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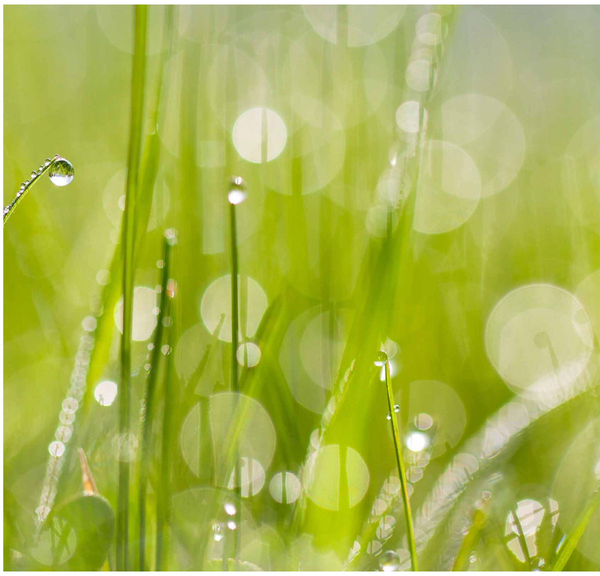
Mitsubishi Electric Guide to the Future of Air Conditioning - Hybrid Technologies



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Air Conditioning | Heating
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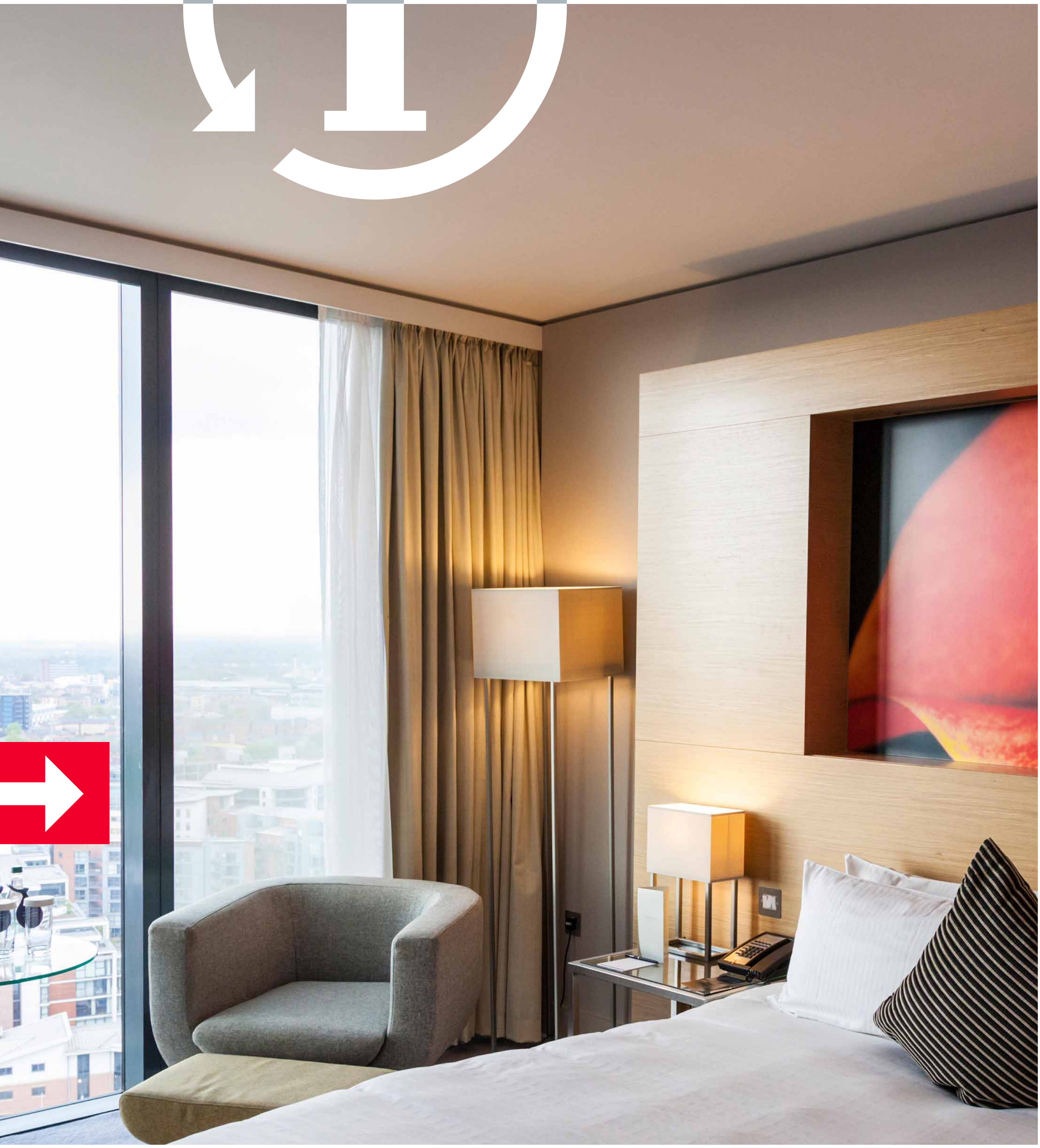

