

EU F-Gas Regulation Guidance

Information Sheet 31: Marine Refrigeration and Air-Conditioning

Target audience for this Information Sheet

This Information Sheet is aimed at organisations that are operators (usually the owner) of marine refrigeration and air-conditioning equipment, for use on ships of all types. It is also useful for those organisations that manufacture, sell, maintain and dispose of marine refrigeration and air-conditioning equipment.

1. Background

This guidance is for organisations affected by the 2014 EU F-Gas Regulation (517/2014). The F-Gas Regulation creates controls on the use and emissions of fluorinated greenhouse gases (F-Gases) including HFCs, PFCs and SF₆. Marine applications might also be affected by the 2009 EU Ozone Regulation (1005/2009) if HCFC refrigerants such as R-22 are still in use.

In the marine sector, the F-Gas Regulation mainly affects the use of HFCs as refrigerants for refrigeration and air-conditioning systems. It may also impact the use of insulation foam and fire protection equipment. The 2014 EU F-Gas Regulation replaces the 2006 Regulation, strengthening all of the 2006 requirements and introducing a number of important new measures.

The F-Gas Regulation is an important piece of legislation that will result in significant reductions in the emissions of F-Gases. These are very powerful greenhouse gases, with global warming impacts that are several thousand times higher than CO₂ (per kg of gas emitted). All EU Member States agree that it is important to reduce emissions of these gases.

This Information Sheet describes the requirements that apply to marine applications of F-Gases. Further guidance is available – see Information Sheet 30 for a full list of Information Sheets and for a glossary of terms.

Marine Applications: Compliance Checklist for EU F-Gas and Ozone Regulations

Purchase of new equipment

- ✓ **NEW:** Take account of HFC phase-down when selecting refrigerants
- ✓ **NEW:** Rules regarding supply of pre-charged refrigeration equipment
- ✓ Requirement to label new equipment containing HFCs

Operation of existing equipment

- ✓ **NEW:** Obligation to avoid unintentional HFC leakage
- ✓ **NEW:** A service ban affecting maintenance of existing high GWP systems (e.g. HFC-404A)
- ✓ Ban on the use of HCFCs to service existing refrigeration or air-conditioning equipment

End-of-life requirements

- ✓ Recovery of refrigerant by qualified technician

2. Sector description

The marine sector is a significant user of HFCs and HCFCs. The main uses of these fluids is as refrigerants in refrigeration and air-conditioning (RAC) systems. Refrigeration is used for storage of certain types of cargo and for storage of food and drink products required by passengers or crew. Air-conditioning is used for comfort cooling of areas occupied by passengers or crew. Some types of ship require specialised refrigeration systems such as fishing vessels and factory ships.

Other applications could include: (1) foam insulation that is manufactured using HFC or HCFC blowing agents and (2) fire protection systems based on HFC fire suppression fluids.

Mobile applications

This Information Sheet is targeted at marine applications in ships that move on a regular basis. The F-Gas Regulation makes a distinction between **stationary** and **mobile** applications. Mobile is defined as “*normally in transit during operation*”. This applies to any equipment filled with F-Gases used in a ship that moves on a regular basis.

Some marine applications are used in the offshore hydrocarbons industry, in offshore installations such as fixed / floating platforms and mobile facilities e.g. mobile drilling units and floating production, storage and offloading units. All fixed and mobile facilities that are involved in hydrocarbon operations are treated as **stationary** applications under the F-Gas Regulation because the units normally operate in fixed locations and are generally only in transit for the purpose of moving from one fixed location to the next. This Information Sheet does not deal with offshore hydrocarbons installations. Specialist guidance for such installations is available¹. In addition to the specific guidance for the hydrocarbons sector, the rules that apply to stationary equipment are described in other Information Sheets in this series².

Movement in and out of the EU

The marine sector can be considered a special case in relation to the F-Gas Regulation due to the movement of ships in and out of the EU. The rules described in this Information Sheet:

- apply to all ships that are in EU territories (e.g. in an EU port)
- do not apply to a non-EU registered ship that is outside the EU
- the Regulation does not specify whether the rules apply to an EU registered ship operating outside the EU; as the F-Gas Regulation is intended to protect the environment, it is recommended that EU registered ships should apply the rules in this Information Sheet irrespective of the ship's location.

