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Mitsubishi Electric Guide to Controls & Monitoring

Information Guide 73

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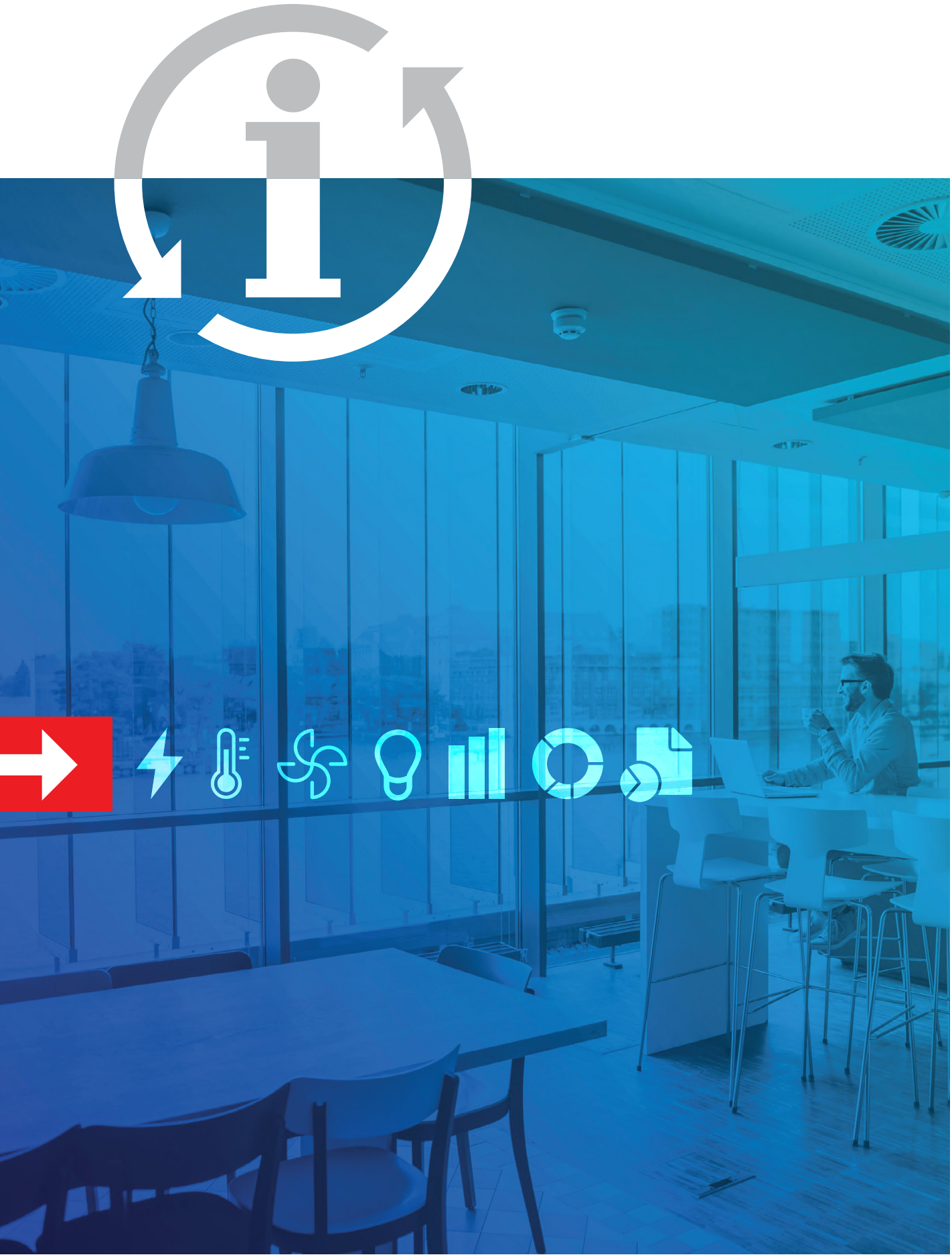


Mitsubishi Electric Guide to Controls & Monitoring

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.

