

EU F-Gas Regulation Guidance

Information Sheet 3: Industrial Refrigeration

Target audience for this Information Sheet

This Information Sheet is aimed at organisations that are operators (usually the owner) of industrial refrigeration equipment. It is also useful for those organisations that manufacture, sell, maintain and dispose of industrial refrigeration 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.

In the industrial refrigeration sector, the F-Gas Regulation affects the use of HFCs as refrigerants and as blowing agents for the insulation foam used for cold stores and pipe / vessel insulation. 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 industrial refrigeration. Further guidance is available – see Information Sheet 30 for a full list and for a glossary of terms.

Industrial Refrigeration: Compliance Checklist for EU F-Gas Regulation

Purchase of new equipment

- ✓ **NEW:** Comply with a ban on the use of high GWP HFCs in new industrial equipment
- ✓ **NEW:** Take account of service ban when selecting refrigerants
- ✓ **NEW:** Take account of HFC phase down when selecting refrigerants

Operation of existing equipment

- ✓ Mandatory leak checks and repairs
- ✓ **NEW:** Use new CO₂ equivalent size thresholds for mandatory leak checks
- ✓ **NEW:** Use new size thresholds for automatic leak detection (from 1st Jan 2015)
- ✓ Keep records about all refrigeration equipment using HFC refrigerants
- ✓ **NEW:** Service ban, affecting maintenance of existing high GWP systems (e.g. HFC 404A)
- ✓ Use qualified technicians for leak checking and refrigerant handling operations

End-of-life requirements

- ✓ Mandatory recovery of refrigerant by qualified technician

2. Sector description

The industrial refrigeration sector is a significant user of HFCs. Industrial refrigeration systems are used in a wide range of industry sectors. The most important are food and drink manufacturing and the chemicals / petrochemicals / pharmaceutical sectors. Other industry sectors such as printing and plastic moulding also require refrigeration. Industrial refrigeration systems are also used in non-industrial sectors such as cold storage, ice rinks and ski centres. There is a wide range of different industrial refrigeration requirements both in terms of size and temperature level. Examples include:

- a) Large central systems serving several major loads e.g. used for blast freezing and large cold stores. These systems often contain several tonnes of refrigerant.
- b) Large chiller systems, cooling a secondary refrigerant such as glycol which is distributed to a number of loads. Chillers often contain several hundred kg of refrigerant.
- c) Smaller dedicated plants, each serving a single cooling load. These usually contain less than 100 kg of refrigerant.

3. Purchase of new equipment

NEW: HFC Bans

For **all industrial refrigeration equipment** there is a ban on very high GWP refrigerants from 2020 – this will mainly affect the use of HFC 404A and HFC 507:

- Ban 1: The use of HFCs with a GWP¹ above 2,500 will be banned in all new industrial refrigeration equipment placed on the EU market **after January 1st 2020**

This ban applies to all sizes of industrial equipment. There are 2 exemptions from the ban:

- a) For equipment that cools a product to below -50 °C (note the Regulation refers to a product temperature, not to the refrigerant evaporating temperature).
- b) For military equipment – this exemption refers to specialised military equipment e.g. cooling in a tank or a military aircraft. It does not apply to non-specialised applications such as refrigeration for a military barracks kitchen.

Any foam insulation used in industrial systems, such as pipe and vessel insulation or insulated panels used for cold and chill stores, is subject to 2 further bans:

- Ban 2: The use of HFCs with a GWP above 150 will be banned in **extruded polystyrene foam (XPS)** placed on the EU market **after January 1st 2020**
- Ban 3: The use of HFCs with a GWP above 150 will be banned in other foams, including **polyurethane foam (PU)** placed on the EU market **after January 1st 2023**

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

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

¹ GWP: Global Warming Potential. See Information Sheet 25 for more details on GWP.

NEW: Impact of the HFC Phase Down on the purchase of new equipment

When purchasing new industrial refrigeration equipment you should also consider the HFC phase down². This will reduce the quantity of HFCs that can be sold in the EU – by 2030 there will be an 80% cut in HFC supply. Equipment bought now will still be operating when deep cuts in HFC supply are in force. Irrespective of the bans described above, it makes sense to always purchase equipment using refrigerants with the lowest practical GWP to minimise the future impact of the phase down³.

4. Operation of existing equipment

The 2014 F-Gas Regulation includes a number of requirements that affect the use and maintenance of existing industrial refrigeration equipment containing HFC refrigerants. The rules depend on the type and size of industrial refrigeration equipment being used. The regulations affecting existing equipment relate to (a) leak prevention, (b) record keeping, (c) the Service Ban and (d) the use of trained technicians. These requirements are described below.

Leak prevention and mandatory leak checks

The intentional release of F-Gases into the atmosphere is prohibited and operators of all industrial refrigeration equipment must take all measures that are technically and economically feasible to minimise leakage. Where leaks are detected, operators must carry out repairs without undue delay.

NEW: Under the 2006 Regulation, the legal responsibility for preventing F-Gas releases was only given to the operator (usually the owner) of the equipment. In the 2014 Regulation there is a similar legal responsibility given to third party contractors carrying out installation, maintenance, leak checking or refrigerant recovery on behalf of operators.

Mandatory leak checks are required on all industrial refrigeration equipment above certain size thresholds. It is likely that almost all industrial systems are well above the minimum size threshold for mandatory leak tests.

Under the 2006 F-Gas Regulation, the thresholds were set in terms of the physical quantity of refrigerant in the system – those containing more than 3 kg required a regular leak check.

