Mitsubishi Electric Guide to F Gas Regulations and the Future of Refrigerants

Information Guide 85

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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

Introduction

The F Gas Regulations were developed by the European Union to phase down the use of fluorinated (F) gases within its member countries. F gases are powerful greenhouse gases, which trap heat in the earth's atmosphere, contributing to global warming and climate change. The aims of the Regulations are to cut the use of F gases and to reduce their release into the atmosphere.

The Regulations particularly focus on the most common type of F gas, HFCs (hydrofluorocarbons). Under the Regulations, each HFC is allocated a global warming potential (GWP) number to reflect its impact on the environment. GWP indicates how much heat is trapped by a mass of the HFC compared to a similar amount of carbon dioxide. The higher the GWP, the greater its potentially damaging impact on the environment.

The F Gas Regulations also introduced other requirements for equipment containing HFCs. These include regular checks, leakage reduction, training and certification of individuals handling HFC-using products.

Although the F Gas Regulations were introduced by the EU in 2006, the original form of the legislation did not accomplish the significant reduction in emissions that was intended. As a result, the EU introduced a new version of the F Gas Regulations in 2014 (517/2014) with the aim of achieving a 79% cut in emissions across the EU by 2030. This is to be carried out through a phase down process that gradually reduces the amount of HFCs permitted onto the market.

In February 2024, the European Union adopted an updated version of the F Gas regulations (officially titled *Regulation 2024/573 on fluorinated greenhouse gases*). This revised legislation put in place a steeper phase down programme for higher GWP refrigerants than its predecessor.

EU figures show that the refrigeration and air conditioning sectors are by far the largest users of HFCs. Hence the air conditioning sector has been significantly impacted by F Gas Regulations. Manufacturers have adapted to the rules and developed products that make use of new generations of low-GWP refrigerants - and continue to do so as the phase down of HFCs continues.

The introduction of more environmentally friendly refrigerants into the air conditioning sector is welcome, but creates challenges for installers, specifiers, and designers. Lower-GWP refrigerants have different performance characteristics and there are implications for costs, energy efficiency, installation, and maintenance of those systems.

It is therefore important to understand the F Gas regulations as they impact the UK, and what they mean for developments in refrigerants and the performance of air conditioning equipment in buildings.

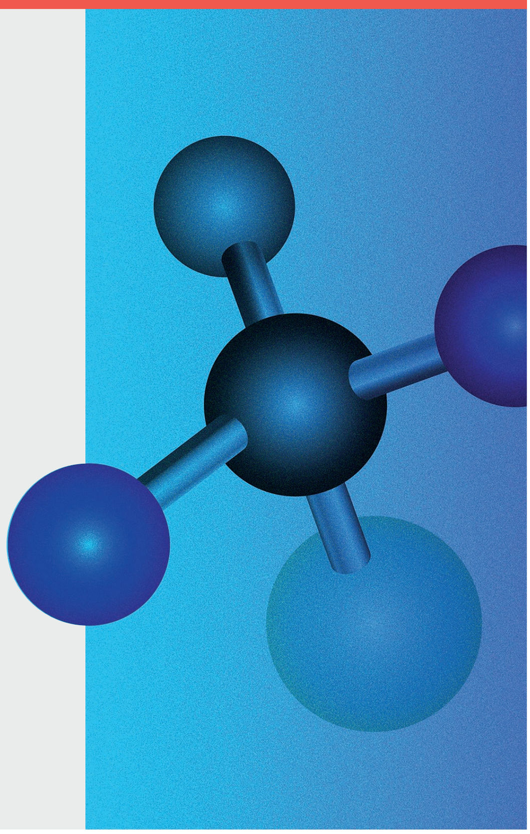
CALCULATING THE **CARBON DIOXIDE EQUIVALENT QUANTITY** OF AN **F GAS**

The UK government[1] offers a method for calculating carbon dioxide equivalent for an F gas[1]. This is an indication of how much a gas contributes to global warming relative to CO_2.

The amount in tonnes of CO_2 equivalent is the mass (in tonnes) of F gas multiplied by the GWP of that gas. For example, the global warming potential of HFC 404A is 3,922.