This guide accompanies a series of seminars, all of which are CPD certified.

Contents

Introduction

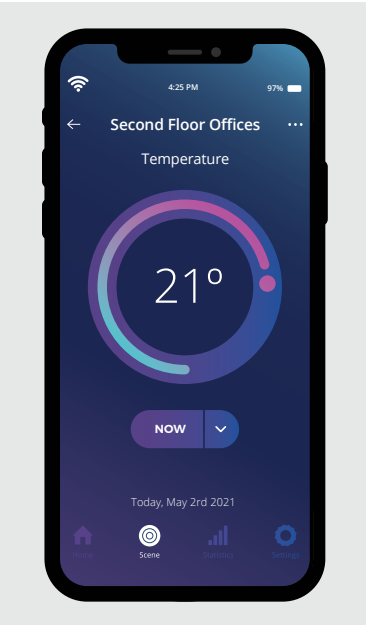
Today's consumers have access to an array of controls for their everyday lives. From smartphones and tablets that can change the heating or lighting in homes; to in-car voice control of navigation and audio systems on the road.

Controls make life easier, more comfortable and often more energy-efficient too. The same can be said for controls in our workplaces. They are vital for ensuring that buildings operate effectively and efficiently. Legislation on building design and operation reflects their contribution to energy saving.

Several legal requirements and targets for energy use in non-dwellings are set to change soon. With the UK's national objective of achieving net-zero carbon emissions by 2050, the built environment will have to become much more energy-efficient. Building controls will have a significant part in ensuring that happens.

Increasingly sophisticated technology teamed with internet connectivity means that controls can do more for building occupants and managers than ever before. Simultaneously, prices are falling, making controls more cost-effective and straightforward to install in new and existing buildings. Controls are, therefore, an attractive option for building managers looking for new approaches to monitoring and managing their estates.

This guide highlights the benefits of building controls for several essential areas of building operation and management and looks to the future of buildings controls and their role in tomorrow's workplace.



Controls - at the heart of today's building requirements

In non-dwellings, building controls have three main functions:

1:	**To help achieve building energy efficiency and carbon reduction targets that are set by law**
2:	**To manage the indoor environment to optimise occupant health, comfort and productivity**
3:	**To support good maintenance practice and to manage wear-and-tear on controlled equipment by preventing unnecessary operation**

We consider each of these areas in the following sections:

- **Controls for efficiency and carbon reduction**
- **Controls for health, comfort and wellbeing**
- **Controls for monitoring and maintenance**

Controls for efficiency and carbon reduction

Heating, ventilation and air conditioning (HVAC) account for around **70% of the energy** used in today's workplace buildings[1]. Even though HVAC equipment manufactured by leading suppliers is designed for optimum efficiency, controlling its performance is vital. There is no point investing in the most efficient air conditioning system if it operates when not required or at the incorrect parameters for a building and its occupants' needs.

Part L2A of the Building Regulations: *Conservation of Fuel and Power in new buildings other than dwellings (2016)* requires the use of fixed building services that 'have effective controls'. It recommends that controlled systems should be able to achieve 'reasonable standards' of energy efficiency in use. Part L (Section 2.42) makes four general proposals for control system design:

1	**The systems should be subdivided into separate control zones that reflect different usage patterns or solar heat gains.**
2	**Each of these zones should be controlled independently for timings, temperature and ventilation rates.**
3	**If heating and cooling are provided, they should be controlled so that they do not operate simultaneously in any zone.**
4	**Central plant should operate only when zone systems require it - the default condition should be 'off'.**

While these suggestions are relatively general, there are updates to legislation on the horizon that will almost certainly raise the bar for building energy performance and carbon emissions. These, in turn, could impact the requirements for controls either directly or indirectly by setting higher standards for the operational energy efficiency of non-dwellings, for example.

The UK has a goal to achieve net-zero carbon emissions by 2050[2]. As a result, the government is setting tighter carbon reduction targets for building design and operation. For example, the government is currently consulting on an update to Part L of the Building Regulations. Included in this consultation is a proposal to raise the required target for Minimum Energy Efficiency Standards (MEES).

