MITSUBISHI ELECTRIC
AIR CONDITIONING SYSTEMS

Information Guide

The new Part L of the Building Regulations 2006

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Issue Eight >

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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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An overview of Part L 2006

Introduction

This Mitsubishi Electric Guide to Part L is one of a series on the same topic We recommend that you also refer to these other guides to Part L, and the European Performance of Buildings Directive, as well as reading this one.

Part L of the Building Regulations is a key part of the Government's drive to reduce UK CO_2 emissions and will therefore continue to develop in the coming years. The 2006 version is only the first step.

It is important for anyone working in construction to stay well informed on this area as it has a huge impact on the way buildings are designed and operated, and on the type of services equipment which will be specified. You can find copies of the legislation at www.odpm.gov.uk. It is also significant to note that in order to comply with Part L, other sources such as CIBSE Guides are required.

On the 6th April 2006 new versions of two key elements of the Building Regulations for England and Wales - Part F (Ventilation) and Part L (Conservation of fuel and power) - came into force. The revisions encompassed in these new regulations include extended measures to reduce the energy consumption of new and refurbished buildings, while also ensuring adequate ventilation.

Although the aim of this Mitsubishi Electric Guide is to explore the changes to Part L, it is important to note that Parts L and F are closely linked, reflecting the importance of adequate ventilation in tightly sealed buildings.

The purpose of Part L

According to the Office of the Deputy Prime Minister (ODPM), some 30% of the UK's carbon emissions come from use of buildings. Consequently, the Government sees the control of energy usage in buildings as a key part of the strategy to meet its Kyoto commitments.

Once implemented, the measures in Part L are expected to achieve considerable reductions in carbon dioxide emissions, compared to the current regulations, and these are broken down as follows:

Dwellings – flats 18%

Dwellings – houses 22%

Non-domestic – heated only 24%

Non-domestic – mechanically cooled 28%

Part L is also tied in closely with the impending EU Energy Performance of Buildings Directive (EPBD), an EU-wide scheme that will set energy performance targets for buildings. Requirements of the EPBD include energy certification of large public buildings and all existing buildings at the time of sale or rent. When the EPBD is implemented, many of its requirements will be enforced through application of Part L of the Building Regulations.

In order to target different types of properties Part L is broken down into four sections, or Approved Documents (ADs). These are as follows:

Approved Document L1A (ADL1A) - new dwellings

Approved Document L1B (ADL1B) - existing dwellings

Approved Document L2A (ADL2A) - new non-dwellings

Approved Document L2B (ADL2B) - existing non-dwellings

This document will focus on the changes to ADL2A and ADL2B, pertaining to non-dwellings.

Building performance

Energy performance for dwellings and non-dwellings is calculated in terms of the building's overall energy use, expressed as carbon dioxide emissions. Designers must establish a Target CO_2 Emission Rate (TER) and then calculate the projected emission rate for the actual building, known as the Building carbon dioxide Emission Rate (BER). The BER must not exceed the TER.

The TER is found by calculating the emissions from a notional building that complies with the minimum 2002 regulations, and then making reductions in energy consumption.

In calculating both the BER and the TER, designers must use the National Calculation Method, which is approved by the EU. For dwellings this is the Standard Assessment Procedure (SAP) and for non-dwellings this is the newly introduced Simplified Building Energy Model (SBEM). A number of software packages based on SBEM will soon be available on the market.

Existing buildings

While most of the impact of the new Part L will come from new buildings, it does also apply to existing buildings under certain circumstances.

Consequential improvements

This applies on buildings with a floor area of over 1000m^2 where there is a new extension or an increase in the capacity of a fixed building service. Under these circumstances, the principal works have to comply with the Part L guidance and improvements to the rest of the building as a consequence of this new work will also have to follow the guidance. This includes bringing thermal elements (floors, walls and roofs) up to 2006 standards, and any services that are over 15 years old will have to be upgraded.

Extensions

Any extension that is over 100m^2 AND greater than 25% of the existing building counts as a new building and will have to achieve a satisfactory BER. Smaller extensions, down to 30m^2, have to make 'reasonable provision' to meet the standards through measures such as using controlled services and thermal elements that meet the standards laid down in ADL2B.

Material change of use

Approved Document L2B gives a number of examples of material change of use. These include conversion of a non-dwelling to a dwelling; conversion of a private commercial building to a public building; and addition of rooms. Detailed information is provided in paragraph 28 of ADL2B.

Material alteration

This applies to any work that would lead to non-compliance of a building or service, which previously did comply. Or, with a building or service that did not comply, where any proposed changes would worsen the non-compliance.

