The Renewable Solutions Provider
Making a World of Difference

Hybrid VRF Systems

Frequently Asked Questions

MITSUBISHI ELECTRIC

R32 | HybridVRF

Hybrid VRF offers an integrated solution both now and into the future

Legislation is impacting on the use of energy in the built environment as never before and at the same time, there is a drive to look for new refrigerants to mitigate any harm to the environment.

Coming to terms with the impact of the F-Gas Regulations and the move towards refrigerants with a low global warming (GWP) potential, what is needed is a new approach in delivering energy efficient heating and cooling to buildings.

The first R32 VRF solution to the market alongside our tried and tested R410a solutions, the R32 Hybrid VRF system uses R32 as refrigerant and operates without using refrigerant in occupied spaces, removing the need for leak detection equipment and allowing more properties to take advantage of manageable phased installation through the system's modular two-pipe design.

This unique air conditioning system delivers levels of comfort normally associated with chiller technology, whilst providing the flexibility and efficiencies of refrigerant based air conditioning.

Hybrid VRF therefore offers an additional solution to traditional VRF or chiller systems, all supported by the quality, technical expertise and customer service that Mitsubishi Electric is famous for.

Focusing on the technical aspects of the system, this FAQ brochure seeks to assist you in answering the majority of questions you may have.

hybridvrf.co.uk

For information on Hybrid VRF training courses please call: **0161 866 6089** (option 6 followed by option 1)

Q1. How does Hybrid VRF compare to VRF and what are the benefits?

A. **Hybrid VRF provides a future proofed low GWP R32 solution that is scalable and shields the market from refrigerant price fluctuations keeping costs down today and tomorrow. It offers higher comfort, higher sensible cooling and shorter defrost times with no transient fan coil noise.**

Hybrid VRF can mostly or wholly remove the need for leak detection where charge limits apply, whilst the lower refrigerant charge can reduce cost and increase the number of points available under BREEAM. The Hybrid VRF system can also be used with R410a with the HBC being common across both refrigerants. VRF and Hybrid VRF control interfaces are identical and since the offering is constantly evolving, Hybrid VRF can be applied in most VRF applications - VRF and Hybrid VRF can even be mixed on the same site. With the increased installs of Hybrid VRF it is achieving (and in some cases exceeds) cost parity with VRF. Free assisted commissioning incorporating multiple site visits is available for the first system installed by a contractor. Any contractor or designer wishing to apply this system can be trained for free at any of Mitsubishi Electric's training centres.

Contact details are on page 2, or visit:
les.mitsubishielectric.co.uk/events/hybrid-vrf-design-application-and-installation-course-hvrf

Q2. How does the Hybrid VRF compare to chilled water systems and what are its benefits?

A. **Chillers are used in bespoke, high comfort systems and make commercial sense when cooling on a large scale, or when a mixture of HVAC strategies are required - chilled beams, fan coil units, AHUs, radiators etc.**

Hybrid VRF is smaller in scale, modular, easier to design and install by a wider contractor base using off the shelf components, using the same tried and tested VRF control architecture, is available for next day delivery, all whilst offering the comfort of a chiller system with the efficiency and flexibility of Mitsubishi Electrics' R2 VRF system.

Q3. What types of indoor unit are available in the Hybrid VRF range? How are the Hybrid VRF indoor units different from the standard VRF range?

A. **The indoor units below are available:**

- Ducted
- Slim line ducted
- Floor standing chassis
- 4-way ceiling cassette
- Wall mounted units (available soon)

The flow of water through each indoor unit heat exchanger is controlled by the valve block located inside the Hybrid Branch Controller (HBC). Indoor unit sizes are either the same size or larger than the equivalent sized VRF unit. This allows the coil to be at a higher temperature in cooling mode for the same capacity which improves comfort.

Q4. What type of water pipes should be used with Hybrid VRF?

A. **For the water circuit between the HBC and indoor units, standard water copper pipes or multi-layer composite (MLC) pipes must be used.**

The MLC pipe must conform to standard EN ISO 21003. Pipe systems must be able to withstand pressures of 10 bar. Only use brass/plastic fittings and do not use any steel/iron fittings. Standard refrigerant pipe should be used between the outdoor unit and hybrid branch controller.

