Information Guide

Part F of Building Regulations

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MITSUBISHI ELECTRIC
LIVING ENVIRONMENTAL SYSTEMS

Part F of Building Regulations

This is an independent guide produced by Mitsubishi Electric to enhance the knowledge of its customers and provide a view of the key issues facing our industry today. The guide accompanies a series of seminars, all of which are CPD accredited.

Poor ventilation in homes has been a particular concern for Government, as it has been shown to be the cause of respiratory illness and increased rates of asthma. Four main methods of ventilation in homes are outlined in Part F:

- Background ventilators and intermittent extract fans
- Passive stack ventilation
- Continuous mechanical extract
- Continuous mechanical supply and extract with heat recovery

The documentation for Part F provides in-depth guidance on design and performance criteria for these systems. However, under today's Building Regulations, the challenge is not only to select, design and install the correct ventilation system for your project. It must also be energy efficient.

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1. A breath of fresh air

With an update of Part L of the Building Regulations in 2010, changes to Part F were also introduced. This section of the Building Regulations deals with ventilation of domestic and commercial buildings, and should be regarded as very important by designers, installers and building operators alike.

The main aim of the requirements of Part F "is that a ventilation system is provided that under normal conditions is capable of limiting the accumulation of moisture, which could lead to mould growth, and pollutants originating within a building which would otherwise become a hazard to the health of the people in the building."

In other words, Part F deals with indoor air quality. This has been a thorny topic for many years. In the 1960s, the first tentative links were made between poor occupant health and bad indoor air quality – otherwise known as sick building syndrome. Since that time, a growing number of studies are clearly demonstrating the link between well ventilated offices (and homes) and the health and performance of people in them. It's certainly not contentious to say that good ventilation makes occupants feel better about the building they're in.

The issue of indoor air quality is again high on the agenda with designers as they are faced with requirements in Part L 2010 of the building regulations to ensure their buildings are air tight. This keeps heat in and saves energy, but it can also create poor air quality for occupants if offices and homes aren't correctly ventilated.

For the purposes of the new Part F, a reasonably high level of air tightness must be assumed. The legislation states that: "Through good design and execution, domestic and non-domestic buildings can currently achieve an air permeability down to around 2 to 4 m^3/ ($h.m^2$) of envelope area at 50 Pascal (Pa) pressure difference. It can be assumed that there will be a continual trend towards more airtight buildings due to drivers for higher energy efficiency and lower carbon emissions."

Under Part F, ventilation is defined as the removal of 'stale' air from a building and replacing this with 'fresh' outside air. The aim is to remove airborne pollutants including odours; to control excess humidity; and to provide outside air for breathing. Ventilation is also a method for controlling indoor temperatures, but this use is covered by Part L (summer overheating).