¹ See UK Guidance at: <https://www.gov.uk/oil-and-gas-legislation-on-emissions-and-releases#fluorinated-greenhouse-gases-regulations-2015>

² e.g. Information Sheet 2: Commercial Refrigeration; Information Sheet 3: Industrial Refrigeration; Information Sheet 5: Stationary Air-conditioning and Heat Pumps

3. Purchase of new equipment

HFC Bans

There are no bans on the use of HFCs in new RAC equipment being installed on a ship.

Foam insulation is affected by bans on new foam that is manufactured with a blowing agent with a GWP³ above 150. The ban applies to extruded polystyrene (XPS) foam from January 2020 and to other foams (e.g. polyurethane) from January 2023.

New fire protection equipment is affected by bans on use of PFCs (banned in 2007) and HFC-23 (banned from January 2016).

NEW: Impact of the HFC phase-down on the purchase of new equipment

When purchasing new marine RAC equipment you should carefully consider the impact of the HFC phase-down which is a key feature of the 2014 F-Gas Regulation⁴. The phase-down will reduce the quantity of HFCs that can be sold in the EU – by 2030 there will be an 80% cut in HFC supply⁵ compared to 2015. Equipment bought now will still be operating when deep cuts in HFC supply are in force. It is important to always purchase equipment using refrigerants with the lowest practical GWP to minimise the future impact of the HFC phase-down. HFC-404A is widely used in marine refrigeration systems and it has an especially high GWP. A wide range of low GWP alternatives are becoming available for new equipment, as a response to the new F-Gas Regulation⁶.

NEW: Impact of the Service Ban on purchase of new equipment

Purchasers of new marine refrigeration equipment must be aware that a “Service Ban” will affect certain **existing** systems using HFCs with a GWP above 2,500 from January 2020. To avoid future problems, it is recommended that you select only refrigerants with a GWP below 2,500, with immediate effect. The service ban is discussed in detail below.

Product Labelling

All marine products that contain F-Gases (including HFCs) must be installed with the F-Gases used being identified with a label. The label shall indicate the following information:

- 1) A reference that the system contains F-Gases
- 2) The accepted industry designation for the F-Gas concerned or, if no such designation is available, the chemical name
- 3) The quantity of F-Gas contained in the equipment expressed in weight (kg) and **NEW:** from January 2017 the quantity expressed in tonnes CO₂ equivalent and the GWP of the gas
- 4) If applicable, a reference that the F-Gases are contained in hermetically sealed equipment

The label should be in the language of the Member State where the equipment is placed on the market. The labelling information should also be included in instruction manuals supplied with the new equipment.

³ GWP: global warming potential, see Information Sheet 25 for further details

⁴ HFC phase-down: see Information Sheet 28 for further details

⁵ The phase-down in HFC supply is “GWP-weighted” and is measured in terms of tonnes CO₂ equivalent. This creates an incentive to use low GWP refrigerants and to avoid very high GWP refrigerants such as HFC-404A.

⁶ Low GWP alternatives to HFCs: see Information Sheet 29 for further details

NEW: Pre-charged RAC equipment

From January 2017 RAC equipment pre-charged with HFCs cannot be placed on the market unless the HFCs are accounted for within the EU HFC phase down quota system⁷. This rule that affects all pre-charged RAC equipment (including equipment manufactured in the EU and equipment that is imported). Examples of equipment affected includes:

- a) Hermetically sealed systems (e.g. for refrigerators and freezers used to store food)
- b) Split system and VRV air-conditioning systems
- c) Chillers

Companies that import pre-charged RAC equipment into the EU for installation in ships and other marine applications must comply with these rules. Details of the new rules for pre-charged RAC equipment can be found in Information Sheet 16.

4. Operation of existing equipment

The 2014 F-Gas Regulation includes an important general requirement to avoid the intentional release of F-Gases from any equipment, including RAC on ships. Article 3 of the Regulation states:

- a) The intentional release of F-Gases is prohibited where the release is not technically necessary for the intended use⁸
- b) Operators must take precautions to prevent leakage, taking all measures that are technically and economically feasible to minimise leakage
- c) Where leakage is detected the equipment must be repaired without undue delay.

For stationary applications the Regulation provides significant detail about mandatory requirements that would support compliance with these general rules. In particular, there are rules related to:

- regular leak checking
- record keeping
- the use of trained technicians.

