However, as IES VE does not take into account the thermal comfort in the context of cold draughts, this major advantage does not need to be modelled.

IES VE models a room with a 'bulk air temperature', which means the requirement to preheat the incoming air (and associated energy consumption) of other conventional natural ventilation systems is not included in the IES model. It is however worth noting that in a real-world situation **our** systems would have you covered to comply with the new BB101 regulations.

Summer Mode

When it is warm outside the system operates in upflow displacement mode, using the stack effect to achieve high air flow rates and keep the room at a pleasant temperature.

Fan boost and night cooling modes offer greater thermal comfort in exceptional summer conditions.
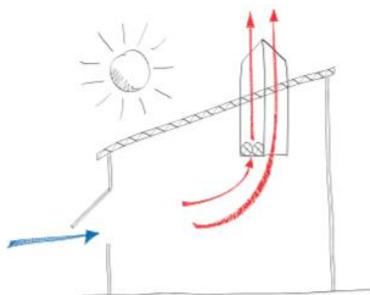
Winter Mode

When the outside temperature becomes too low to bring directly onto the occupants the R Series unit operates as inflow and outflow. The fans in the unit pre-mix the incoming air with air from within the room, preventing the need for wasteful pre-heating.
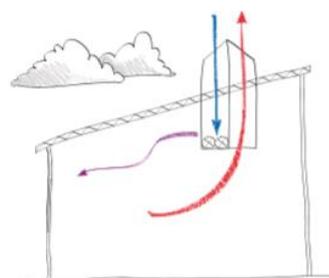
The e-stack system is not a heat exchanger, and therefore cannot be modelled as a mechanical system with heat recovery. The system saves energy by bringing air into the space and mixing it with the room air to reduce cold draughts.

This document explains in detail how to set up an E-Stack unit in in IES VE, which for the purpose of this user guide we have selected the S1500 unit for this example.

Download, unzip and attach the e-stack geometry file

Start by creating the model of your room or building within the VE. Once you have your building set up, with the necessary construction properties applied, you are ready to add an e-stack system.

http://www.breathingbuildings.com/wp-content/uploads/2017/04/Adding-an-e-stack-unit-to-a-model.pdf

Follow the above link to our dedicated guidance, download '*Importing & Installing the E-Stack Geometry Files'*, then follow the instructions to attach the e-stack to your model as shown in the image below.
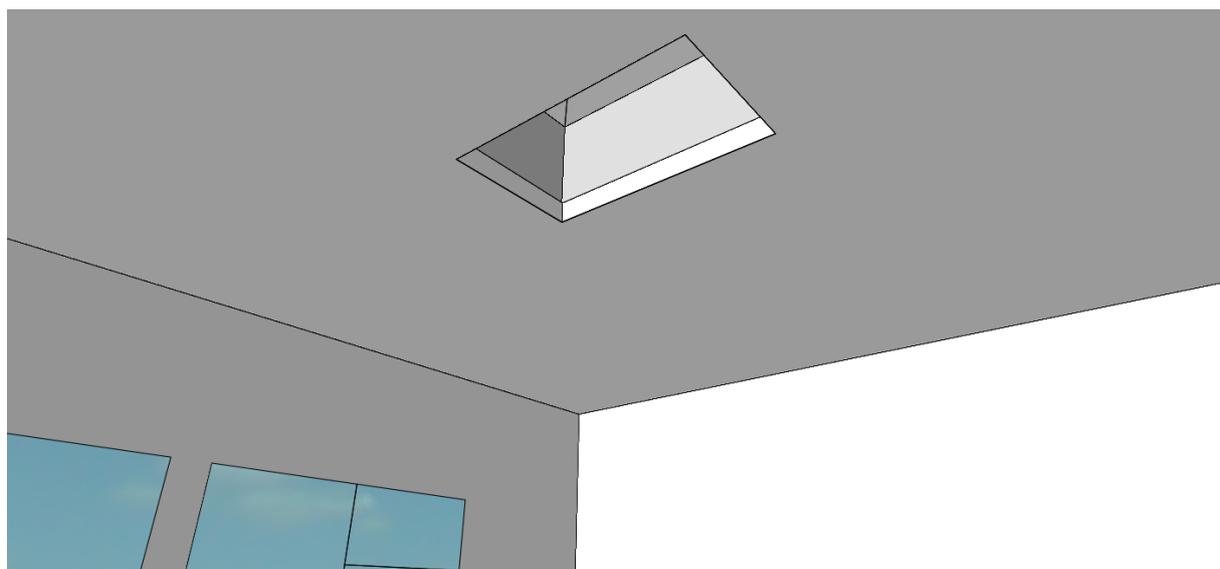
Modelling functionality of the e-stack in IES VE

The functional control of an e-stack system takes into account: modulating damper control, window opening, fan operation, temperature sensing, CO_2 sensing, and timed functions. The complexity of this system can be difficult to model in any dynamic simulation software.