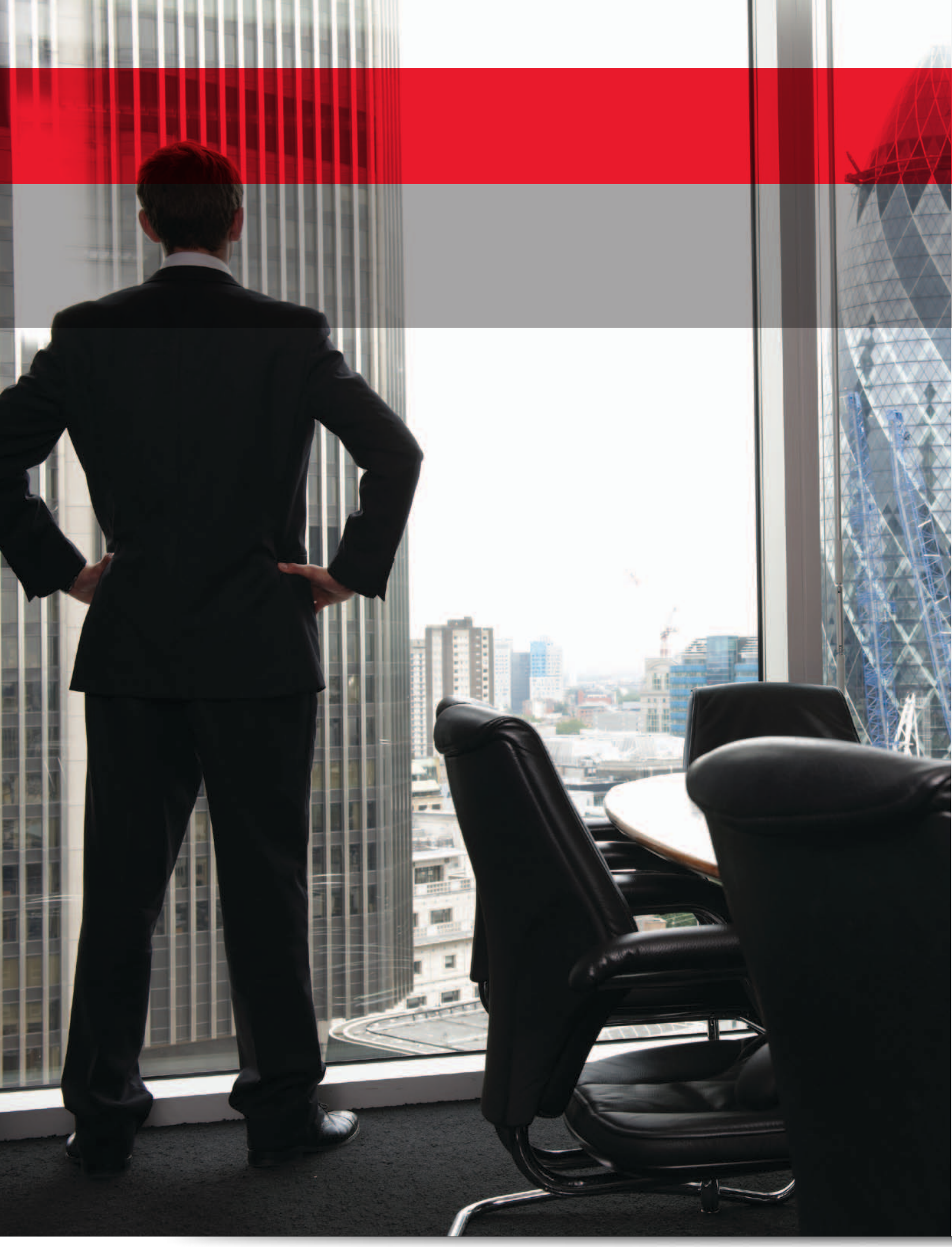
The type of pollutants which need to be removed will vary with the type and use of building. Generally they are considered to be moisture from kitchens or shower rooms; odours from kitchen areas; emissions from photocopiers, printers, carpets and furniture; and general body odour. Indoor air quality is affected by the presence of Volatile Organic Chemicals (VOCs) such as nitrogen dioxide, ozone and carbon monoxide. There are also fibres, fungi and pollen.

The effects on occupant health can range from irritation of eyes and skin to respitory illnesses and even carcinogenic toxic effects. The classic symptoms of sick building syndrome include dry eyes, runny nose, headaches and general loss of concentration.

Part F offers designers a number of approaches to ensure their building meets its requirements. The legislation highlights extract ventilation for rooms where most water vapour or pollutants are released (for example bathrooms and kitchens); whole building/ dwelling ventilation to provide fresh air to the building and disperse residual water vapour and pollutants now dealt with by extract ventilation; and purge ventilation throughout the building to aid removal of high concentrations of water vapour and pollutants caused by activities such as painting and decorating or accidental releases such as burnt food.

These strategies can be delivered by natural ventilation, mechanical ventilation or a combination of both – a hybrid system.

The new legislation also continues to emphasise that control of the ventilation system is paramount so that the need for good ventilation can be balanced against the need to lower energy use in buildings. Our next feature considers this challenge.



2. Inspections and maintenance for long-term efficiency

The 2010 update to Part F reflects the fact that mechanical ventilation of a building uses power, and must therefore be specified, designed and installed with a view to long-term energy efficiency.

Part L 2010 sets tighter targets for air tightness in homes and commercial buildings, in order to reduce the need for heating. This means that the control of airflow, which in turn affects heat loss, is even more important.

It is in the domestic building arena that the effects of Part F 2010 are likely to be felt most. The new Part F includes guidelines for airtight properties with infiltration rates lower than $5m^3h/m^2$ at 50 Pascal (Pa). For Intermittent System 1 and Passive Stack System 2 approaches in airtight dwellings, the new Part F guidance increases background ventilation rates by up to 50%.