These requirements are not mandatory for applications used on ships. However, a ship operator should consider how compliance with the Article 3 requirements listed above can be assured. Much of the RAC equipment used on a ship is very similar to that used in stationary applications in buildings and industrial facilities. If a ship operator follows the rules that apply to similar stationary equipment it is reasonable to expect that you are in compliance with Article 3. The key rules that apply to stationary applications are summarised below. It must be stressed that these are not mandatory for RAC systems on ships, but that they represent a reasonable framework for compliance with Article 3 and for responsible use of refrigerants.

Regular leak checks

For stationary equipment mandatory leak checks are required above a certain size threshold. A leak check must be carried out with an appropriate leak detection device (e.g. a hand-held electronic sniffer) in all parts of the systems that might leak. For small systems the mandatory leak checks are annual and for larger systems the checks must be done every 6 months.

⁷ See Information Sheet 28 for more details on the EU HFC phase down quota mechanism

⁸ This allows release from an application such as an aerosol but would not allow release from RAC equipment

The size thresholds used to define leak test frequency are defined in terms of the quantity of refrigerant in each refrigeration unit, measured in tonnes CO₂ equivalent⁹.

The use of CO₂ equivalent (CO₂e) size thresholds means that the kg threshold for each refrigerant is different. Refrigerants with a high GWP (e.g. HFC-404A) will have a lower kg size threshold than those with a lower GWP (e.g. HFC-134a). Table 1 shows leak testing requirements. Example thresholds are given for HFC-404A and HFC-134a. For other refrigerants, see Information Sheet 25.

If a leak is found during a mandatory leak check it must be repaired without undue delay and the leak test repeated within one month to ensure the repair was effective.

Implications for RAC on ships: Use of the leak checking rules that apply to stationary systems is a good way to ensure that intentional release of F-Gases is not occurring.

Table 1: Size Thresholds for Mandatory Leak Checks of Stationary RAC Equipment

Leak Check Frequency*	2014 Regulation		
	tonnes CO ₂ e threshold for all HFC refrigerants	kg threshold for HFC 404A	kg threshold for HFC 134a
Annual	5 tonnes CO ₂ e **	1.3 kg	3.5 kg
Every 6 months	50 tonnes CO ₂ e	13 kg	35 kg
Every 3 months	500 tonnes CO ₂ e	127 kg	350 kg

* Leak check frequency is halved if automatic leak detection system is installed

** The threshold for annual leak checks of hermetically sealed equipment is 10 tonnes CO₂e

Automatic leak detection

For all stationary RAC systems containing 500 tonnes CO₂e or more there is a mandatory requirement for an automatic leak detection system to be fitted. For HFC-404A refrigeration systems this means any plant containing more than 127 kg.

An automatic leak detection system is defined as a “*calibrated mechanical, electrical or electronic device for detecting leakage of F-Gases which, on detection, alerts the operator or a service company of any leakage*”. Automatic leak detection systems must be tested at least once every 12 months to ensure their proper functioning.

Implications for RAC on ships: It is good practice to consider fitting automatic leak detection on larger pieces of RAC equipment, although it is not mandatory for ships under the F-Gas Regulation. Early warning of leakage is good for the environment and also reduces the risk of a ship suffering a major refrigeration system failure that could lead to the spoilage of goods being transported.

Record keeping

For stationary equipment, operators must keep records for each piece of equipment that is subject to a mandatory leak check (i.e. above the 5 tonnes CO₂e threshold). The records to be kept include:

- quantity and type of F-Gas installed
- quantities of F-Gas added during installation, maintenance or when repairing a leak
- whether the F-Gases used have been recycled or reclaimed (including the name and address of the recycling or reclamation facility and, where applicable, the certificate number).
- quantity of any F-Gases recovered

⁹ Understanding CO₂ thresholds: see Information Sheet 25 for further details

- e) the identity of the undertaking that installed, serviced or decommissioned the equipment, including, where applicable, their certificate number
- f) dates and results of all mandatory leak checks
- g) for equipment decommissioned, the measures taken to recover and dispose of the F-Gases.

Records must be kept by the operator for at least 5 years. Records collected by a contractor on behalf of an operator must be kept by the contractor for at least 5 years. The records shall be made available on request to the Member State competent authority or to the Commission.