Q5. What size water pipework and insulation should be used between the HBC and indoor units, and what is the maximum pipe run?

A. **Minimum pipe diameters, insulation and maximum equivalent pipe lengths are shown in the table below:**

Unit Size	MLC ID	MLC OD	DN Copper	Max Equivalent Pipe Length (m)	Min Insulation (mm)
10	12	16	DN15	60	6
15	15.5	20	DN22	60	9
20	15.5	20	DN22	60	9
25	20	25	DN22	60	9
32	20	25	DN22	60	9
40	20	25	DN22	60	9
50	20	25	DN22	60	9
63	32.6	40	DN35	60	13
80	32.6	40	DN35	60	13

We have allowed some smaller size pipes with shorter pipe runs to improve flexibility as per the table below:

Unit Size	MLC ID	MLC OD	DN Copper	Max Equivalent Pipe Length (m)	Min Insulation (mm)
25	15.5	20	DN22	40	9
32	15.5	20	DN22	25	9
63	26	32	DN28	45	13
80	26	32	DN28	30	13

Note that the pipe runs stated above are equivalent lengths. The length of pipe run must be reduced depending on the number and types of bends and fittings. The resultant pipe length is the maximum allowed from the main HBC to the indoor unit whether a sub-HBC is installed or not.

The insulation level has been calculated at the Hybrid VRF operating temperatures using the calculation method stated in BS EN 12241:2008. All elbows, connections and exposed components should be covered with insulation. Armaflex insulation, class O type, is used in commercial applications.

Thicker insulation maybe required for condensation control depending on the environment.

Q6. How do different fittings impact the overall equivalent length of the water pipe circuit?

A. **The equivalent length will vary for each manufacturer and is also dependent of the type of fitting. Guidance is provided below:**

Fitting	Equivalent Length Reduction (m)
Swept bend radius > 1.5 x pipe diameter	0.55
Non-full bore connector	1
Elbow (bend < 1.5 x pipe diameter)	4

Table 1. Equivalent length for water pipe fittings

The equivalent pipe length reductions need only be counted once, i.e. count the fittings on the flow direction only, then apply the equivalent length reduction.

Q7. Does the Hybrid VRF system have its own dedicated outdoor unit?

A. **The Hybrid VRF uses the same City Multi VRF Heat Recovery outdoor units, including water sourced units as standard VRF.**

Q8. How big are the Hybrid Branch Controller Boxes (HBC) and how much does it weigh?

A.

HBC	Dimension (mm)	Weight (kg) (with water)
CMB-WM108V-AA	300 x 1,520 x 630	96
CMB-WM1016V-AA	300 x 1,800 x 630	111
CMB-WM108V-AB	300 x 1,520 x 630	49
CMB-WM1016V-AB	300 x 1,520 x 630	62

Table 1. HBC and SUB HBC Dimensions

Q9. How much service space is required for the Main HBC and Sub HBC?

A. **Refer to Figure 1 and Figure 2 for service space requirements.**

HBC	A (mm)	B (mm)
8 Port Main/Sub HBC 16 Port Sub HBC	1520	160
16 Port Main HBC	1800	300

Figure 1. Top View
(Dimensions in mm)

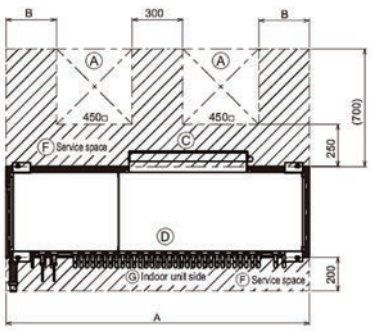
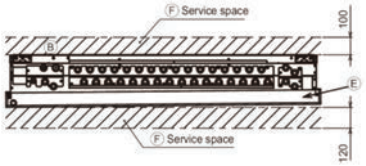


Figure 2. Front View
(Dimensions in mm)



Q10. Does the water side of the system require pumps, balancing valves, strainers or any other third party items when compared to a traditional VRF system?

