



R290: KEEPING OUR INSTALLER
NETWORK AND SERVICE ENGINEERS
SAFE EVERY DAY

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INTRODUCTION

Over the decades, the global direction of refrigerant use has shifted away from traditional refrigerants such as CFC's and HFC's gases, towards more environmentally friendly alternatives.

This work continues today, which is now supported by the Kigali amendment to the international agreement of the Montreal Protocol, together with the imposed targets set by the European Parliament, which have been purposefully designed to regulate and reduce the use of such traditional refrigerants.

The MHIAE Hydrolution EZY is a residential heat pump that delivers energy efficient heating and cooling using natural R290 refrigerant. While traditionally MHIAE have chosen gases such as R-410A and R32, this is our first product range to use natural refrigerant R290, following an amendment to F-gas regulation.

This useful guidebook is designed to provide best practice to installers and service engineers on how to safely handle, store and transport R290 (propane) natural refrigerant. The recommendations contained in the guide, are to serve as informational purposes only. Adopting these practices is designed to ensure user safety and product integrity.

The below image depicts a genuine installation, demonstrating the use of R290 monobloc, as an efficient alternative to traditional gas boilers. Supporting communities across Europe to transition safely to renewable and environmentally friendly solutions in our commitment to achieve net zero.

Image source: Condex Distributor, Bulgaria.



Our latest **Hydrolution EZY case study** can be viewed [here](#)

MHIAE COMMITMENT TO R290 SAFETY

At MHIAE, safety standards are of paramount importance and we remain committed to continually assessing industry safety standards, so that we remain best placed to inform and educate our distributor and partner network. We routinely deliver industry-leading training seminars to all our network, so that they can remain

reliably informed and are equipped with trusted knowledge within the scope of refrigerants. This ensures that our end users can have complete confidence in their Mitsubishi Heavy Industry solution each and every day.

What is R290 Refrigerant?

R290 is a highly effective, natural, yet flammable propane gas; it is therefore classified as an A3 refrigerant. Propane is widely used across many different sectors, including catering appliances and landscaping/farming equipment, it is also used across the HVAC industry and is the preferred refrigerant across Air-to Water heat pumps, as it is recognised to have a lower GWP (Global Warming Potential) than that of other CFC's. As R290 is odourless and colourless and exists in vapour form in normal atmospheric conditions – R290 needs to be handled with respect.

How are Refrigerants Classified?

ASHRAE 34 & ISO 817 are used to determine refrigerant flammability and toxicity properties. R290 is classified as an A3 refrigerant.

Advantages of R290 Refrigerant versus traditional refrigerants

- ✓ Ability to increase outlet temp up to 75°C
- ✓ Efficient refrigerant – even at low ambient temperatures
- ✓ Capable of producing hotter water
- ✓ Minimal environmental impact
- ✓ Lower refrigerant charge
- ✓ Lower discharge temp
- ✓ Cost effective
- ✓ Abundant supply



STORAGE & TRANSPORTATION

Considerations When Storing R290 Refrigerant

- Stow away dangerous goods correctly (ADR 7.5.7)
- Do not store units containing R290 below ground or near floor level drains
- Store cylinders in silages or dedicated areas 1.5m away from any possible ignition source
- Avoid build-up of static electricity
- Use leak sensors to detect leakage
- Clear signage prohibiting smoking/vaping must be visible
- Follow local fire brigade's risk assessment and regulations
- Install barriers
- Please check our local distributor/guidelines for storage requirements

Transportation

ADR = **European Agreement concerning the International Carriage of Dangerous Goods by Road** governs the safe transport of dangerous goods by road across Europe, setting standards for classification, packaging, documentation and vehicle requirements.

MHIAE understands that on occasions R290 refrigerant will need to be safely transported. It is therefore important that this is undertaken with care and in a controlled manner – for the protection of everyone.



Transportation of R290 Cylinders

As R290 is classified as an A3 refrigerant, we recommend full compliance with ADR regulation (category 2 & 3) as these explain the transportation of substances that are or can be hazardous.

NB: Refrigerating machines and refrigerating machine components are not subject to the provisions of ADR if they contain less than 12kg of gas in Class 2 Group A or O according to 2.2.2.1.3.

How to Transport R290 Safely

- Vehicles need to be well ventilated
- Flammable and compressed gas diamond stickers must be visible on the vehicle
- TREMc card (Transport Emergency Card) or the material safety datasheet should accompany the R290 cargo
- Vehicles must carry 2Kg dry powder fire extinguishers (blue flash) per vehicle (ADR 8.1.4.2)
- A training record is required (ADR 1.3.3)

Maximum Load: 1000 units/points where each unit is equivalent to 1Kg

The maximum limit of R290 charge can vary if other refrigerants are also being transported. 1000 units/points is the total no. of units allowed for all substances.

As R290 is considered 3x more dangerous, the allowed 1000 units/points becomes 333 units/points = 333Kg maximum load.

Distributor Training

Our distributors arrange regular industry approved training within their local markets. To find out when the next training opportunity is scheduled for or to make a reservation on the training course, please visit:

