

Guidance for Stationary Refrigeration & Air-Conditioning

This Information Sheet provides further guidance related to the impact of the F gas and Ozone Regulations on stationary refrigeration, air-conditioning and heat pump equipment (RAC systems).

Other RAC Information Sheets give details about the key obligations related to RAC systems in the EC F gas and Ozone Regulations. In this Information Sheet we discuss various issues in more depth and address a number of Frequently Asked Questions.

1. How should leak checking be carried out?

RAC systems containing 3 kg or more (or 6 kg if hermetically sealed and labelled) of fluorinated gas (F gas) or 3 kg of an Ozone Depleting Substances (ODS) refrigerant need regular leak tests. The leak test frequency will vary depending on the total refrigerant charge – see Information Sheet RAC 3 to confirm the frequency of testing.

Commission Regulation 1516/2007 sets out details of leak testing requirements for F gases. The test has to be carried out by qualified personnel (see Information Sheet RAC 5). The following parts of the RAC system shall be systematically checked:

- ◆ Joints;
- ◆ Valves including stems;
- ◆ Seals, including seals on replaceable driers and filters;
- ◆ Parts of the system subject to vibration;
- ◆ Connections to safety or operational devices.

Direct Leak Detection

In all situations the leak test can include checks made with one or more of three “direct” measuring techniques:

- 1) Hand held electronic gas detector.
- 2) UV sensitive detection fluid or dye in the refrigerant.
- 3) Soap suds or proprietary bubble solutions.

It is often best to use a combination of techniques e.g. an electronic detector to test a wide area and soap suds to identify the exact location of the leak.

Electronic detectors need to be checked every 12 months to ensure their proper functioning. The sensitivity of portable gas detection devices shall be at least five grams per year.

Indirect Leak Detection

In some situations it is possible to use “indirect” leak measurement. This involves observation of parameters such as temperatures and pressures in the refrigeration system to ascertain whether there is a shortage of refrigerant. This can be especially useful if parts of the plant are inaccessible or located outdoors (when a hand held leak detector may not function). If a leak is suspected it will often be necessary to use direct measurement methods to identify the exact location of the leak.

Indirect measuring methods can be applied in cases where the leakage develops very slowly and where the equipment is placed in a well ventilated environment making it difficult to detect fluorinated greenhouse gases escaping from the system in the air. The decision on the measuring method to be used should be taken by certified personnel who have the necessary training and experience to determine the most appropriate measuring method on a case by case basis.

Leak Repair

If a leak is found it must be repaired by appropriately qualified personnel. The repair must be retested for leakage within a month of the repair (the retest can be done immediately after the repair is completed providing the plant is back in service).

2. What type of automatic leak detection system can be used?

Plants with more than 300 kg of an F gas refrigerant must be fitted with an automatic leakage detection system, which is defined as:

“A calibrated mechanical, electrical or electronic device for detecting leakage of refrigerants which, on detection, alerts the operator”.

The detection system must be checked at least once a year to ensure proper functioning.

Systems containing more than 300 kg of an HCFC refrigerant do not need to be fitted with a mandatory automatic leak detection system.

For any F gas containing plant fitted with a leakage detection system (including those below the mandatory 300 kg threshold), the frequency of leak checking can be halved, although an annual check remains the minimum frequency. This allowance does not apply to HCFC containing systems.

Two different types of leak detection system can be considered:

A direct system, that uses electronic sensors to detect the presence of leaked refrigerant in areas adjacent to the refrigeration plant.

An indirect system, which interprets appropriate measurements within the refrigeration plant to predict a leak. This might include liquid level in a receiver vessel combined with relevant temperatures and pressures.

There are advantages and disadvantages to both types of system and it is necessary to take the specific circumstances of a refrigeration installation into account to select the best approach:

- ◆ A direct system gives a “robust” indication of a leak if the sensor is located in the right place, but is not effective if a leak is outdoors or a long way from a sensor. A direct system often helps locate the general vicinity of the leak.
- ◆ An indirect system requires built-in “intelligence” as it is quite difficult to interpret varying conditions of liquid level and pressures / temperatures within a refrigeration system, as these vary widely even if no leak has occurred. However, if an RAC system has components in several locations or has components in exposed outdoor locations then an indirect system might be the only practical option.

