Section 1: Introduction

Dynamic Insulation an overview

What is Dynamic Insulation?

A dynamic insulation system works by drawing outdoor air into a building using mechanical means through the insulation layer. Heat that would otherwise be lost to the building by conduction is recovered in the incoming ventilation air.

The thermal transmittance of a dynamically insulated envelope is a function of the building fabric and the speed at which air is drawn through the insulation layer. As a consequence low heat loss building fabric can be achieved with thinner envelopes.

Why use Dynamic Insulation?

1. Delivers much lower U-Value performance per unit thickness of Insulation
2. Reduces build cost, as lower U-Values can be achieved in thinner envelopes
3. Captures and recycles heat energy otherwise lost to the building
4. Reduces space heating requirement
5. Energyflo dynamic insulation reduces fuel bills and carbon emissions

This document provides ventilation system integration guidance for the Energyflo XSCW and Energyflo XSTF in-cavity products.

Glossary of Terms

Novel terminology is introduced to the built environment lexicography in the course of designing a dynamically insulated dwelling. A glossary of the key terms is provided below.

Term	Definition
Air Flow Rate	The speed at which ventilation air flows through the dynamic insulation product
Air Intake Point	Grille, vent or airbrick that permits air movement through the external façade into the dynamic insulation product
Air Take Off Point	Point on the Energyflo Dynamic Insulation Collector Duct where air that has passed through the dynamic insulation is collected for subsequent distribution to the interior volume of the dwelling
Flow Path Length	Distance over which ventilation air is drawn horizontally in a dynamically insulated façade to the air take off point
MEV	Mechanical Extract Ventilation system for dwellings
PIV	Positive Input Ventilation System for dwellings
ach	Air change rates per hour, typical ventilation rate used in building design
ADF-2010	Building Regulations Approved Document Part F – Ventilation 2010
DI maximum pressure drop	Pressure drop in the flow path from external façade to (but not through) the air take off point on the Energyflo Dynamic Insulation Collector Duct

Important Note Regarding Design of a Dynamically Insulated Dwelling

Energyflo Dynamic Insulation panels are a component part of the dwelling's mechanical ventilation system *(comprising parts supplied by others).* Adherence to the design advice contained in this document will ensure that air delivery via the dynamic insulation product, to the mechanical ventilation system, is of the required flow and volume rate to satisfy the given ventilation design.

A comprehensive series of documentation describing the design, installation, commissioning and quality assurance requirements for dynamically insulated dwellings is available (www.energyflo.co.uk). Help, advice and training are available from Energyflo Ltd and Energyflo Insulation Technologies Ltd and this may be very useful prior to commencing the design and specification stage of a project.

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Section 2: General Design Guidance for Coupling Energyflo Dynamic Insulation Panels to Mechanical Ventilation Systems

The Energyflo Dynamic Insulation System comprises a series of insulation panels that permit the ventilation air of the building to be drawn through the building fabric. As it does so it is pre-warmed by conductive losses that would otherwise be lost to the building. The system is installed in selected walls of the dwelling. Overall, the Energyflo Dynamic Insulation System acts as an air input to the dwelling ventilation system.

It should be noted therefore that the Energyflo Dynamic Insulation Panels are not an isolated product but that they are an integral part of the ventilation system.

The air flow path for the Energyflo Dynamic Insulation Panels is through vents or air bricks in the external layer, through the Energyflo Dynamic Insulation Panels, into the Collection Area and from the Collection Area into habitable rooms through conventional ducting or grilles as illustrated in Figure 1 and Figure 2.

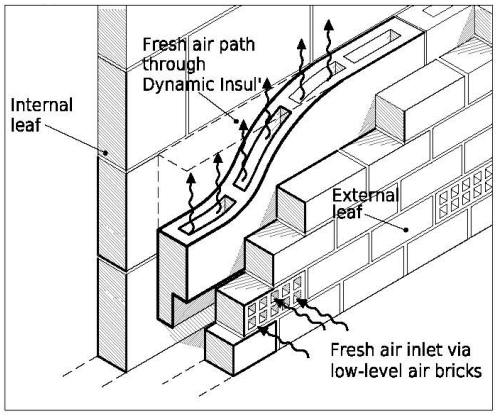
The actual design of air intake points and air take off points will be a function of the dwelling design and the ventilation system design. It is strongly recommended that Energyflo be consulted when defining the dwelling ventilation strategy.