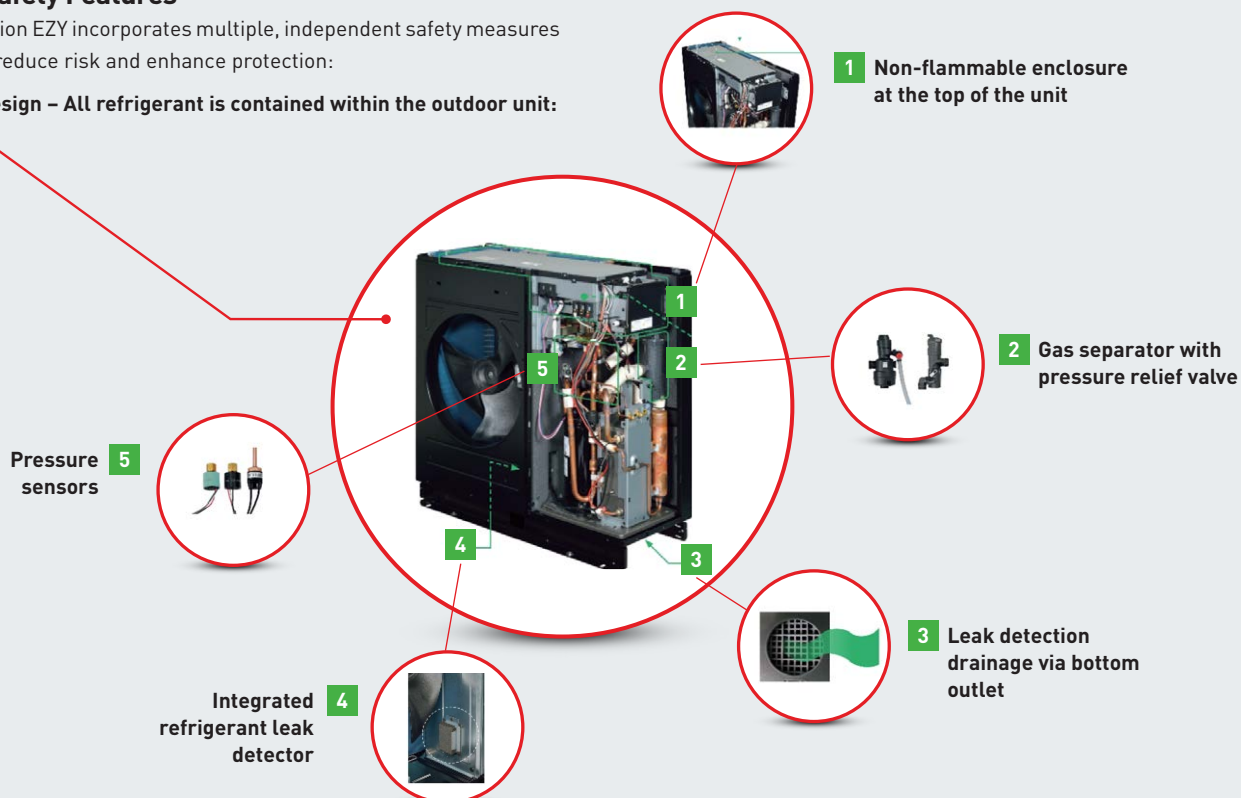
<https://mhiae.com/suppliers>

INSTALLATION & SERVICE

Built-In Safety Features

The Hydrolution EZY incorporates multiple, independent safety measures designed to reduce risk and enhance protection:

Monobloc design – All refrigerant is contained within the outdoor unit:



These features ensure that, even in the unlikely event of a refrigerant leak, safety is maintained while allowing the system to operate efficiently.

For further details, please refer to page 10 of the **Hydrolution EZY brochure**.

Considerations when working with R290 Refrigerant

For R290 refrigerant to reach flash point, the following conditions must be present:

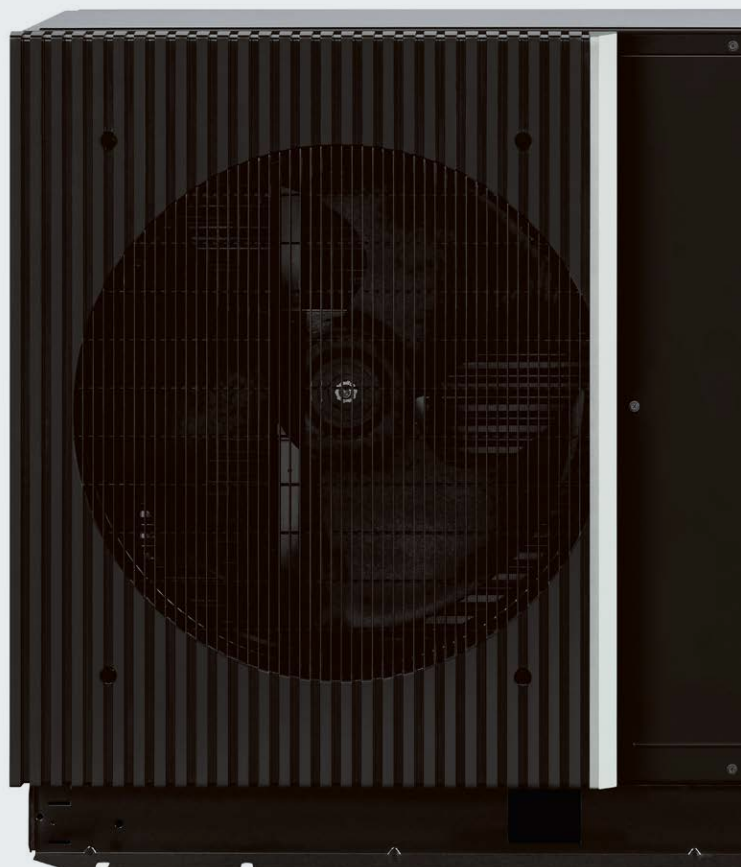
- Refrigerant leakage
- Flammability concentration range* of 2.2% to 9.5% (**LFL to UFL)
- Ignition source

* Flammability concentration = refrigerant concentration range

** LFL - lower flammability limit
UFL - upper flammability limit

Ensure the correct and safe handling of R290; please always read the safety guidelines prior to working and adopt best practice.

Always refresh your knowledge on how to safely handle R290.



