Assigning profiles to an e-stack F1000 Unit

This document provides a comprehensive step-by-step guide to assigning opening profiles for an e-stack F1000 Unit 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**.

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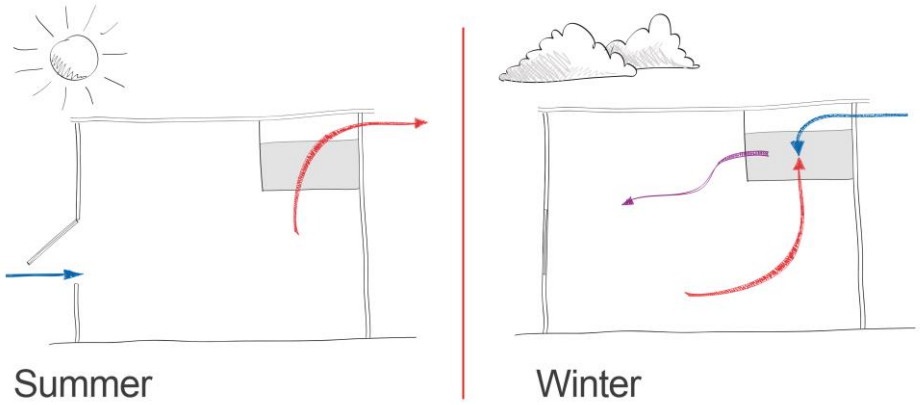
Modelling natural hybrid ventilation in IES VE

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.



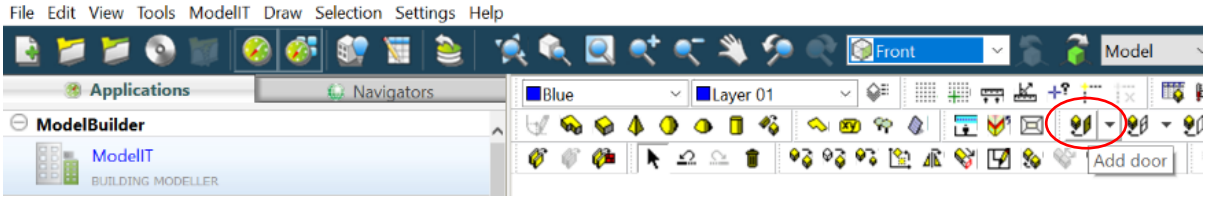
The e-stack system is not a heat exchanger, and therefore cannot be modelled as a mechanical system with heat recovery. The system saves energy by bringing air into the space and mixing it with the room air to reduce cold draughts.

This document explains in detail how to set up an E-Stack F1000 unit in in IES VE.

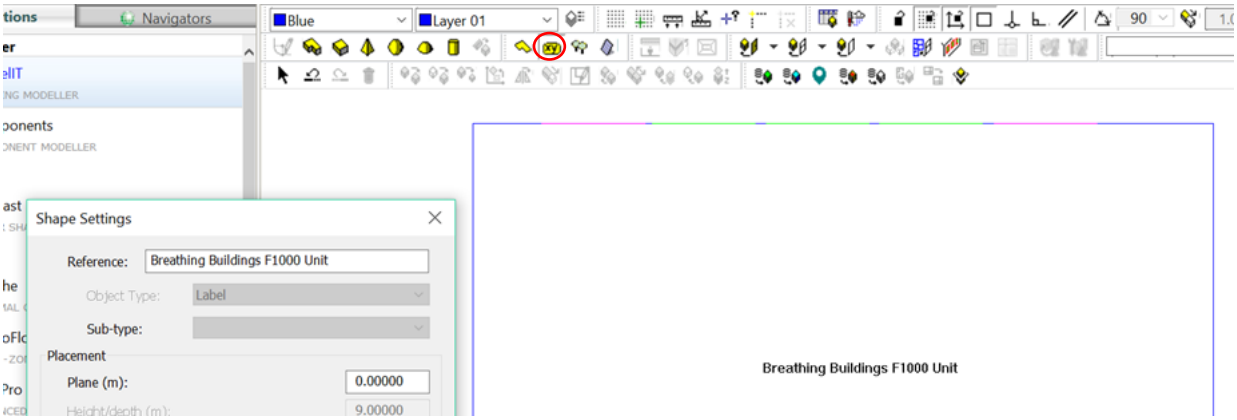
Adding the F1000 to your Model

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 F1000 system and its associated balanced opening. This balanced opening can either be a second louvre (modelled as a door in IES) or a high-level window and it acts as an exhaust airflow pathway in winter and summer. In practice the balanced opening must be at the same level or high to ensure it acts as an outflow pathway.

Because the unit only requires access to the façade via a louvre, no external geometry file need be imported - unlike adding the S1500, S1200 or R Series E-stack units which require the roof terminal geometry to be added to the model. The louvre can be added by creating a door of the correct dimensions (1250mm(W) x 560mm(H)) in ModelIT. This door will later be assigned an opening profile.



If there are other louvres added to rooms without F1000 units and you wish to make it clear which rooms have F1000 profiles applied and which do not, labels could be added in ModelIT.