The vents or air bricks in the external façade are located adjacent to the inlet to the Energyflo Dynamic Insulation panels i.e. on the Base Course Panel.

The vents or air bricks in the external façade must provide a free area of 3000mm^2 per linear metre of brick. This could be provided (for instance) by installing an air brick every 3 bricks.

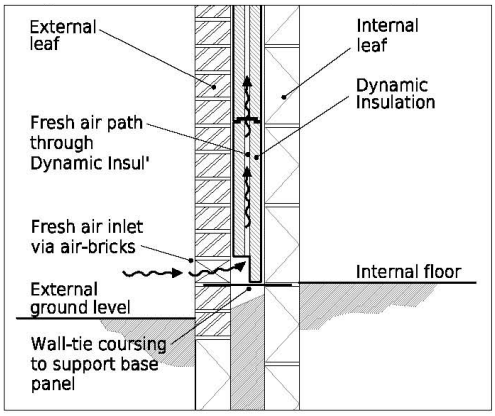
Detailing of the vent or grille arrangements at the air take off point is at the behest of the dwelling and/or ventilation system designer. Particular attention should be paid to the DI maximum pressure drop to the air take off point when selecting vent/grille design. This is defined for each ventilation system in Sections 4-6 of this document.

Figure 1: Air Inlet to Energyflo Dynamic Insulation Panels via External Façade



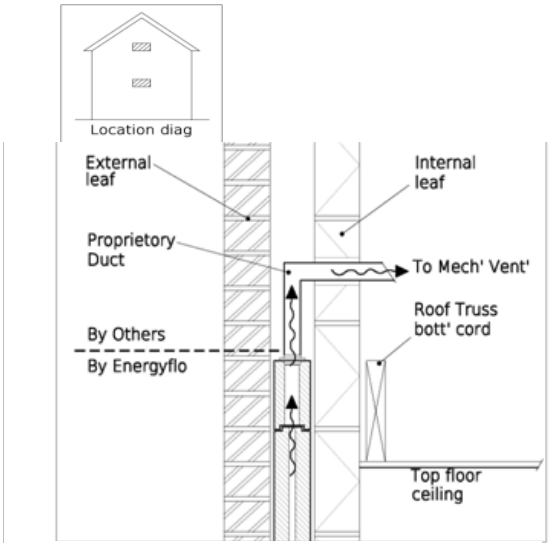
Typical External Wall Configuration at Low Level

For Illustrative Purposes Only

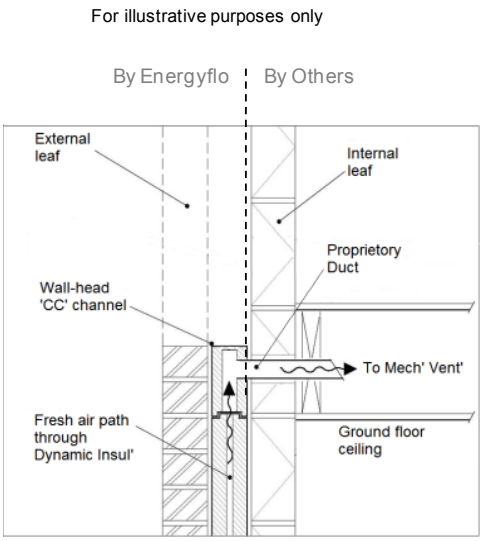


Section Through Base of Typical External Wall

Figure 2: Schematic description of air take off detailing



a) Section through head of Energyflo Dynamic Insulation System at Wallhead showing demarcation line