A. **The Hybrid VRF system makes the design and installation process simple as the pumps and control valves are all included in the HBC box.**

Mandatory field supply items on the mains water supply side at the HBC are listed below:

- **1 x Expansion Vessel** per Master HBC box
  The expansion vessel is a small tank used to protect the system from excessive pressure caused by thermal expansion

- **Back Flow Protection**
  This is installed to make sure that the water being circulated in the system cannot go back into the potable water system. Refer to the water treatment guide for more information

- **Strainer** (40 Mesh minimum)
  To filter out any solid debris on the incoming mains water

Q10. Continued

A.

- **Pressure Reducing Valve** (set to 1 ~ 1.6 bar)
  To reduce the pressure of the incoming water line. 1 bar where indoor units are less than 5 meters above the HBC, 1.6 bar where indoor units are > 5 meters above the HBC. Maximum height difference 15m max

- **Isolation Valve**
  To shut off and open the incoming water mains

- **Pressure Gauge**
  To monitor the operating water pressure of the system

The use of the following field supply items on the indoor unit water pipework is strongly recommended.

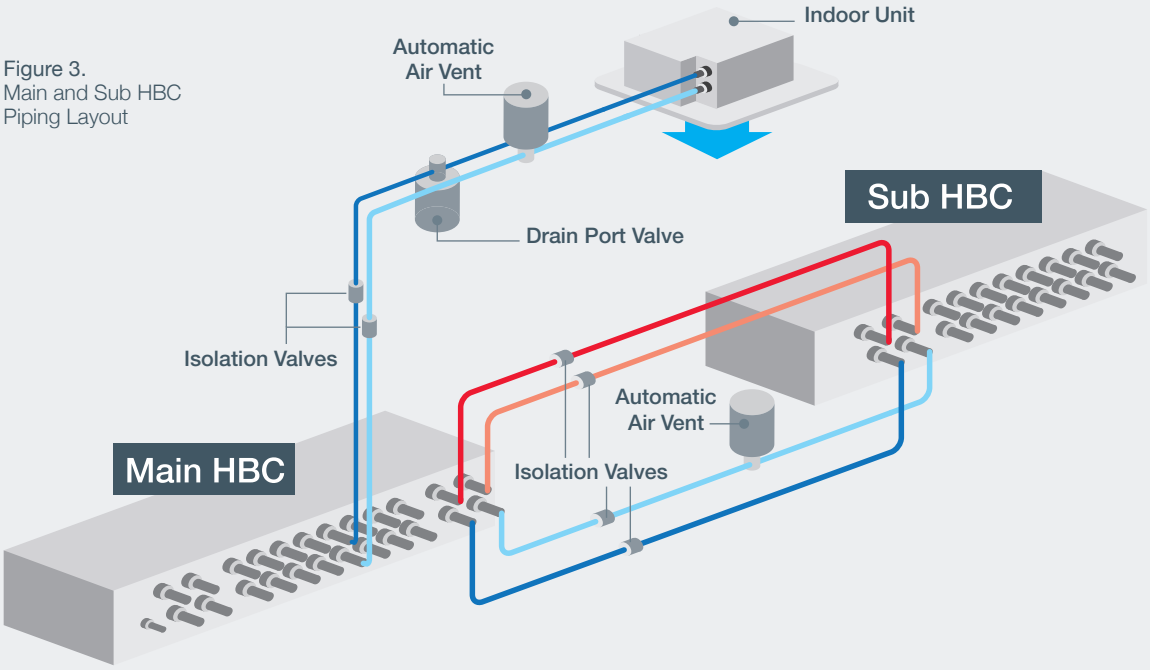
- **Isolation valves** (flow and return) per port of the HBC and Sub HBC
  To isolate each indoor unit without affecting rest of the system

- **Drain Cock Valve on the lowest point of water pipe per indoor unit**
  To purge each unit with water prior to commissioning in order to remove any excess air

- **Automatic Air Vent (AAV)**
  At the highest point of on the water pipe flowing to the indoor unit from the HBC

- **Dosing Pot**
  To add inhibitors to the system. Refer to the water treatment guide for location

Figure 3.
Main and Sub HBC
Piping Layout



Automatic air vent should be located at the highest point of pipework.
Drain valve on the lowest point of pipework.
A shopping list tool also allows you to input the cost of each component for costing purposes.

Q11. What size expansion vessel do I need?

A. **Use the latest Hybrid VRF expansion vessel sizing tool to calculate the total water volume of the system.**

Please contact our pre-sales team for further assistance.