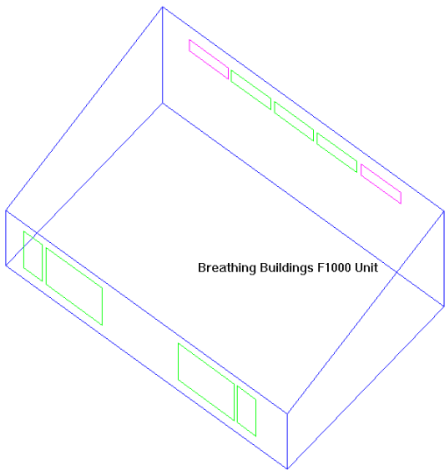
Modelling functionality of the e-stack F1000 in IES VE

The functional control of an e-stack system takes into account: modulating damper control, window opening, fan operation, temperature sensing, CO2 sensing, and timed functions. The complexity of this system can be difficult to model in any dynamic simulation software.

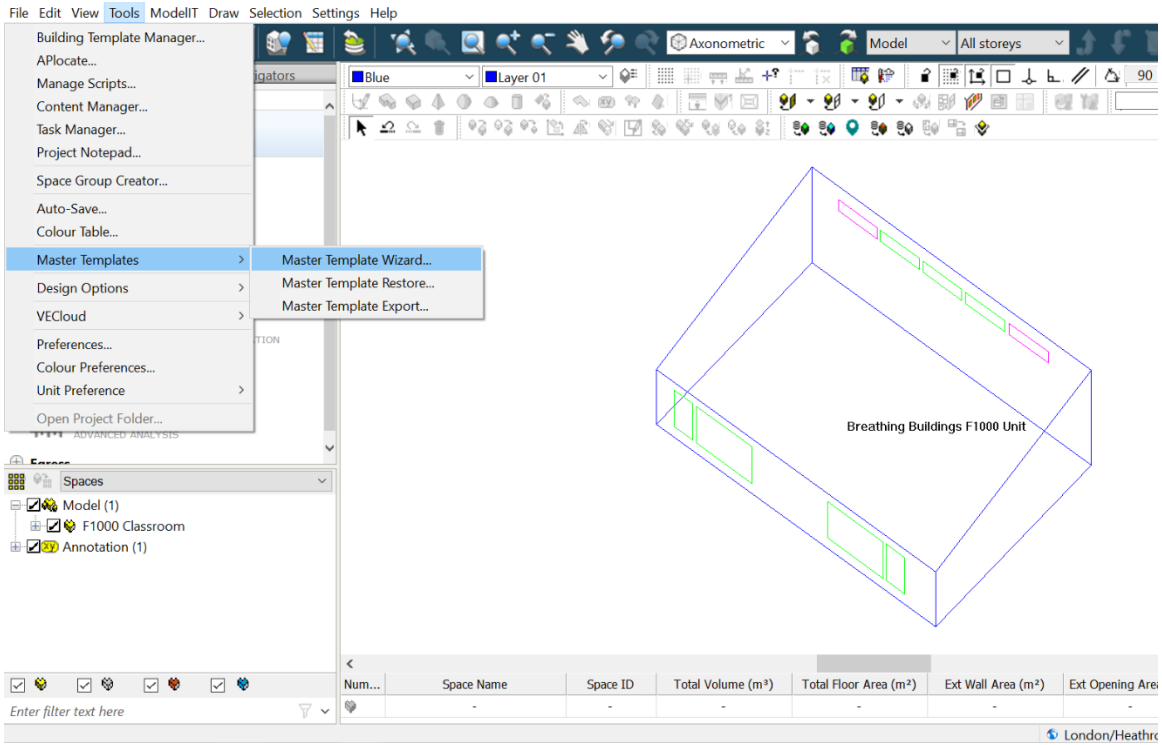
We have therefore created all the profiles necessary and included them in the cabinet file folder.

Importing e-stack profiles into your project

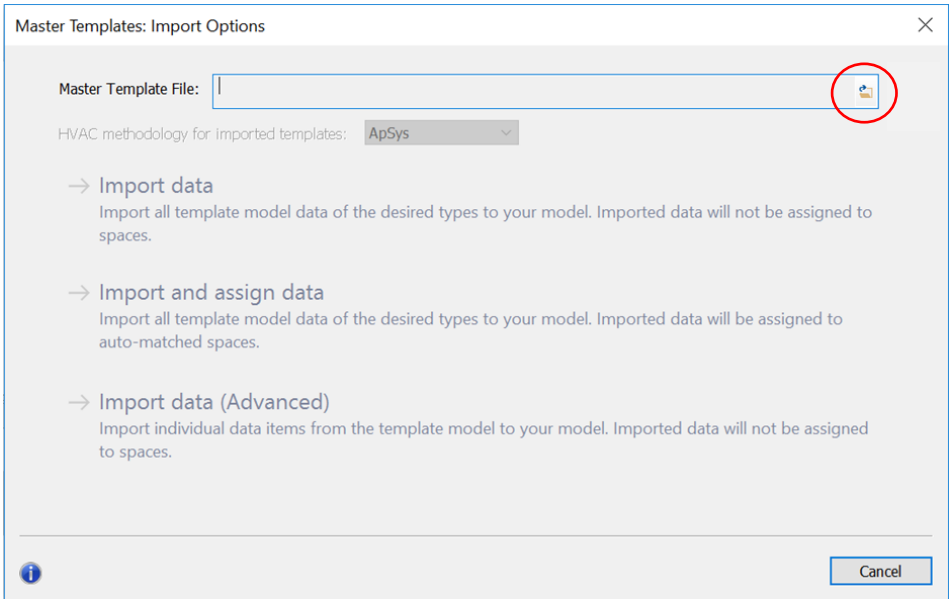
Once the geometry file has been imported into your project, you'll be in a comparable situation to that shown below, with the F1000 and balanced opening (either high-level louvre or window) added to the required room:



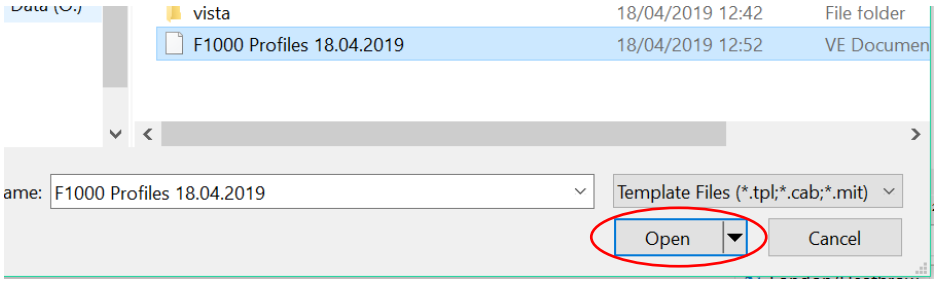
Once you have downloaded the F1000 files, the profiles, air exchanges and MacroFlo openings should be imported into the model using the 'M*aster Template Wizard'* found in the *'Tools'* menu.



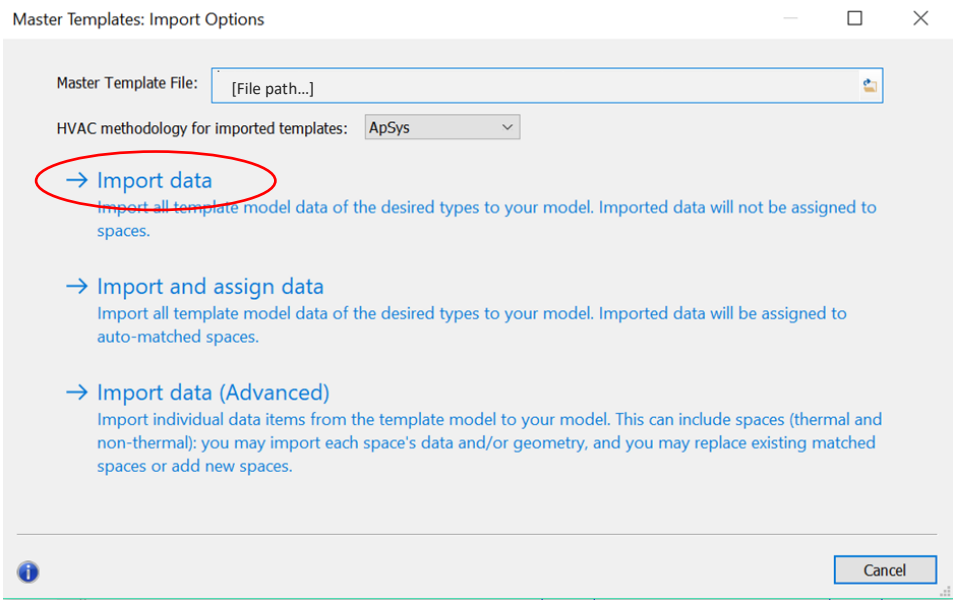
Click the ‘find folder’ button:



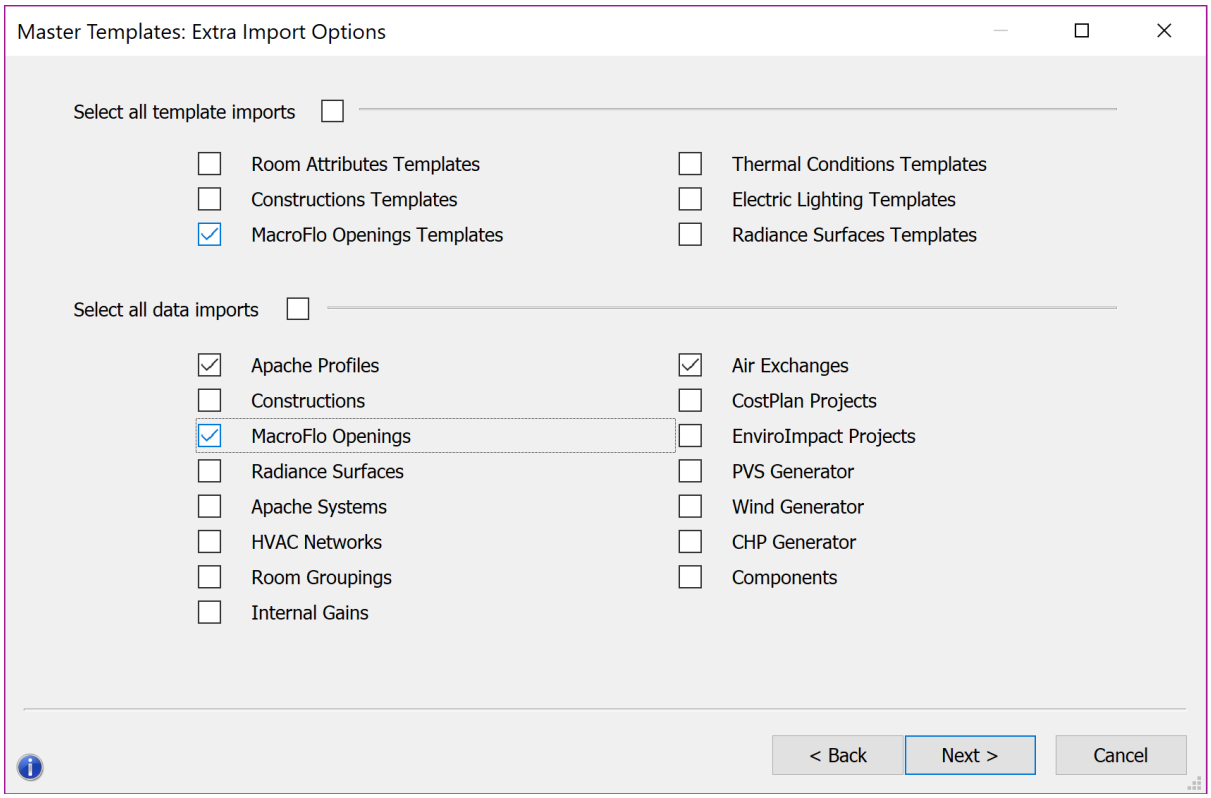
Find the relevant unit folder, in this case the ***F1000*** folder in the location it was saved after being downloaded from our website, and select the VE Document entitled ‘***F1000 Profiles’***:



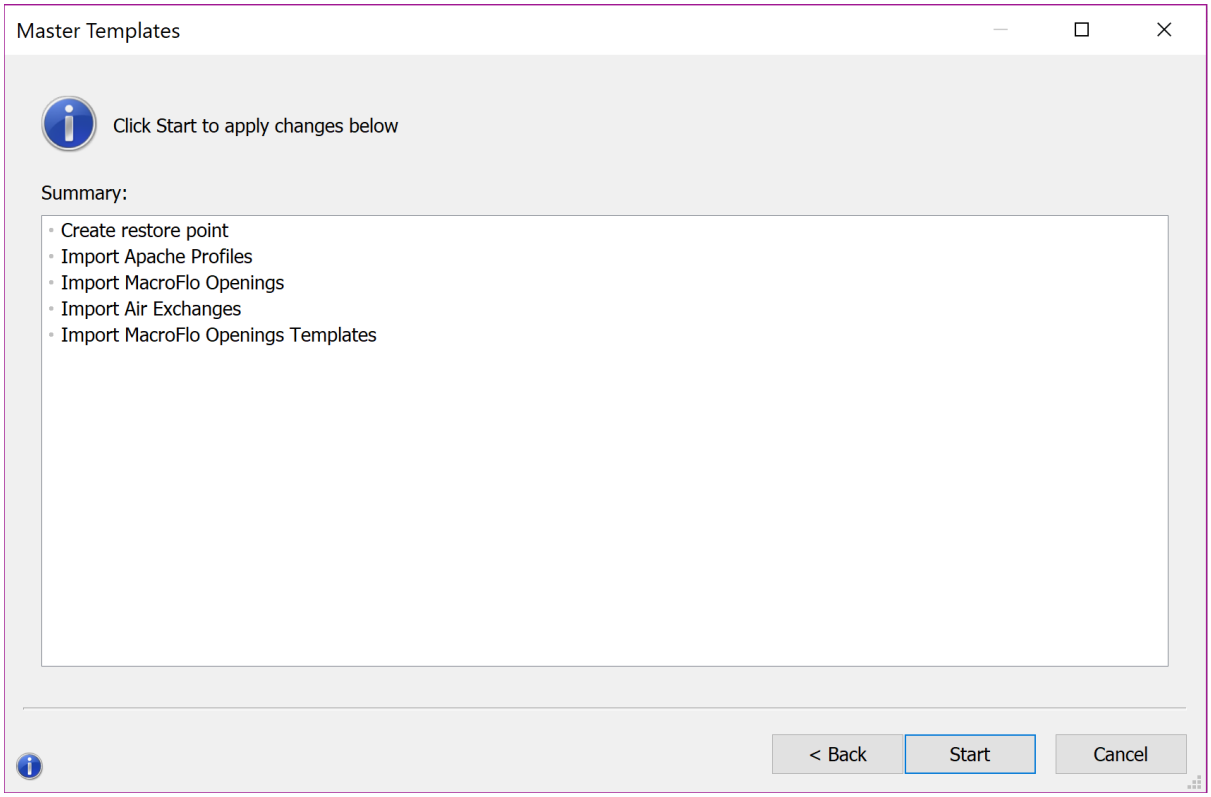
Click the ‘Import data’ button:



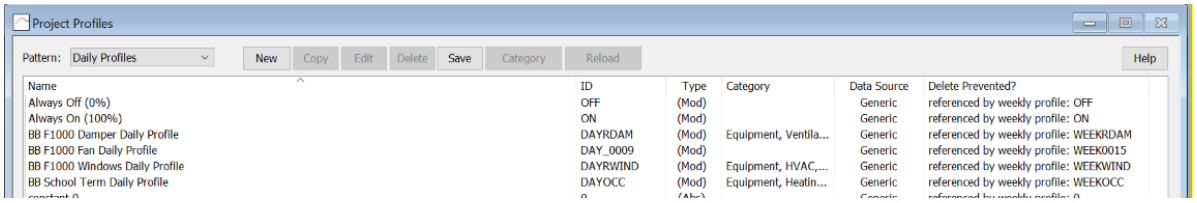
Select the ‘MacroFlo Openings Templates’, ‘Apache Profiles’, ‘Air Exchanges’ and ‘MacroFlo Openings’ options as shown below:



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 F1000' for the F1000 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 F1000) Damper Profile – Damper control of the actual e-stack unit in your project (also used for a high-level window being used as a balanced opening)

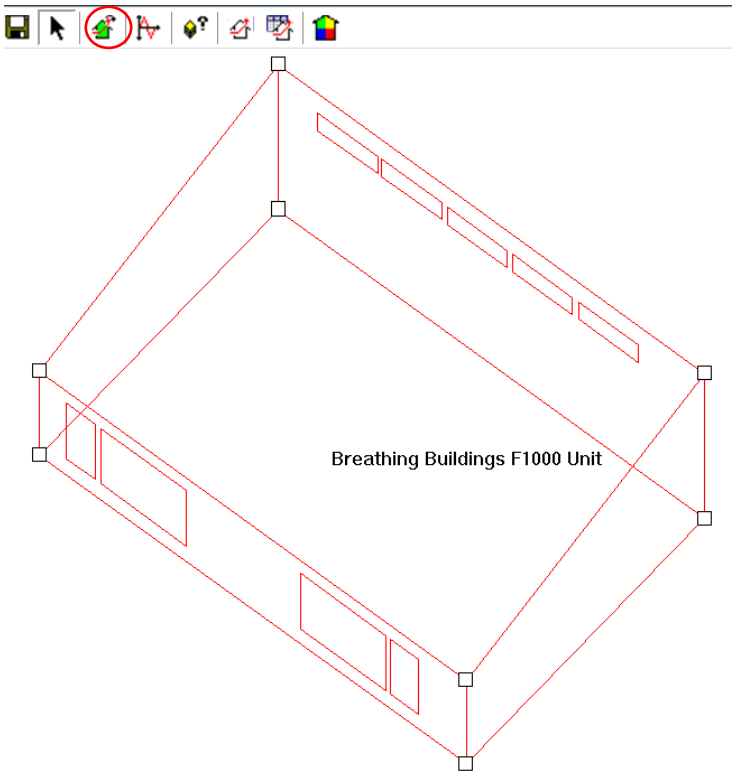
e-stack (BB F1000) Fan Profile (this accounts for all fan operations) – Auxiliary ventilation control

e-stack (BB F1000) Windows Profile – Low-level window opening profiles

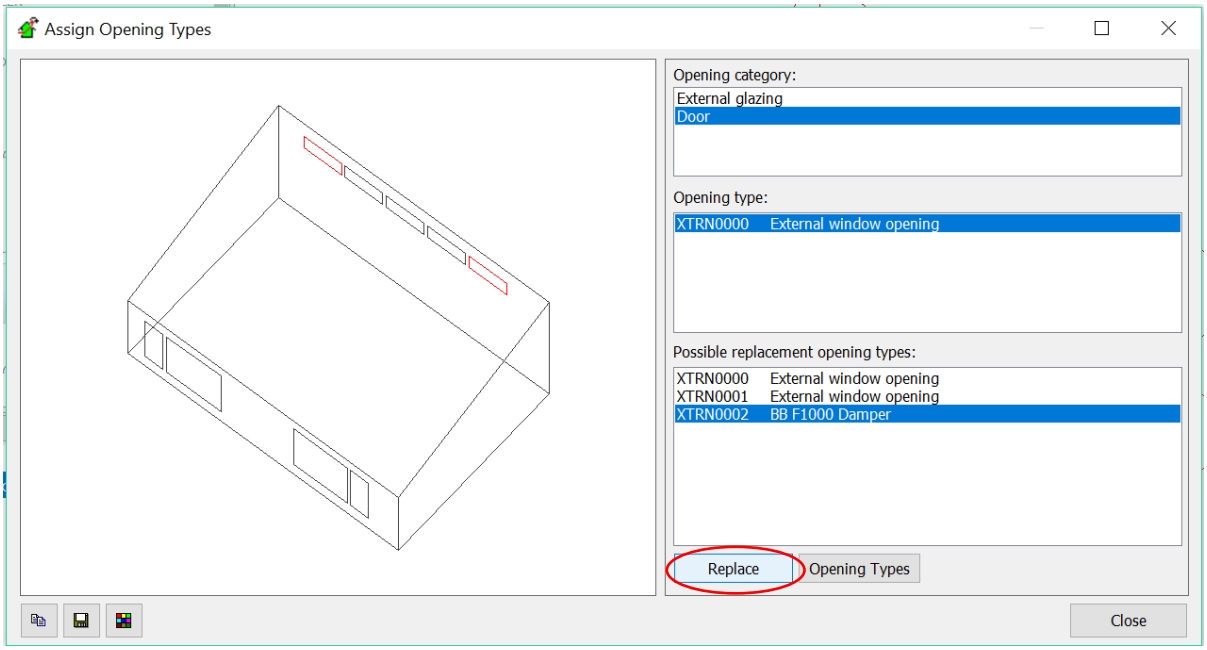
BB School Term weekly Profile – 9am-4pm occupancy profile with a lunch break 12noon-1pm.