NEW: Under the 2014 Regulation the requirements are similar, but the size thresholds are defined in terms of tonnes CO₂ equivalent⁴. These new CO₂ equivalent (CO₂e) size thresholds mean 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 refrigerants with a lower GWP (e.g. HFC 134a). Table 1 shows leak testing requirements under both Regulations. Example thresholds are given for HFC 404A and HFC 134a. A comprehensive table of thresholds is given in Information Sheet 24.

The new CO₂e thresholds will require some systems below the old 3 kg threshold to be regularly leak tested. As shown in Table 1, the size threshold for HFC 404A is only 1.3 kg. Operators should check which of their systems are affected by the new CO₂e size thresholds. Most of the leak checking rules apply from 1st January 2015, continuing the similar requirement in the 2006 Regulation. However, for systems with less than 3 kg, the 5 tonnes CO₂e threshold only applies from 1st January 2017.

² HFC phase down: see Information Sheet 28 for further details

³ Low GWP alternatives to HFCs: see Information Sheet 29 for further details

⁴ Understanding CO₂ thresholds: see Information Sheet 25 for further details

Table 1: Size Thresholds for Mandatory Leak Checks

Leak Check Frequency*	2006 Regulation	2014 Regulation		
	kg threshold for all HFC refrigerants	tonnes CO ₂ e threshold for all HFC refrigerants	kg threshold for HFC 404A	kg threshold for HFC 134a
Annual	3 kg	5 tonnes CO ₂ e **	1.3 kg	3.5 kg
Every 6 months	30 kg	50 tonnes CO ₂ e	13 kg	35 kg
Every 3 months	300 kg	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

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.

Mandatory automatic leak detection

NEW: For all industrial refrigeration systems containing more than 500 tonnes CO₂e there is a mandatory requirement for an automatic leak detection system to be fitted. Mandatory automatic leak detection is a continuation of a similar requirement in the 2006 Regulation, although the size threshold is changed from 300 kg to 500 tonnes CO₂e. This will have a significant impact on plants using high GWP refrigerants. For HFC 404A systems the new threshold for automatic leak detection systems is reduced from 300 kg to 127 kg.

This rule applies from 1st January 2015. The lower size threshold for HFC 404A will affect many industrial systems as they often contain more than 127 kg. Table 2 shows the size threshold for automatic leak detection for a number of refrigerants used in industrial systems. For most industrial refrigerants, the new size threshold is lower than the 300 kg threshold in the 2006 Regulation.

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.

Table 2: Size Thresholds for Automatic Leak detection and the Service Ban

Refrigerant	GWP	Auto leak detection: kg equivalent of 500 tonnes CO ₂ e	Service Ban kg equivalent of 40 tonnes CO ₂ e
HFC 508	13,214	38	3.0
HFC 507	3,985	125	10.0
HFC 404A	3,922	127	10.2
HFC 434A	3,245	154	12.3
HFC 422D	2,729	183	14.7
HFC 438A	2,264	221	n/a*
HFC 410A	2,088	239	n/a*
HFC 407C	1,774	282	n/a*
HFC 134a	1,430	350	n/a*

* Note: the service ban only applies to refrigerants with a GWP above 2,500

Record keeping

Operators of industrial refrigeration equipment 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 that must be kept are similar to those required under the 2006 Regulation:

- a) quantity and type of F-Gas installed
- b) quantities of F-Gas added during installation, maintenance or when repairing a leak
- c) **NEW:** 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).
- d) quantity of any F-Gases recovered
- 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) **NEW:** For decommissioned equipment, measures taken to recover and dispose of F-Gases.

NEW: Records must be kept by the plant operator for at least 5 years

NEW: 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 UK Government's competent authority (i.e. the Environment Agency) or to the Commission.

NEW: Service Ban

An important new feature of the 2014 F-Gas Regulation is the Service Ban, affecting existing systems:

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

For industrial refrigeration this will mostly affect systems that use HFC 404A. The size threshold of 40 tonnes CO₂e is equivalent to 10.2 kg of HFC 404A. The size thresholds for various other refrigerants used in industrial systems are given in Table 2. Almost all industrial systems are above these size thresholds and hence will be affected by the Service Ban. Refrigeration systems intended to cool products to temperatures below – 50 °C and military equipment are exempt from the Service Ban.

It is important to note that several refrigerants used as “drop-in” replacements for R22 have a GWP above 2,500 and are affected by the Service Ban. Some of these are listed in Table 2 (e.g. HFC 4343A, HFC 438A, HFC 422D).

It will be legal to continue operating systems affected by the Service Ban, but you will not be allowed to top up any leaks with virgin refrigerant. Operators of equipment affected by the Service Ban have 3 main 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 refrigerant with a lower GWP alternative (for HFC 404A you can use alternatives such as HFC 407A, HFC 407F, HFC 448A and HFC 449A). This option is a good one for younger equipment. There is good evidence that retrofilling HFC 404A with these refrigerants will improve energy efficiency by between 5% and 10% - this creates a good financial case for retrofill.
- c) You can use reclaimed or recycled refrigerant for plant maintenance until 1st January 2030.

Use of trained technicians

All refrigerant handling operations on industrial 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.

5. Requirements at end-of-life

Any industrial refrigeration equipment containing HFCs in either the refrigeration circuit or the insulation foam that is being disposed of at end-of-life must undergo an HFC recovery process.

For industrial systems all refrigerant must be recovered by a certificated technician before the plant is dismantled. Modern refrigerant recovery machines should be able to remove well over 95% of the refrigerant in an old system. Any insulating foam associated with these refrigeration systems (e.g. PU foam used for pipe / vessel insulation or in cold store panels) 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. 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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This Information Sheet has been prepared by Gluckman Consulting

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