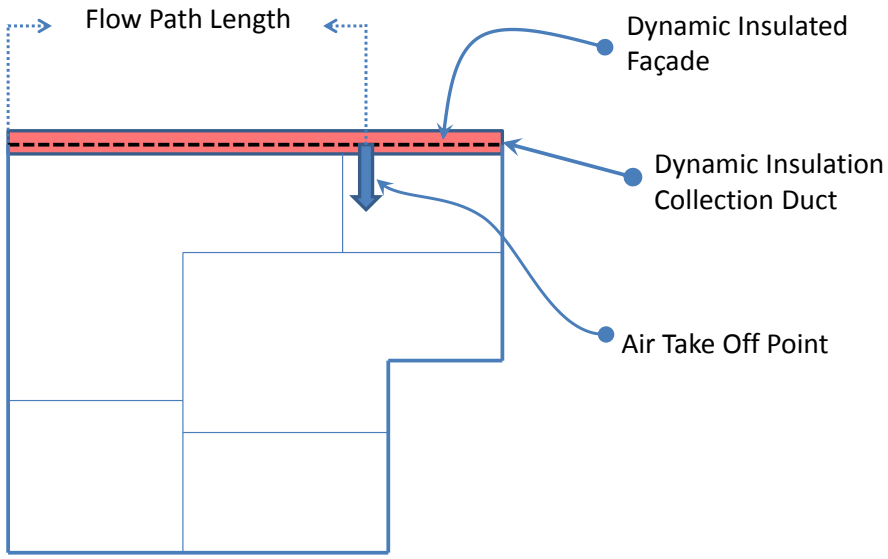
b) Section through head of Energyflo Dynamic Insulation System at Ceiling Void showing demarcation line

The pressure drop through the dynamic insulation system is a function of the Flow Path Length. The Flow Path Length is shown in the floor plan schematic in Figure 3 and describes the horizontal distance over which air is pulled to an air take off point. As the Flow Path Length increases, the pressure drop through the system increases.

The Maximum Flow Path Length is the maximum length along which the pre-tempered air moves along the Dynamic Insulation Collection Duct to ensure that the pressure drop through the Dynamic

Insulation system does not exceed a certain level. This design constraint will be a function of the ventilation system defined for the dwelling. Information regarding this design constraint is provided in the following sections; Section 4-6.

Figure 3: Floor Plan schematic indicating the flow path length for a dynamically insulated façade



Design air permeability guidance with respect to choice of ventilation system is provided in ADF-2010. The required design air permeability for a dynamically insulated dwelling is also a function of the ventilation system chosen. Information regarding design air permeability constraints is given in Sections 4-6.

Inlet grille location to habitable rooms must comply with ADF-2010 requirements

Assessment of the energy performance of a dwelling incorporating Energyflo Dynamic Insulation products can be calculated using SAP. The exceptional performance of the Energyflo Dynamic Insulation product series is a result of the ventilation flow rate moving through the insulation. It has been designed to operate at flow rates that are generated by whole house ventilation rates as defined in ADF-2010.

Careful attention must be paid to the fan unit and ducting arrangements – its condition has an impact on the thermal performance attributable to the Dynamic Insulation systems.

If the fan unit is not pre-insulated, insulation must be added to minimise the risk of condensation forming within, or on, the fan unit casing.

Ducting must be insulated where it passes through unheated areas and voids (e.g. loft spaces).

Ducts within the building heated envelope carrying cold air between the external supply/discharge terminals and the fan unit must be insulated and must be vapour tight to prevent condensation.

Particular attention should be paid to the requirements for ensuring free flow of air at the dwelling's design air permeability level and for ensuring provision for purge ventilation meets Appendix B: ADF 2010.

Energyflo Dynamic Insulation Systems achieves its performance specification as a key component within a Ventilation System. The design and installation rules attaching to the Energyflo Dynamic Insulation product family have been developed to provide a simple "ordinary course of business" interface point that already well understood by the Ventilation systems installers.

To ensure correct adherence of the design and installation rules, a design checklist and an installation checklist have been produced.

A Quality Audit Plan has been defined to accompany the design and installation checklist. The audit process contains a series of levels that are designed in the first instance to ensure that the Dynamic Insulation System is achieving the thermal performance predicted by the calculation method that is contained within the National Calculation Method, i.e. The Standard Assessment Procedure (SAP).

Assurance of the performance of the integrated Dynamic Insulation:Ventilation system is therefore achieved using the following procedures:

a) The design constraints and guidance outlined in this document are adhered to
b) Satisfactory completion of Dynamic Insulation design and installation checklists
c) Standard commissioning procedures applicable to the Ventilation System installation as stipulated in ADF-2010, supporting documentation (e.g. the Domestic Ventilation Compliance Guide) and Manufacturer's Instructions
d) Compliance with the Energyflo Quality Audit Plan contained within the Energyflo Quality Assurance Statement – this is available at www.energyflo.co.uk

Help, advice and training are available from Energyflo Insulation Technologies Ltd and this may be very useful prior to commencing the design and specification stage of a project.

