



EU F-Gas Regulation Handbook 2024

The World's first HFC phase-out

The European Union's revised F-gas Regulation will support decarbonisation goals and drive innovation and green investment across a wide range of sectors, including heat pumps, the cold chain, healthcare and more.

The use of climate-damaging hydrofluorocarbons (HFCs) and other fluorinated gases (F-gases) in the EU is coming to an end, with the world's first total HFC phase-out scheduled for 2050. Mapping out a pathway to support the longer-term vision, many sectors are selected for early climate wins.

In February 2024, the EU adopted Regulation (EU) 2024/573 on Fluorinated Greenhouse Gases (hereafter EU F-Gas Regulation). This revised Regulation significantly strengthens the phase-down of HFCs when compared with the previous version (2014/517). The 2024 regulation includes a total HFC phase out by 2050 and accelerates the transition to natural refrigerant-based alternative technologies.

The EU F-Gas Regulation is part of the EU Green Deal and is expected to avoid approximately 500 million tonnes of carbon dioxide equivalence (CO₂e) by 2050.¹ This is equivalent to annual emissions from 129 coal fired power stations.²

The efficacy of the EU F-Gas Regulation comes from its comprehensive nature. Underpinned by an accelerated HFC reduction schedule with a 2050 phase-out, and building on the experience with the 2014 Regulation, regulators recognised the importance of additional demand reduction measures to guide the phase-out. These include further actions to prevent illegal trade, allocation fees for HFC quotas, additional bans on new HFC-based equipment in key

sectors (including air-conditioning, heat pumps and refrigeration), a prohibition on dumping inefficient and outdated HFC-based equipment in developing countries and mandatory training and certification of technicians on natural refrigerants.

The revision comes with significant benefits. A European Commission (hereafter Commission) assessment estimated economy-wide negative abatement costs (cost savings) of €36.3 per CO₂e tonne.³ Additionally, it avoids unnecessary use of per- and polyfluorinated substances (PFAS), harmful to human health, plants and animals, accumulating in soil and water for centuries.

It strengthens those EU industries that manufacture components and equipment relying on natural refrigerants, opening up the EU marketplace. It further strengthens competitiveness outside of the EU in countries undergoing a similar transition.

Finally, the EU F-gas Regulation will spearhead Europe's transition away from HFCs to natural refrigerants, paving the way for the global transition, setting the stage for more ambitious action under the Montreal Protocol to accelerate a worldwide phase-down of HFCs.

The final revision agreed by the European Parliament and the European Council is ambitious, despite enormous industry lobbying. This handbook details many of the key measures introduced by the Regulation. The key task ahead is to ensure its effective implementation.

EIA calls on manufacturers, technicians, end-users, enforcement authorities and policy-makers to prioritise measures which support the effective implementation of the EU F-gas Regulation. These are listed below.

Recommended actions needed to support implementation of the EU F-gas Regulation

Commission and Member States:

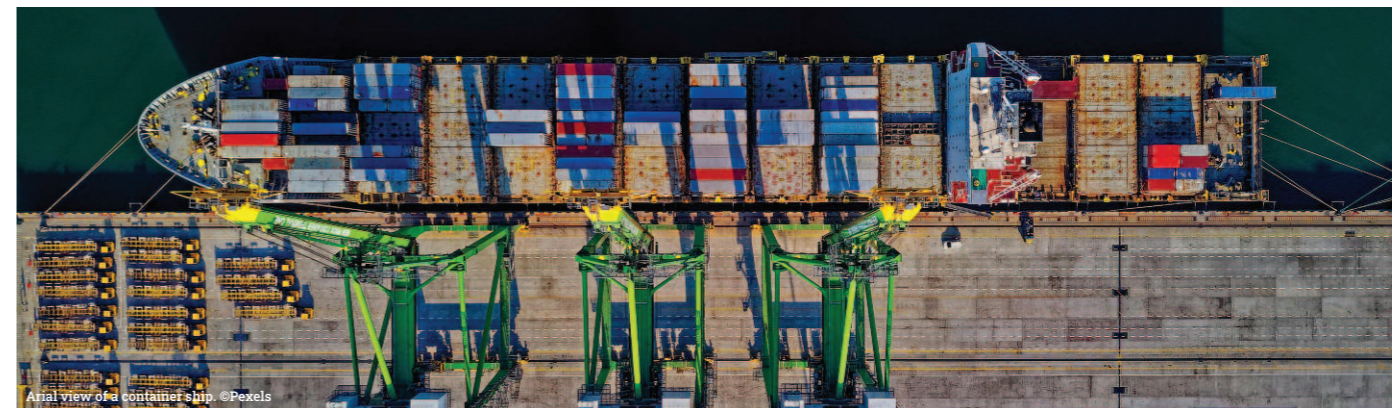
- Prioritise roll-out of expanded F-gas and F-gas alternatives training and certification programmes
- Develop extended producer responsibility schemes for financing the recovery, recycling, reclamation or destruction of F-gases contained in waste electrical and electronic equipment ahead of the 2028 deadline
- Introduce subsidies to accelerate the uptake of F-gas-free technologies, along the lines of those introduced for heat pumps by Germany,⁴ as well as terminating subsidies that still promote F-gas technologies
- Rapidly adopt key product standards at European and national levels to enable wider roll-out of natural refrigerant technologies
- Introduce procurement policies which ban use of F-gases
- Support science, research and innovation for F-gas-free alternatives with funding
- Ensure exemption requests are transparent.