BB F1000 Damper Profile setup

Through the MacroFlo tab select the louvres/doors of the F1000 room and click the '*Edit selection set opening types'* button as shown below:



Select the *'BBF1000 Damper'* opening type and click replace.

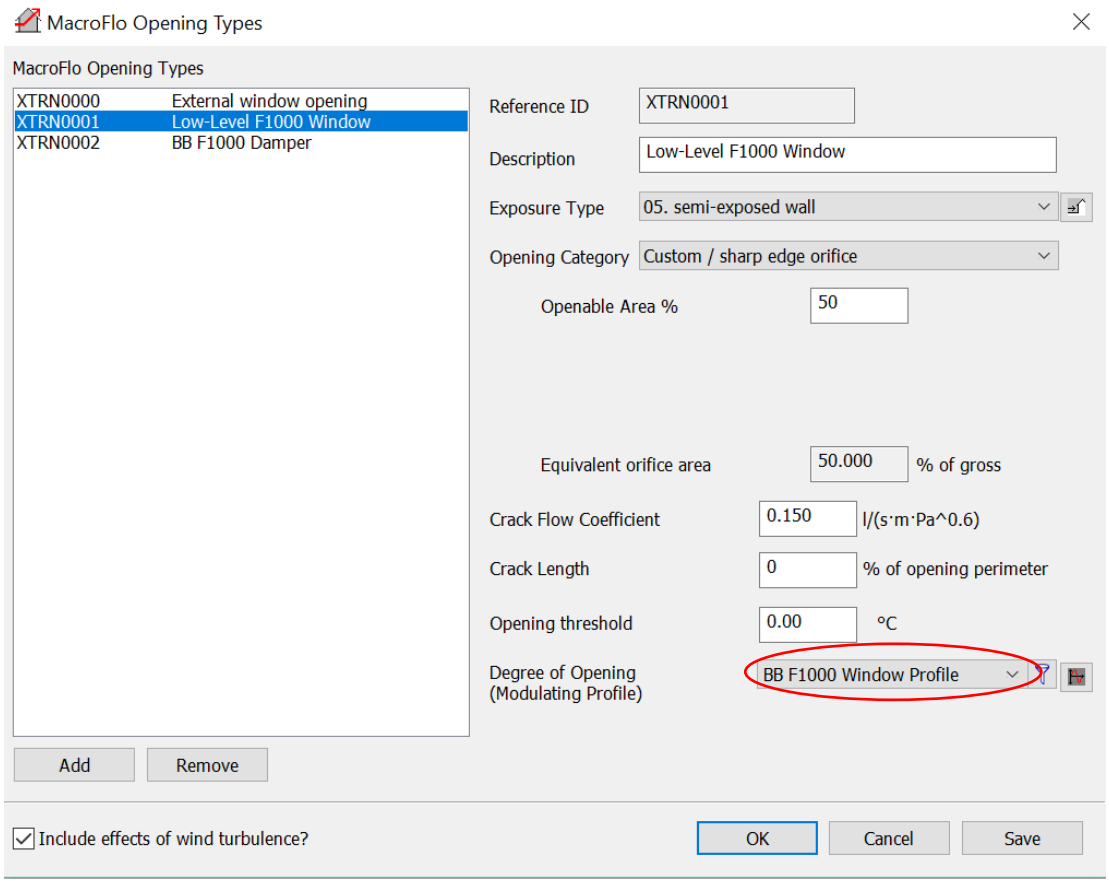


You now have the Macroflo opening profiles set up correctly. This will enable the F1000 damper and balancing damper to open and close automatically, depending on internal and external conditions, replicating the real-life operation of our F1000 systems.