We have therefore created all the profiles necessary and included them in the cabinet file folder. The geometry file contains an easily importable e-stack unit which can be copied as many times as required.

Name	Type	Size
BB S1500 [VE2017]	Cabinet File	19 KB
BB S1500.gem	GEM File	2 KB

Importing e-stack profiles into your project

Once the geometry file has been imported into your project, you'll be in a comparable situation as shown below, with the e-stack attached to the roof of the required room:
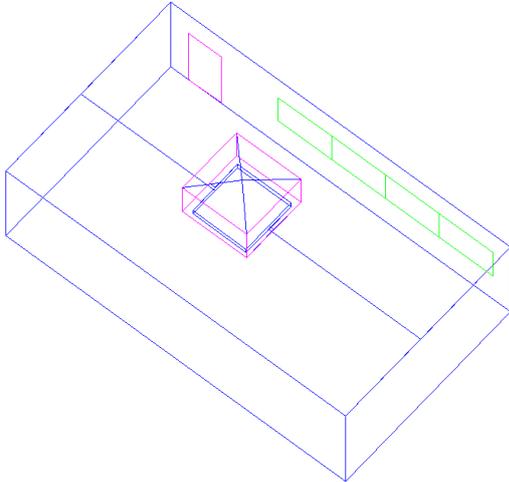
Next you will need to import the profiles, in this case from the '**BB S1500 [VE2017]**' cabinet file using the '*master template Wizard'* option as shown below:
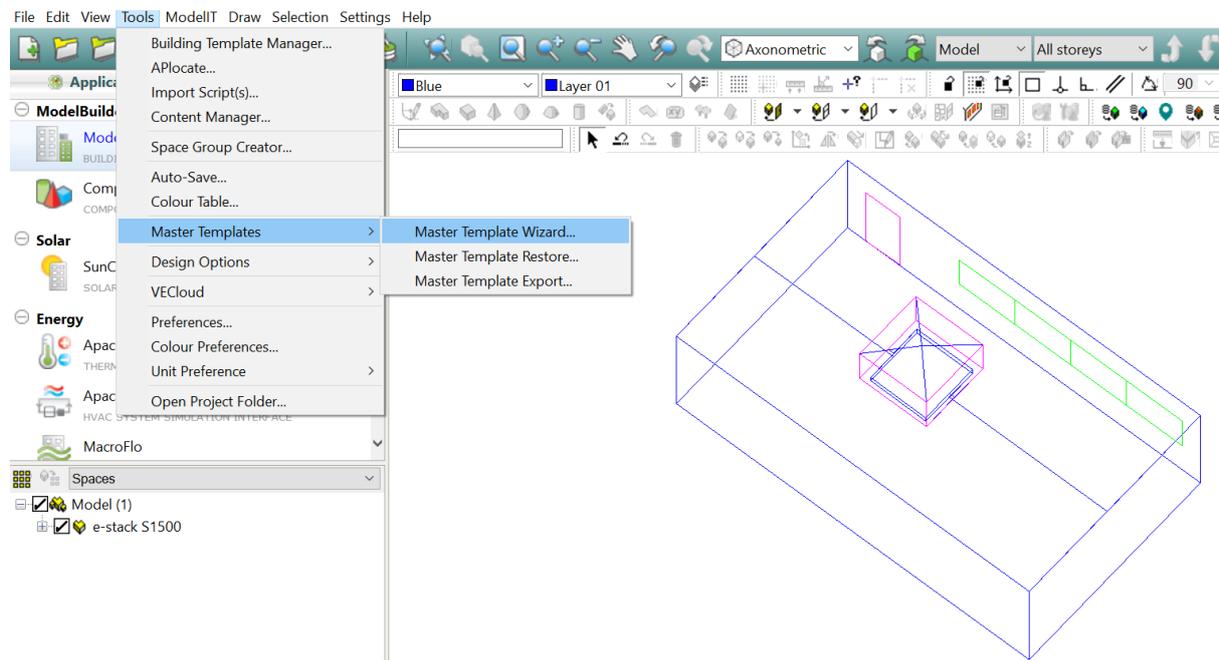
Click the 'find folder' button:
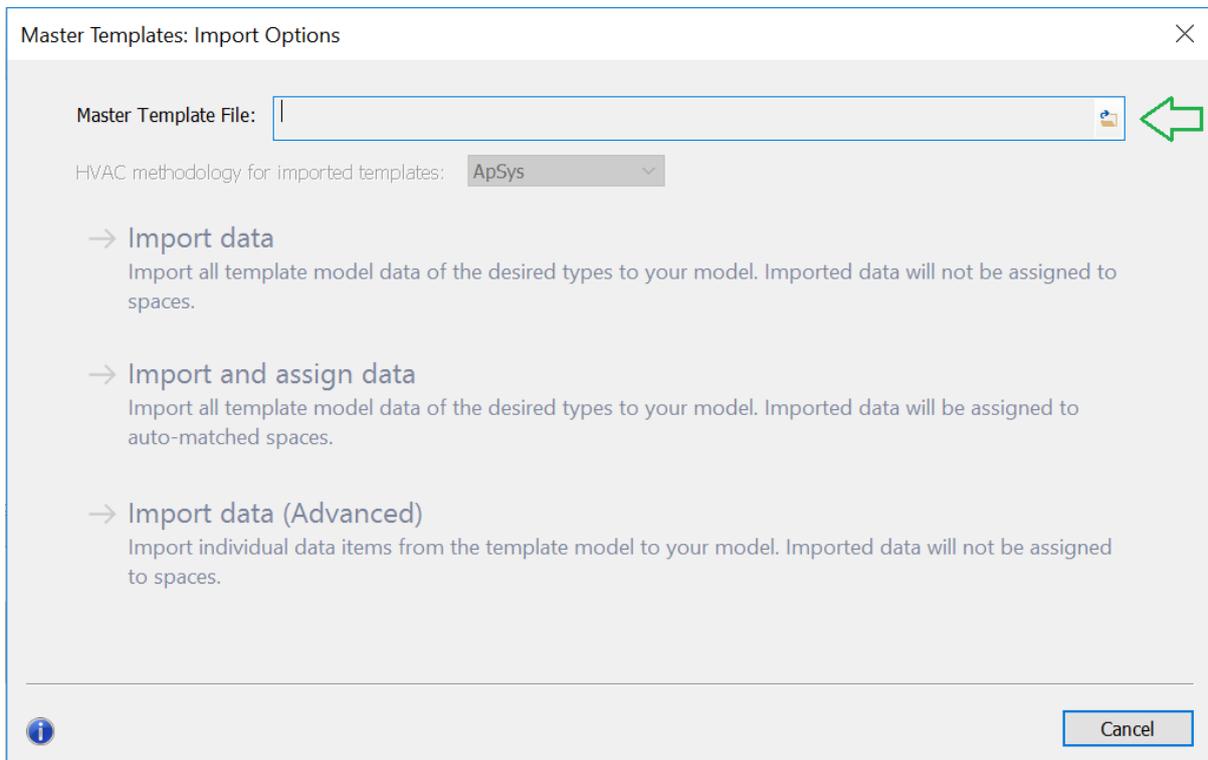