The tonnes CO_2 equivalent of 10kg of HFC 404A is:

1. Mass in tonnes of F gas multiplied by GWP of F gas
2. = (10/1000) x 3,922
3. = 39.2 tonnes CO_2 equivalent



1. F Gas Regulations in the UK

Because the UK left the European Union, the EU F Gas Regulations have not applied in the UK since January 2021. F Gas regulation is now overseen by DEFRA (the Department for Environment, Food & Rural Affairs). However, the UK continues to use the same schedule as the EU to phase down HFCs and the UK government has stated that it will follow the updated EU path in future, although this will probably lag by six to twelve months.

When the European Union proposed the updates to its phase down programme, in December 2023 Lord Carrington addressed a question to the government on its "proposed timescale for the consultation and review of F Gas regulation."

In January 2024, Lord Benyon, Minister of State for DEFRA replied to this question: "We are in the process of reviewing the GB F Gas Regulation and intend to consult on proposed changes in due course."

Lord Benyon added that: "Any consultation on proposals for change will allow sufficient time for industry to share views on aspects such as the safety of those alternatives."

The current UK objective therefore reflects the pre-2024 EU programme: a 79% reduction in F gases by 2030 against a baseline of the average volume of HFCs on the market between 2009 and 2012. This rule applies across England, Scotland, and Wales. Northern Ireland continues to follow the EU F Gas Regulations.

F Gas Regulations in the UK will not change the process of phase down, although there are now UK-based IT systems in operation to manage quotas and report on usage. Any company placing F gases, or products that use them, onto the EU market must comply with EU rules.

Phase down - understanding quotas

The phase down process under F Gas, is based on the concept of quotas. The Regulations do not restrict particular HFCs, instead, they focus on reducing the total amount of HFCs on the market in terms of their 'CO_2 equivalent'. This method influences the market to focus on cutting the use of the F Gases with the highest global warming potential.

Table 1 shows the current UK the planned phase down of HFCs from 2015 to 2030. The percentages shown here represent the proportion of HFCs allowed onto the market against the reference average (calculated as the average volume on the market between 2009-2012.

For example, between 2021 and 2023 the Regulations limit the total amount of HFCs on the market to 45% of the average amount on the market between 2009-2012.

Time period	Percentage of maximum HFCs on the market
2015	100%
2016 - 2017	93%
2018 - 2020	63%
2021 - 2023	45%
2024 - 2026	31%
2027 - 2029	24%
2030	21%

(Table 1: Figures from Regulation (EU) 517/2014)

Future phase-downs in the European Union

Although the UK has not yet adopted the 2024 EU F Gas regulation, it is important to consider the new programme of phase downs adopted across the EU in February 2024, as it will have an impact on systems specified and installed in the UK. The overarching aim of the EU programme is to phase out the consumption of hydrofluorocarbons (HFCs) by 2050.

Time period	Previous overall phase-down percentage	EU phase down programme adopted in February 2024
2021 - 2023	45%	
2024 - 2026	31%	23.6%
2027 -2029	24%	10.1%
2030	21%	5%
2048		2.38%

Table 2

It is useful to look in some detail at the impact of these changes on HVAC products, as their impact will be felt in just a few years here in the UK.

In addition to the overall phase-down schedule, the updated EU F Gas regulation text introduces a full ban on placing several categories of products containing HFCs on the market. These include HVAC equipment such as chillers and heat pumps. (More details on the products affected are given in Section 2 of this Guide.)

Although the UK is not an EU member, the impact of updated F Gas regulations will be considerable. They will affect the availability of HVAC equipment and the price of refrigerants since most are imported via the EU. This will impact the design of new HVAC systems as well as the maintenance of installed equipment.

Other requirements under F Gas

Refrigerant phase down is only one aspect of these regulations. The objective of the requirements is to reduce the likelihood that any HFCs can leak into the atmosphere, impacting the environment. As a result, there is also a focus on checking systems that incorporate HFCs and ensuring that anyone who handles a refrigerant is properly qualified to do so.

The Regulations therefore require:

- Prevention of F gas release (intentional or unintentional)
- Minimisation of leaks and timely repairs when detected
- Regular leak checks and record-keeping. In some cases, leak detection systems are required (e.g., where R32 is present - see below for more details)
- Recovery of F gases for recycling, reclamation, or destruction when equipment is decommissioned or repaired
- Restriction of the sale of equipment to businesses that do not hold relevant qualifications
- Correct product and equipment labelling

In the UK, handling F gases requires registration on a government-recognised scheme. One example is REFCOM, which is part of the Building Engineering Services Association (BESA). It is vital to check that anyone installing or maintaining air conditioning equipment is correctly certified and registered.