Since April 2018, property in the non-domestic private rented sector (PRS) must achieve an EPC rating of E before landlords can grant a new lease or renew an existing tenancy. From 1st April 2023, this standard will also apply to the continuation of an existing lease.

The government is now exploring options for setting higher EPC requirements. Level B is the 'preferred trajectory'. This change would require all non-domestic privately rented buildings to achieve an EPC of B by 1st April 2030 (if the measures required are 'cost effective'). The alternative route is to set the target at C by 1st April 2030.

Since the start of the EPC requirements for non-dwellings, a total of 967,722 EPCs have been registered[3]. Of these, a total of 61.7% are D, E, F or G ratings. This proportion represents many non-dwellings that would not meet even the lower proposed 2030 MEES standard.

As CIBSE points out[4] in its guidance for preparing for an EPC, building controls are crucial for achieving the required energy efficiency standard: **"Effective control not only reduces the carbon emissions but also helps to increase the comfort of the internal environment for its occupants."**

Rating	Number	% of total
A+	543	0.06%
A	15,634	1.5%
B	83,098	8.6%
C	270,149	27.9%
D	299,967	31.0%
E	165,046	17.0%
F	60,196	6.2%
G	72,568	7.6%
Not recorded	541	0.05%
TOTAL	**967,722**	

From: Live tables on Energy Performance of Buildings Certificates Ministry of Housing Communities and Local Government.[3]

Furthermore, depending on the geographical location of a building, it may face other regulatory requirements for energy efficiency. For instance, the updated London Plan (finalised in February 2021) requires that 'major developments' have, in addition to an EPC, a Display Energy Certificate (DEC).

A DEC shows actual building energy performance based on energy consumption in the previous 12 months. Also, the London Plan requires major projects to submit energy use data to a central database for the first five years of operation. This stipulation is part of a drive to ensure that buildings are designed for energy efficiency and achieve that goal in operation.

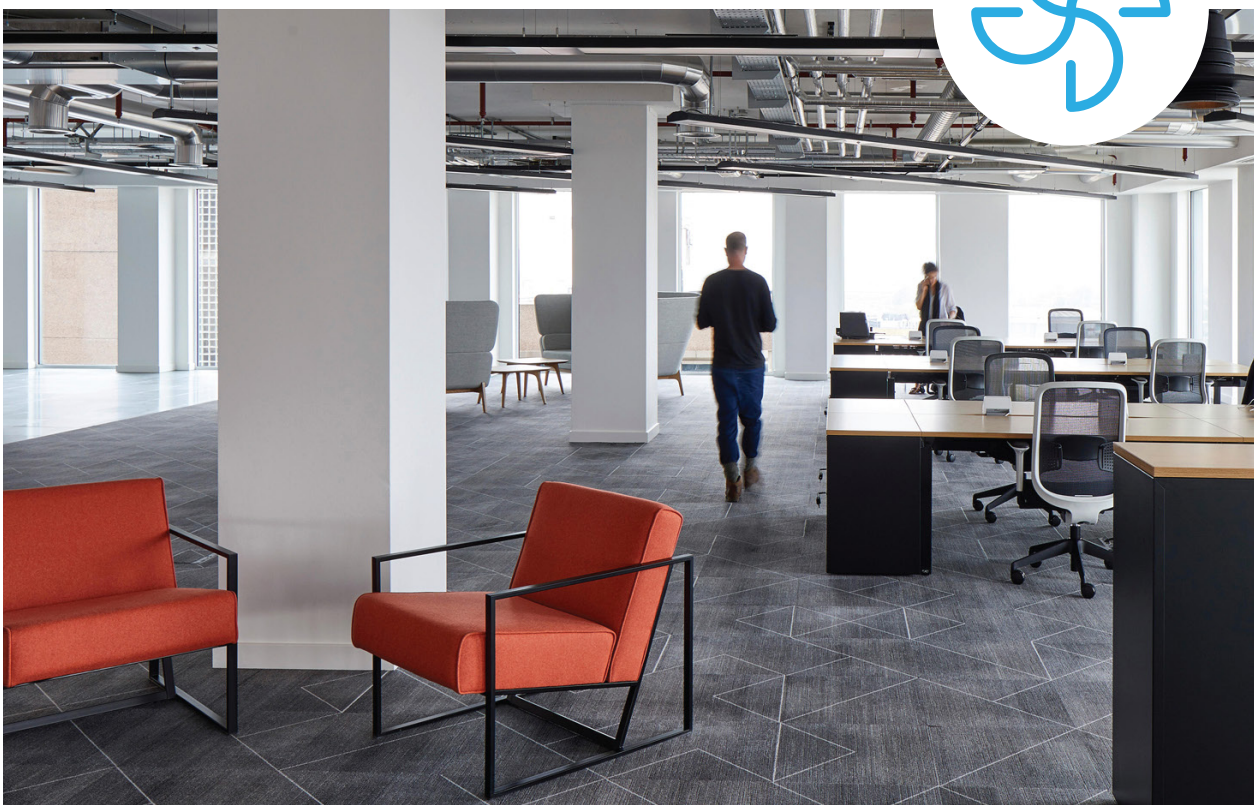
Building controls are vital for monitoring and managing energy use. It also makes financial sense to control HVAC systems effectively. CIBSE's advice on EPCs is that controls offer many benefits: "Where not installed in the building under assessment you energy assessor should recommend the installation of controls within the accompanying report."[4]