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(a) Energyflo® coupled with positive input ventilation (PIV)

Dwellings incorporating Dynamic Insulation systems integrated with PIV systems will meet or contribute to meeting the National Building Regulations and Standards ventilation requirements providing the PIV manufacturer's installation and commissioning guides are followed.

Positive input ventilation coupled with the Energyflo Dynamic Insulation System supplies pre-heated air into a home using heat normally conducted through the construction to outside.

Pre-tempered makeup air is collected from dynamic insulated facades directly. This can, for instance be via duct runs at the loft.

The pressure drop in the Energyflo Dynamic Insulation system is a function of the flow path length and the height over which the air is being pulled.

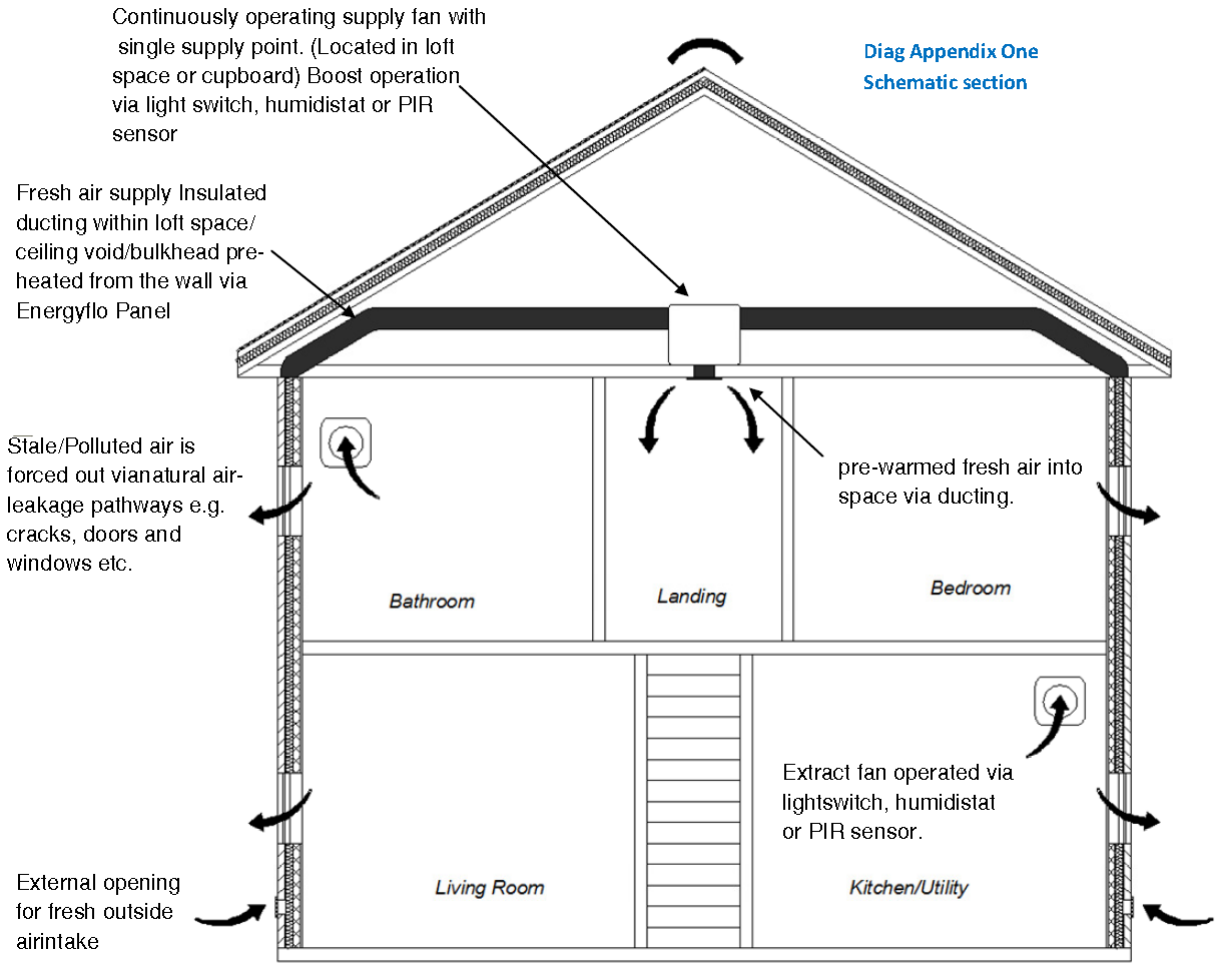
Careful attention has to be paid to the location of inlet grilles to habitable rooms, the maximum flow path length and the number of stories over which air is being moved through the Energyflo Dynamic Insulation System. Ventilation system design must comply with the design constraints outlined below. Further design guidance should be sought from Energyflo.