Mitsubishi Electric Guide to the Future of Air Conditioning - Hybrid Technologies

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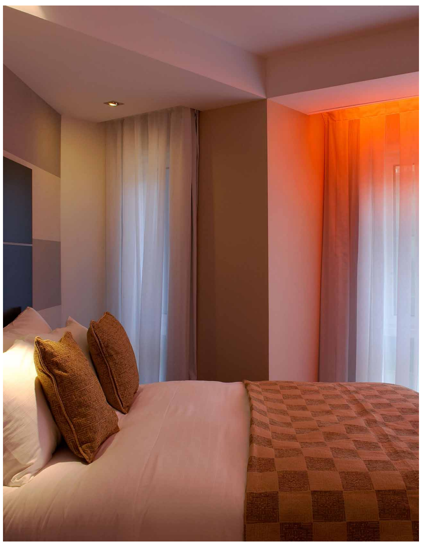
This is an independent guide produced by Mitsubishi Electric to enhance the knowledge of its customers and provide a view of the key issues facing our industry today.

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

Contents

The air conditioning industry is changing

In much the same way the automotive industry is adopting new, hybrid technology to power vehicles in the face of changing legislation and rising fuel costs, so too is the HVAC sector beginning to blend innovative and traditional methods in the search for greater energy efficiency and lower long-term operating costs.



The drive for innovation in air conditioning

There have been a number of factors affecting the changes taking place in the air conditioning industry over the past few years.

We are currently in the middle of the phase-down route to 2030, and the air conditioning market has already seen the impacts of changing refrigerant use. As higher GWP refrigerants were phased out like R22, we have seen increased use of R410A (GWP 2088), R32 (GWP 675) and many low GWP refrigerants in a range of products including VRF, heat pumps and chillers.

Leak detection has become another factor that installers must bear in mind. British and European Standard BS EN 378 (Refrigeration systems and heat pumps - safety and environmental requirements) is particularly notable. It restricts the use of refrigerants in buildings in order to minimise possible dangers to occupants and property arising from leakage.

Hotels, for example, are affected since leakage of a system's refrigerant into a single room could exceed the levels set out in BS EN 378.

Leak detection must be provided if, in the case of R410A, a concentration of 0.44 kg/m^3 refrigerant could be exceeded if the entire refrigerant from a system were to leak into a single room. Air conditioning technologies have adapted to take these factors into account. We are also seeing a drive to make our buildings more energy efficient. For example, new minimum energy efficiency standards (MEES) came into force from April 2018. It is now illegal to rent out or to sell a building which has an EPC (Energy Performance Certificate) rating of below E.

Air conditioning has a significant impact on the energy use of a building, so leading manufacturers have been developing technologies to optimise energy efficiency. While building owners share these concerns over energy use, they must also balance efficiency and legislative requirements with occupant comfort.