Find the relevant unit folder, in this case the **BB S1500** folder in the location it was saved after being downloaded from our website, and select the VE Document entitled '**BB S1500**':
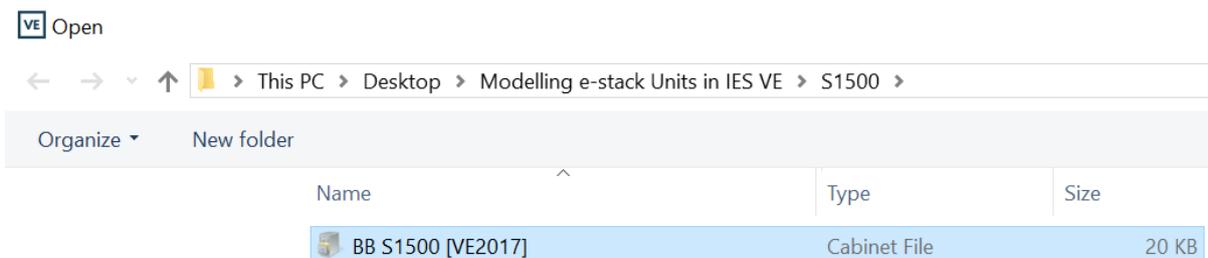
Click the 'Import data' button:
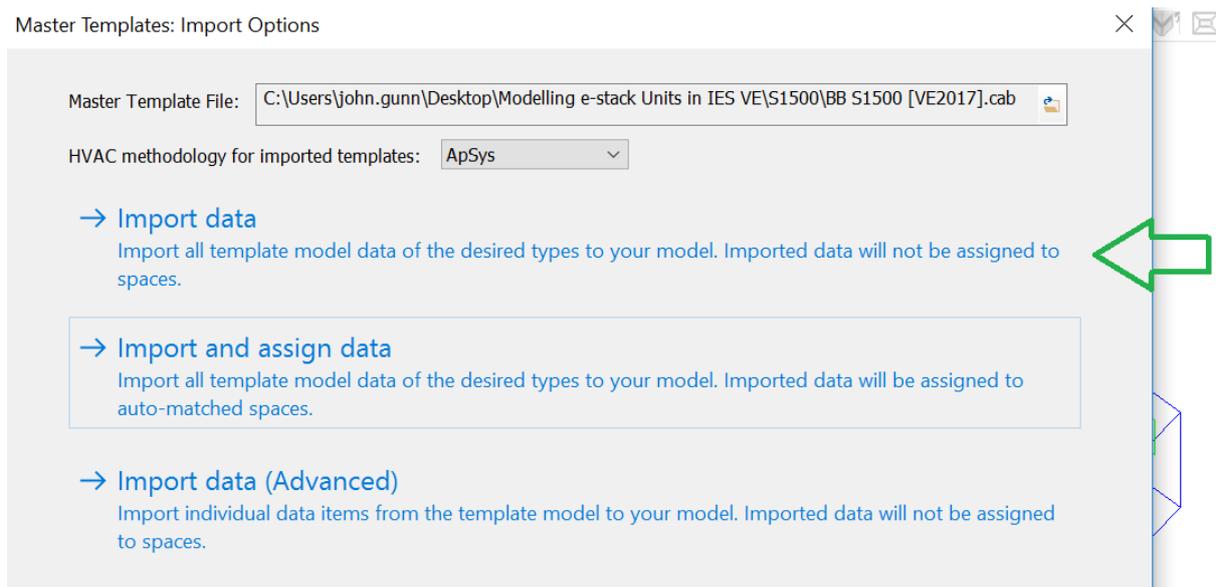
Select the 'MacroFlo Openings Templates', 'Apache Profiles', 'Air Exchanges' and 'MacroFlo Openings' options as shown below:
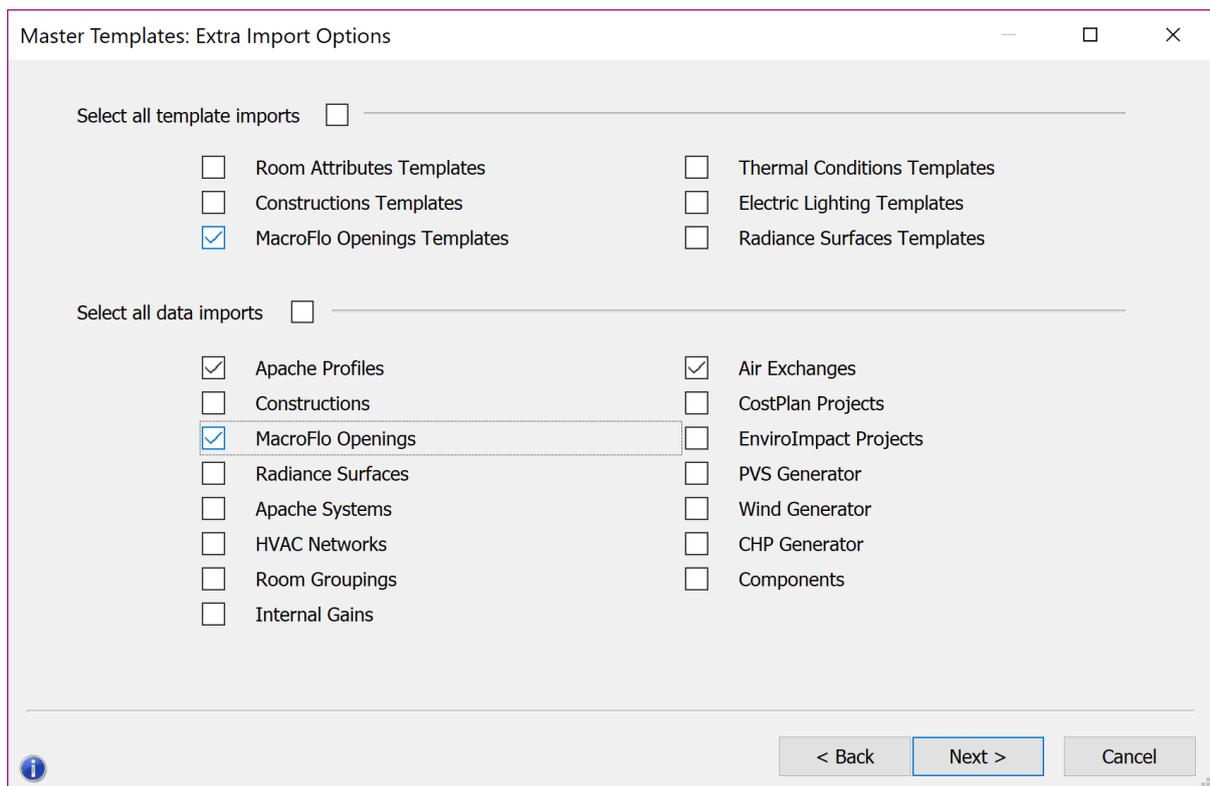
Click 'next', and then 'Start':
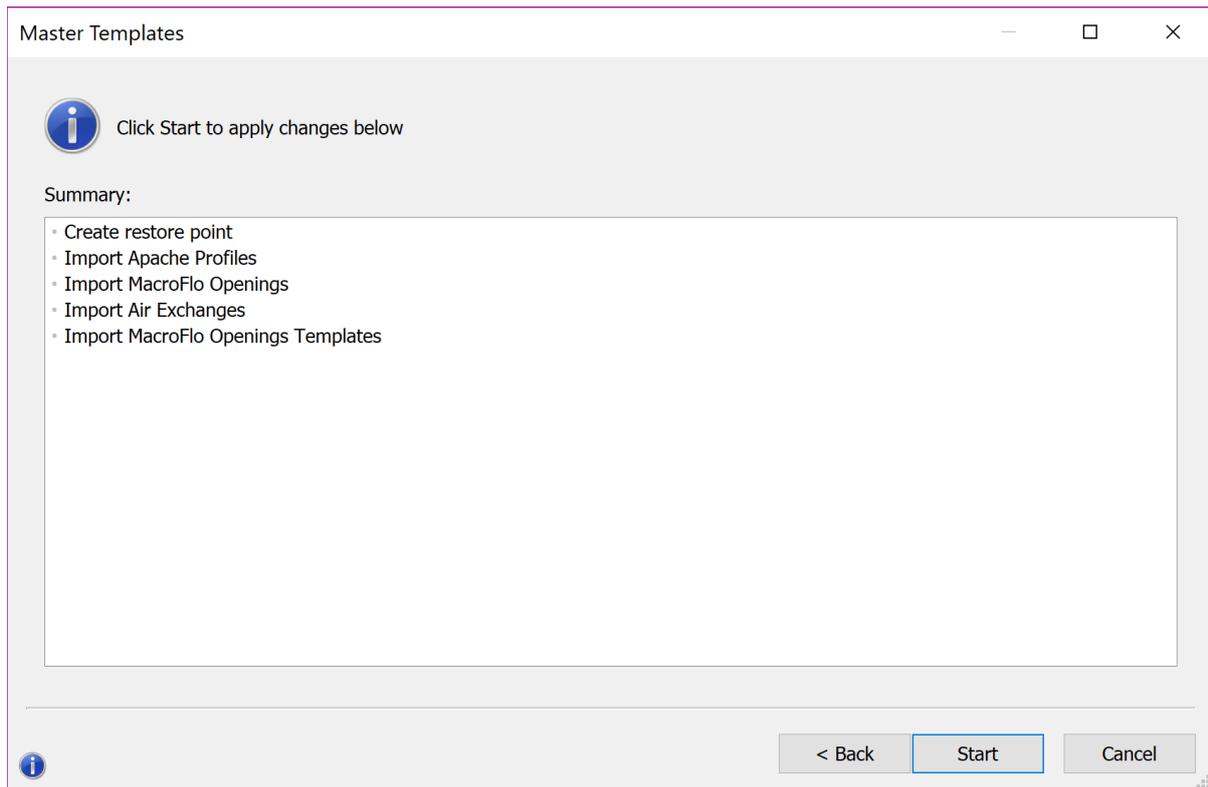
Your IES VE file will now contain the Breathing Buildings e-stack profiles required to control the unit. The profiles have been prefixed, in this case with 'BB S1500' for the S1500 e-stack unit, to make them easy to identify and group within the Profiles Database:

The profiles included are daily and weekly profiles culminating in:

e-stack (BB S1500) Damper Profile – Damper control of the actual e-stack unit in your project

e-stack (BB S1500) Fan Profile (this accounts for all fan operations) – Auxiliary ventilation control

e-stack (BB S1500) Windows Profile – Window opening profiles as controlled by the unit

e-stack (BB S1500) School Term weekly Profile – UK school term times

BB e-stack Damper Profile setup

Through the MacroFlo tab select the four opening doors of the S1500 unit.

= All four vertical doors
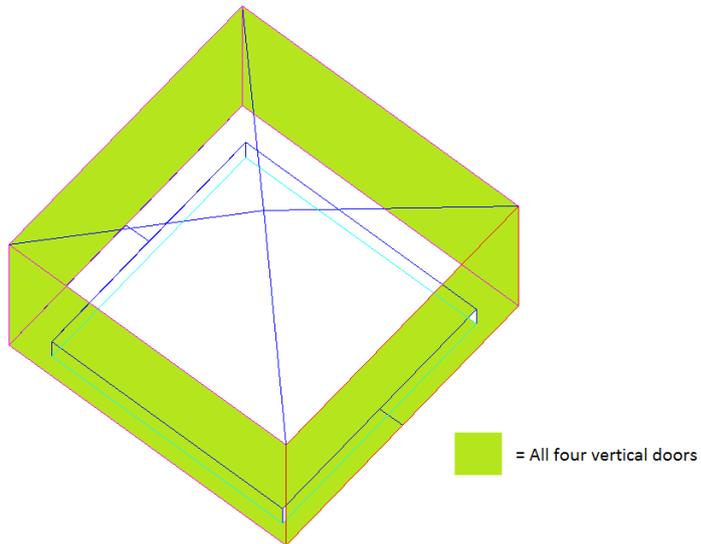
Click the '*edit selection set opening types*' button as shown below:
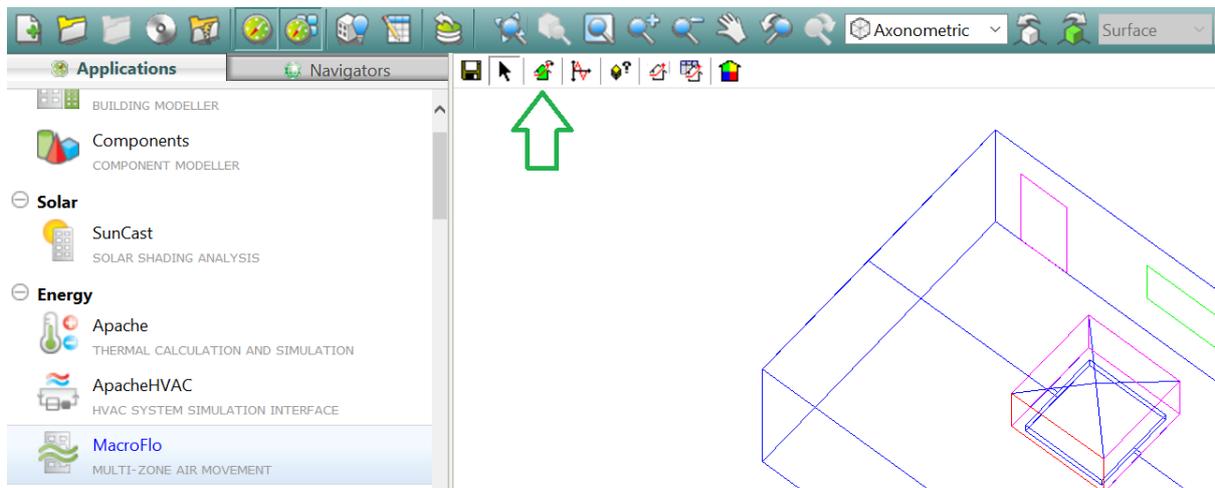
Select the appropriate e-stack unit roof cowl type (mushroom or penthouse) and click replace.
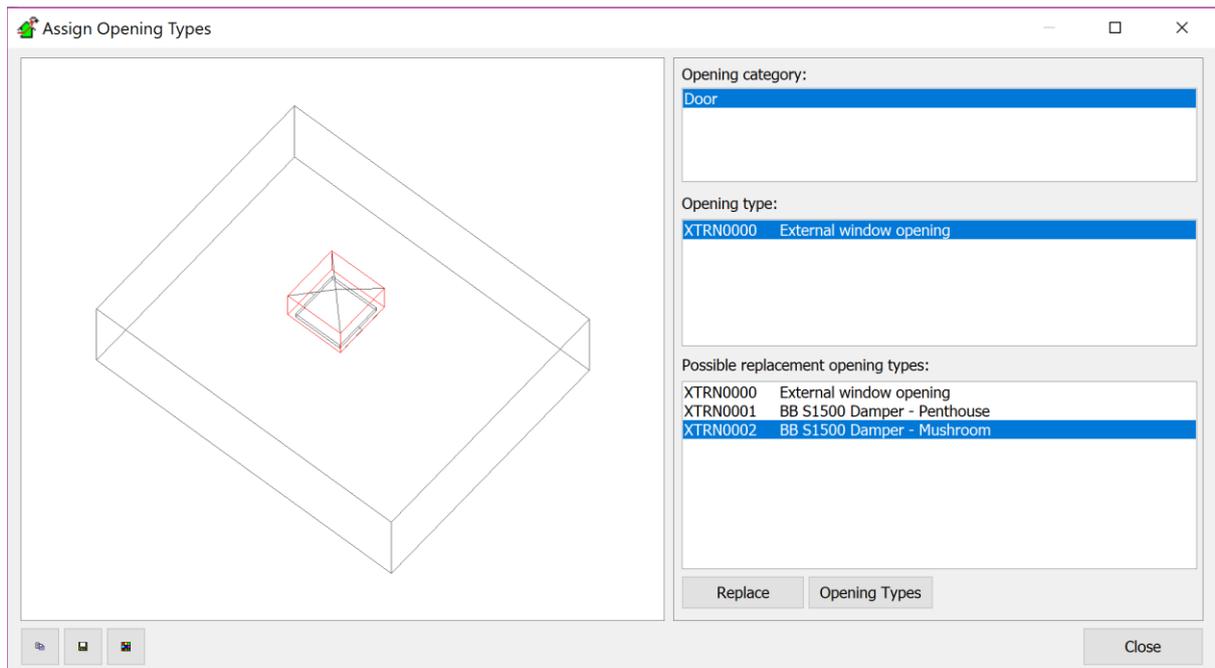
You now have the Macroflo opening profiles set up correctly. This will enable the roof vent to open and close automatically, depending on internal and external conditions, replicating the real-life operation of our e-stack system.