Manufacturers:

- Prioritise R&D and roll-out of F-gas-free equipment and support uptake of natural alternatives to F-gases through manufacturer-led training programmes.

Installers and end-users:

- Rapidly transition cooling and heat pump equipment away from using very high global warming potential (GWP) (≥2500) HFCs to prepare for extended servicing bans coming into effect from 2025. EIA investigations show very high GWP HFCs are commonly smuggled into the EU, putting users of these gases at significant risk of purchasing illegal products⁵
- Take note of increased leakage and containment measures for all stationary and some mobile equipment using F-gases, including HFOs. Also note additional recovery requirements for most types of F-gas-based equipment including mobile sectors and foam panels.



Specific actions required for tackling illegal trade in HFCs

Ongoing illegal trade in HFCs threatens to undermine investment in green alternatives and decarbonisation efforts. Effective implementation of the F-gas Regulation is key to addressing this issue.

Member States:

- Designate customs offices to process imports of Annex 1 (HFCs and PFCs) gases and HFC-containing equipment, as well as opening closing of transit procedures
- Prioritise connecting national single windows to the F-gas portal, enabling customs to be able to check quotas in real time
- Update national penalties to take account of the significant environmental harm and profits made from HFC smuggling. For example, define smuggling as a criminal offence (in addition to an administrative offence) to give it a higher priority with police and public prosecutors offices
- Push for a joint, consistent, mandatory and effective coordination of harmonised implementation across all Member States as already successfully proven for REACH via the European Chemicals Agency's Enforcement Forum⁶
- Build knowledge and concentrate investigations and execution power on F-gases in one expert team. In Hessen, Germany, the "Climate Gases Competence Team" is very effective, where one police department always works together with the same public prosecution office..

Commission:

- Consider specifying criteria to be taken into consideration by competent authorities when carrying out checks
- Tackle the ongoing challenges associated with seizing non-quota HFCs once they are already placed on EU markets by introducing supply chain tracing methodologies
- Specify elements needed for the declaration of conformity required to prove a cylinder is refillable.

Customs:

- Ensure evidential requirements for placing F-gases on the market are fulfilled. These include: checking proof of HFC-23 by-product destruction, including information on the facility of origin, and ensuring documents of conformity indicating logistical arrangements of cylinder return along the full supply chain are correct. Where cylinders are deemed to be non-compliant, customs are required to confiscate and destroy them.

Other national competent authorities:

- Co-operate and alert each other to infringements. Ensure financial investigations are carried out alongside investigations of F-gas infringements to enable more substantive penalties to be applied
- Market surveillance has a key role to play in monitoring online sales of HFCs to ensure that non-compliant cylinders are removed.

Installers and users:

- Cognisant that illegal HFCs are frequently sold at below market prices on online marketplaces, purchasers should avoid buying cheap HFCs online. Non-quota HFCs not only lead to additional emissions but may be contaminated and adversely affect equipment performance and safety.