Since the F Gas Regulations control HFCs allowed onto the market, the government must keep track of imports and production. To do this, any company producing or bulk importing HFCs equivalent to 100 tonnes or more of CO_2 must register with the government for an F gas account and apply for a quota. The application must be made annually, and there is a time limit on applications (for example, the window to apply for HFCs quotas in 2022 closed in August 2021).

Once a business has a quota, it may use that to import or produce the HFCs. Alternatively, the business may transfer its quota to another gas producer or authorise an equipment manufacturer or importer to use its quota.

It is against the law to place HFCs on the market if a business does not have the correct amount of quota. Breaking the law can result in a fine or a quota penalty. The Environment Agency can remove 200% of the amount illegally imported from the applicant's quota allowance in the next year and beyond, until the penalty is spent.

2. The Impact of Refrigerant Phase Downs

According to the European Environment Agency (EEA)[2] the phase down process is having the desired effect in reducing use of fluorinated greenhouse gases.

Figures indicate that in 2020 across the EU, the placement of HFCs on the market was 4% below the market limit set by the F Gas Regulations. In fact, all the available quotas were not required to meet available demand from importers and manufacturers. The market is adapting to a low-GWP future.

We are currently six years from the target year of 2030, with several significant phase-down steps ahead. It is useful to consider what that might signify for allowable GWP levels in HFC refrigerants as we move into the future.

The market estimate of the average GWP level of refrigerants placed on the market in 2013 is around 2300 CO_2-equivalent[3]. With this starting point, the percentage figures can be translated into average CO_2-equivalent consumption figures for each year. Table 3 below shows the potential impact this may have in the coming years:

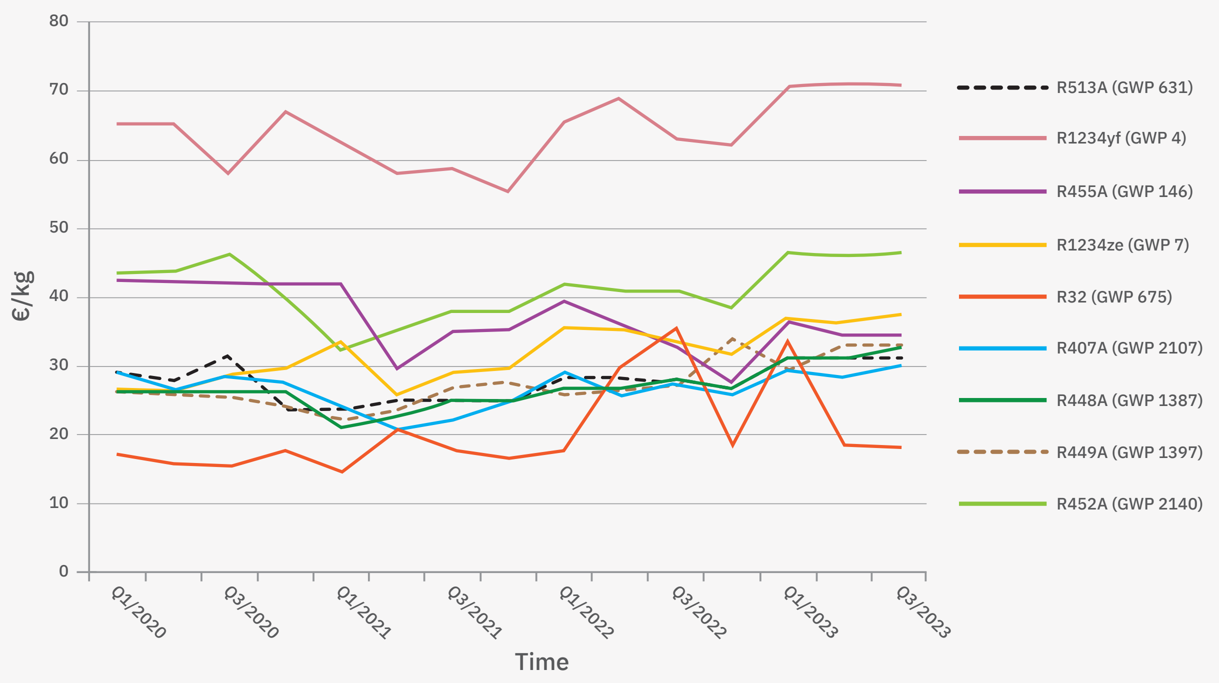
Time period	Phase-down percentage	Average CO_2-equivalent
2015	100%	2300
2016 - 2017	93%	2139
2018 - 2020	63%	1449
2021 - 2023	45%	1035
2024 - 2026	23.6%	543
2027 -2029	10.1%	232
2030	5%	115
2048	2.38%	55