Implications for RAC on ships: It is impossible to comply with the Article 3 requirements if you have no records of the HFC equipment installed and the use of HFCs for maintaining that equipment. Keeping records in a similar format to those required for stationary applications will enable operators to review their F-Gas equipment and take the necessary steps to minimise leakage.

Use of trained technicians

For stationary applications, all refrigerant handling operations on refrigeration equipment containing HFC refrigerants must be carried out by suitably trained technicians holding an F-Gas handling certificate and working for an F-Gas Certificated company. This includes plant installation, leak testing, maintenance and end-of-life decommissioning. See Information Sheet 21 for details of all training and certification requirements.

Implications for RAC on ships: To minimise leakage it is important that technicians working on RAC systems have adequate training. Using F-Gas certificated technicians (i.e. with the appropriate training for similar stationary equipment) is a good way of ensuring this, although other forms of training (e.g. in-house) may also be considered adequate if they are of an equal standard.

NEW: Service Ban for High GWP HFCs

A new feature of the 2014 F-Gas Regulation is the Service Ban, affecting existing equipment on ships:

- From 1st January 2020 the use of F-Gases with a GWP above 2,500 to maintain transport refrigeration systems with a charge size of 40 tonnes CO₂e or more shall be prohibited.

In the marine refrigeration sector this affects systems that use HFC-404A if they have a charge above 10.2 kg. The service ban also affects other refrigerants with a GWP above 2,500 such as HFC-507A and HFC-422D. See Information Sheet 25 for a list of refrigerants and size thresholds.

From 2020 it will be legal to continue operating such systems, but you will not be allowed to top up any leaks with virgin refrigerant. Owners of equipment affected by the Service Ban have 3 options:

- a) You can replace the plant with new equipment using a refrigerant with a lower GWP. This is a good option for plants close to end-of-life.
- b) You can “retrofill” the plant, replacing the HFC-404A with a lower GWP alternative such as HFC-407A, HFC-407F, HFC-448A, HFC-449A or HFC-452A.
- c) You can use reclaimed or recycled HFC-404A for plant maintenance until 1st January 2030.

Service Ban for HCFCs

Under the Ozone Regulation there is now a complete ban on the servicing of HCFC equipment (e.g. HCFC-22). This ban came into force at the start of 2015 and it applies to both virgin and reclaimed HCFCs. It is still legal to use RAC equipment that contains HCFCs, but no refrigerant can be added to a system during maintenance.

5. End-of-life requirements

Any marine refrigeration equipment or foam insulation containing HFCs that is being disposed of at end-of-life must undergo an HFC recovery process. For stationary RAC equipment there is an explicit mandatory requirement for recovery. For mobile RAC equipment there is a “catch-all” requirement for the recovery of F-Gases *“to the extent that it is technically feasible and does not entail disproportionate costs”*. It is considered technically feasible and cost-effective to recover refrigerant from marine RAC systems, so all operators should ensure that F-Gases are recovered.

F-Gas refrigerant must be recovered by *“an appropriately qualified”* technician before the system is dismantled. The training required for technicians that work on stationary RAC is not mandatory for marine RAC, but would be considered “appropriate”. Modern refrigerant recovery machines should be able to remove well over 95% of the refrigerant in an old system. Any insulating foam containing HFCs should be sent to a specialist recovery facility, where the foam can be crushed and the HFCs recovered.

All recovered F-Gases can either be:

- a) sent for destruction by incineration at a licenced waste facility
- b) sent to a specialist plant that can re-process the old refrigerant into a gas with properties identical to virgin refrigerant, to create “reclaimed refrigerant”
- c) given a basic cleaning process, to create “recycled refrigerant”.

Given the HFC supply shortage that will be created by the phase-down process, it is worth trying to send the old refrigerant for reclamation as it may have a good residual value. If the old refrigerant is too contaminated it cannot be reclaimed and must be sent for destruction. It is important not to mix different gases in the same recovery cylinder – as this would render them unsuitable for reclamation.

Reclaimed refrigerant can be used in any refrigeration equipment. Recycled refrigerant must always be used with care as it may be contaminated or of unknown composition. From 2020 the use of recycled refrigerant with a GWP above 2,500 is restricted to either (a) the organisation owning the plant from which the gas was recovered or (b) the organisation that carried out the recovery.

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