3. What records must be kept?

Records must be kept about each RAC system containing 3 kg or more of HFC or HCFC refrigerant. The key obligations in relation to F gases came into force on 4th July 2007, are described in Article 3 of the EC F gas Regulation and are explained in more detail in Articles 2 and 3 of supporting Commission Regulation 1516/2007. New requirements in relation to HCFCs came into force on 1st January 2010; the requirements in relation to HCFCs mainly mirror those for F gases.

The F gas records must include:

- ◆ The name, postal address and telephone number of the operator.
- ◆ The **quantity** and **type** of F gas refrigerants installed in each system,
- ◆ Any **quantities** of refrigerant **added**,
- ◆ The **quantity** of refrigerant **recovered** during servicing, maintenance and final disposal.
- ◆ The **identity** of the **company** or **personnel** who performed the servicing or maintenance, as well as the **dates** and **results** of leakage checks and leakage detection system checks.

These **records shall be made available** on request to the competent authority and to the Commission.

Where the F gas charge is not indicated in the manufacturer's technical specifications or on the label of the system, the operator shall ensure that it is determined by appropriately certified personnel (see Information Sheet RAC 5). See section 8 and Information Sheet GEN 5 that explains how to do this in more detail. It includes reference to a spreadsheet tool that has been designed to help you assess the refrigerant charge. GEN 5 and the spreadsheet can both be downloaded from the F-Gas Support website.

Before carrying out leakage checks, certified personnel shall check the equipment records to determine any previous issues and consult previous reports.

An example F gas log sheet is shown on the next page and an example HCFC log sheet is shown in RAC 8.

In relation to the use of recycled or reclaimed HCFCs in a system an additional obligation applies to all undertakings. When recycled or reclaimed HCFC refrigerants are added to a system a record needs to be kept which should show who supplied the reclaimed HCFCs and of the source of recycled HCFCs.

4. How is F Gas recovered from end user equipment?

During decommissioning or maintenance, refrigerant must be extracted from a system carefully without causing any wilful release to the environment. This must only be carried out by correctly certificated maintenance personnel (see Information Sheet RAC 5 for certification requirements).

In practice, this can be done using a refrigerant recovery unit, which comprises of a small compressor, filters and controls. One side is connected to the refrigeration system via service valves and the other side to an empty refrigerant cylinder. Some recovery units have the capability to extract most of the refrigerant in liquid form, before switching to extract any remaining vapour.

Great care should be taken to label the recovery cylinder in order to identify its contents and not to mix different refrigerants (see section 5).

Further details are given in the Institute of Refrigeration's Good Practice Guide 11 "Recovery of Refrigerant".

Sample F Gas Log Sheet for Record Keeping Obligation

The table below shows an example record sheet for compliance with the EC F gas Regulation. Records of this type must be kept for each refrigeration plant that contains 3 kg or more of HFC refrigerant.

RECORD SHEET FOR F GAS REGULATION			
General Information			
Plant Name		Reference No.	
Location of plant			
Plant Operator (Name, Address, Telephone)			
Operator Contact			
Cooling loads served			
Refrigerant Type		Refrigerant Quantity (kg)	
Plant manufacturer		Year of installation	
Refrigerant Additions			
Date	Personnel/Company	Amount Added, kg	Reason for addition
Refrigerant Removals			
Date	Personnel/Company	Amount Removed, kg	Reason for removal. What was done with recovered refrigerant
Leak Tests			
Date	Personnel /Company	Test Result (including location and cause of any leaks identified)	Follow up actions required
Follow-up Actions			
Date	Personnel /Company	Related to test on	Actions Taken
Testing of Automatic Leak Detection System (if fitted)			
Date	Personnel /Company	Test Result	Comments

5. What can I do with recovered refrigerant?

Recovered refrigerant can be reused in the original refrigeration system it was removed from, without any reprocessing. This is not recommended as the old refrigerant may be contaminated.