HYDRAULIC CONNECTION OF HYDROLUTION EZY

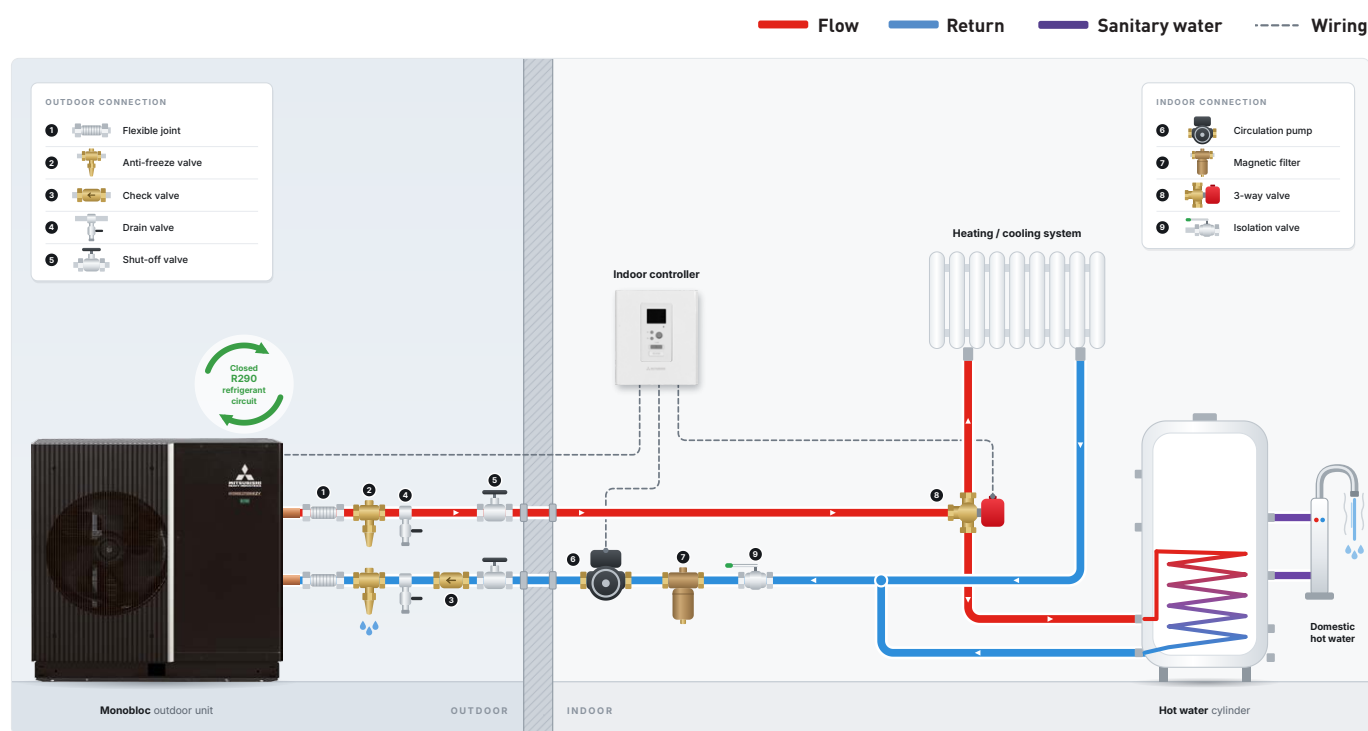
The Hydrolution EZY outdoor unit is equipped with a 3-bar safety relief valve and an integrated gas separator. All refrigerant is contained within the outdoor unit, with only water circulating between the indoor and outdoor components.

The hydraulic circuit connected to the outdoor unit must be fitted with the necessary protection devices to ensure safe and reliable operation. These include flexible connections, an anti-freeze valve, drain valves, and isolation valves. A check valve must be installed on the return water pipework to the outdoor unit (supplied by MHI).

The indoor hydraulic system typically incorporates a circulation pump, a 3-way valve, and the necessary insulation of pipework and components. Air vents should be installed at all high points within the hydraulic system to facilitate effective air removal.

Outdoor and indoor connections

Valves and accessories on each side of the wall — from the monobloc outdoor unit to the heating/cooling system and domestic hot water



R290 Refrigerant charge

FDCM60VNX-P	0.65kg
FDCM71VNX-P	0.85kg
FDCM100V(S)NX-P	1.30kg
FDCM140V(S)NX-P	1.60kg

Water quality

— System water	JRA water quality standards (JRA GL-02-1994)
— Sanitary water quality	EU directive 98/83/EC

⚠ Glycol must not be used as the heating medium

Schematic diagram. Pipe connection positions differ on the actual units and will vary on site.

The installation of a magnetic filter is also strongly recommended to maintain water quality, protect system components, and improve long-term reliability.

The recommended water quality throughout the system must comply with the requirements of JRA GL-02-1994 Water Quality Standards.

OBSERVE PROTECTIVE ZONES

The safety or protective zone is the controlled area around the heat pump that must remain free from ignition sources and features that could allow propane to collect, such as drains, pits, or enclosed openings.

Electrical equipment and other potential ignition hazards within this zone must be suitably protected or positioned outside the zone to ensure safe operation in the event of a refrigerant leak

KEY	UNIT	POWER
FDCM60	FDCM60VNX-P	Single phase
FDCM71	FDCM71VNX-P	Single phase
FDCM100	FDCM100VNX-P	Single phase
FDCM100	FDCM100VSX-P	Three phase
FDCM140	FDCM140VNX-P	Single phase
FDCM140	FDCM140VSX-P	Three phase

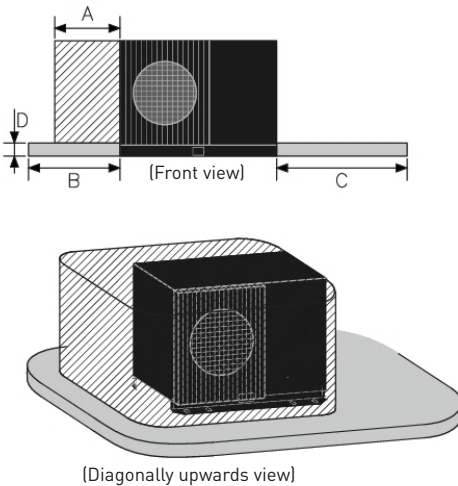
Important:

It is the responsibility of the installer or service engineer to ensure that they comply with local and national regulations at all times.

Work should only be carried out in accordance with the manufacturer's recommendation. For the Hydrolution EZY range, please refer to the user/installation manual.

OUTDOOR UNIT - PROTECTIVE ZONES

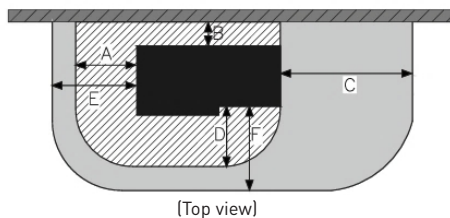
1. Ground installation/flat roof at open areas



Unit height
Height on the bottom side of the unit

Protective zone for ground installation at open areas				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	500	500	500	500
B	600	700	800	1100
C	800	1000	1100	1300
D	100	100	150	150
E	500	600	800	1000
F	500	700	800	1000
G	500	700	800	1100