If air is being collected over a single storey i.e. <3m then the maximum flow path length will be 3.6m

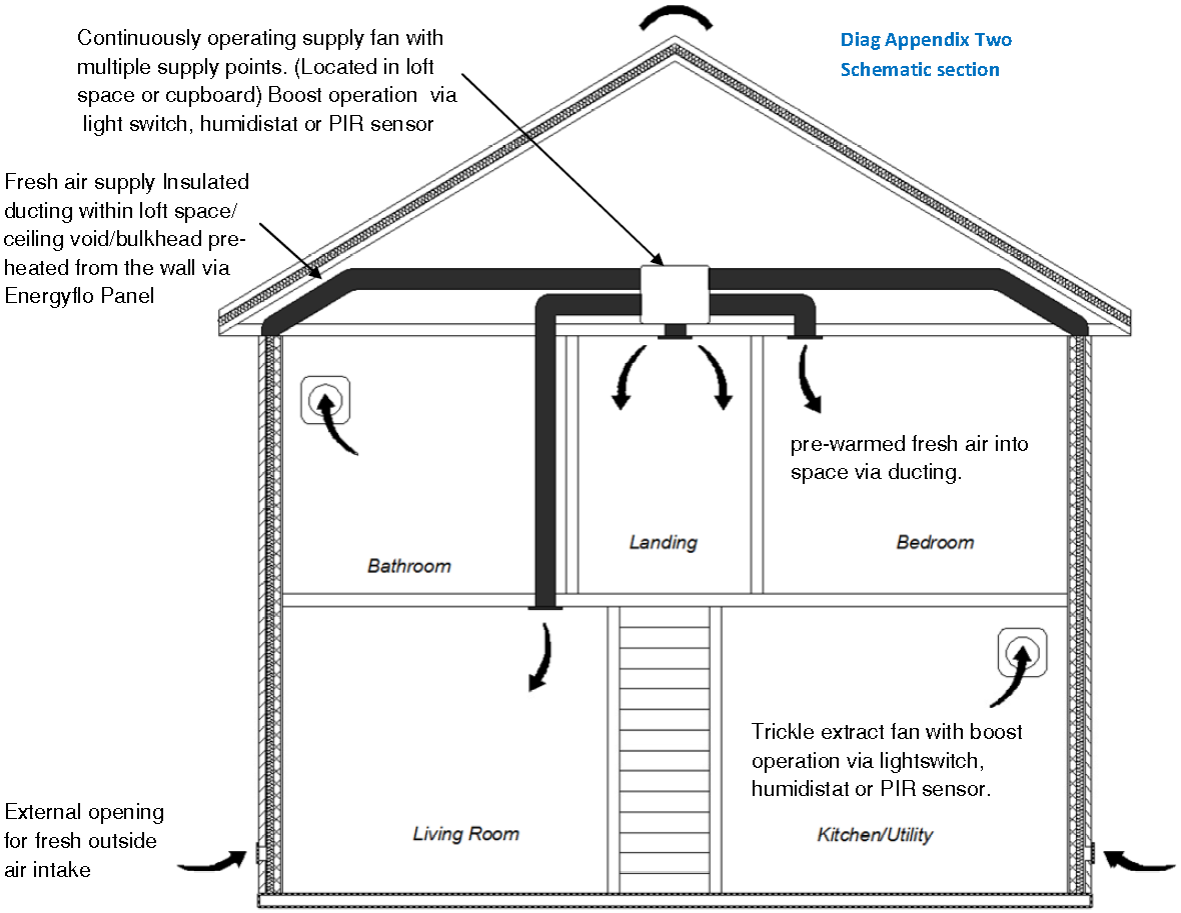
If air is being collected over 2 stories then maximum flow path length will be 3.6m for the maximum DI pressure drop to be <10Pa.

