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

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Information Guide

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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.

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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.

The reduction in refrigerants with a global warming potential (GWP) is happening. R22 can no longer be sold or used to top up systems under the new F-Gas regulations. Looking to the future, other refrigerants such as R404A and R410A will be phased out or phased down.

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/m³ 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) will come into force from April 2018. From that date, it will be illegal to rent out or to sell a building which has an EPC (Energy Performance Certificate) rating of F or G.

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.



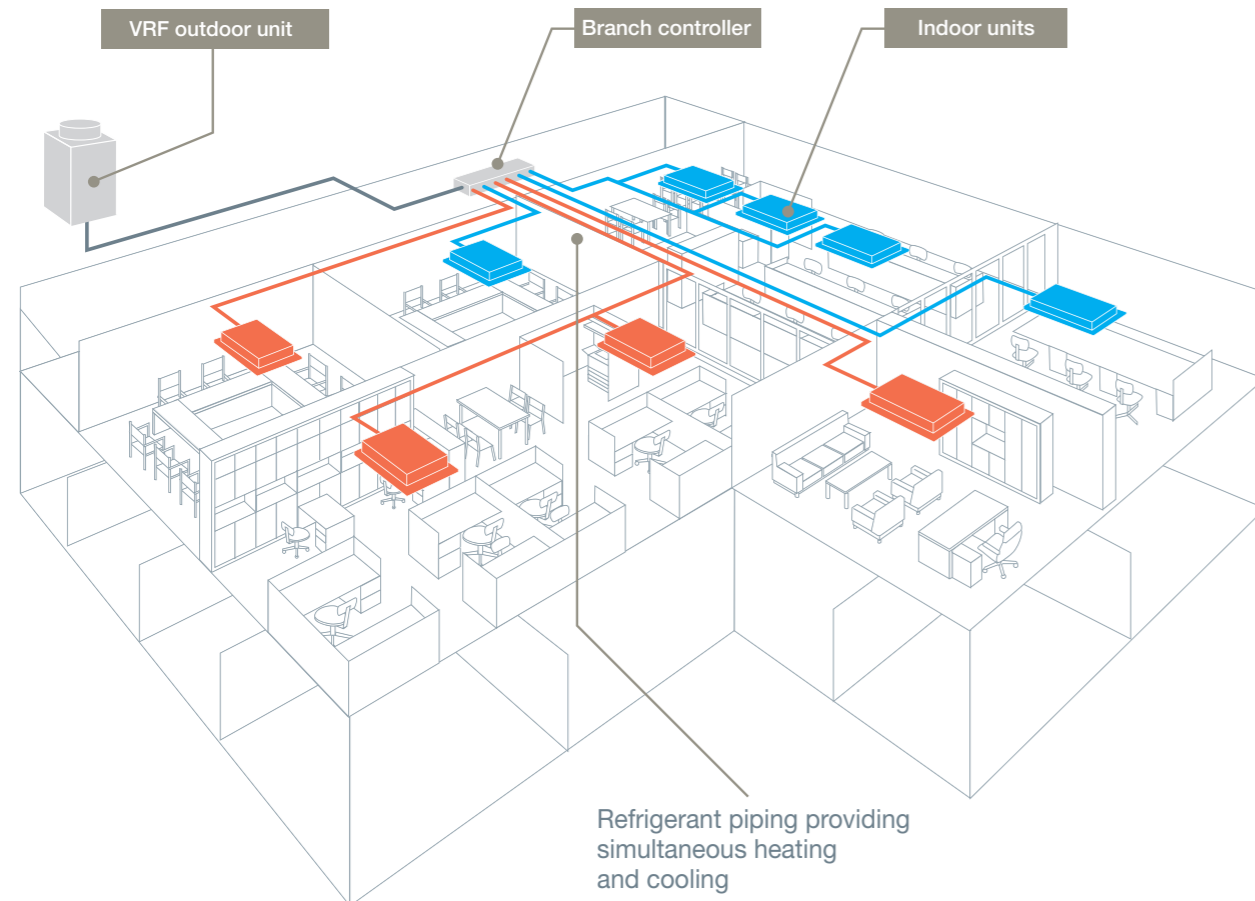


Traditional approaches

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.