World's first HFC phase-out

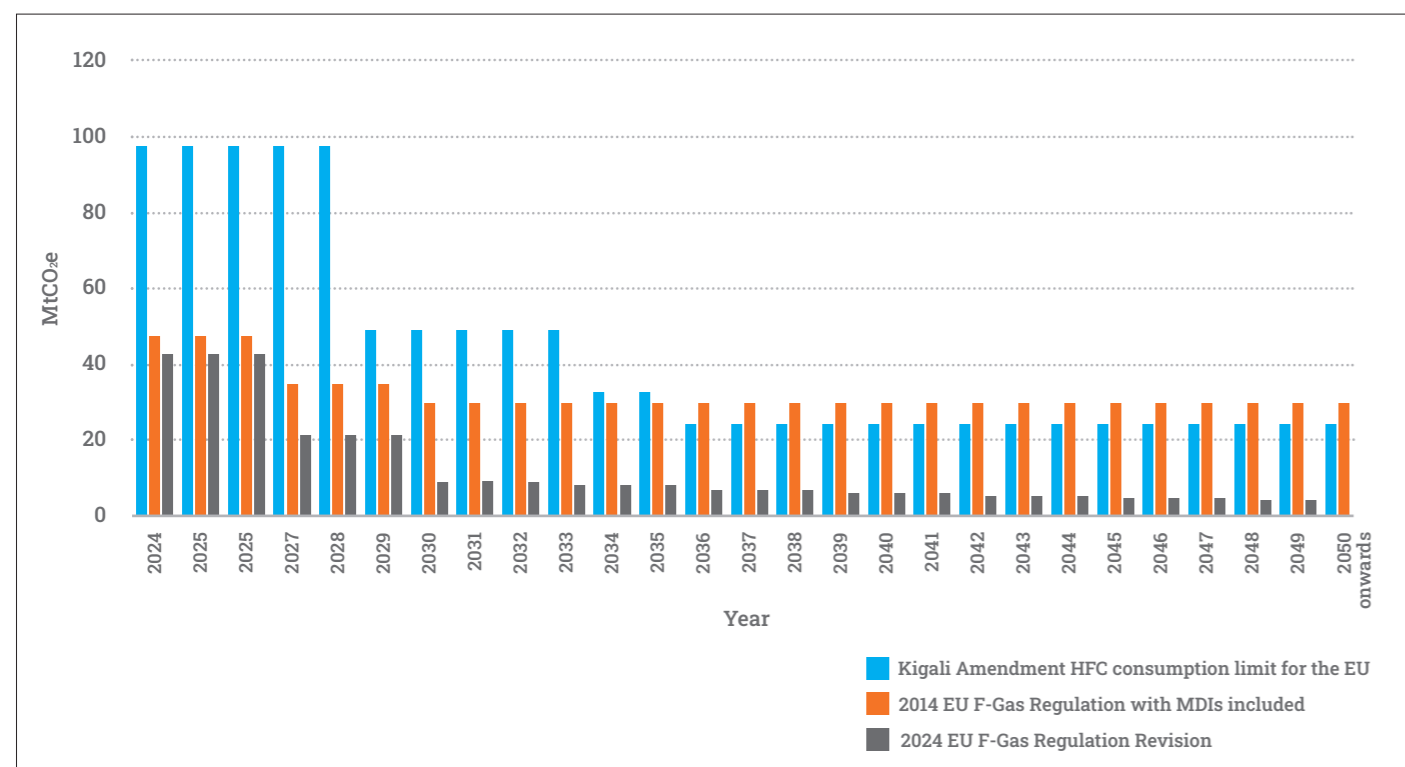
The main regulatory measure of the EU F-Gas Regulation is a quota-based HFC phase-down, an EU economy-wide progressive reduction of HFCs placed on the market each year based on carbon-dioxide equivalence (CO₂e).

The earlier Regulation, adopted in 2014, already boasted the most ambitious HFC phase-down schedule in the world, outpacing the required schedule for non-A5 (developed) Parties under the Kigali Amendment until at least 2034.

The latest revision significantly accelerates the reduction in consumption under the EU HFC phase-down from 2024 onwards, culminating in a complete phase-out of consumption in 2050.⁷

This represents the world's first HFC phase-out and sets the stage for an acceleration under the Kigali Amendment.

Figure 1: Comparison of allowed EU HFC consumption levels under the Kigali Amendment, 2014 EU F-Gas Regulation and 2024 EU F-Gas Regulation



Several other important changes to the HFC phase-down were made. HFC quotas, which were previously allocated for free, now cost €3 per CO₂e tonne. Although this price lies well below the current carbon price in the EU of about €68 per CO₂e tonne, the fee is anticipated to prevent abuse of the new entrants reserve and reduce illegal trade.⁸ The HFC phase-down now also covers metered dose inhalers (MDIs),⁹ which predominantly use HFC-134a and HFC-227ea, from 2027 onward.¹⁰ As a result, alternatives such as dry powder inhalers and soft mist inhalers, as well as low-GWP HFC alternatives, are expected to enter the market from 2025.¹¹

Prohibitions on new F-gas-based products and equipment

In Annex IV, the HFC phase-down is supported by bans on placing new HFC-based equipment on the market by specified dates. EU policymakers included several new prohibitions into Annex IV and, in some cases, banned all F-gases to spur a complete transition to natural refrigerant alternatives and hinder an uptake of fluorinated substitutes. The new bans are as follows:

Self-Contained Air-Conditioning and Heat Pump Equipment: prohibitions on F-gases GWP ≥ 150 in smaller (up to and including 12 kW) self-contained air-conditioning and heat pump equipment from 2027 and on all F-gases from 2032;¹² prohibition on F-gases GWP ≥ 150 in medium (>12 to 50 kW) self-contained air-conditioning and heat pump equipment from 2027; prohibition on F-gases GWP ≥ 150 in all other self-contained air-conditioning and heat pump equipment from 2030.¹³