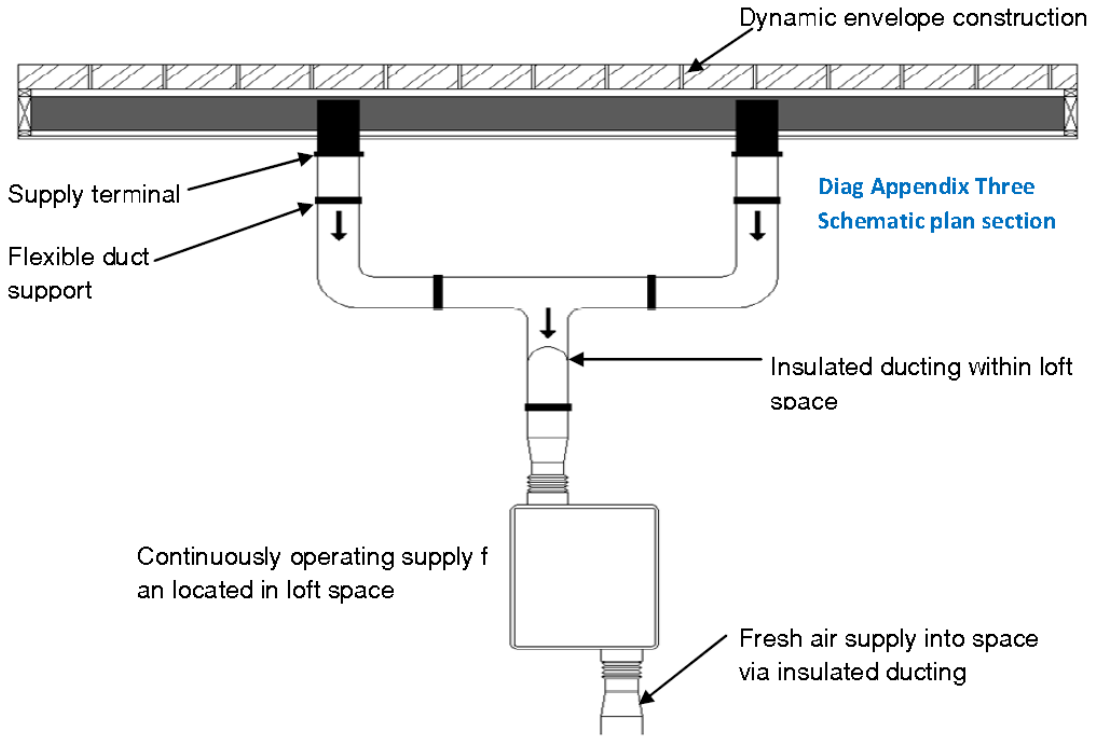
No additional guidance regarding the design air permeability of the dwelling is required for a dynamically insulated dwelling integrated with a PIV system over and above that contained in ADL1A-2010 and ADF-2010

Energyflo Cell – Coupled with Positive Input Ventilation (PIV) with Single Supply Point