Work on a controlled service or fitting

Controlled services and fittings are defined as a service or fitting covered by Parts G (Hygiene), H (Drainage and waste disposal), J (Combustion appliances and fuel storage systems), L (Conservation of fuel and power) or P (Electrical safety). These include windows, roof windows, rooflights; entrance doors, vehicle access doors and roof ventilators.

Summary

The latest revisions to Part L of the Building Regulations include a broad range of amendments designed to improve the energy performance of new buildings and extensive work on existing buildings.

Efficiency by design

Design standards

As mentioned in the 2005 Mitsubishi Electric Guide to Part L, the measurement of a building's efficiency is centred on the use of a Target carbon dioxide Emission Rate (TER). This is the mass of CO_2 emitted per year, per square metre of the total useful floor area of the building – shown as kg/m²/year.

The TER is calculated using one of the approved calculation tools, which are as follows:

- Standard Assessment Procedure (SAP) for dwellings
- Simplified Building Energy Model (SBEM) for non dwellings
- OR other software tools that have been approved by the ODPM, which will be based on SBEM.

Calculating the TER

An approved calculation tool is first used to calculate the emission rate from a notional building (notional). This figure is then reduced by 20% for mechanically ventilated or air conditioned buildings, or 15% for naturally ventilated buildings, and then by a further 10% to arrive at the TER.

This 10% is a benchmark for the use of low and zero carbon (LZC) energy sources in the building. These include ground source cooling, photovoltaics, and wind turbines. LZC energy sources are not obligatory in Part L but there will be many occasions where their use is required to offset less efficient systems and achieve the TER.

To provide a meaningful measure, the notional building must mirror the key characteristics of the actual building. These are as follows:

- Size and shape
- Building fabric
- Fixed building services
- Air permeability
- Vehicle access doors and display windows
- Activity areas
- Classes of building services
- Occupancy times
- Temperatures
- Illuminance
- Ventilation rates
- Climate for the area

In making these comparisons, designers must work with pre-defined standard activity areas (e.g. office space, kitchen areas) and classes of building services, as specified in SBEM.

Services that are not fixed building services, such as lifts, are excluded. Where mains gas is to be used as the heating fuel in the actual building, this is used in the calculation. Otherwise, designs should be based on the assumption that oil will be used.

Arriving at the BER

Once the TER has been calculated, this provides a target for the actual Building carbon dioxide Emission Rate (BER). The BER must not exceed the TER.

The BER must be calculated using the same calculation tool as was used for establishing the TER. The final calculation must also take account of the following:

- Any changes to the performance specification during construction
- The measured air permeability, ductwork leakage and fan performance as commissioned

In order to determine the BER, Approved Document L2A provides a table of CO_2 emission factors for the various fuels that might be used. BER calculations can also take account of any management features that will improve energy efficiency in practice, as long as they are provided in the actual building.

Seasonal adjustments

One area which has caused some concern in the design of air conditioned buildings is use of Energy Efficiency Rates (EER) and Seasonal Energy Efficiency Rates (SEER).

The SBEM software has been designed to make allowances where their SEER is not known. For example, where users only know the EER at full load for a piece of equipment, this can be used. Sometimes, more information such as half load performance is available, in which case this can be added to the data for a more accurate reading. For example, for a chiller with a full load EER of 2.9, the input of SEER in the SBEM software will be 2.9. For a chiller with 100% and 50% EERs of 2.0 and 2.5 respectively, the SEER would be 2.25.

Guidance does make it clear however, that the more information designers can supply, the better the results. Eurovent is introducing voluntary part-load testing later in 2006, which should help to increase knowledge of SEER figures.

Design limits for building services

Part L sets out design limits for the fixed building services in the building:

Controls

All systems should be provided with appropriate controls to allow reasonable levels of energy efficiency to be achieved in use. The following features are considered appropriate for heating, ventilation and air conditioning in normal circumstances.

- **Use of separate control zones for each area of the building that has a different solar exposure, pattern or type of use**
- **Each zone must be capable of independent timing and temperature control – and, where appropriate, ventilation and air re-circulation rate**
- **Services should respond to the requirements of the space – for example, controls should ensure that heating and cooling do not operate simultaneously in the same space**
- **Central plant should only operate when needed by each zone. The default condition should be 'off'**

Energy meters

Metering systems should be installed to allow at least 90% of the annual energy consumption of each fuel to be assigned to various end-use categories (heating, lighting etc). In addition, any LZC systems should be separately monitored.

For buildings with a total useful floor area of more than 1000m^2, automatic meter reading and data collection facilities should be provided.

Heating, hot water, air handling and cooling

Guidance on the reasonable provision of efficient plant and controls for these areas should follow the guidance in the Non-domestic Heating, Cooling and Ventilation Compliance Guide, published separately by the ODPM. This guide also sets standards for insulation levels for pipes, ducts and vessels. Ductwork should minimise leakage, usually through compliance with the specifications given in HVCA DW/144.