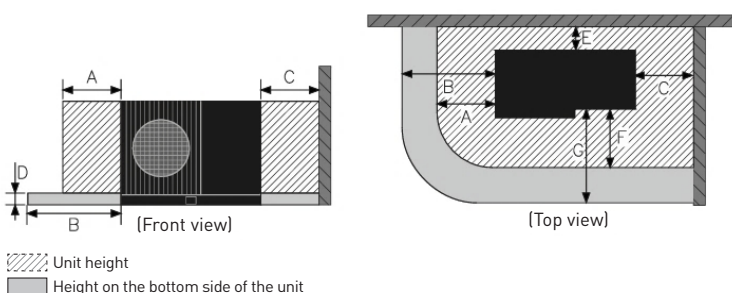
2. Ground installation in front of a wall



Unit height
Height on the bottom side of the unit

Protective zone for ground installation in front of a building wall				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	500	500	500	500
B	200	200	200	200
C	900	1100	1200	1500
D	500	500	500	500
E	600	700	900	1100
F	500	700	900	1000

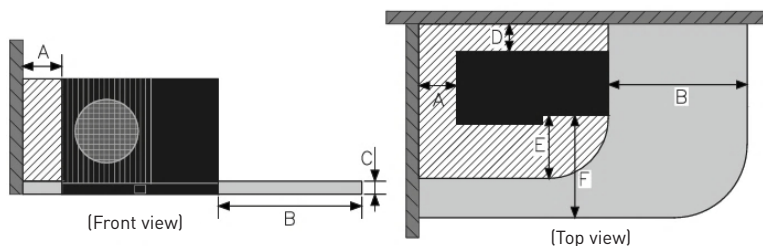
3. Ground installation in a building corner



Unit height
Height on the bottom side of the unit

Protective zone for ground installation in a building corner (right)				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	500	500	500	500
B	600	800	1000	1200
C	500	500	500	500
D	100	100	150	150
E	200	200	200	200
F	500	500	500	500
G	600	800	1100	1400

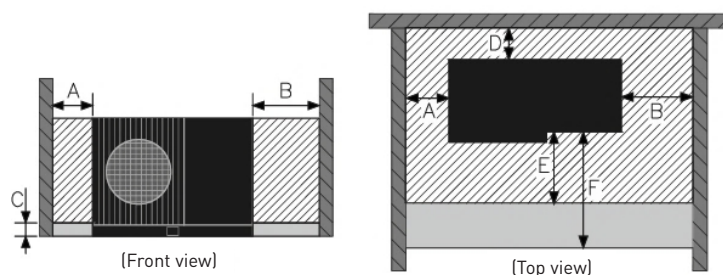
4. Ground installation with building on left corner



Unit height
Height on the bottom side of the unit

Protective zone for ground installation in a building corner (left)				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	300	300	300	300
B	900	1100	1300	1600
C	100	100	150	150
D	200	200	200	200
E	500	500	500	500
F	500	700	900	1300

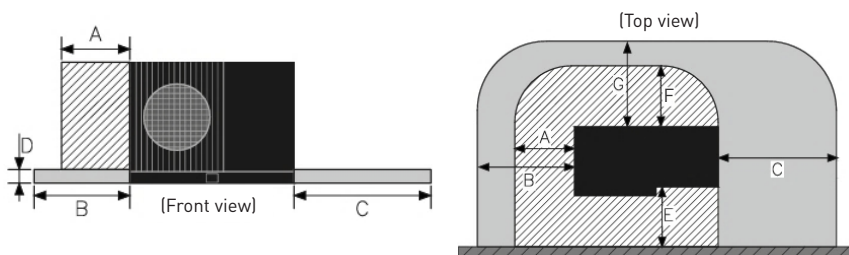
5. Ground installation enclosed by walls on 3 sides



Unit height
Height on the bottom side of the unit

Protective zone for ground installation surrounded by 3 sided wall				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	300	300	300	300
B	500	500	500	500
C	100	100	150	150
D	200	200	200	200
E	500	500	500	500
F	600	800	1200	1500

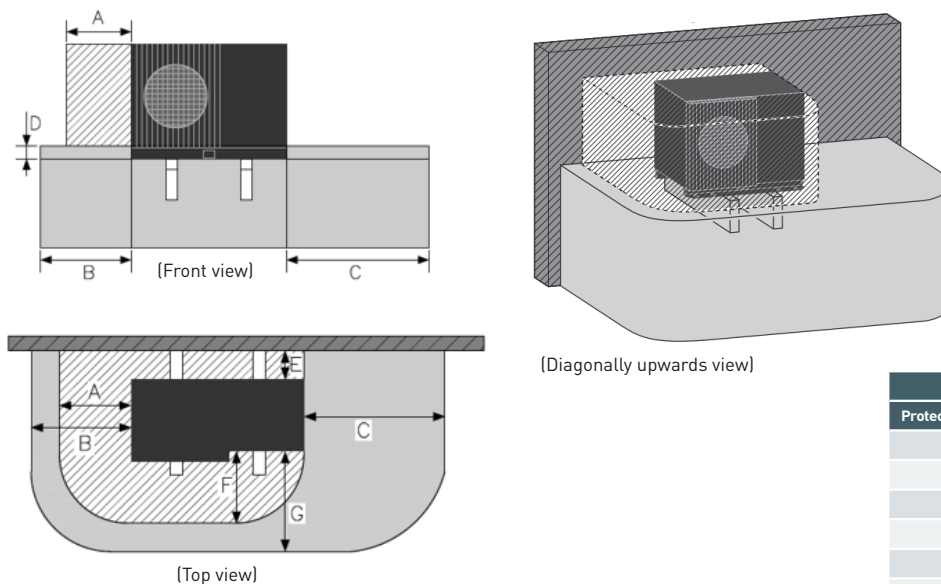
6. Ground installation facing a building wall



Unit height
Height on the bottom side of the unit

Protective zone for ground installation facing a building wall				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	500	500	500	500
B	700	800	900	1100
C	900	1000	1100	1300
D	100	100	150	150
E	500	500	500	500
F	500	500	500	500
G	600	700	800	900