BB F1000 Windows Profile setup

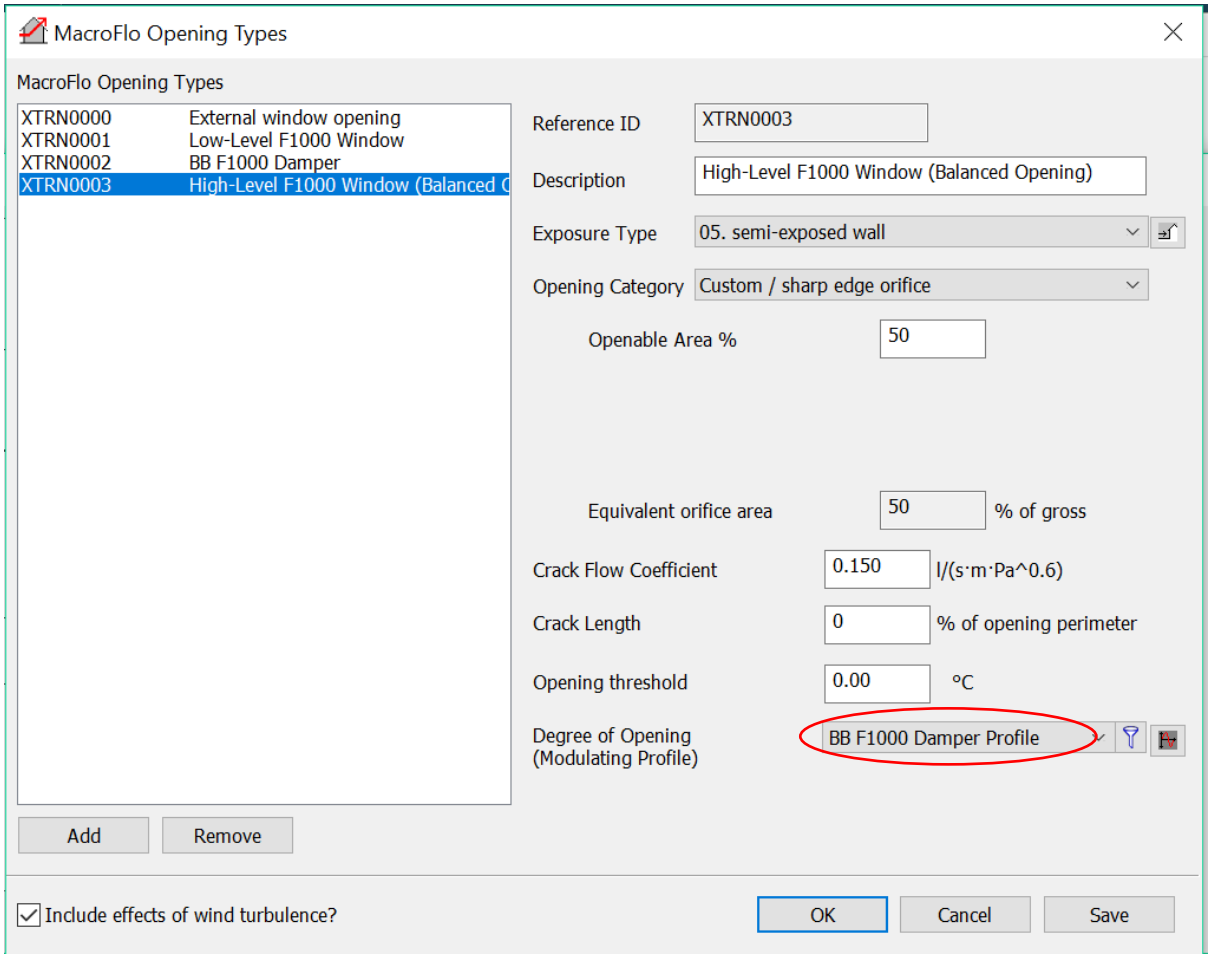
The F1000 systems are designed to perform optimally in summer conditions when working in conjunction with openable windows. In a real building, the opening and closing of these windows would be done by the room occupants. When simulating the building, however, we need to set the window opening profiles 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 model. You simply need to assign them to the windows in your building by selecting the *'BB F1000 Window Profile'* in the *'Degree of Opening'* 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*'

If the balanced opening is a high-level opening window rather than a damper, a new opening window type should be created and assigned to the balanced opening, with the degree of Opening (Modulating Profile) set to 'BB F1000 Damper Profile'. By doing this, the balanced opening will operate in the same way as the unit damper.


MacroFlo Opening Types
MacroFlo Opening Types
XTRN0000 External window opening
XTRN0001 Low-Level F1000 Window
XTRN0002 BB F1000 Damper
XTRN0003 High-Level F1000 Window (Balanced O
Reference ID
XTRN0003
Description
High-Level F1000 Window (Balanced Opening)
Exposure Type
05. semi-exposed wall
Opening Category
Custom / sharp edge orifice
Openable Area %
50
Equivalent orifice area
50
% of gross
Crack Flow Coefficient
0.150
l/(s·m·Pa^0.6)
Crack Length
0
% of opening perimeter
Opening threshold
0.00
°C
Degree of Opening (Modulating Profile)
BB F1000 Damper Profile
Add
Remove
Include effects of wind turbulence?
OK
Cancel
Save

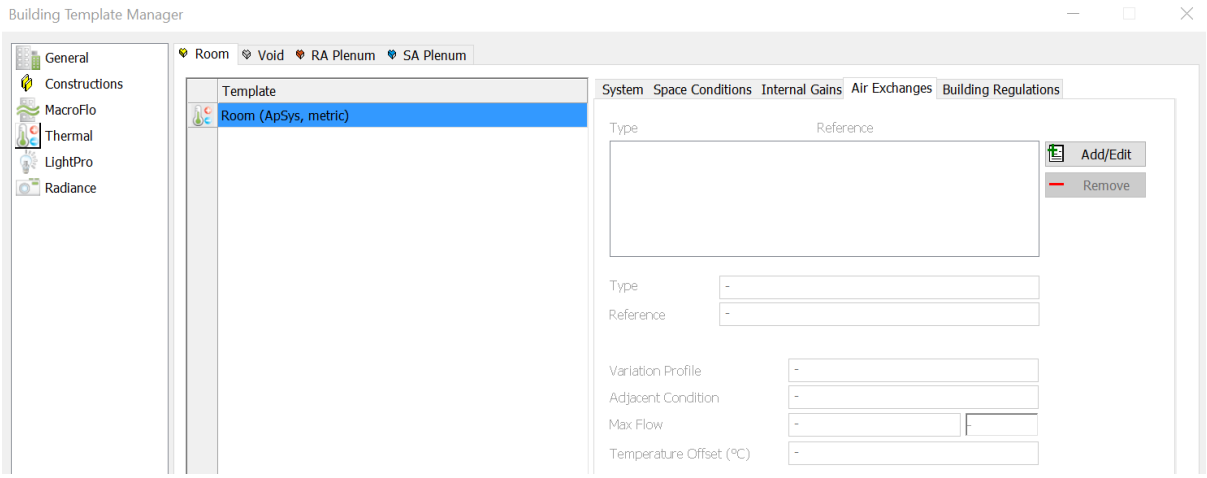
BB e-stack F1000 Auxiliary Ventilation Profile setup