Table 3

One of the reasons that the Regulations have been successful is their impact on refrigerant availability and pricing. At each stage of phase down, the higher-GWP refrigerants have become less readily available on the market, leading to steep or widely variable price rises in many cases.

This has led designers, installers, and end-users to seek out refrigerants with less volatile pricing, with a view to future-proofing their air conditioning systems from uncertain pricing for maintenance, for example. Graph 1 shows the fluctuating prices of refrigerants from January 2020 to March 2023. The pattern is that as another phase-down stage approaches, the prices of higher GWP refrigerants tend to rise and fluctuate. In the longer term, it becomes more costly to maintain systems using higher GWP refrigerants as they are removed from the market.

Refrigerant Prices



Graph 1: Source: European Commission Monitoring of Refrigerant Prices against the background of Regulation No 517/2014

Refrigerants in use today - and tomorrow

The air conditioning market has already seen the impacts of changing refrigerant use. For example, as higher GWP refrigerants were phased out, we have seen increased use of R410A (GWP 2088) and R32 (GWP 675).

Manufacturers are also introducing low and lower GWP to the market in a range of products including VRF and chillers. These refrigerants include hydrofluoro-olefins (HFOs) which are proving increasingly popular with specifiers and end-users. Table 4 highlights some of these new refrigerants:

Refrigerant	GWP	Notes
R1234ze	7	HFO
R1234yf	4	HFO
R513A	631	A blend of R1234yf and R134a
R454b	466	A blend of R1234yf and R32
R32	675	HFC

Table 4

In addition to the overall phase-down schedule, the updated EU F Gas regulations include a full ban on placing several categories of products containing HFCs on the market. These include HVAC equipment such as chillers and heat pumps.

The information shown in the tables below is taken from Annex IV (parts 4, 5, 7, 8 and 9): *Placing on the market prohibitions referred to in Article 11 (1)*. It is clear that the new regulation will greatly impact the type of refrigerants and equipment available to specifiers and installers.

i) Chillers - Ban 7

Chillers are defined as a single system whose primary function is to cool a heat transfer liquid such as water, glycol, brine or CO_2) for refrigeration, process, preservation or comfort purposes.

X <= 12 kW at 150 GWP	1st January 2027
X <= 12 kW full F Gas prohibition	1st January 2032
X > 12 kW at 750 GWP	1st January 2027

ii) Self-contained air conditioning and heat pump equipment except chillers (including chillers with the primary function of providing heat) - Ban 8

Here, the term 'self-contained' refers to a complete, factory-made system in a suitable frame or encasing which is fabricated and transported complete, or in two or more sections. No gas-containing parts are connected on site, but the product may contain isolation valves.

X <= 12 kW at 150 GWP	1st January 2027
X <= 12 kW full F Gas prohibition	1st January 2032
12kW < X ≤ 50kW at 150 GWP	1st January 2027
X > 50 kW at 150 GWP	1st January 2030

iii) Split air conditioning and heat pump equipment - Ban 9

A 'split system' in the documentation refers to a system consisting of a number of refrigerant piped units that form a separate but interconnected unit. These require the installation and connection of refrigerant circuit components at the point of use.

Split Air-to-Water

X <= 12 kW at 150 GWP	1st January 2027
X <= 12 kW full F Gas prohibition	1st January 2035
X > 12 kW at 750 GWP	1st January 2029
X > 12 kW at 150 GWP	1st January 2033

Split Air-to-Air

X <= 12 kW at 150 GWP	1st January 2029
X <= 12 kW full F Gas prohibition	1st January 2035
X > 12 kW at 750 GWP	1st January 2029
X > 12 kW at 150 GWP	1st January 2033

Maintenance is also covered (Article 13 Control of use) with a ban on the use of F gases with a GWP of 2500 or more to service or maintain refrigeration equipment with a charge size of 40 tonnes of CO_2 equivalent or more (in force from 1st January 2025).