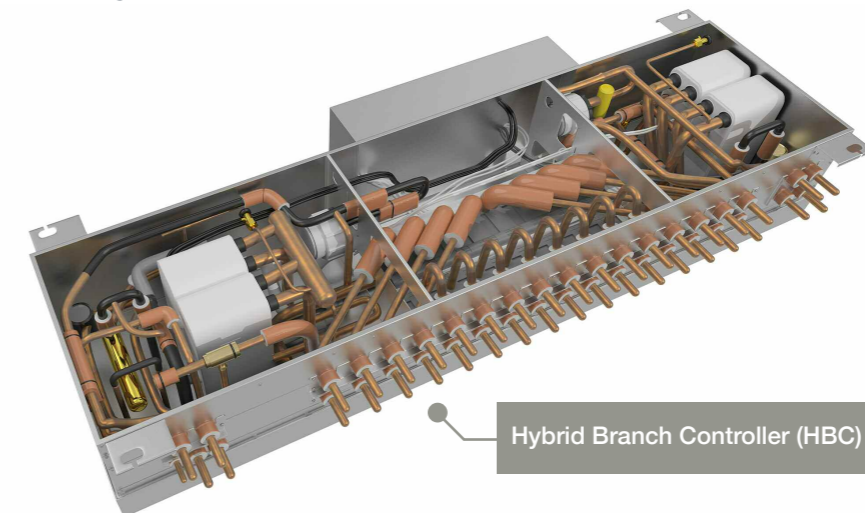
This is an additional approach to VRF that will suit a range of applications.

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 (H-VRF) provides simultaneous heating and cooling through a simplified two-pipe design. Significantly, the requirement for leak detection is removed because H-VRF 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, H-VRF 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 H-VRF uses a decentralised plant, it is possible to update an existing system in a phased approach - reducing business disruption.





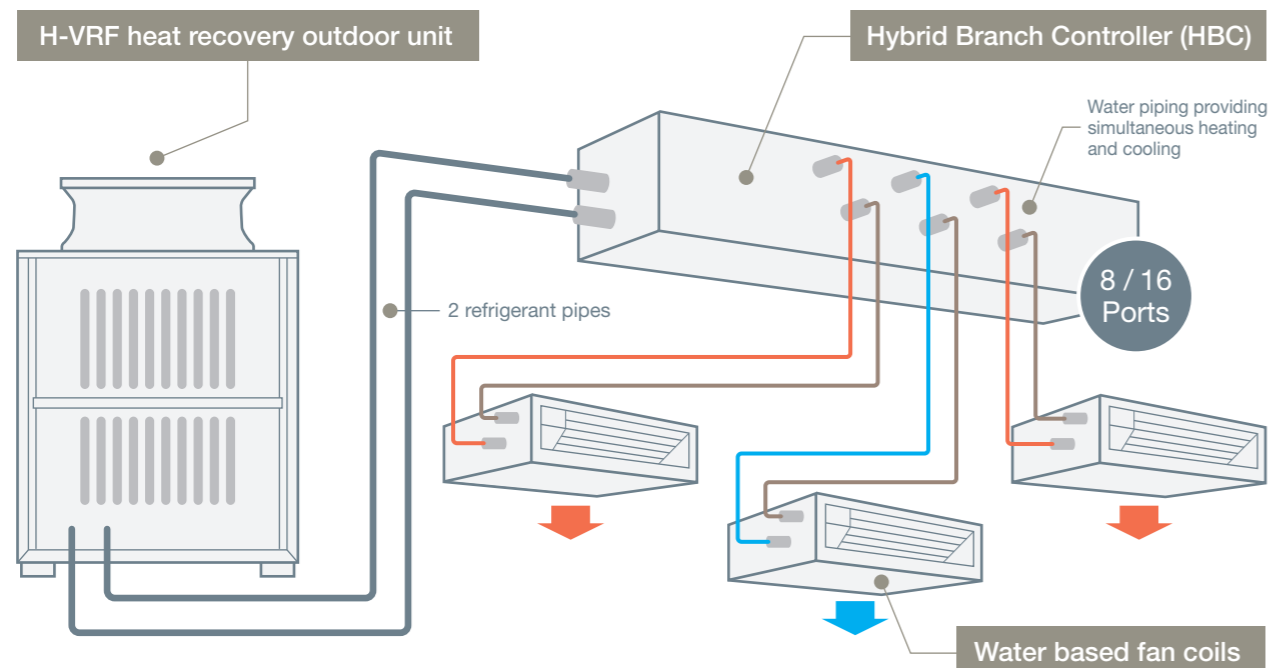
How does it work?

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.

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 box 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 present design of the HBC box, which would typically be installed in a ceiling void, has eight pairs 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 box. A valve on each circuit controls flow rate. Between the HBC and indoor fan coils, the system uses plastic or copper water piping but still offers high sensible cooling and stable room temperatures for maximum comfort.



The case for Hybrid VRF (H-VRF)

This means H-VRF 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 H-VRF is a highly energy efficient system.

Phased installation is also possible for H-VRF 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.

H-VRF 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 and also to take a more **'green'** approach to their property management, H-VRF offers a flexible and reliable option.