Part F 2010 seems likely therefore to move designers away from the use of intermittent fans towards continuous ventilation.

For Continuous Mechanical Extract System 3 approaches used in dwellings with infiltration rates above $5m^3h/m^2$, Part F 2010 removes the requirement for background ventilation.

One of the most important points to remember is that while property developers must comply with Part F, they also need to ensure that their designs and buildings are acceptable under the Standard Assessment Procedure (SAP). This was also updated fairly recently, to include an Appendix Q, which encourages greater use of energy efficient ventilation systems, such as mechanical heat recovery ventilation (for example the Lossnay system from Mitsubishi Electric).

Another important aspect of Part F 2010 is that for the first time post-completion testing of ventilation equipment is a legal requirement. A new Domestic Ventilation Installation and Commissioning Compliance Guide has been published. The aim is to ensure that ventilation systems operate effectively, quietly and energy efficiently.

The legislation is also designed to reduce the threat of airborne bacteria and mould build-up in our increasingly insulated and airtight buildings.

After commissioning, a Commissioning Notice has to be given to Building Control, which must also receive details of the ventilation rates.

In light of the changes to Part F and Part L, it seems likely that developers will move away from the use of intermittent ventilation systems and trickle vents towards continuous mechanical ventilation, possibly linked to heat recovery, known as Mechanical Heat Recovery Ventilation (MHRV).

These systems have a number of advantages for occupants, including more predictable and controllable ventilation and low running costs. Furthermore, where windows have to be opened to enable ventilation this increases noise levels for occupants, as well as allowing pollutants to enter the house.

Summary of Part F 2010 updates

1. Fixed mechanical ventilation systems must be commissioned and a notice given to Building Control.

2. Air flow rates of mechanical ventilation systems (including intermittent systems in bathrooms or in kitchen extracts) installed in new dwellings must be measured on-site and a notice given to Building Control.

3. The building owner must receive sufficient information about the ventilation system, and any maintenance requirements, to ensure long-term energy efficient operation.

4. Background ventilation rates for dwellings with infiltration rates lower than $5m^3h/m^2$ at 50 Pascal (Pa) have been increased.

5. Part F 2010 includes guidance on ventilation systems for refurbished kitchens and bathrooms.

6. The diameter of passive stack ventilators is increased to 123mm

Background ventilators and intermittent extractor fans

Passive stack ventilation

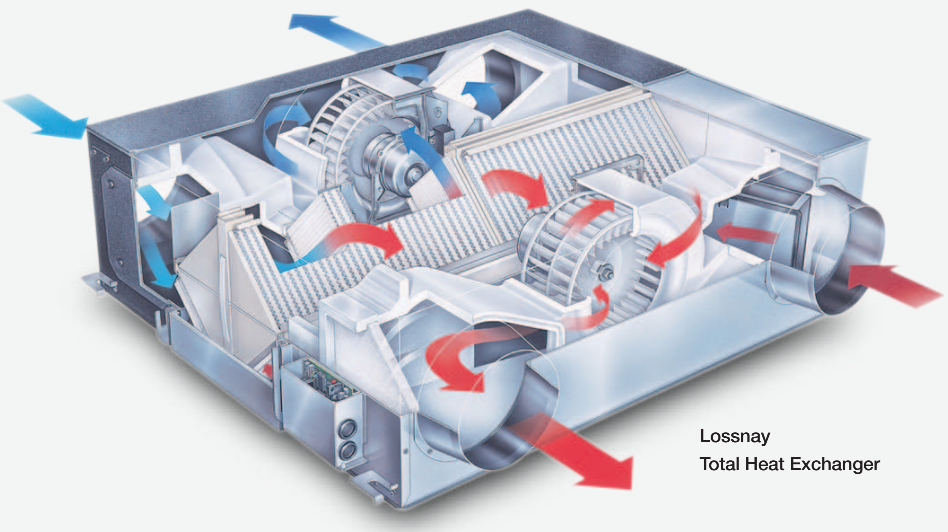
3. Effective and efficient – heat recovery and ventilation

As we have seen, achieving required ventilation rates while achieving targets on energy efficiency is something that specifiers and installers need to consider carefully. Part F allows designers to use whatever strategies are best for each project's requirements. The documentation states: "This Approved Document focuses on performance-based guidance which suggests to the designer what level of ventilation should be sufficient, rather than how it should be achieved. Therefore the designer has the freedom to use whatever ventilation provisions suit a particular building, including the use of innovative products and solutions..."