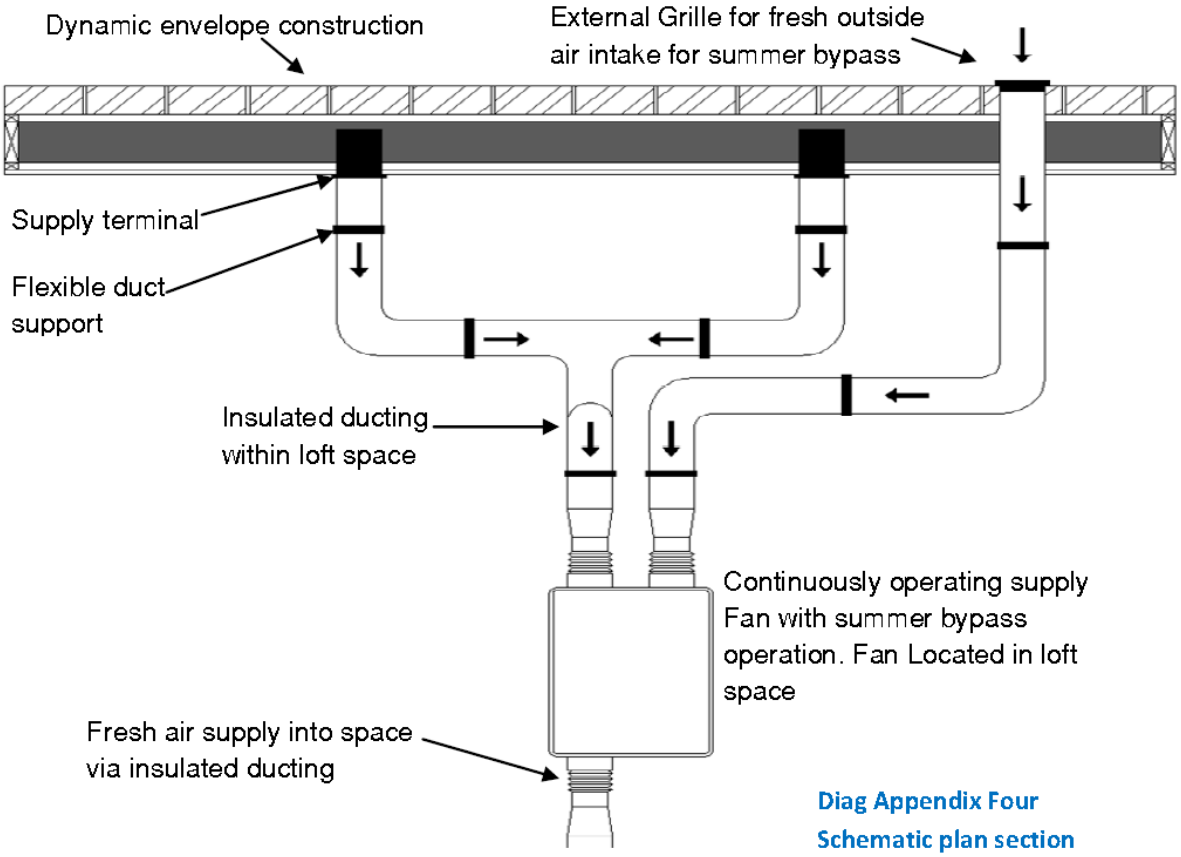
Energyflo Cell – coupled with positive Input Ventilation (PIV) with Multiple Supply Points





Diag Appendix Three
Schematic plan section

Installation Detail of Ducting from Energyflo Panels to Continous Supply Fan with Summer Bypass



Diag Appendix Four
Schematic plan section

(b) Energyflo coupled with Continuous mechanical extract ventilation (MEV)

Continuous mechanical extract ventilation systems (MEV) comprise ***System 3*** in ADF-2010. Guidance on minimum provisions for extract and whole dwelling ventilation is set out in table 5.2c of ADF-2010 and in manufacturer's instructions contained in SAP Appendix Q (http://www.sap-appendixq.org.uk).

In MEV applications Energyflo Dynamic Insulation Panels are installed instead of window trickle vents, i.e. the air take off point to the habitable room represents the background ventilator.

NOTE: Dynamic Insulation products cannot be installed in conjunction with continuous mechanical extract systems in dwellings with a design air permeability greater then $3m^3/hr/m^2$.

Careful attention has to be paid to the location and number of inlet grilles to habitable rooms and the maximum flow path length over which air is being moved through the Energyflo Dynamic Insulation System. Ventilation system design must comply with the design constraint outlined below.

If air is being collected over a single storey i.e. <3m then the maximum flow path length is 3.6m.

With MEV systems the internally heated space is held at a slight negative pressure causing air to flow into the dwelling through the dynamic insulation system. However, air may also flow into the dwelling through unintentional air leakage paths in the building fabric. To account for this, the ventilation flow rate ascribed to the dynamic insulation system when coupled to an MEV system is computed using a ventilation rate lower than 0.5ach according to equation (1) below.