7. Elevated installation



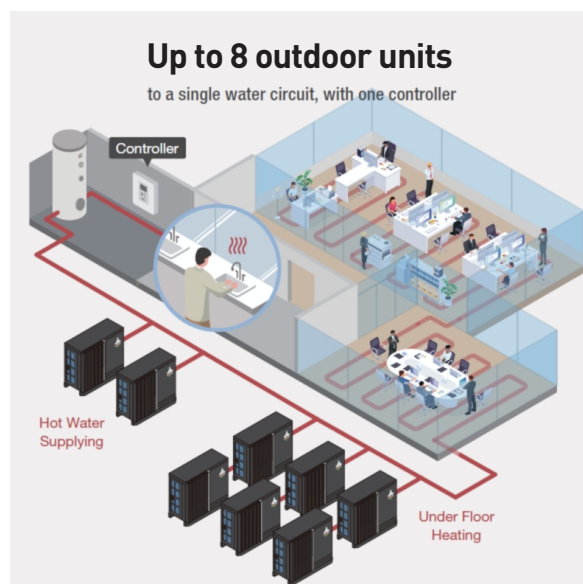
Unit height
Height on the bottom side of the unit

Protective zone away from ground installation (wall)				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	500	500	500	500
B	600	700	800	1100
C	800	1000	1100	1300
D	100	100	150	150
E	500	600	800	1000
F	500	700	800	1000
G	500	700	800	1100

CASCADE FUNDAMENTAL INFORMATION

With Hydrolution EZY it is possible to have a cascade connection with up to 8 units with the following units:

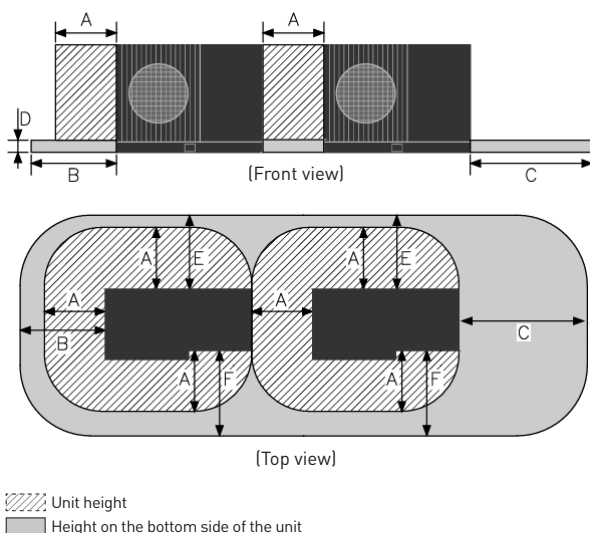
- FDCM60VNX-P
- FDCM71VNX-P
- FDCM100VN(S)X-P
- FDCM140VN(S)X-P



Cascade is only possible with RC-HY40-W

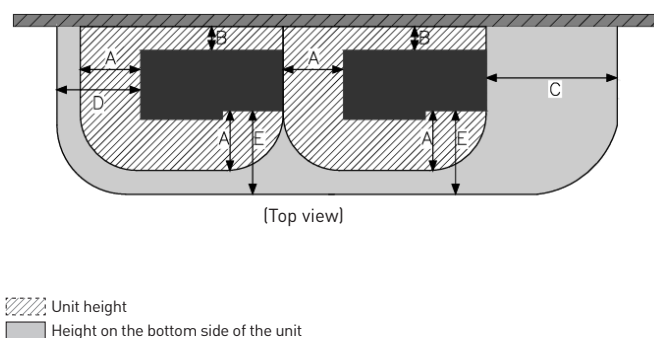
PROTECTIVE ZONE FOR CASCADE CONNECTION

1. Ground installation/flat roof at open areas



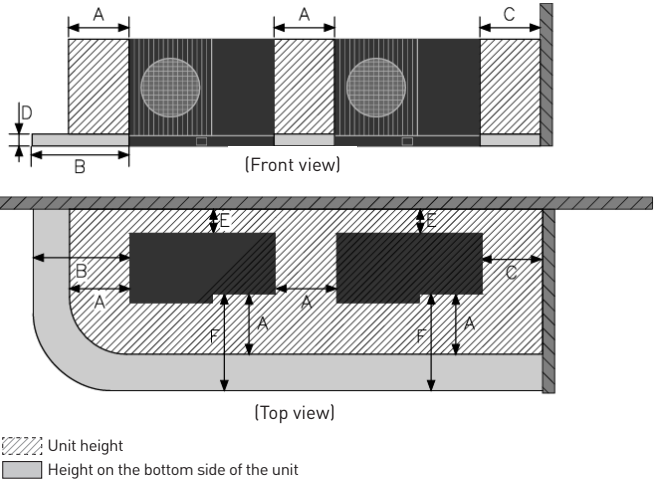
Protective zone for ground installation at open areas				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	500	500	500	500
B	600	700	800	1100
C	800	1000	1100	1300
D	100	100	150	150
E	500	600	800	1000
F	500	700	800	1000

2. Ground installation in front of a wall



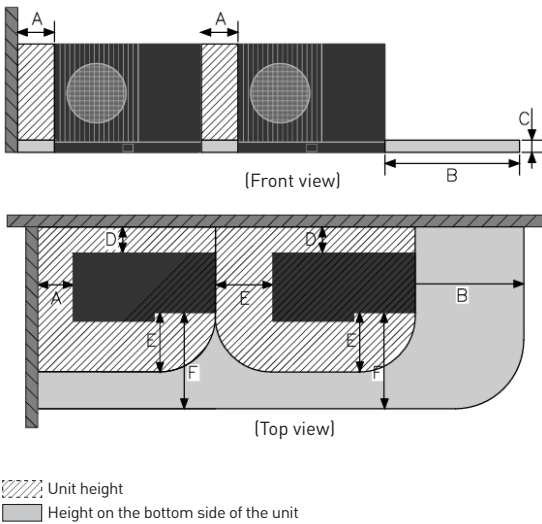
Protective zone for ground installation in front of a building wall				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	500	500	500	500
B	200	200	200	200
C	900	1100	1200	1500
D	600	700	900	1100
E	500	700	900	1000