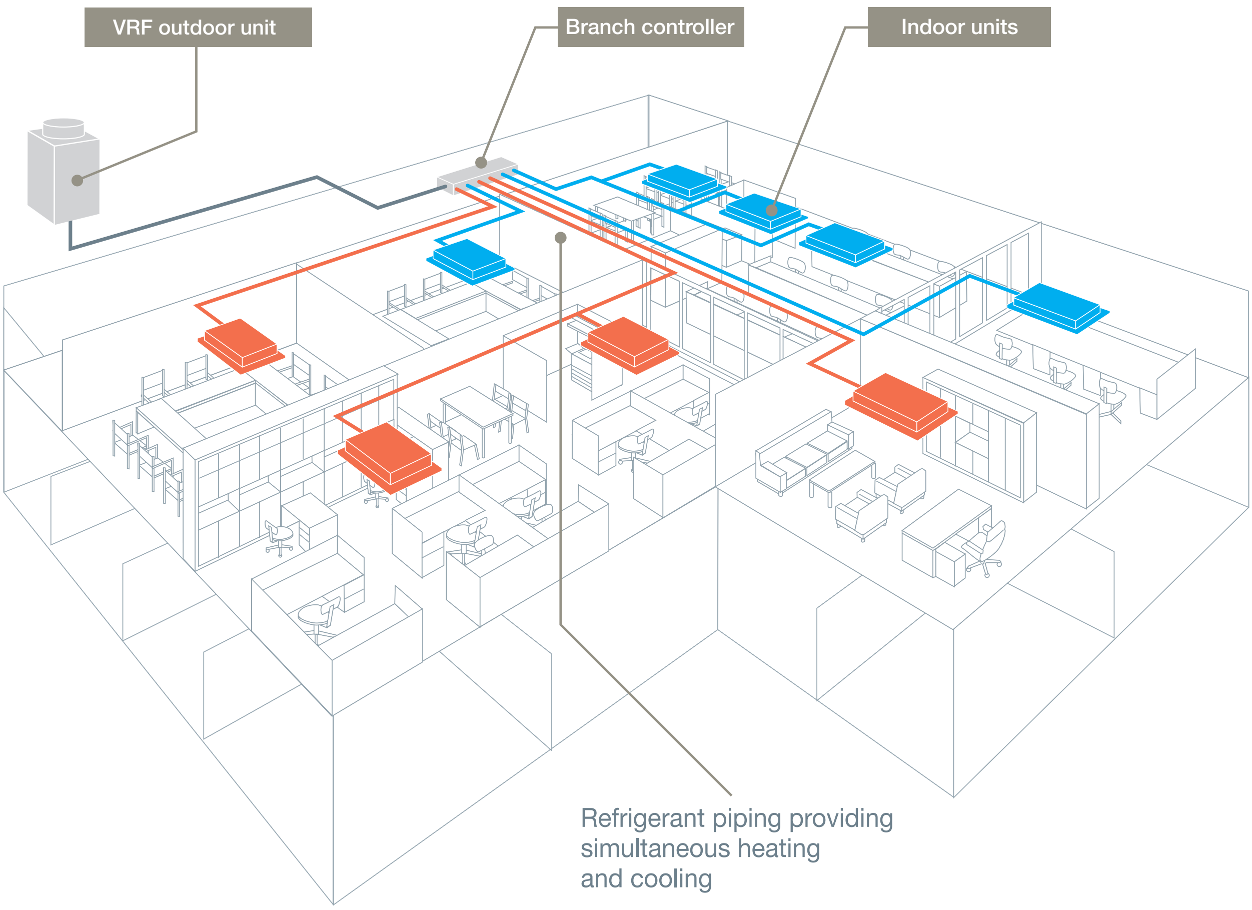
To make well-informed decisions that will help to mitigate global warming, consulting engineers, architects and clients also need to embrace whole-life carbon emissions. This term refers to both operational and embodied carbon emissions, from manufacturing, transportation, constructing, repairing, and maintaining a building, through to deconstructing the building and processing waste. Systems that utilise less and lower GWP refrigerants, such as R32, will have a lower whole-life carbon emissions.

Traditional approaches

Over the last 20 to 30 years, air conditioning technology has evolved, with Variable Refrigerant Flow (VRF) systems gaining popularity with specifiers and end-users.

This is in part due to the fact that ductwork is not required for this type of air conditioning. Also, one outdoor condensing unit can connect to a number of indoor air handling units, reducing cost and installation time.

Refrigerant is cycled from the outdoor unit to the indoor air handlers where hot or cold air is distributed. One of the main benefits therefore is that the system can heat and cool in different spaces around the building, creating higher energy efficiencies through the use of heat recovery and supporting good occupant comfort.



A modern twist on the traditional

With the demands on air conditioning changing under the ever-tightening legislation, a new "best practice approach" has been pioneered.

This is an additional approach to VRF that will suit a range of applications.