Reclaimed and recycled F gases above the GWP threshold can be used until 1st January 2030 providing they have been correctly labelled. And they may only be used by the organisation which carried out the recovery as part of maintenance or servicing.

In addition, from 1st January 2026, the use of F gases with a GWP of more than 2500 and listed in Annex I of the document, is banned for the servicing and maintenance of air conditioning and heat pump equipment. Reclaimed and recycled F gases above the GWP threshold can be used until 1 January 2032.

As noted previously, although the UK is not an EU member state, the impact of updated F Gas regulations will be considerable. They will affect the availability of HVAC equipment and the price of refrigerants since most are imported via the EU.

3. Specifying air conditioning for today's buildings

Changes to the regulations on the use of HFCs are set against a backdrop of growing demand for occupant health and comfort in buildings. Providing good indoor air quality and high levels of comfort are considered must-have requirements for modern workplaces. And with rising temperatures in the UK, there has never been a greater focus on specifying the right systems for today's buildings.

Designers and contractors must balance several considerations when making their choices, particularly for modern office spaces. As more businesses switch to hybrid working for employees, there are new demands on working space to be increasingly flexible and the provision of services such as cooling, heating and hot water must match those requirements. Landlords who are keen to attract increasingly discerning tenants are also offering facilities such as in-house gymnasiums and showering facilities - requiring a greater provision of readily-available hot water in workplaces.

Added to this is the drive to decarbonise heating and hot water production across all building types. Government has put the use of heat pumps high on the agenda for homes and non-dwellings, so we are increasingly seeing the use of refrigerant-based equipment for these services in place of traditional gas boilers. We are also set to see increased application of heat networks, particularly in cities. Modern ambient heat loops are making the application of water-to-water heat pumps in these loops much more achievable – lowering the carbon footprint of several buildings at once.

There is also a growing interest in the embodied carbon of buildings, and the equipment in them. A proposed new Part Z of the Building Regulations which will set requirements for embodied carbon is being explored in 2022 and government is supportive of this move. This will affect building services equipment which can represent a significant proportion of embodied carbon in a commercial building, which includes the refrigerants in cooling systems.

CIBSE has introduced **TM65: Embodied Carbon in building services a methodology**[4] which provides an approach to calculating the embodied carbon of building services. It is important to note that the type and volume of refrigerant have the most significant impact on the embodied carbon of an HVAC system.

At the same time, other regulations are placing greater emphasis on energy efficiency and lower carbon in our buildings. For example, the new Part L of the Building Regulations (2021) requires that new non-dwellings achieve a 27% cut in carbon emissions against the 2016 Part L.

There are also a growing number of local requirements for major projects to demonstrate long-term energy efficiency. For instance, the London Plan requires major new projects to submit data on energy use for five years after completion. Commercial landlords may also face new requirements for Minimum Energy Efficiency Standards (MEES). The minimum EPC rating of E used to apply to new tenancies only, but from 2023 it applied to existing leases. And from 2027 the government is proposing to raise the required minimum EPC to C, and from 2030 that will rise to a minimum of B, however there may be some delay to this change.

That said, corporate tenants are increasingly pushing the targets on energy use in buildings, as they seek to meet their organisational targets for carbon reduction. One example is the growing popularity of EUI (Energy Use Intensity) as a measure for buildings. An advantage of EUI is that it measures actual building energy use (unlike EPCs which are theoretical.) Groups including CIBSE and the UK Green Building Council are promoting EUI as a more useful measure for designers, building owners and occupants. And with a more accurate measure of energy use, the performance of HVAC systems comes into sharp focus - which includes refrigerant selection.

In addition to these drivers, the UK government is also exploring the launch of a new scheme that will rate commercial and industrial buildings (over 1,000m^2) on actual metered energy use and carbon emissions. The proposed title for this scheme is the Property Energy Efficiency Rating Scheme (PEERS).

The choice of refrigerant type impacts the energy performance, carbon emissions and embodied carbon of an air conditioning or heat pump system, so it should therefore be a significant factor in system choice. The long-term implications of the decision can also be financial, given that the F Gas Regulations continue to lower the availability of higher GWP refrigerant. No client wants to be left with an air conditioning or heat pump system that cannot be easily and cost-effectively maintained because the refrigerant is expensive and difficult to purchase.