One technique which is becoming increasingly popular with designers is a ventilation system with heat recovery capability because it offers good ventilation with excellent energy efficiency. Such systems are now readily available for domestic and commercial buildings. These heat recovery units reduce the overall energy costs by extracting stale air from the building and recovering the heating or cooling energy to either warm or cool incoming fresh air. Using this method a good heat recovery ventilation system can save up to 30% on initial capital costs of heating and cooling plant, as well as giving excellent long-term lowered energy costs.

The picture on the right shows how a heat recovery system works within a ventilation system. In winter, warm, stale air is extracted from a building and passes over a diaphragm of specially processed paper. At the same time, cold air is introduced to the system from outside. It too passes over the diaphragm where heat is exchanged and the fresh air temperature is raised before entering the building.

In summer, cooled air from an air conditioned office is extracted and crosses with warm air being drawn into the building. The external air temperature is cooled before it enters the cooling system, thereby lowering energy requirements of the air conditioning units. The superior heat transfer and moisture permeability of the paper ensure highly efficient total heat exchange (temperature and humidity) when inlet and exhaust air supplies cross. This paper core exchanges around 80% of heat energy which would normally be lost.



Lossnay
Total Heat Exchanger

Heat loads in Winter

In winter, air loads for a building will be greater. At an ambient temperature of 2.5°C, the overall heating load can be reduced by 30%.

Heat loads in Summer

In summer using a heat recovery system can reduce the outdoor air load, therefore the overall cooling load, by up to 18% at an ambient temperature of 27°C.

Another important aspect of ventilation is control of sound. In homes particularly, if ventilation systems are too noisy there is a greater likelihood that occupants will switch off; and for commercial premises there can be local planning restrictions on noise. A heat recovery system using paper and with small permeable holes provides excellent soundproofing properties and is even appropriate for soundproof rooms.

Further savings can be made using the bypass damper which operates in summer when outdoor temperatures are lower than indoor air conditioning temperatures. This allows for further intake of fresh outdoor air into the building.

Building services consultants Lorne Stewart used a fresh air heat recovery system in their purpose built offices in Chelmsford, Essex. To meet Part L of the Building Regulations, the building's construction materials were selected to achieve high U values, creating an airtight construction.

The building's fresh air requirements are met using two Mitsubishi Electric Lossnay units, both supplying up to 2000m³ of fresh air per hour. These units recover up to 75% of the waste heat from rejected air, reducing the overall building load further.

Heat loads in winter

Type of Load		Estimated Load [W/m^2]	
		No heat recovery	With heat recovery
Indoor heat loss	Heat loss from walls Heat loss from glass Heat loss from conduction and convention Accumulated heat load on walls	77.7	77.7
Outdoor air load	Sensible heat Latent heat	78.0	23.4
Total		155.7	101.1

Conditions: Outdoor air: DB 2.5 °C, RH 50% Indoor air: DB 21 °C, RH 50%
Ventilation volume: 36m3/Hr/person (10l/s/p)
Middle floor of a general office building facing south

Heat loads in summer

Type of Load		Estimated Load [W/m^2]	
		No heat recovery	With heat recovery
Indoor infiltration load	Heat from walls Heat from glass: • from direct sunlight • from conduction and convection Accumulated heat load in walls	47.6	47.6
Outdoor air load	Generated heat from people • Sensible heat • Latent heat	24.6	24.6
Sensible heat Latent heat	Generated heat from electrical equipment (lighting etc.) • Sensible heat • Latent heat	30.0	30.0
Re-heating load	-----	-----	-----
Outdoor air load	Sensible heat Latent heat	35.8	10.7
Total		139.8	114.7

Conditions: Outdoor air: DB 27 °C, RH 50% Indoor air: DB 21 °C, RH 50%
Ventilation volume: 36m3/Hr/person (10l/s/p)
Middle floor of a general office building facing south

Further information

If you missed the CPD seminar on **Part F of Building Regulations** you can call your Mitsubishi Electric Regional sales office to arrange an in-house presentation of this information.

If you would like to receive invitations to future CPD events, please email **lesmarcomms@meuk.mee.com**

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