MITSUBISHI ELECTRIC
AIR CONDITIONING SYSTEMS

Information Guide

Part F of the Building Regulations

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Issue Eleven >

MITSUBISHI ELECTRIC
AIR CONDITIONING SYSTEMS

Part F of the Building Regulations

Information Guide

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. The changing face of construction in the 21st Century demands that designers, specifiers and suppliers work as teams to create better buildings - for occupants and the environment. Mitsubishi Electric aims to be a part of this by encouraging employees and customers to work together to increase their knowledge of the latest technology, legislation and markets.

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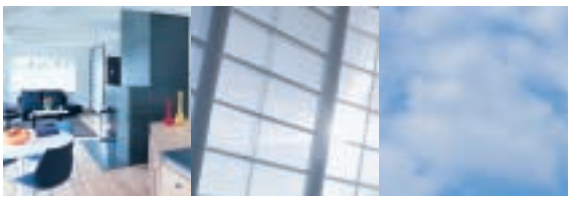
A breath of fresh air

The update of Part F of the Building Regulations slipped in quietly behind the fanfare of the new Part L. Nevertheless, it is a significant piece of legislation, which hasn't been renewed in ten years.

Simply stated, buildings comply with Part F, "where 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 hazardous 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 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 aren't correctly ventilated. Furthermore, for the purposes of the new Part F, a reasonably high level of air tightness is assumed. This means a level higher than the target value recommended under Part L, because all new buildings are expected to improve on the target. This could mean air permeability levels as low as 3-4m^2/h per square metre of envelope.



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).

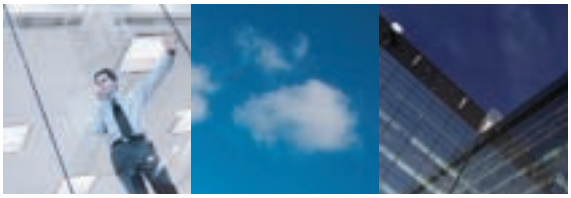
The type of pollutants which need to be removed will vary with the type and use of building. Generally they are considered to be moisture from kitchens or shower rooms; odours from kitchen areas; emissions from photocopiers, printers, carpets and furniture; and general body odour. Indoor air quality 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.

As well as dealing with these potential hazards, Part F also states that control is an important aspect of ventilation. Manual or automatic controls must ensure that as well as doing the job of moving stale air out and fresh air in, the ventilation system is also energy efficient. Part F documentation mentions manually controlled trickle ventilators as a viable option. These are located over the window frames, in the frames above the glass, or through the wall. They are typically positioned 1.7m above floor level to avoid drafts.

Part F offers designers a number of approaches to ensure their building meets its requirements. Firstly, there is 'performance-based guidance'. This means that designers are free to use whatever methods they select to reach the acceptable levels of pollution, moisture etc set out in the legislation. The documentation states: "…the designer has the freedom to use whatever ventilation provisions suit a particular building, including the use of innovative products and solutions, if it can be demonstrated that they meet the performance standard..".

However, not all designers require this level of freedom, and Part F also provides more specific guidance on a number of natural and mechanical ventilation systems, particularly in dwellings. Over the next page we will look at some of these systems in more depth and examine the issue of energy efficiency combined with good ventilation practice.



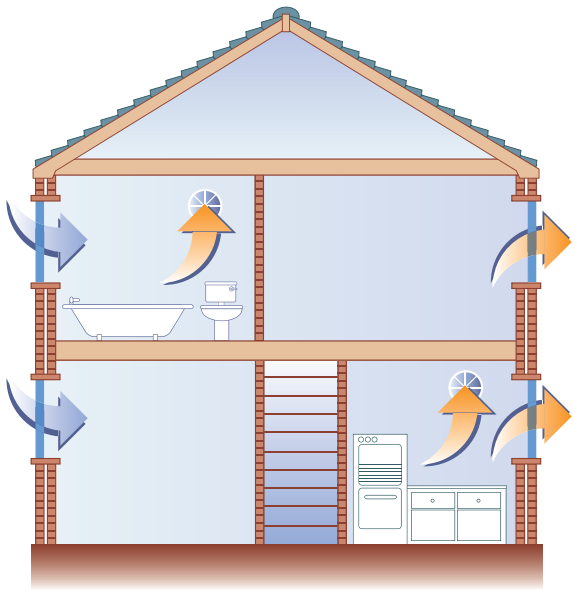
Approaches to ventilation

Since most of us spend around 80% of our time indoors, at home or at work, indoor air quality is a major concern. Part F 2006 outlines a number of ventilation techniques, offering guidance on target rates.