In addition, for air handling plant, the system should be capable of achieving a specific fan power of 25% of design flow rate no greater than that achieved at 100% design flow rate, possibly through the use of inverter controls

Meeting the standards

In Part L 2006 there is even greater emphasis on the interaction between a building and its services in achieving higher energy efficiency. This will require closer co-operation between all disciplines within the design team and earlier involvement of building services engineers.

A case in point is the relationship between glazing, solar heat gains and the energy consumption of cooling systems and lighting.

Limiting solar gains

For example, a combination of window sizing and orientation, solar protection through shading and other solar control measures will help to limit solar heat gains and can be combined with thermal capacity coupled with night ventilation to achieve a low Building carbon dioxide Emission Rate (BER).

At the same time, daylight will enable the electric lighting to be used less and reduce energy consumption in this way. Because of these inter-relationships, the Building Regulations have deliberately avoided specifying minimum daylight requirements. Rather, the Regulations suggest that the designer gives consideration to the provision of adequate levels of daylight with effective controls to reduce internal heat gains in summer.

For example, in relation to an occupied space that is not air conditioned, designers would be considered to have made reasonable provision if the combined solar and internal casual gains (people, lighting and equipment) per unit floor area is not greater than 35W/m^2 over the period 0630 to 1630 during July. Guidance on this is provided in CIBSE TM36.

For spaces served by air conditioning, reasonable provision for the control of excessive solar gains is demonstrated by meeting the TER. Controlling solar gains will reduce cooling energy so it will be easier to achieve the TER.

Again, there is a need for close collaboration within the design team. For example, if the building designer prefers more glazing, the greater solar gains may be offset through enhanced energy efficiency in other areas to achieve the TER.

Building fabric

Part L 2006 also tightens the requirements for the building fabric so that insulation is reasonably continuous over the whole building envelope and that air permeability is within reasonable limits. For example, the construction should ensure there are no avoidable gaps at the joints between elements and at the edges of elements such as those around window and door openings.

Consequently, air tightness is a cornerstone of the Regulations and air tightness tests (pressure testing) are now obligatory, rather than being voluntary as was effectively the case in the 2002 Regulations. The approved procedure for pressure testing is given in the publication Air Permeability Measurement, published by the Air Tightness Testing and Measurement Association (ATTMA).

Pressure testing applies to all non-dwellings, including extensions that are being treated as new buildings for the purposes of compliance with Part L, with a few exceptions as detailed in Approved Document L2A. If a building fails pressure testing, remedial measures have to be taken until the building achieves the required criteria.

Revisions to Part F

In line with the increased air tightness of buildings, the ODPM has revised Part F (Ventilation) to ensure that the building has adequate ventilation. Part F is now closely linked to Part L and lays out a strategy for meeting the requirements through a combination of extract ventilation, whole building ventilation and purge ventilation.

Commissioning of building services

The building services systems should be commissioned so that, on completion, the systems and their controls can be operated efficiently by the building occupier. The approved commissioning procedure is set out in CIBSE Commissioning Code M and it is necessary to give the local authority a notice confirming that the fixed building services have been commissioned in accordance with these procedures.

Part L states 'it would be helpful to building control bodies if such declarations were to be signed by someone suitably qualified by relevant training and experience'.

The requirement for thorough commissioning is also significant, because it means that sufficient time has to be built into the construction schedule.

Building log books

The 2006 Regulations reinforce the requirement of previous regulations to provide the owner of the building with enough information about the building to enable them to operate and maintain the fixed building services efficiently. The information must also be written in a way that is easy for the building owner to understand.

The recommended way of showing compliance is to produce this information following the guidance in CIBSE TM 31 Building Logbook Toolkit. The information should be presented in templates the same as or similar to those in the Toolkit and can refer to other documentation such as operation and maintenance manuals and the Health and Safety file required by the CDM regulations.

The log book should also include the data used to calculate the TER and the BER. Part L recommends retaining an electronic copy of the input file for the energy calculation for use in any future analysis when altering or improving the building.

Model designs

Part L includes an option for builders to adopt model design packages rather than designing for themselves. These include fabric U values, boiler seasonal efficiencies, window opening allowances etc and would achieve overall compliance within certain constraints. However, it will still be necessary to demonstrate compliance through the procedures described in the Approved Documents.

Further information

Copies of all the Approved Documents can be downloaded free of charge from **www.odpm.gov.uk**

For information on CIBSE guidance, see **www.cibse.org** for publications.

The Air Tightness Testing and Measurement Association (ATTMA) website is at **www.attma.org**

If you missed the CPD seminar on **Part L of the Building Regulations 2006**, 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:

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