The installer/designer will also be required to provide the following information:

- Layout of the project with selected pipe sizes and lengths
- Filling water pressure (1 – 1.6 bar)

Our selection is indicative only. We do not accept final design responsibility or product selection/sizing responsibility.

Other information required when sizing an expansion vessel:

- The maximum water temperature is 60°C
- The minimum water temperature is 5°C
- The circuit protection valve set pressure is 3.7 - 4.9 bar
- The circulation pump head pressure is 2.4 bar

The expansion vessel must be charged at the same pressure as the water loop. Set the pressure before connecting to the system.

You should conduct a professional site survey and make on-site measurements where appropriate.

Q12. How many indoor units can be connected to one port of the HBC and do you require a special joint?

A. **A maximum of three indoor units can be connected to a single port of the HBC, provided the total capacity index of the three indoor units is less than or equal to 80 (equivalent to approx. 8kW of cooling capacity) and they are set to control as a group.**

Special joints are not required, but the indoor units should be installed using the reverse return method.

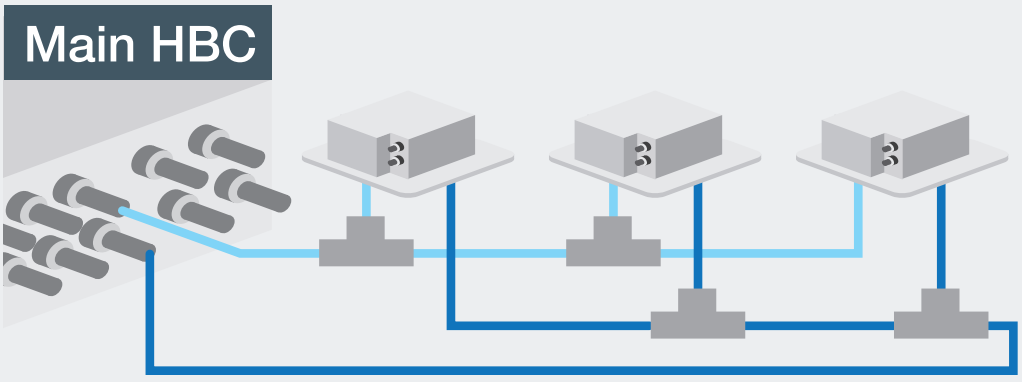


Figure 5. Reverse Return Method

Q13. Which is more efficient Hybrid VRF or VRF and what is the normal operational temperature for the hot and cold water?

A. **The seasonal efficiency of Hybrid VRF is typically 10% lower when compared to City Multi VRF.**

The HBC box has the potential to deliver water temperatures ranging from 5°C to 60°C, but the system does not used a fixed temperature for heating and cooling. Rather, each indoor unit targets a fixed temperature difference, which means a gradual room temperature pull down is achieved with no cold air dumping. Typical operational water temperatures for the HBC box are 35°C to 45°C in heating and 5°C to 15°C cooling.

Q14. Does the system require any corrosion inhibitors or biocides?

A. **The filling water as well as the makeup water must comply with the minimum water quality requirements set by BSRIA or as per the databook. A corrosion inhibitor is recommended and is required where the water quality has not been proven.**

For some projects it might be a specification requirement to use biocides, corrosion inhibitors or glycol. We have tested a number of chemicals and maintain an approved list in the water treatment guide. Please contact our pre-sales team for a copy of this guide.

Q15. Are there any water regulation Hybrid VRF systems should abide to?

A. **The Hybrid VRF system should be installed to WRAS regulations and also follow any additional requirements from the local water company.**

1. Water Filling Loop Connection

A category 3 backflow prevention device with temporary filling loop is the recommended minimum.

2. Pressure Test

If all of the HBC water pipes are connected to the indoor units, then pressure test the entire system to 3 bars. Isolate the HBC and indoor units if pressure testing above 3 bars. The Main-HBC has a built in safety Pressure Relief Valve (PRV) which is set to 3.7 bars, therefore the pressure test should be carried out at 3 bars.

The PRV is located next to the plate heat exchanger in the main-HBC - if the pressure relief valve has operated it may need replacing. If the mains water is at a high enough pressure, please use the pressure reducing valve on the water filling loop to drop the pressure down to 3 bars and pressure test the entire system. The pressure in the system must be reduced to 1~1.6 bars before running the system.