Controls for health, comfort and wellbeing

It is fair to say that in the past decade, we have become increasingly aware of the impact that buildings have on our health. After many offices and other workplaces shut down during 2020, the return to work has FM teams focused on maintaining healthy indoor environments. And with more employees having the option to work from home, it is now widely acknowledged that the future workplace will have to adapt to different patterns of use.

The British Council for Offices (BCO), in its briefing note, Thoughts on office design and operation after COVID-19[5], states: **"As restrictions are lifted, and people return to work, some will look forward to the sense of community and social interaction, while others will have adapted to the convenience of working from home. Concerns about infection will remain for all, and offices will have to change to reassure users."**

The role of building controls will be to help building managers meet this challenge, allowing them to adjust the operating time of mechanical ventilation and humidification systems, for example. Building managers can also use controls to increase ventilation when required.



In the longer term, we may see office buildings used differently, with more employees splitting their time between working from home and attending the office for team meetings or client presentations. This change of use will affect how building services operate, and achieving this while ensuring that energy efficiency is optimised will undoubtedly require the application of building controls.

Another aspect of considering occupant wellbeing is control technology as an interface between the building and the people using it. Building controls can allow occupants a level of self-management of the space they are in, allowing them to achieve an environment that is 'just right'. Looking to a future where employees are 'dropping in' to a workplace, rather than attending every day, controls can also play a role in providing information on the location of available workstations or meeting rooms.

While this may seem to be a minor benefit offered by integrated control systems, there is an increasing focus in the property sector on providing these features in the competitive 'office as a service' marketplace. As the BCO highlights in its report The Space-Time Office[6]: **"If the office's roots lie in the regimentation of tailored industrial production, its future will depend on how well it can realign working life with contemporary and future social trends, which are likely to coalesce around freedom from hierarchies and personal choice of when, where and how to work."**

Controls for monitoring and maintenance

Closely related to energy efficiency and occupant wellbeing is the role of the facilities management team. Its focus is on ensuring buildings operate according to regulations and occupant requirements.

Building controls can support facilities management to a large degree, particularly now that more HVAC equipment can be connected to the internet, enabling remote access to information on equipment performance. The ability to collect data across the whole HVAC system means that building managers can access an overview of performance in terms of impact on occupants and energy use.

And connectivity at this level means that users can access data wherever it is most needed - on a central PC for easy access or even on tablets and smartphones for service engineers working on-site. So FM professionals can access information on a building and its HVAC equipment in advance of any site visits and better understand any problems they will be facing.