3. Ground installation in a building corner



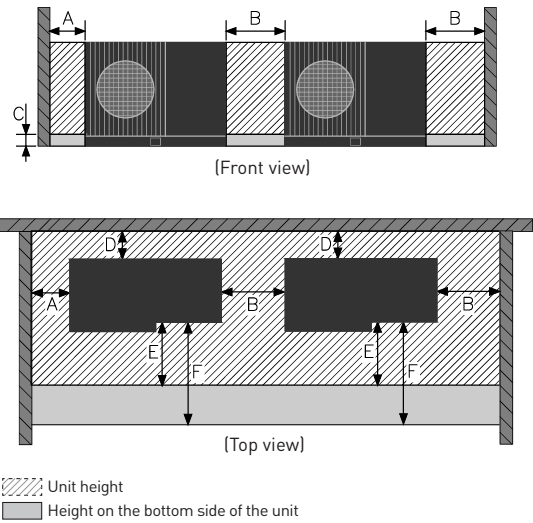
Protective zone for ground installation in a building corner (right)				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	500	500	500	500
B	600	700	900	1100
C	500	500	500	500
D	100	100	150	150
E	200	200	200	200
F	600	800	1100	1400

4. Ground installation with a building on left corner



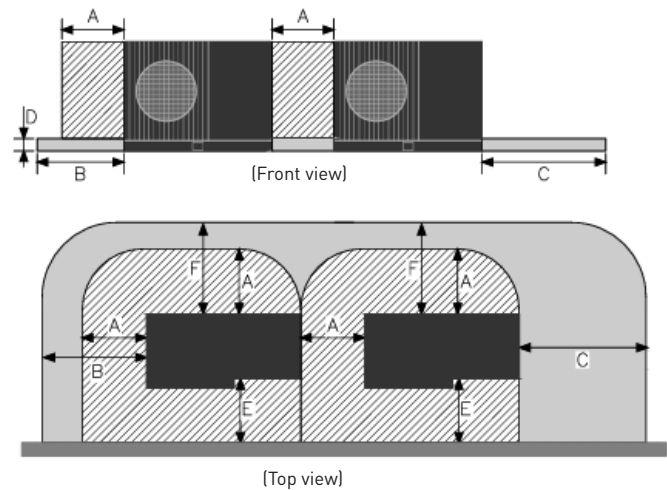
Protective zone for ground installation in a building corner (left)				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	300	300	300	300
B	600	700	900	1100
C	100	100	150	150
D	200	200	200	200
E	500	500	500	500
F	500	800	900	1300

5. Ground installation enclosed by walls on 3 sides



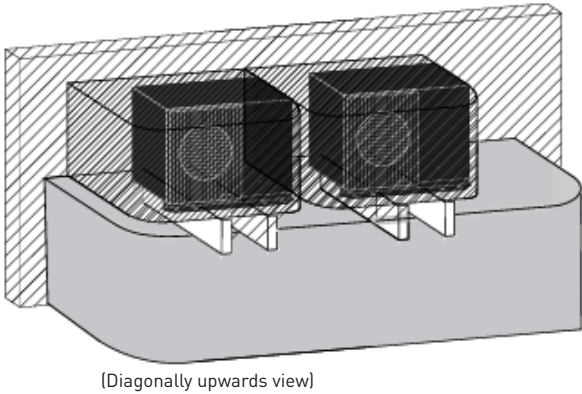
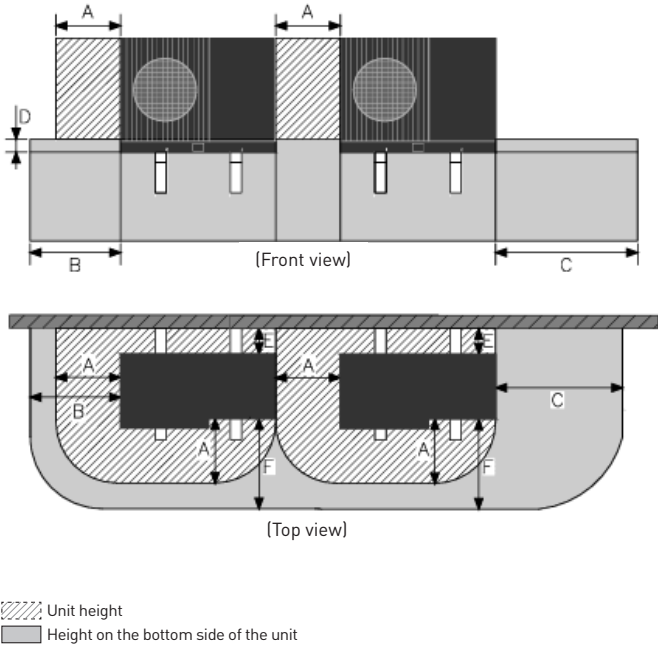
Protective zone for ground installation surrounded by 3 sided wall				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	300	300	300	300
B	500	500	500	500
C	100	100	150	150
D	200	200	200	200
E	500	500	500	500
F	600	800	1200	1500

6. Ground installation facing a wall



Protective zone for ground installation facing a building wall				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	500	500	500	500
B	700	800	900	1100
C	900	1100	1100	1300
D	100	100	150	150
E	500	500	500	500
F	600	700	800	900

7. Elevated installation



Protective zone away from ground installation (wall)				
Protection area	FDCM60	FDCM71	FDCM100	FDCM140
A	500	500	500	500
B	600	700	900	1100
C	900	1100	1200	1300
D	100	100	150	150
E	200	200	200	200
F	600	700	900	1000

PROTECTIVE ZONE

Protective zone must always be adhered to in all installation scenarios.



This image illustrates, as an example only, an installation where the required safety zone is maintained to prevent any leaked R290 refrigerant from entering the building through openings such as windows, doors, escape hatches, cellar entrances, ventilation openings, or drainage channels. The protective zone is also kept clear of potential ignition sources, including light switches, electrical sockets, control switches, and other electrical equipment.

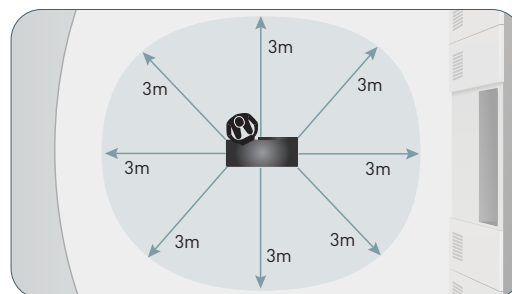
Image is for illustrative purposes only.

A SAFE WORKING ENVIRONMENT

Managing a R290 refrigerant leak

In the unlikely event of a R290 refrigerant leak, we recommend **not to turn on/off** any electrical devices, as they could ignite.