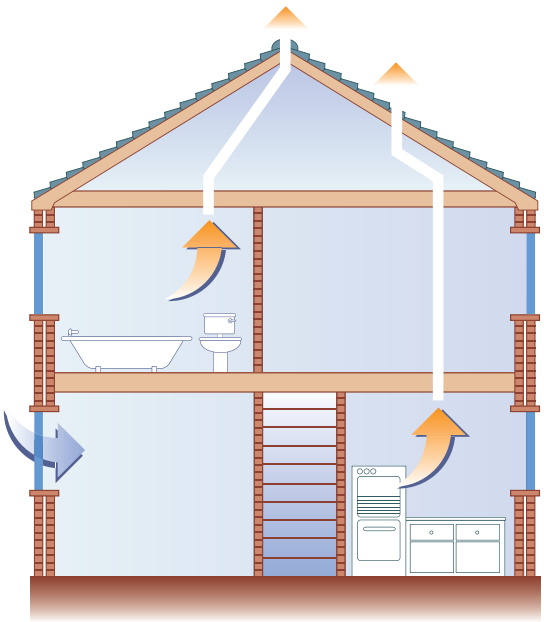
Poor ventilation in homes has been a particular concern for government, as it has been shown to be the cause of respitory illness and increased rates of asthma. Four main methods of ventilation in homes are outlined in Part F:

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

Background ventilators and intermittent extract fans



Passive stack ventilation



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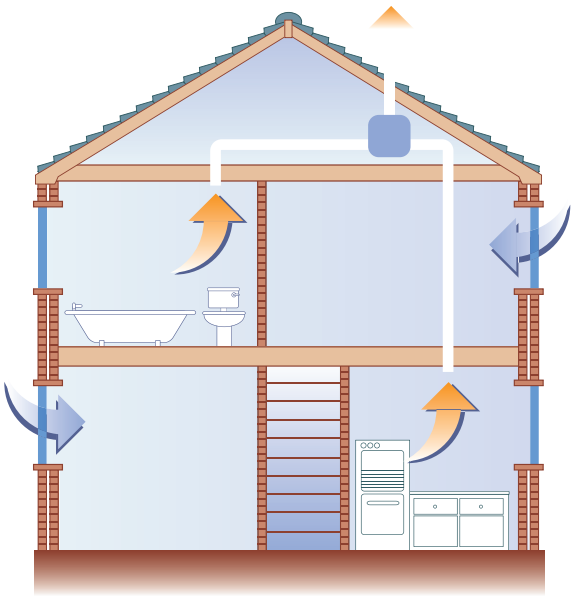
Like commercial buildings, new homes will have to be more air tight under the new Part L of the Building Regulations, reducing uncontrolled ventilation (also known as 'infiltration'). Interestingly, the new Part F doesn't differ greatly from the 1995 version, but it does make some new recommendations. In naturally ventilated flats, for instance, the new Part F mentions increased ventilation provisions of up to 200%. Part F 2006 encompasses existing dwellings. The requirement is that replacement windows must include trickle ventilators - or an equivalent.

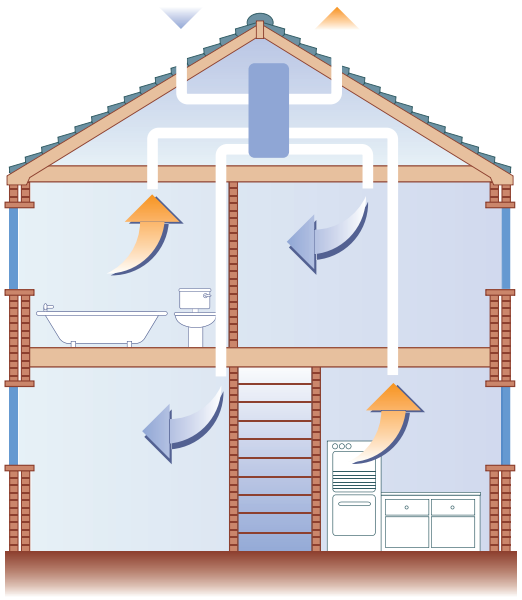
The documentation for Part F provides in-depth guidance on design and performance criteria for these systems. There are also notes on particular types of building. For example, in single storey buildings such as flats and bungalows, stack ventilation is harder to achieve so additional background ventilators are recommended. Also, for buildings with a single exposed façade, cross ventilation can't be used, so it is recommended that habitable rooms should be on the exposed façade. Ventilators should be used to provide single-sided ventilation.