CIBSE

4. Working with low-GWP refrigerants

The choice of air conditioning system will impact the type of refrigerant that can be applied, and vice versa. The continued push to lower-GWP refrigerants is likely to diverge across the different applications and markets leading to significant changes. This progression may even open manufacturers and specifiers to consideration of A3 (flammable) refrigerants for certain applications.

For example, we can categorise refrigerants as low density or high density. Low density refrigerants include R1234ze and R513A are useful in screw compressor and Turbocor systems. On the other hand, high density refrigerants such as R32 and R454B are good for use in inverter-driven systems and fixed speed applications respectively. There are also natural refrigerants such as carbon dioxide and propane to consider in modern systems. Table 5 below gives an indication of some of the important low-GWP refrigerant characteristics.

Low Density Refrigerants	Characteristics	
R1234ze (GWP 7, HFO)	■ Zero environmental impact ■ Small reduction in capacity ■ Efficiency remains the same	■ Increase in cost ■ A2L refrigerant
R513A (GWP 630)	■ Reduced environmental impact ■ Negligible change in efficiency and capacity when using same components as R134a	■ Cost neutral ■ A1 refrigerant

High Density Refrigerants	Characteristics	
R32 (GWP 675)	■ Efficiency remains the same ■ Capacity increases ■ Technology only available for small inverter-driven compressors	■ Cost neutral ■ Specified due to availability of small DX compressors using inverters to manage higher discharge temperature
R454B (GWP 466)	■ Increase in efficiency ■ Small increase in capacity ■ Technology only available for larger, fixed-speed compressors	■ Cost neutral ■ Can be used as a 'drop-in' for R410A chillers ■ Specified due to ready availability of components for manufacturer of cooling equipment

Natural Refrigerants	Characteristics	
R744 - CO_2 (GWP 1)	■ Naturally occurring and safe (non-flammable) ■ Widely used as refrigerant in cars and also available in HVAC equipment (e.g., heat pumps)	■ Cost-effective ■ High pressures required in systems using R744, so must be designed in and not used as a replacement
R290 - Propane (GWP 3)	■ Used in industrial refrigeration for many years; known domestically in use for outdoor heaters and cookers ■ Low GWP ■ Non-toxic	■ Good thermodynamic properties, making it highly energy efficient in systems ■ Flammable

Table 5

In the next five to ten years, we are likely to see a mix of refrigerants coming onto the market. For example, a switch to hydrocarbon refrigerants for split systems and small heat pumps. For VRF and larger split systems, A2L refrigerants seem a more likely option; and HFOs for chillers and heat pumps. And carbon dioxide (CO_2) is already used as a refrigerant for hot water heat pumps such as Mitsubishi Electric's Ecodan QAHV.

New refrigerants and safety requirements

As the industry adopts new refrigerants, there are new safety implications to consider. As REFCOM points out: "The downside to lowering the GWP of a gas tends to be the increasing flammability or related issues".[5]

Table 6 below gives some indication of relative GWP and flammability designations. The refrigerant R410A has been widely used in the industry for many years and has been popular because of its stable performance as a refrigerant. However, its higher GWP (2088) means that it will shortly be phased out and replaced with low-GWP alternatives, including natural refrigerants such as carbon dioxide (CO_2 or R744).

Refrigerant	GWP	Safety Class ISO 817; Ped (EU)
R1234ze	7	A2L (mildly flammable)*
R513A	631	A1 (non-flammable)
R1234yf	4	A2L (mildly flammable)
R454b	466	A2L (mildly flammable)
R32	675	A2L (mildly flammable)
R290 (Propane)	3	A3 (higher flammability)
R744 (CO_2)	1	A1 (non-flammable)
R410A	2088	A1 (non-flammable)

Table 6

Notes: *For storage and transportation purposes R1234ze is effectively A1 because it is non-flammable below 30°C. However, the official safety classification is A2L and it should be handled with that in mind.

The levels of flammability are indicated by designations such as A1 (non-flammable) and A2L (mildly flammable). These are terms adopted from the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) that are recognised globally. 'Mildly flammable' indicates that the refrigerant is difficult to ignite, has a relatively low energy release and a low flame spread.

All refrigerant-using projects must have a DSEAR (Dangerous Substances and Explosive Atmosphere Regulations) risk assessment carried out at an early stage by a qualified person.