Air conditioning units on a building exterior. ©Shutterstock

Split Air-Conditioning and Heat Pump Equipment: prohibition on F-gases GWP ≥ 150 in smaller (up to and including 12 kW) split air-to-water systems from 2027, on smaller split air-to-air systems from 2029 and on all F-gases in smaller split systems from 2035; prohibitions on F-gases GWP ≥ 750 in larger (above 12 kW) split systems from 2029 and on F-gases GWP ≥ 150 in larger systems from 2033.¹⁴

Refrigeration and Chillers: prohibition on all F-gases in domestic refrigerators and freezers from 2026;¹⁵ prohibitions on HFCs GWP ≥ 150 from 2022 and F-gases GWP ≥ 150 in self-contained refrigerators and freezers from 2025 and in all other refrigeration equipment from 2030;¹⁶ prohibition on F-gases GWP ≥ 150 in smaller (up to 12 kW) chillers from 2027 and on all F-gases from 2032; and prohibition on F-gases GWP ≥ 750 in larger (above 12 kW) chillers from 2027.¹⁷ (Note: This complements the prohibitions already in place, such as on F-gases GWP ≥ 150 in domestic refrigerators and freezers from 2015 and in multipack centralised refrigeration systems from 2022).

In those instances where the EU has prohibited all F-gases, this includes hydrofluoroolefins (HFOs), many of which are classified as per- and polyfluoroalkyl substances (PFAS) or 'forever chemicals' under the OECD definition¹⁸ which is the basis for the currently discussed restriction proposal within the EU Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation.

The persistent and additional mobile, bio-accumulative and toxic effects of PFAS have resulted in severe contamination of soil, water and food as well as harmful exposure to humans.¹⁹ Experts worldwide, including the European Chemicals Agency, have identified PFAS as a global threat to environmental and human health. Other sectors where all F-gases will now be prohibited include fire protection and personal care products from 2025, foams from 2033, technical aerosols from 2030 and medium voltage switchgear from 2030.²⁰

Heat pumps

Heat pumps are a key tool for the decarbonisation of heating in Europe. However, locking in HFC refrigerants in tens of millions of heat pumps will increase future climate impacts.

Heat pumps using ultra-low GWP PFAS-free natural refrigerant alternatives to HFCs not only reduce climate emissions through energy savings but also eliminate the climate and environmental impact of leaking refrigerant emissions from heat pumps.

As the EU rapidly decarbonises its electricity grid, the climate impact of leaking refrigerants during use and at end of life will proportionately grow.

Since the publication of the European Commission proposal for the revision which included product bans for high GWP refrigerants in heat pumps, the market began pre-emptively moving towards the natural refrigerant propane. Many major heat pump manufacturers began offering propane heat pumps in their portfolios, including Viessmann, Panasonic, LG, Daikin, Samsung, Bosch, Vaillant, AIT, Auer, Ecoforest, Hautech, Hoval, Thermocold, Clivet and NIBE, while Bosch,²¹ Viessmann,²² Groupe Atlantic,²³ Aira²⁴ and others announced production investments in the EU.

Anti-dumping measures

There is growing international concern over the 'dumping' of outdated cooling equipment in countries that lack the resources and capacity to properly handle and dispose of them.

Several developing countries have raised the problem at the Montreal Protocol of the export from other parties of inefficient refrigeration and air-conditioning appliances, using obsolete, high-GWP refrigerants, to their markets thus increasing servicing needs.²⁵

In response, the latest revision will prohibit the export of foams, technical aerosols, stationary refrigeration, stationary air-conditioning and stationary heat pump equipment with F-gases with a GWP ≥ 1000 to non-EU countries from March 2025.²⁶ Furthermore, exports of refrigeration, air-conditioning and heat pump equipment must not violate any import restrictions of which the Montreal Protocol has been notified.²⁷

Where a member state can prove that the economic value and the expected remaining lifetime of a specific good places a disproportionate burden on the exporter, the Commission can issue a derogation, provided that the export does not break any laws in the destination country.²⁸

Mandatory extended producer responsibility

The accumulation of F-gases in old equipment, also referred to as 'banks,' is a growing international concern. Ozone-depleting substances (ODS) and HFC banks are estimated to release 1.5 GtCO₂e emissions annually (equivalent to the emissions of 441 coal-fired power plants).²⁹ Addressing ODS and HFC banks is a multi-billion CO₂e tonne climate mitigation opportunity³⁰ and extended producer responsibility (EPR) could play an important role in preventing these emissions.³¹ However, the previous F-Gas Regulation did not include mandatory measures or minimum requirements for producer responsibility. As a result, in 2021 just five member states confirmed that a producer responsibility scheme was in place (Denmark, Estonia, France, Germany and Spain).³²