A better option is to “recycle”. This involves a few fairly simple cleaning processes that remove certain contaminants, such as moisture and particulates. Recycled refrigerant can be reused in the original system or, in some circumstances, used in another system. Recycling can be carried out in portable equipment at the end users site. Some refrigerant recovery units include recycling stages.

Another option is to have recovered refrigerant reclaimed. This can only be done at a specialist facility which reprocesses the refrigerant to a specification that is equivalent to virgin refrigerant. After reclamation, the refrigerant can be reused in any system.

If the recovered refrigerant is very badly contaminated or it is mixed with other refrigerants, then recycling or reclamation may be impossible. If this is the case, the old refrigerant must be sent for destruction. This can only be done in licensed waste facilities that are designed to destroy the particular refrigerants involved.

Please note that from 1st January 2010 the use of virgin HCFC is banned and only recycled or reclaimed HCFC can be used. See Information Sheet RAC 3 section 5 for more details.

6. What equipment needs to be labelled?

6.1. F gases

All new RAC equipment containing F gas refrigerant and F gas blown foam must be labelled, irrespective of size, as required by the EC F gas Regulation. This rule does not apply to RAC systems contained in motor vehicles.

The labelling rule applies to equipment and equipment containing foam placed on the market after 1st April 2008.

A mandatory label must include:

- ◆ The text ‘Contains fluorinated greenhouse gases covered by the Kyoto Protocol’;
- ◆ For equipment containing F gas blown foam the text “Foam blown with fluorinated greenhouse gases”.
- ◆ The abbreviated chemical names for the fluorinated greenhouse gases contained or designed to be contained in the equipment using accepted industry nomenclature standard to the equipment or substance;
- ◆ The quantity of the fluorinated greenhouse gases, expressed in kilograms;
- ◆ That the label may be placed in any of the following positions
 - adjacent to the service points for charging or recovering the F gas,
 - on that part of the product or equipment which contains the F gas,
 - on, or adjacent to existing nameplates or product information labels.
- ◆ The text ‘hermetically sealed’ where applicable.

Existing equipment does not need to be labelled, although it is good practice to label all equipment. If you have existing systems containing 3 kg or more then it is necessary to record the type and amount of refrigerant used (see Section 3 above). Placing a label on the plant is a logical way of linking a particular piece of plant to these records.

The label should be in English in Great Britain, other Member States may require labels to be in their own language

As well as being labelled, instruction manuals that come with the products/equipment need to contain information on the type of F gas contained and its global warming potential.

6.2. ODS

When recycled or reclaimed HCFCs are added to RAC equipment it should then be labelled. A label should show:

- ◆ The type of refrigerant, and
- ◆ The total quantity contained in the system, and
- ◆ The label elements set out in Annex I to Regulation EC/1272/2008 for substances or mixtures classified as Hazardous to the Ozone Layer.

An example of a label is shown below:

<p style="text-align: center;">This equipment contains RECYCLED/ RECLAIMED refrigerant Type of Refrigerant..... Total Refrigerant Charge (kg)..... DANGER EUH059: HAZARDOUS TO THE OZONE LAYER AVOID RELEASE TO THE ENVIRONMENT DISPOSE OF THIS REFRIGERANT AS HAZARDOUS WASTE</p>

7. Are there any refrigerant bans related to this sector?

It is important to note that there are no bans in the EC F gas Regulation related to the use of HFCs in RAC systems.

The use of virgin HCFCs is now banned for servicing and maintenance of existing RAC systems. Only recycled or reclaimed HCFC may be used and only up until 1st January 2015. After 1st January 2015 HCFCs can no longer be used in any servicing and maintenance activities. See RAC 3 & RAC 8 for more details.

There are three F gas bans related to refrigeration applications, but none of these affect "mainstream" stationary RAC systems.

The bans referred to above are:

- a) A ban on R134a for car air-conditioning systems (for new vehicle types from 2011).
- b) A ban on the use of non-refillable containers for transporting HFC refrigerants (already in force).
- c) A ban on the use of HFCs and PFCs for "non-confined direct evaporation systems" (already in force).