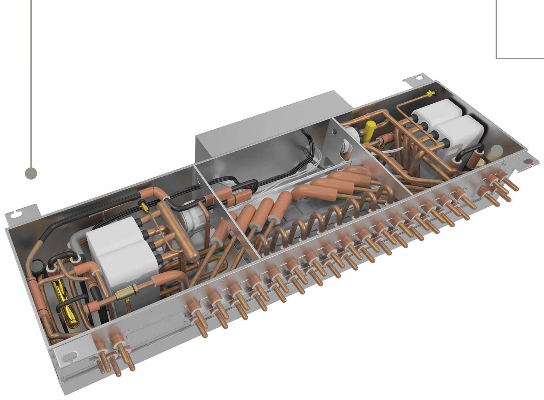
Hybrid Variable Refrigerant Flow can combine the heat recovery benefits of VRF together with the functional benefits of a four-pipe fan coil system, while using only two pipes.

Hybrid VRF (HVRF) provides simultaneous heating and cooling through a simplified two-pipe design. Significantly, the requirement for leak detection is removed because HVRF uses water instead of refrigerant in occupied spaces. The potential dangers to occupants and property, as highlighted by BS EN 378, are therefore removed completely.

For installers, HVRF is as easy and flexible to design and install as VRF, and a hybrid system can use the same controls and network as the traditional VRF approach.

What's more because HVRF uses a decentralised plant, it is possible to update an existing system in a phased approach - reducing business disruption.

Horizontal Hybrid Branch Controller (HBC)



Vertical Hybrid Branch Controller (HBC)

How does it work?

At the heart of the new system design is a **Hybrid Branch Controller (HBC)** box, which is connected to the outdoor unit via traditional refrigerant piping.

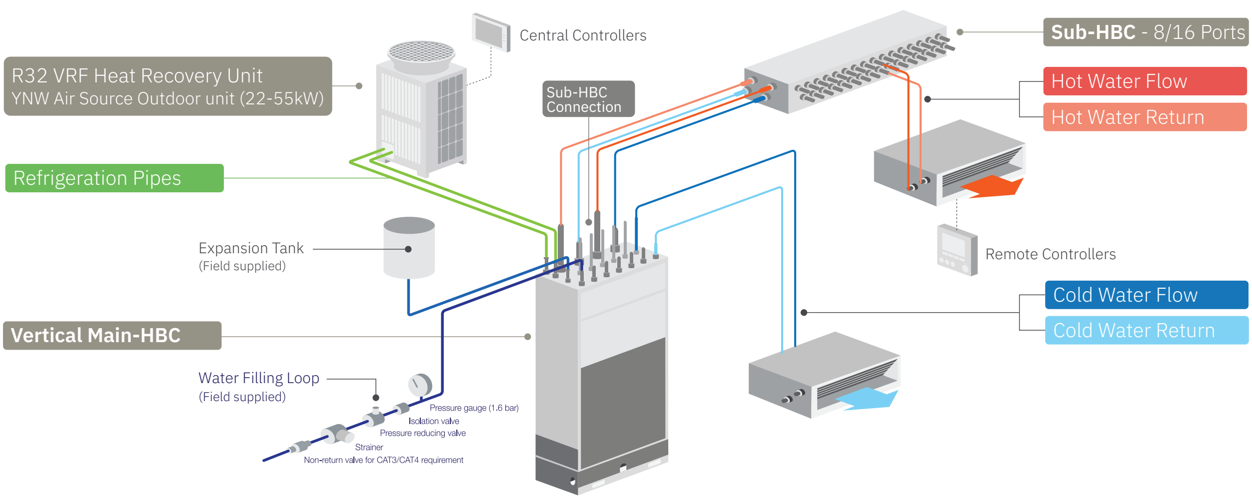
With the growing pressure of the F-Gas phase down regulation, the market demands viable and positive solutions. R32 is a highly efficient refrigerant that is easy to recycle and offers a lower Global Warming Potential (GWP) than R410A and is used in the HVRF system.

The HBC is the gatekeeper. It allows refrigerant to enter from the outdoor unit; and ensures that only water leaves the HBC to service occupied spaces. The Hybrid Branch Controller is the key part of this system because it also supplies the heat exchange mechanism between refrigerant and water.

A HBC is required to deliver both heating and cooling to the fan coil units it is servicing, the outdoor unit delivers a mixture of liquid and hot gaseous refrigerant to it. This mixture first passes through a plate heat exchanger to heat water by condensing the gaseous refrigerant. Liquid refrigerant then passes to a second plate heat exchanger to provide cooling.