To tackle the issue, the revised regulation includes mandatory measures for EU member states to require extended producer responsibility by 2028 for financing the recovery, recycling, reclamation or destruction of F-gases contained in waste electrical and electronic equipment.³³

Proof of HFC-23 by-product destruction

HFC-23 is one of the world's most potent F-gases, with a GWP of 14,600. HFC-23 is created mostly as a by-product in the manufacture of HCFC-22, a key feedstock ingredient used in the manufacturing of many F-gases (including e.g. HFC-32, HFC-125, HFC-1234yf and HFC blends thereof).³⁴ Despite abatement technology existing, emissions of HFC-23 have been on the rise in recent years.³⁵

In line with Kigali Amendment requirements, under the previous EU F-Gas Regulation, placing HFCs on the market required evidence demonstrating that any HFC-23 produced as a by-product during the manufacturing process (including of feedstocks) had been destroyed or recovered. However, the obligation contained neither evidential nor reporting obligations, making it practically unenforceable.

The revision includes new requirements which prohibit producers and importers from placing F-gases on the EU market, unless evidence is provided to show that any HFC-23 by-product during the manufacturing process has been recovered or destroyed using best available technology.³⁶ The evidence must include the origin of the F-gases, the production facility of origin, including identification of any precursor substances which involve generation of HCFC-22, proof of availability and operation of approved HFC-23 incineration methods and additional information to facilitate the tracking of the gas prior to import.

Servicing ban

Given the number of natural refrigerant solutions, as well as lower-GWP HFC drop-in solutions, continued use of very high-GWP HFCs such as HFC-404A (GWP 4728) for servicing existing equipment is no longer necessary. The revision therefore prohibits the use of virgin F-gases with a GWP ≥ 2500 for servicing or maintenance of any refrigeration equipment (except for military equipment and equipment intended to cool below -50°C) from 2025. From 2030, the prohibition will extend to reclaimed and recycled F-gases with GWP ≥ 2500 .³⁷ From 2032, the prohibition will apply to virgin F-gases with GWP ≥ 750 , although chillers will be excluded.³⁸

Similar prohibitions have been put in place for the maintenance and servicing of air-conditioning equipment and heat pumps with virgin F-gases with GWP ≥ 2500 banned from 2026 and reclaimed and recycled F-gases with GWP ≥ 2500 banned from 2032.³⁹

Mandatory certification and training for natural refrigerants

One of the key barriers to the uptake of HFC-free technologies has been the lack of appropriately trained and certified installers and technicians. HFC alternatives, including natural refrigerants, have distinct properties that require specialised knowledge and training on handling them safely – namely flammability, high pressure and toxicity. The revision extends mandatory certification and training on the installation, servicing, maintenance, repair, decommissioning, leak checks and recovery to all F-gas alternatives including natural refrigerants.⁴⁰

Certification programmes must also provide information about promoting energy efficiency during installation and maintenance.⁴¹ German market data shows propane air to water heat pumps are, on average, seven per cent more efficient than HFC-based equipment, so certification programmes may provide guidance on the type of refrigerant and how it impacts energy performance.⁴² It is anticipated new certification measures will create new green jobs and accelerate the safe roll out of natural refrigerant alternatives.

The Commission will establish minimum requirements for certification programmes and training no later than 2 years after entry into force of the revision.⁴³ Member states then have one year to establish or adapt certification programmes and ensure that training is available.⁴⁴

Outdated standards and building codes have presented additional significant barriers to the uptake of climate-friendly alternatives relying on flammable natural refrigerants, such as hydrocarbons. Two revised standards have been published in recent years by the International Electrotechnical Commission (IEC) increasing the allowable charge size of flammable refrigerants. IEC 60335-2-89 on commercial refrigeration appliances (2019) and IEC 60335-2-40 affecting electrical heat pumps, air-conditioners and dehumidifiers (2022) are currently being incorporated into relevant European standards.

In order to mainstream these standards across the EU, the revision calls on Member States to ensure that national safety standards and building codes are updated in line with these IEC standards.⁴⁵



Customs trained by PROZON at Gdansk container terminal. ©PROZON Fundacja Ochrony Klimatu

Measures to prevent illegal trade and support compliance

Since 2015, HFC producers and importers have been required to hold a quota to be able to place HFCs on EU markets. As HFCs became scarcer, the market price of HFCs in the EU soared, reaching peaks of up to 13 times higher than pre-phase-down prices.⁴⁶ High prices increased potential profits for those smuggling non-quota HFCs from non-EU countries into Europe. In 2022 EU HFC prices were about five times higher than 2014 levels.⁴⁷ As the EU continues to tighten its HFC phase-out schedule, prices may rise further, increasing the likelihood of illegal trade and reinforcing the need to take strong measures to curtail it.