It also makes maintenance record-keeping easier to achieve as engineers can use their smartphones to take pictures of equipment and record updates of F-Gas checks, for example. These can be stored electronically, where they are less likely to be lost.

For building owners, the ability to collect performance data at a granular level can be powerful. It is possible to compare building performance (in terms of energy use and cost, for example) across an entire property portfolio. Comparison of this type can highlight where energy use is excessive for a building of a particular type and size, allowing the building owner to reduce energy waste and carbon emissions.

Data collected from building services equipment can also allow facilities teams to spot faults before they impact occupants. For instance, if a fan coil unit operates below optimal levels (e.g. temperature at the coil is higher than usual), the system recognises this as a pre-fault condition. It sends a message via the remote monitoring service. An engineer can then make a site visit to examine the FCU and take remedial action (for example, spare part replacement) before the unit fails.

This type of predictive maintenance marks an advance from preventative maintenance. It provides building owners with higher standards of performance from their building services - particularly those that impact indoor environmental quality and hence occupant wellbeing.

The future of HVAC and controls

The connectivity of today's HVAC equipment, based on standard protocols such as BACnet, also means that data can be collected from other building services such as lighting, access control and security. This capability can provide a whole-building approach to monitoring and maintenance.

Future developments for HVAC and controls include greater application of artificial intelligence (AI). Although AI has a range of definitions, in terms of building monitoring and control, it means using large amounts of data collected from around the building to enable systems to ‘learn’ how a building operates. Using algorithms based on past performance, a control system that harnesses AI can predict occupants' future requirements and respond to any deviations away from ‘standard’ performance.

Ultimately, the application of technology leads to a shift from preventative maintenance to predictive maintenance. This approach allows for better prediction of building energy use and the automation of actions that pre-empt occupant requirements. AI technology will mean minimise breakdowns because they are prevented before they occur.

Climate as a service

Once the performance of HVAC can be monitored remotely and analysed using AI, it is possible to see a future where the indoor climate in the workplace can be offered' as a service'.

This concept is the next step from energy management companies that promote energy efficiency in a building by managing HVAC, taking a proportion of energy cost savings in return. Climate-as-a-service might take a similar approach, perhaps with an equal focus on maintaining a healthy indoor environment based on air conditioning, ventilation, lighting and other factors.

While this may be some time away, the predictability of costs and certainty of service might be appealing to companies becoming less focused on multi-year leases of office space based on the number of desks.

As the workplace becomes more flexible than in previous decades, controls will allow building managers to meet the demands of an ever-changing workforce and working patterns.

Conclusions

Building controls are vital for building energy efficiency, which is a significant issue for building designers and managers. The benefit of controls is that more advanced technologies are becoming more affordable for buildings, and they can be applied at a scale that suits the client.

However, given the range of capabilities of building controls, customers need to understand what they are buying to be sure it will meet their exact requirements. As a result, it is more important than ever to speak with experts early on in a project to understand how to make the most of this valuable technology.

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3. **Energy Performance of Buildings Certificates in England and Wales: 2008 to March 2019**

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4. **CIBSE Certification guidance on Energy Certificates and preparing for an EPC**

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6. **British Council for Offices, The Space-Time Office: New demands, new possibilities (June 2019)**

https://www.bco.org.uk/Research/Publications/The_Space-Time_Office_-_New_demands,_ new_possibilities.aspx

To receive a CPD seminar on ‘Controls & Monitoring’, you can call your Mitsubishi Electric Regional Sales Office to arrange an in-house presentation of this information.

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Note: The fuse rating is for guidance only. Please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric’s air conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP:2088), R32 (GWP:675), R407C (GWP:1774), R134a (GWP:1430), R513A (GWP:631), R454B (GWP:466), R1234ze (GWP:7) or R1234yf (GWP:4). *These GWP values are based on Regulation (EU) No 517/2014 from IPCC 4th edition. In case of Regulation (EU) No.626/2011 from IPCC 3rd edition, these are as follows. R410A (GWP:1975), R32 (GWP:550), R407C (GWP:1650) or R134a (GWP:1300).

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