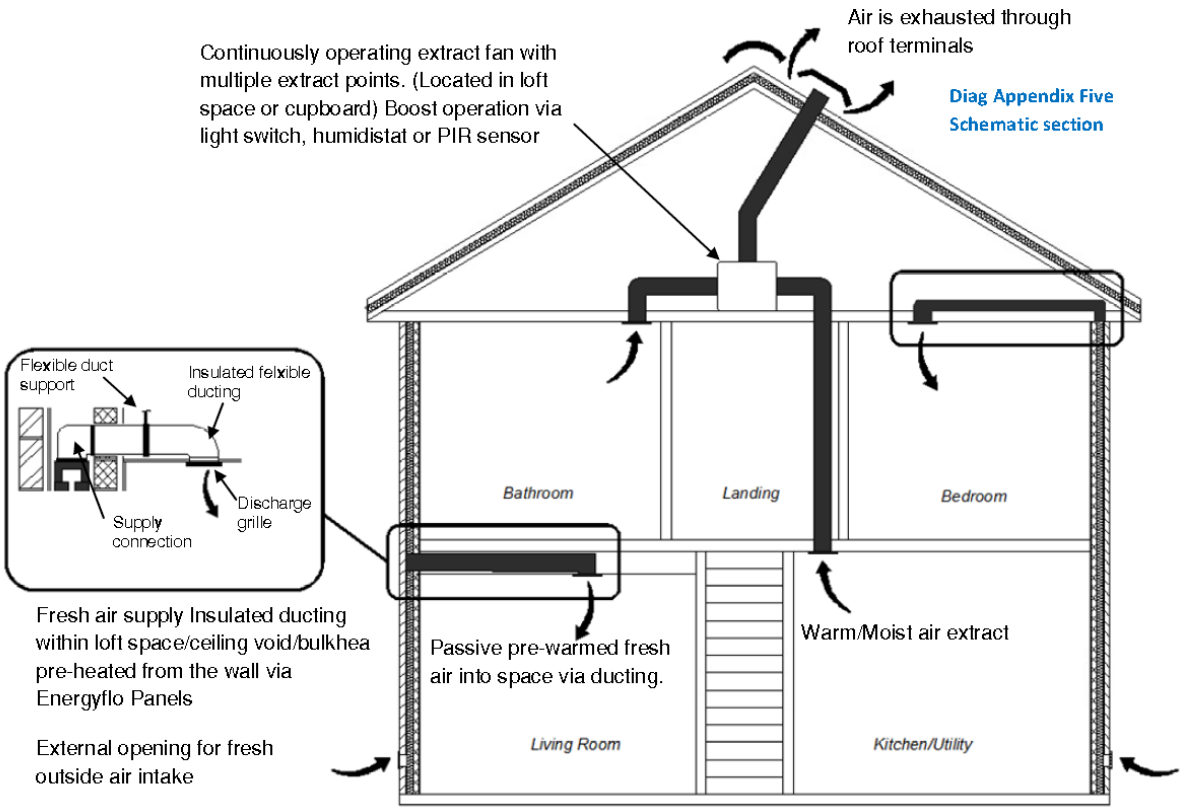
$$V_r = 0.5 - [(P_d/20) \times R_f] \qquad (1)$$

Where:

V_r	Dwelling Ventilation rate (ach)
P_d	Design air permeability for the dwelling ($m^3/h/m^2$)
R_f	Air resistance factor to take account of higher impedance to air flow through unintentional leakage pathways in dwellings of design air permeability equal or lower than $3m^3/h/m^2$ – taken to be 0.667[1]

[1] R_f = 0.667 is an arbitrary figure rather than a computed quantity – care should be taken in assuming that the value has relevance in determining other relationships between infiltration and ventilation

Energyflo Panels - Coupled with Continous mechanical Extract Ventillation (MEV)



(c) Energyflo coupled with balanced whole house mechanical ventilation

Balanced ventilation provides fresh air to habitable rooms in the dwelling through dynamic wall via ducting and extracts exhaust air from wet rooms.

A balanced system without heat recovery extracts from wet rooms via ducting using a centrally located extract fan. Air is supplied to habitable rooms, either via ducting connected to dynamic wall elements and a central fan.

NOTE: Dynamic Insulation products cannot be installed in conjunction with Continuous Mechanical Extract Systems or Balanced Mechanical Ventilation Systems in dwellings with a design air permeability greater then $3m^3/hr/m^2$.

Both the extract and supply air are provided via ducting connected to the dynamic wall

Provision of adjustable vents will allow fresh air supplied directly to habitable areas through dynamically insulated wall elements.

Careful attention has to be paid to the location of inlet grilles to habitable rooms, the maximum flow path length and the number of stories over which air is being moved through the Energyflo Dynamic Insulation System. Ventilation system design must comply with the design constraints outlined below. Further design guidance should be sought from Energyflo.

If air is being collected over a single storey i.e. <3m then the maximum flow path length is 3.6m.

If air is being collected over 2 stories then maximum flow path length is 3.6m for the DI pressure drop to be <10Pa.

Energyflo Panels - Coupled with Balanced Whole House Mechanical Ventilation