Furthermore, use of refrigerants is also impacted by the Standard BS EN378: Refrigerating systems and heat pumps. The Standard relates the size of an occupied space with the amount of refrigerant allowed within that space. This is dependent not only on the size of the space, but also the type of refrigerant. One of the requirements of BS EN378 can be that refrigerant leak detection is installed (which can increase project costs).

For example, BS EN378 restricts the amount of A2L refrigerants that can be used in occupied spaces, which can make the application of R32-based VRF systems in hotels, for example, challenging unless a hybrid VRF system is applied (see below).

However, in recognition of the changing landscape of refrigerant types, in February 2022 the European Commission announced a review of EN378. The proposal is to explore new standards on safety and use with the objective of smoothing the way for the application of low-GWP refrigerants in future.

RECOVERY, RECYCLING, RECLAIMING

These three terms are often used in relation to refrigerants and the maintenance of air conditioning systems. It is useful to understand what they mean. It is important to note that recovery, recycling, and reclamation should only be carried out by properly certified personnel who are certified under REFCOM or a similar scheme.[6]

1. RECOVERY.

Recovery involves collecting the refrigerant from a system and storing it in an approved container. This can be carried out during maintenance or at the system's end-of-life.

The correct equipment must be used to carry out recovery (particularly in the case of A2L refrigerants such as R32).

2. RECYCLING.

This refers to the re-use of certain refrigerants after they have undergone a basic cleaning process to remove oil, water vapour and particulate matter.

3. RECLAIMING.

Means processing a refrigerant to return it to a state where it will match the performance of a 'virgin' refrigerant. The process is usually carried out by a manufacturer.

5. Air conditioning and heat pump systems that use low-GWP refrigerants

Over the past decade, air conditioning manufacturers have extended the range of low-GWP options for specifiers, making it possible to find the right solution for most building types.

For example, Mitsubishi Electric has developed several chiller options which use low-GWP refrigerants such as R32 or HFO 1234ze. Designing a product around a refrigerant ensures that the equipment makes the most of those characteristics, ensuring excellent energy efficiency and robust performance.

For specifiers considering VRF, the low-GWP R32 refrigerant is also available. One way to avoid the requirements of EN378 for leak detection within occupied spaces is to opt for a hybrid VRF (HVRF) approach. This keeps the R32 refrigerant between the outdoor unit and hybrid branch controller box (often located in a restricted access area) only, using water as the medium for transferring cooling or heating into occupied spaces.

Not only does R32-based HVRF remove the need for leak detection, but it also uses significantly less refrigerant than a traditional VRF system. As a result, the overall carbon footprint of the equipment is reduced, and ongoing maintenance costs (including replacement of refrigerant) are also reduced.

The HVRF system is also highly flexible, making it an excellent choice for Cat A to Cat B projects. It's also straightforward to extend the system, providing future options for building owners who need to respond to changing tenant requirements. One example of this is the Mitsubishi Electric City Multi HVRF system which has been installed successfully in a variety of buildings including hotels and offices.

6. The future is low GWP

As we move towards 2030 and beyond, our use of low-GWP refrigerants will increase. However, there are now plenty of options for designers and installers to select that will not only meet the requirements of F Gas Regulations, but that also offer high energy efficiency, easy maintenance, and flexibility for the modern building.

The Building Regulations 2023 are putting the spotlight on competence and safety compliance (for all buildings, not just high risk buildings). So, tracking decisions around choice of refrigerant will be increasingly important. It will also be vital to ensure that any value engineering of projects does not result in refrigerant chance that impacts either the safety of installers or occupants, or system performance.

Although changes to the refrigerant landscape may result in some challenges, they also provide an opportunity to innovate. By embracing the low-GWP approach today, it's an opportunity to adopt modern systems that will deliver excellent performance for end-users and building occupants tomorrow. Mitsubishi Electric is supporting its clients through this process and has a future roadmap of products which will comfortably meet the new regulations.

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   For full details on regulations covering reclamation, recycling and reclaiming see:
   https://www.refcom.org.uk/media/1203/tb_023_refcom-final.pdf

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Note: 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), R290 (GWP:3), R32 (GWP:675), R407C (GWP:1774), R134a (GWP:1430), R513A (GWP:631), R454B (GWP:466), R454C (GWP:148), 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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