Sources of ignition		
	• Electrical sockets	• Contactors
	• Light switches	• Timers
	• Pressure switches	• Brazing torches
	• Thermostats	• Matches/open flame
	• Compressor relays	• Cigarettes/E-cigarettes/Vapes
	• Overloads	• Static electricity



The above ignition sources need to be kept away from the 3m protective zone.

How to Ensure a Safe Working Environment

It is critical that installers and service engineers create a safe working environment. To achieve this, they must adopt a number of measures before commencing works.

1. Installers/service engineers should familiarise themselves with R290 safety datasheet
2. Conduct a site survey to ensure good ventilation in the area
3. Ensure a 3m safety/protection zone around the unit is established, removing all possible sources of ignition
4. Never smoke or vape within the safety zone
5. Conduct leak testing: use soapy water, leak detection fluid, or an electronic leak detector
6. All works must only be carried out only by a qualified person
7. Be sure to inform end users if the unit contains R290 refrigerant
8. Ensure that a suitable fire extinguisher (CO2 or dry powder) is readily available in the vicinity



**FIRE
EXTINGUISHER**

WEAR PROTECTIVE CLOTHING

MHIAE recommends that before commencing any work that involves the use of R290 refrigerant, installers / service engineers must protect themselves and others by wearing the following personal protective equipment (PPE) at all times.



SAFETY GLOVES
(ANTI-STATIC)



SAFETY GLOVES
(PROTECT FROM
REFRIGERANT)



**SAFETY
FOOTWEAR**
(ANTI-STATIC)



SAFETY GLASSES



**LONG SLEEVED
WORKWEAR TOP**

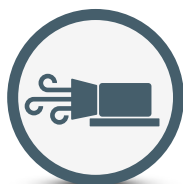
Using the Correct Tools

Not only does MHIAE recommend that installers / service engineers wear the correct PPE clothing, but we also advise that they use the correct tools when working with R290 refrigerant.

- Gauge manifolds – only use manifolds which are compatible with R290
- Recovery machine and exhaust fan – that is compliant with A3 refrigerant or ATEX Certified.
- Vacuum pump suitable for A3 refrigerant



LEAK DETECTOR



EXHAUST FAN



VACUUM PUMP

Safety When Charging Systems

Please follow the below principles when safely charging R290 systems:

- Keep charging lines as short as possible to minimise the risk of flammable refrigerant escaping
- Use charging lines that are factory fitted with a ball valve at one end
- Never part-charge or add refrigerant to a system that is already part-loaded
- Do not mix different refrigerants



CYLINDER
R290

Health & Safety/First Aid

When handling refrigerants, appropriate health and safety procedures should be followed at all times. Below are some best practice guidance that should be observed:

- **Inhalation of refrigerant:** immediately move into fresh air
- **If breathing changes:** seek immediate medical attention
- **Direct skin contact:** run affected area under cold/tepid water for at least 15 minutes and seek immediate medical attention
- **Direct eye contact:** Flush the eye(s) with cold/tepid water for at least 15 minutes and seek immediate medical attention

Setting Users up for Success!

Once correctly installed and commissioned, it is recommended the homeowners notify their home insurance provider of the newly installed solution.



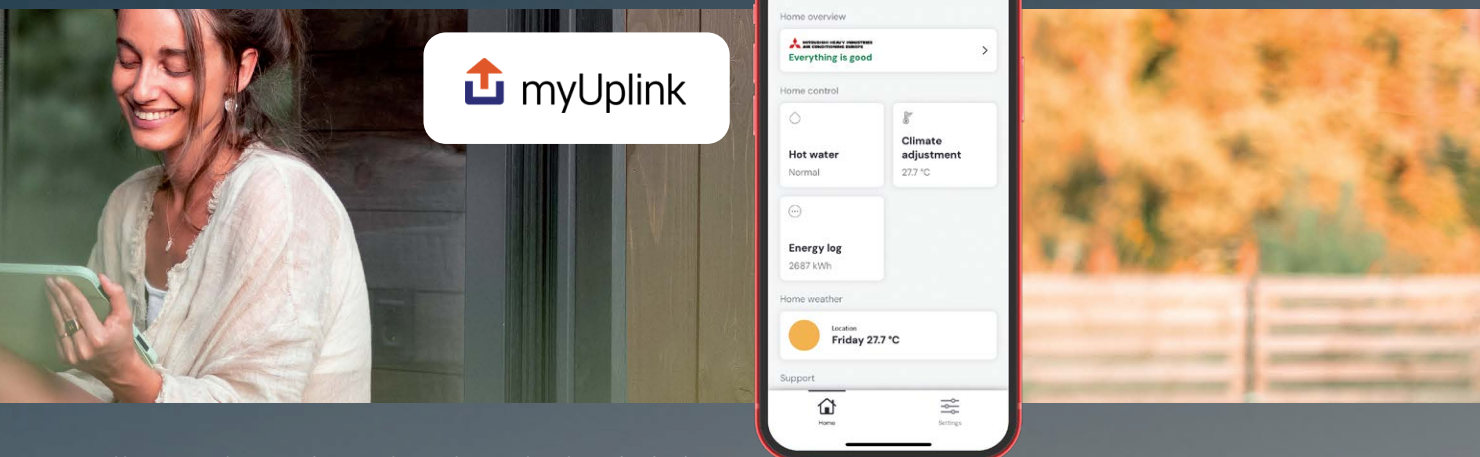
MYUPLINK

MHIAE offers the ultimate in monitoring and safeguarding with myUplink. The Hydrolution EZY unit seamlessly interfaces with an independent remote monitoring system via the myUplink platform, a dedicated platform tailored for users.

This sophisticated system empowers users to remotely oversee and control the Hydrolution EZY unit, enabling real-time monitoring of its performance, identification of maintenance requirements and ensuring optimal efficiency.