EIA first alerted the world to the problem of HFC climate crime in 2019, highlighting how companies were brazenly importing non-quota HFCs into the EU soon after the HFC phase-down under the EU F-Gas Regulation was implemented in 2015.⁴⁸

In 2021, EIA estimated that illegally traded HFCs in the EU could be as high as 30 million CO₂e tonnes – comparable to the annual emissions of driving 6.5 million petrol cars.⁴⁹ As well as leading to additional HFC emissions, the illegal trade slows the uptake of greener alternatives by perpetuating HFC demand.

The revised EU F-Gas Regulation offers additional measures and tools to combat illegal trade, including:

Connecting to EU Single Window: From March 2025, the Commission will ensure the interconnection of the F-gas Portal with the EU Single Window Environment for Customs and member states are required to do the same for their national single window environments for customs.⁵⁰ This will allow customs offices to verify that importers have adequate quota at the point of import.

Imports and licensing: Valid registration in the F-gas Portal at the moment of import or export is considered to be a licence.⁵¹ A valid licence must be presented to customs authorities in all cases of import and export of F-gases and relevant products and equipment, except in the case of temporary storage and personal effects.⁵² Import and export declarations must include the F-gas portal ID number, the Economic Operators Registration and Identification (EORI) number, the net mass of bulk gases and gases in products and equipment, commodity code and the CO₂e of bulk gases and gases in products and equipment and parts thereof.⁵³ All F-gases imported in the EU shall be considered as virgin gases.⁵⁴

Customs offices: To ensure that customs officers are adequately knowledgeable and have access to suitable equipment, member states must designate or approve customs offices for the presentation, at entry and exit, of Annex I F-gases (HFCs and PFCs) and pre-charged equipment containing these gases. Only designated offices are authorised to open or end a transit procedure.⁵⁵ Customs personnel at the offices are required to have knowledge of illegal trade in F-gases and have access to equipment needed in order to carry out physical controls.⁵⁶ Additionally, the European Commission is empowered to specify criteria to be considered by competent authorities when carrying out checks.⁵⁷

New entrants: To avoid abuse of the new entrants reserve, only those with three years of F-gas trading or servicing experience can apply for quota and must provide a physical address for their business, with only one undertaking allowed to be registered at the same address.⁵⁸

Cylinders: New definitions and requirements for non-refillable cylinders have also been introduced. Any cylinder placed on the market or distributed without a takeback provision is considered to be non-refillable. Importers of refillable containers must provide a declaration of conformity including logistical evidence of arrangements in place for the return of the container for refilling throughout its distribution network to the end user.⁵⁹ The Commission can, by means of an implementing act, specify elements needed for the binding arrangements.⁶⁰ Customs and market surveillance authorities are required to confiscate non-refillable containers.⁶¹

Penalties: Member states continue to have final say on penalties but in an effort to ensure penalties are adequately dissuasive and evenly applied across the EU, the revision now includes guidelines for setting these penalties. Penalties shall be effective, proportionate and dissuasive, taking into account the gravity of infringement, protection of human health and the environment, previous infringements and financial situation of the responsible undertaking.⁶² Penalties include administrative financial penalties and/or criminal penalties, confiscation and seizure and temporary prohibition from F-gas-related activities.⁶³ Furthermore, the revision includes maximum financial penalties of at least five times the market value of gases or equipment concerned and eight times the value for repeat infringements (within a five-year period).⁶⁴ Additionally, quota exceedance infringements will be penalised with a reduced quota allocation in the following allocation period of 200 per cent of the amount that quota was exceeded.⁶⁵

Re-export prohibition: The re-export of non-compliant F-gases is prohibited but authorities may take alternative measures to destruction including auctioning, provided the subsequent placing on the market is in accordance with the regulation.⁶⁶

Tracing: The revision allows the Commission to amend the regulation through a delegated act to adopt supply chain tracing methodologies.⁶⁷

Cooperation: To promote enforcement, the revision includes measures to increase cooperation and exchange of information between member states, customs authorities, market surveillance authorities, environmental authorities and other inspection authorities.⁶⁸ When an infringement is detected, competent authorities must alert relevant authorities, the Commission (if related to quota) and authorities in other member states if they are affected.⁶⁹ Checks for non-compliance must be carried out when authorities are alerted to evidence or information from the Commission, another member state, relevant authorities or substantiated concerns by third parties.⁷⁰ Checks shall include on-site visits and checks of online platforms.⁷¹