BB e-stack Auxiliary Ventilation Profile setup

Breathing Buildings' e-stack systems are hybrid natural ventilation systems, which include low-powered fans, primarily there to enable mixing ventilation in colder weather - Breathing Buildings' energy saving method for mitigating cold draughts whilst ensuring occupancy comfort.

Since these low-powered fans are present, it makes sense to utilise them, wherever possible, to assist the predominantly natural ventilation airflow in warmer weather - i.e. summer mode.

In summer mode, we are able to run the fans to assist the natural ventilation airflow. This fan assistance should be represented within IES as an auxiliary ventilation within the room.

The fans in the unit are modelled in IES as auxiliary ventilation within the room, added through the '*building templates manager*' '*Air Exchanges*' tab as shown below **(Note – Please skip the 'BB e-stack Auxiliary Ventilation Profile setup' section for passive stack only (not fans) versions of these units)**:
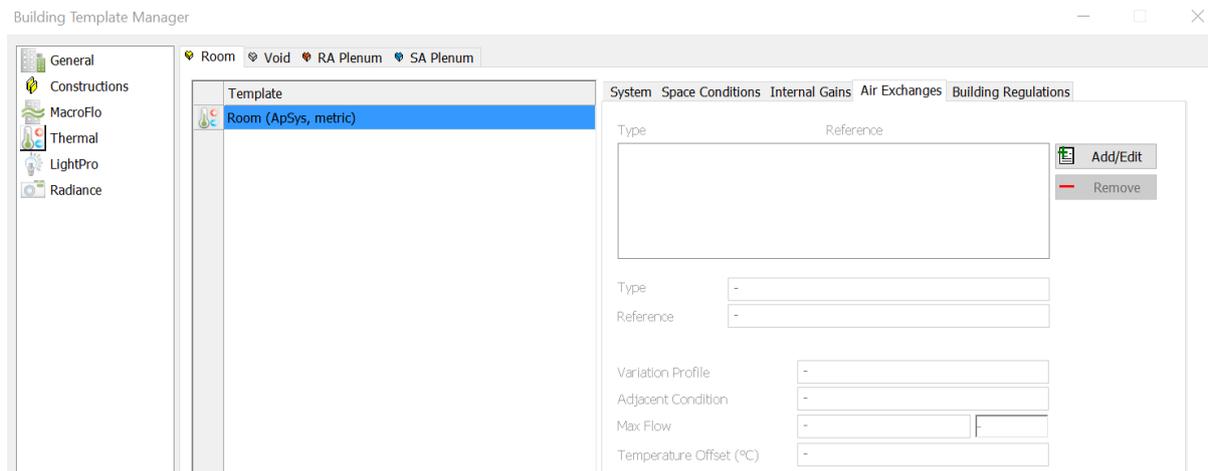
Click the '*Add/Edit*' button. Add the 'BB e-stack Fan' profile to the template.
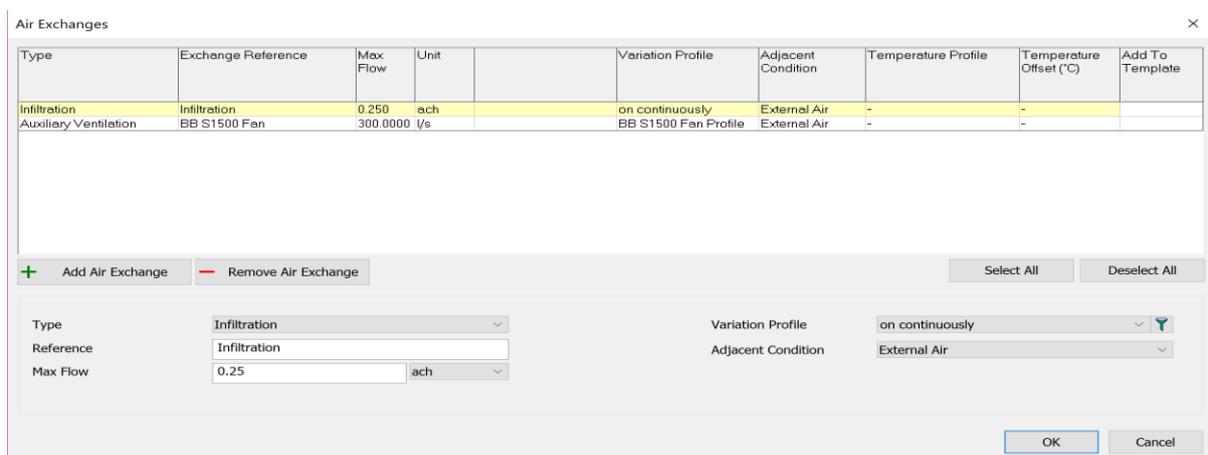
Below is a completed version of all auxiliary ventilation modules required:

By allowing for the Infiltration you can avoid CO_2 being trapped in the room during unoccupied hours, this is a more realistic model of the building and we recommend 0.25 ach as is the default for IES VE.

All air exchanges through the unit have now been set up:

Click '*save*' and '*OK*'.

BB e-stack Windows Profile setup

The e-stack system is designed to perform optimally when working in conjunction with openable windows at low-level. In a real building, the opening and closing of these windows would be done by the room occupants. When simulating the building, however, we need to set the window opening profiles in line with the internal and external conditions.

The profiles you need are all included in the CAB file you downloaded and imported into your IES. You simply need to assign them to the windows in your building by selecting the 'BB S1500Window Profile' in the area of 'MacroFlo Opening Types' as detailed below. Please ensure the hours for when windows can be used are altered accordingly in the highlighted window profile below (currently assumed to be 9am to 4pm).

Click '*Save*' and '*OK*'

Heating and Cooling defaults within the building

IES VE will automatically set your room up to have heating set at 19 degrees continuously, and cooling set at 23 degrees continuously throughout the year. These should be changed to suit the building using the '*Space Conditions*' tab of the building template manager. Please note that in the summer months an automatic night cool strategy operates, the heating profile should be chosen in order not to conflict with this scheme.