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. The next two pages look at options which are available to create excellent indoor air quality, while saving energy in offices and homes alike.

Continuous mechanical extract



Continuous mechanical supply and extract with heat recovery



Effective and efficient - heat recovery and ventilation

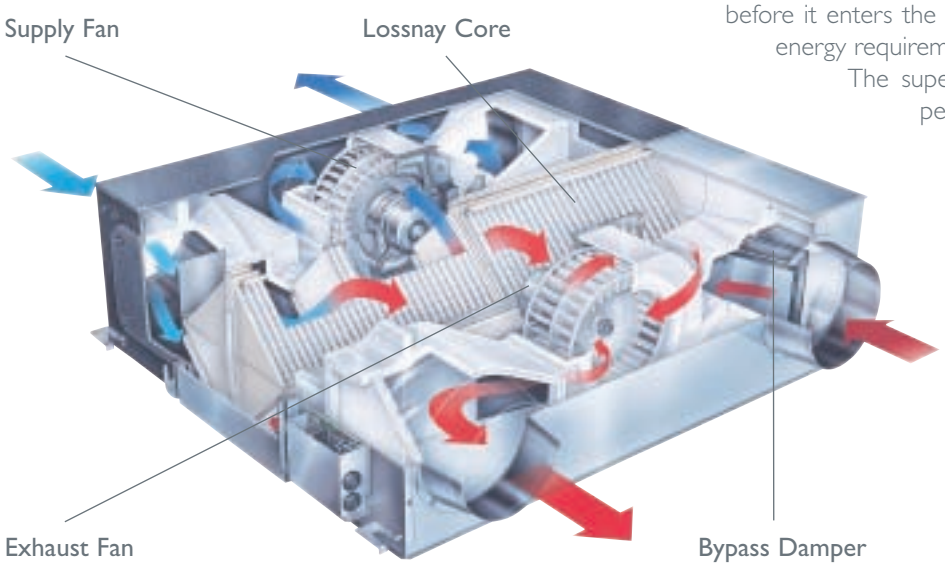
An important aspect of Part F is that it emphasises both good indoor air quality and energy efficiency. The documentation states: "Ventilation systems result in energy being used to heat fresh air being taking in from outside and to move air around the building… Consideration should be given to mitigation of ventilation energy use, where applicable, by employing heat recovery devices, efficient types of fan motor and / or energy saving control devices in the ventilation system."

One technique which is becoming increasingly popular with designers is a ventilation system with heat recovery capability. 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 diagram below 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



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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.

Type of Load	Estimated Load [W/m2]	
	No heat recovery	With heat recovery
Indoor infiltration load		
Heat loss from walls Heat loss from glass - from direct sunlight - from conduction & convection Accumalated heat loads in walls	47.6	47.6
Indoor generated load		
Generated heat from people - Sensible heat - Latenet heat	24.6	24.6
Generated heat from electrical equipment (lighting etc.) - Sensible heat - Latenet heat	30.0	30.0
Re-heating load	-	-
Outdoor air load		
Sensible heat Latenet heat	35.8	10.7
Total	**139.8**	**114.7**

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%.

Type of Load	Estimated Load [W/m2]	
	No heat recovery	With heat recovery
Indoor heat loss		
Heat loss from walls Heat loss from glass Heat loss from conduction & convention Accumalated heat loss on walls	77.7	77.7
Outdoor air load		
Sensible heat Latent heat	78.0	23.4
Total	**155.7**	**101.1**

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 2000m^3 of fresh air per hour. These units recover up to 75% of the waste heat from rejected air, reducing the overall building load further.

Further information

PART F OF BUILDING REGULATIONS

Please visit **www.planningportal.gov.uk** for copies of approved documents for Part F. Go to the 'Building Regulations' section and click on 'Technical Guidance'.

GUIDANCE ON VENTILATION

Further guidance on Ventilation can be found in CIBSE Guide A and CIBSE Guide B.

CIBSE Guide A (2006) Section 4.2
Provides detail of the role of ventilation.

CIBSE Guide A (2006) Section 1.7
Deals with pollutants in some (mathematical) detail.

CIBSE Guide A (2006) Section 8.4
Provides in-depth detail on ventilations rates for specific building types.

CIBSE Guide B (2005)
Advises that "Section 1 of CIBSE Guide A: Environmental design (12) should be consulted for the definition of, and requirements for achieving, suitable indoor air quality standards."

For further details please visit **www.cibse.org**

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

Please call one of the numbers below:

London North East & East Anglia	**01707 282480**
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Issue 11 Version 1 (October 2006)