Technician checking air conditioning unit. ©Shutterstock

Measures to address SF6 emissions

Sulphur hexafluoride (SF6), used as insulation gas in switchgear, is the most potent greenhouse gas in the world, with a GWP of 25,200. Given the availability of F-gas-free alternatives, new bans in this sector have been included in the revision. Putting into operation of medium voltage electrical switchgear relying on F-gases from 2026 (up to and including 24kV) and 2030 (from more than 24kV and up to and including 52kV) is banned.⁷² Putting into operation high voltage switchgear using F-gases with a GWP of one or more is banned from 2028 (from 52kV up to and including 145kV) and 2032 (more than 145kV).⁷³ From 2035, the use of virgin SF6 for maintenance and servicing is prohibited.⁷⁴ Furthermore, leakage checks, emission containment and labelling requirements have been extended to cover SF6 in electrical switchgear.

Measures to reduce other F-gas emissions

The use of sulfuranyl fluoride (GWP 4,630) for fumigation must be accompanied by documentation of the use of capturing and collection measures by the operator. Where this is not technically or economically feasible, the operator must specify the reasons and keep the supporting evidence for five years.⁷⁵

From 1 January 2026, desflurane (GWP 2,540), used as an inhalation anaesthetic, is only permitted where less potent alternatives cannot be used for medical grounds.⁷⁶ Evidence of the derogation must be kept by the healthcare institute and the desflurane should be captured.

Containment and leakage

Direct emissions through leakage during the filling, operation and end-of-life handling of equipment is a significant cause of refrigerant gas emissions. Annual leakage rates during operation vary across subsectors from 0.3 per cent in domestic refrigeration, 15 per cent in commercial refrigeration central systems to 28 per cent in vans, 18 per cent in trucks and trailers and 40 per cent in ships.⁷⁷ To reduce direct emissions from leakage, the revision has tightened containment and leakage requirements.

Precautionary actions and leakage repair are required to be undertaken without undue delay.⁷⁸ Additionally, leakage check thresholds and frequencies have been revised from the previous regulation to cover all F-gases (previously only HFCs) and to tighten all requirements.⁷⁹

Leak checks are now required for stationary refrigeration, air-conditioning and heat pumps, fire protection equipment, organic rankine cycles and electrical switchgear as well as mobile equipment including refrigerated trucks and trailers, light duty vehicles, reefers and train wagons. Air-conditioning and heat pump systems in various types of mobile equipment, including trains and aircraft, are also included. Ships are currently still outside of the scope but there is a stipulation for the Commission to assess the feasibility of their inclusion when reviewing the implementation of the regulation.⁸⁰ Requirements for mobile equipment only apply from 2027.⁸¹

Equipment containing five tonnes or more of CO_{2e} of Annex I gases or 1 kg or more of Annex II Section 1 F-gases not contained in foams will require leak checks.⁸² The frequency will depend on the amount of gas contained and presence of leakage detection systems.

Hermetically sealed equipment does not need to be checked for leaks provided it is labelled and contains less than 10 tonnes of CO_{2e} of Annex I F-gases or less than 2 kg of F-gases Annex II Section 1 (for residential buildings the limit is less than 3 kg of F-gases).⁸³

Electrical switchgear does not need to be checked for leaks if it has a tested leakage rate of less than 0.1 per cent per year, is equipped with a pressure or density monitoring device with an automatic alert, or it contains less than 6 kg of Annex I F-gases.⁸⁴

Reporting

From April 2025, reporting limits are as follows:

Producers, importers and exporters of more than one tonne of HFCs, or 100 tonnes of CO_{2e} of other F-gases, during the preceding calendar year.⁸⁵

Undertakings which destroyed more than one tonne of HFCs, or 100 tonnes of CO_{2e} equivalent of other F-gases, during the preceding calendar year.⁸⁶

Undertakings which used 1,000 tonnes or more of CO_{2e} of Annex I gases as feedstock during the preceding calendar year.⁸⁷

Undertakings which placed 10 tonnes or more of CO_{2e} of HFCs, or 100 tonnes of CO_{2e} of other F-gases contained in products and equipment, during the preceding calendar year.⁸⁸

Additionally, undertakings placing 1,000 tonnes CO_{2e} or more of HFCs on the market annually must have their reports verified by an accredited independent auditor.⁸⁹

Labelling

Products and equipment containing F-gases must include the F-gas designation, the weight and CO_{2e} of F-gases contained within and the GWP of those gases clearly legible on labelling and in instruction manuals.⁹⁰

Additionally, any products and equipment containing F-gases with GWP 150 or more must have this information included in advertising descriptions.⁹¹