The Horizontal and Vertical HBC Controllers are available as 6, 8 or 16 port models (6 port exclusive to the Vertical HBC), with each port consisting of a pair of flow and return connections to fan-coil units. Each circuit can independently deliver heated or chilled water via an arrangement of 3-port valves to connect to one of the plate heat exchangers using a speed-controlled pump in the HBC. A valve on each circuit controls flow rate. Between the HBC and indoor fan coils, the system uses barrier plastic pipe or copper water piping but still offers high sensible cooling and stable room temperatures for maximum comfort. An overall system can be expanded using additional horizontal Sub-HBC's, allowing up to 50 indoor units to be supplied by one heat recovery outdoor unit.

Vertical Main-HBC layout



The case for Hybrid VRF (HVRF)

This means HVRF is particularly suited to applications such as hotels and prestige offices, where legislation would otherwise require leak detection.

Load capacity control is achieved through the use of inverter driven pumps and flow control valves which are built into the Hybrid Branch Controller. Heat exchange and inverter technologies mean that HVRF is a highly energy efficient system.

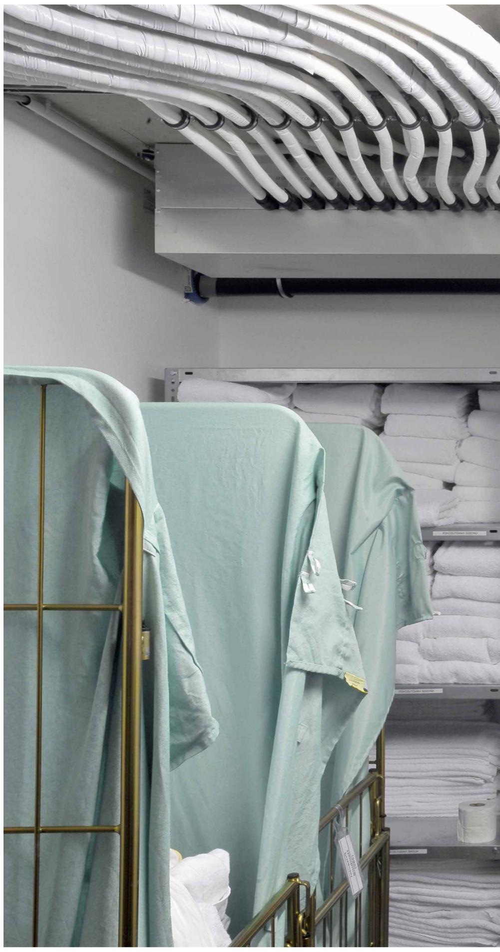
Reductions in both whole life carbon and embodied carbon are achieved by specifying R32 HVRF. By virtue or there being 40% less refrigerant in the system, alongside an 87% reduction in CO_2 equivalent, when compared to an R410A VRF system, this has the combined effect of lowering embodied carbon by 70%.

Phased installation is also possible for HVRF which also reduces building down-time. The system also takes up less of the valuable indoor room space, while still providing a high quality and robust heating and cooling system.

As legislation on heating and cooling in buildings continues to focus on saving energy while reducing the refrigerant options available, manufacturers have had to look for innovative approaches to solving these challenges.

HVRF builds on well-known technology, adding elements that reduce capital outlay (for example on leak detection) while also offering an environmentally friendly approach by the use of water rather than refrigerant.

For organisations looking to reduce energy consumption, lower their carbon emissions and also to take a more **'green'** approach to their property management, HVRF offers a flexible and reliable option.



To receive a CPD seminar on the 'Future of Air Conditioning - Hybrid Technologies', 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 **livingenvironmentalsystems@meuk.mee.com**

Further information

Regional Sales Offices, please call one of the numbers below:

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MITSUBISHI ELECTRIC
Changes for the Better

Telephone: **01707 282880**

email: **livingenvironmentalsystems@meuk.mee.com**
web: **les.mitsubishielectric.co.uk**

@meuk_les @green_gateway | Mitsubishi Electric Living Environmental Systems UK | Mitsubishi Electric Cooling and Heating UK | mitsubishielectricuk_les | mitsubishielectric2 | BLOG thehub.mitsubishielectric.co.uk

UNITED KINGDOM Mitsubishi Electric Europe Living Environment Systems Division
Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, England
General Enquiries Telephone: 01707 282880 Fax: 01707 278881

IRELAND Mitsubishi Electric Europe Westgate Business Park, Ballymount, Dublin 24, Ireland
Telephone: Dublin (01) 419 8800 Fax: Dublin (01) 419 8890 International code: (003531)

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Note: Refer to 'Installation Manual' and 'Instruction Book' for further 'Technical Information'. The fuse rating is for guidance only and 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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Green Gateway greengateway.mitsubishielectric.co.uk