Key features of myUplink

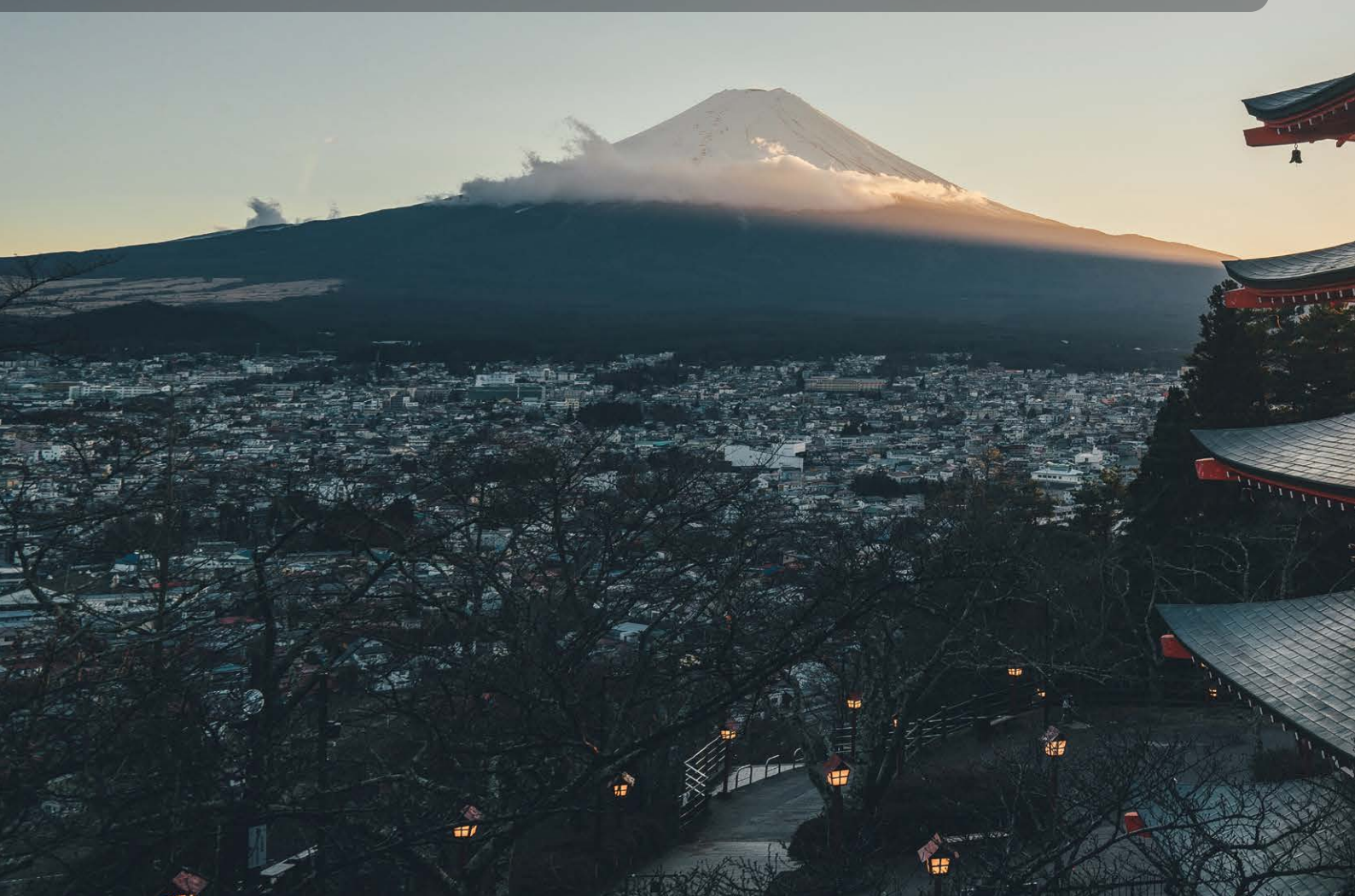
- Real-time accurate performance monitoring
- Real-time leakage alerts
- Easy to use app to control the system – for user comfort



Users can also experience enhanced control and monitoring*

- **Status Overview** – offers a detailed overview to the health of the heat pump
- **Heating Level Control** – users can control and adjust heating and hot water production to meet their requirements
- **Instant Notifications** – receive on-the-go notifications via text and email, alerting you to any issues, allowing you to take appropriate action

**This is a paid for monthly subscription*



USEFUL RESOURCES & FURTHER READING

Manual links – www.mhi-mth.co.jp/en/products/detail/air-conditioner_users_manual.html

Brochure links – www.mhiae.com/brochures

Kigali Amendment – www.undp.org/chemicals-waste/conventions/kigali-amendment

Montreal Protocol – www.unep.org/ozonaction/who-we-are/about-montreal-protocol

ADR Regulations – www.unece.org/adr-2025-files

ISO 817 – www.iso.org/standard/83452.html

ASHRAE 34 – www.ashrae.org/technical-resources/bookstore/ashrae-refrigeration-resources

RECYCLING & DISPOSAL

At MHIAE we strongly advise that users, installers and service engineers familiarise and abide by local recycling practices, at the end of a system's life. For further information regarding the correct recycling/disposal guidance, please refer to the user manual.

Your responsible actions, ensure a safe and environmentally-friendly disposal of our refrigeration systems.





R290 HYDROLUTION EZY BROCHURE



READ OUR LATEST HYDROLUTION EZY CASE STUDY



OUR YOUTUBE CHANNEL

www.youtube.com/@mitsubishiheavyindustriesa2689

We provide our YouTube channel which has useful video demonstrations and animations.



OUR WEBSITE

<https://mhiae.com/>

If you wish to learn more about our products, please visit our website.

Distributor details:

Mitsubishi Heavy Industries Air Conditioning Europe Ltd, 5 The Square, Stockley Park, Uxbridge, UB11 1ET

Disclaimer: This guide is intended for general information purposes only and does not replace professional training courses, competence, risk assessment, or judgment required for the safe installation, commissioning, servicing and maintenance of R290 equipment. Installers, service engineers and end users remain responsible for complying with all applicable regulations, standards, codes of practice and manufacturer instructions.

While every effort has been made to ensure the accuracy of the information provided, Mitsubishi Heavy Industries Air-Conditioning Europe, Ltd. (MHIAE) reserves the right to make changes to the content without notice.

MHIAE make no representations or offer warranties, express or implied, regarding its accuracy, completeness, reliability, or suitability and accept no liability for any loss, damage, or injury arising from its use or reliance upon it.

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HYDROLUTION EZY

Mitsubishi Heavy Industries Air-Conditioning Europe, Ltd. (MHIAE) holds certification under the European Heat Pump KEYMARK Scheme. The validity and current status of this certificate can be verified through the official Heat Pump KEYMARK certified products database: <https://keymark.eu/en/products/heatpumps/certified-products>