Q16. How is the Hybrid VRF defrost operation different to standard VRF?

A. **The Hybrid VRF defrost cycle has two types: Bypass defrost which works in the same way as the City Multi VRF system and a heat recovery defrost method which is the default method for the Hybrid VRF system.**

Heat is transferred from the water circuit to the refrigerant circuit and allows the shorter defrost cycle. If the water temperature dips below 28ºC, then the system will switch over to standard defrost to enable heating to commence straight after defrost has completed. The fans on the indoor unit will stay off during the defrost process as it makes the whole defrost cycle shorter.

Q17. How is the Hybrid VRF commissioning process different from a VRF system?

A. **All processes required to commission a VRF system must be followed along with the additional processes that are specific to the Hybrid VRF system.**

The two additional processes required for the Hybrid VRF system are:

1 Automatic Debris Removal Process

The system will run for about 40 minutes collecting any dirt etc. into strainers of the main-HBC. The strainers will need to be removed and cleaned after this process.

2 Automatic Air Removal Process

The system will run for about 2 hours starting and stopping the water pumps and also varying the speed of the pump in the process in order to remove the air from the system through the Automatic Air Vents and the Air Purge Valves on the HBC.

Please follow:
City Multi Hybrid VRF Pre-commission Check List
Hybrid VRF Debris and Air Removal Operation

Q18. If the outdoor unit is connected to two Main-HBC, could I run the air and debris removal process on the two Main-HBC's simultaneously?

A. **The automatic debris removal process can be carried out on both Main-HBC's at the same time.**

The automatic air removal process should be carried out separately on both Main-HBC's connected to the same outdoor unit or a fault will occur.

Q19. Are there any restrictions/standards for brazing or soldering copper water pipework?

A. **Compression fittings are recommended rather than soldering copper pipework for water circuits.**

Brazing is acceptable if nitrogen is purged through the pipework while brazing. While brazing the copper pipework to the HBC copper stubs, make sure the copper pipes are covered with a wet cloth in order to prevent the plastic valve block from burning and shrinking by heat.

Q20. What additional parts are required for an installation where two main hybrid branch controllers are connected to one outdoor unit?

A. **Mitsubishi Electric twinning kit CMY-R100VBK4 will allow the low pressure pipes and high pressure pipes to be connected to each Main HBC.**

Note that a refrigerant balancing pipe is required between two Main HBC's. Please refer to system schematics.

Q21. What noise level considerations should be taken into account when installing a HBC?

A. **The sound pressure level of a HBC is 41dBA when measured 1m below the unit.**

The HBC should be located away from quiet occupied spaces as there will be noise generated from the water pumps and refrigerant during operation and mode change.

Q22. What is the typical overall refrigerant charge percentage reduction comparison between a standard VRF and a Hybrid VRF?

A. **There is approximately 30%-40% reduction in the refrigerant volume, depending on the size of the system.**

Q23. How many BREEAM points (POL 01) can be achieved with Hybrid VRF?

A. **Hybrid VRF will achieve the first point more easily than a VRF system as there is less refrigerant volume. The second point may be possible with the lower GWP R32 Hybrid VRF system.**

The third point for leak detection and automatic pump down is possible using the Mitsubishi Electric pump down system with safety valves and leak detectors. This is also considered as two safety measures under BS-EN378:2016.

Q24. Are leak detectors required?

A. **Leak detectors may be required depending on the type and volume of refrigerant, the location of the HBC and the location of the pipework.**

Usually, no leak detectors will be required for R410a Hybrid VRF and in many cases only one detector will be required with R32 Hybrid VRF systems. Speak to your local sales representative for further guidance or request a CPD from us or BS-EN378 training.

Q25. Have you considered BSRIA commissioning standards?

A. **The BSRIA water commissioning document only applies to conventional systems such as chillers or boilers.**

As Hybrid VRF is a fully packaged system, installation requirements and commissioning should be carried out to our specifications.

MITSUBISHI ELECTRIC
Changes for the Better

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Warranty - option 3
Training - option 6 followed by option 1

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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) or R134a (GWP:1430). *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).

Date effective as of August 2019

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