Products or equipment which have been retrofitted and the F-gases changed shall be relabelled with updated information. This also applies to refilled containers of F-gases.⁹²

Foam panels, laminated boards, foams and pre-blended polyols must be clearly labelled to state they contain F-gases with the industry designation for the contained F-gas.⁹³

Where F-gases have been reclaimed or recycled, the batch number and name and address of the reclamation facility must be clearly labelled on containers.⁹⁴

Finally, containers holding F-gases for destruction, direct export, military use, etching of semiconductor material or cleaning of chemical vapour deposition chambers, supplied for feedstock, or supplied for MDIs shall be labelled with an indication that the contents can only be used for the specified use.⁹⁵

Recovery and destruction

The new F-gas Regulation stipulates recovery and destruction obligations for operators of stationary equipment, mobile equipment and building owners and contractors.

Operators of stationary, fire protection and some types of mobile equipment, as well as electrical switch gear and F-gas-based solvents shall ensure those substances are recovered and subsequently recycled, reclaimed or destroyed by a certified person, where technically feasible.⁹⁶



From March 2027, these requirements will apply to additional mobile sectors, namely refrigerated light-duty vehicles and intermodal containers, including reefers, train wagons, air-conditioning equipment and heat pumps in heavy duty vehicles, vans, non-road mobile machinery used in agriculture, mining and construction operations, trains, metros, trams and aircraft.⁹⁷

From 1 January 2025, building owners and contractors must ensure that emissions are avoided when removing foam panels and laminated boards containing F-gases during renovation, refurbishing or demolition either by recovery by a qualified person or through destruction. Where this is not technically feasible, evidence must be documented and kept for five years.⁹⁸

Furthermore, re-use of any recovered HFC and HFO for filling or refilling equipment is prohibited unless the gas has been recycled and reclaimed.⁹⁹ HFCs shall only be destroyed using destruction technology approved by the Montreal Protocol. Where destruction technologies have not yet been approved, other F-gases must be destroyed by technology that complies with EU and national law on waste.¹⁰⁰

Standards

Outdated safety standards have long been a key barrier to the widespread uptake of HFC alternatives, which are often flammable. However, since the last F-gas Regulation, revised international safety standards have been published, increasing the allowable amount of flammable refrigerants in certain cooling and heating equipment.

The revised regulation has included explicit reference to these standards (International Electrotechnical Commission (IEC) 60335-2-89 and IEC 60335-2-40) stating that 'Member states should ensure that national safety standards and building codes are updated to reflect the relevant international and European standards.'¹⁰¹

Exemptions

HFCs for use in specific applications or specific products can be, exceptionally, exempted from the quota requirements for up to four years. The exemption can be renewed if, after assessment, the Commission concludes that alternatives are still not available.¹⁰²

Additionally, a carry-over from the previous EU F-gas Regulation includes an exemption for Annex IV product and equipment bans where it is proven that its lifecycle CO₂e emissions would be lower than those of equivalent equipment which meets those relevant Ecodesign requirements.¹⁰³ It should be noted that to date this exemption has not been used.

A number of the bans in Annex IV include exemptions where required to meet national safety standards. These exemptions must be substantiated by member states, although it is unclear how these will be substantiated.¹⁰⁴

The Commission is also empowered to allocate additional quota for heat pumps, should the need arise. It is required to annually assess the impact of the phase-down on the heat pump market and include conclusions in the Annual Activity Report on Climate Action. Where the assessment demonstrates a severe shortage of F-gases which could endanger the RePowerEU heat pump deployment targets, the Commission may amend Annex VII in order to allow the placing on the market of an additional quantity of F-gases (up to 4,410,247 tonnes of CO₂e, per year, for the period 2025-26 and up to 1,425,536 tonnes of CO₂e, per year, for the period 2027-29.) The additional quota will be distributed to producers and importers who have reported heat pump use as one of their main categories of application in the previous year's reports.¹⁰⁵

The Commission may also authorise an exemption for up to four years to allow the placing on the market of products and equipment or putting into operation of new or extended electrical switchgear where alternatives are not available or cannot be used for technical or safety reasons or would entail disproportionate costs.¹⁰⁶

Similarly, the Commission is empowered to authorise a four-year exemption for the servicing bans if, after a substantiated request by a member state and assessment of the availability of reclaimed and recycled F-gases, a verified shortage is found.¹⁰⁷



Earth from space. ©Unsplash

Conclusion

By adopting a suite of ambitious measures aimed at reducing consumption and emissions, the EU F-gas Regulation offers a comprehensive approach to tackling F-gas emissions.

As the rest of the world begins to cut HFC use via the Kigali Amendment to the Montreal Protocol, Europe's approach offers a gold standard. However, the effectiveness of this ambitious policy lies in its implementation.

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