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.

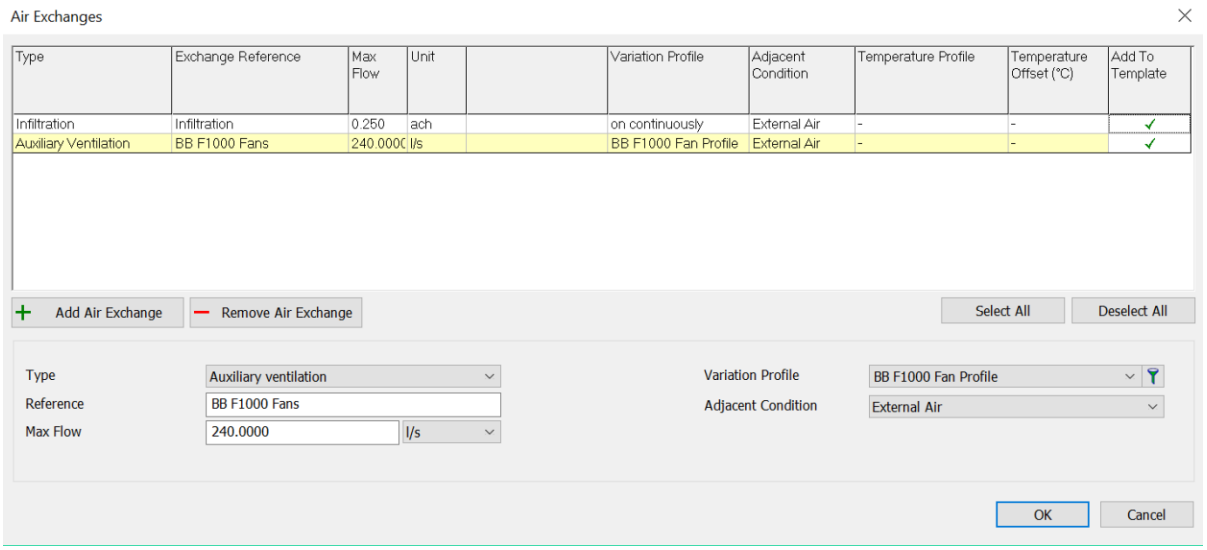
Since these low-powered fans are present, it makes sense to utilise them, wherever possible, to assist the predominantly natural ventilation airflow in warmer weather - i.e. summer mode.

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.

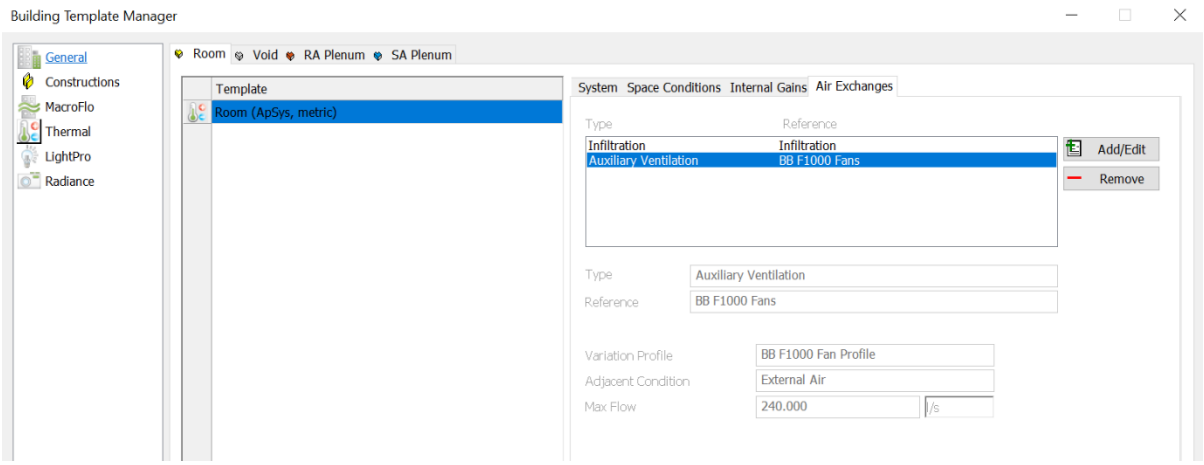


Click the '*Add/Edit*' button. Add the BB F1000 Fans profile to the template.



By allowing for the Infiltration you can avoid CO2 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*'.

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.