There are specific regulations in certain EU Member States that introduce HFC bans for some types of new RAC systems (e.g. in Denmark).

8. How do you estimate refrigerant charge?

If you have established that you are using an F gas or ODS refrigerant in an RAC system, the next step is to find out how much refrigerant is in the system. This is important as it affects the way that the Regulations will apply. The key size thresholds specified in the F gas and Ozone Regulations are as follows:

- ◆ All systems with less than 3 kg of F gas/ODS refrigerant are not covered by the obligation to carry out regular leakage checks and to keep records.
- ◆ For all systems above 3 kg records must be kept.
- ◆ For systems above 3 kg that are not hermetically sealed regular leak checks must be carried out by qualified personnel.
- ◆ Hermetically sealed systems with between 3 kg and 6 kg of F gas/ODS refrigerant are exempt from the obligation to carry out regular leakage checks. Examples of hermetically sealed systems include domestic refrigerators and small self-contained commercial systems such as bottle coolers, display cabinets and ice makers. Any system requiring on-site fabrication of refrigerant pipe work is unlikely to fall in the hermetic category (even if it has a hermetic compressor). It should be noted that for hermetically sealed equipment containing between 3 and 6 kg of refrigerant to be exempt from leak testing it must be labelled with the text 'hermetically sealed'. If it is not labelled it should be treated as for non-hermetically sealed RAC systems.
- ◆ There are further thresholds at 30 kg and 300 kg which are used to define the regularity of leak testing required and the requirements for automatic leak detection.

The initial options for establishing refrigeration charge of a system are as follows:

- ◆ The refrigerant charge might be shown on a label attached to the plant.
- ◆ The charge might be recorded in the instruction manual or in commissioning records.
- ◆ You might be able to get details from the plant manufacturer or the installation contractor.

If these options are not appropriate you will need an appropriately qualified person to look at the plant in more detail to calculate the amount of refrigerant in the system. Information Sheet GEN 5 explains how to do this in more detail. It includes reference to a spreadsheet tool that has been designed to help you assess the refrigerant charge. GEN 5 and the spreadsheet can both be downloaded from the F-Gas Support website.

9. When installing RAC system pipe work can it be located behind plasterboard walls or ceiling?

The Regulation does not restrict the location of refrigerant pipe work and it does allow indirect leak checks to be made (see Section 1 above). Commission Regulation 1516/2007 Article 5.1 allows for both direct and indirect checks. If an effective indirect leak test can be carried out then it is possible to locate pipe work in locations that are inaccessible for direct leak testing.

If a leak detected via indirect testing and direct testing of exposed components shows no leakage then you must assume the leak is in the inaccessible location and you will need to gain access to locate and repair the leak.

If there is only brazed pipe work in the inaccessible location then it is reasonable to use indirect testing and accept there is a small risk of needing to gain access.

It is not considered good practice to locate "leaky" components like uncapped valves behind an inaccessible ceiling or wall, but it would be reasonable to apply common sense e.g. a good quality isolating valve fitted with a valve cap need not fall into the "leaky" category.

10. Help managing leakage

Practical guidance aimed at reducing leaks has been produced by Institute of Refrigeration. The guidance and tools they have developed are aimed at all sectors of business and industry. The aim of the guidance is to achieve significant reductions in carbon emissions that are due to refrigerant leakage from installed systems. Visit www.realzero.org.uk for more details.



How to Contact F-Gas Support:

Email: fgas-support@enviros.com **Website:** www.defra.gov.uk/fgas

Post: F-Gas Support, P O Box 481, Salford, M50 3UD

This document has been prepared by F-Gas Support; the information provided is intended as guidance and must not be taken as formal legal advice nor as a definitive statement of the law. Ultimately only the courts can decide on legal questions and matters of legal interpretation. If you have continuing concerns you should seek legal advice from your own lawyers.

F-Gas Support is a Government funded team set up to help organisations understand their obligations under the EU Fluorinated Greenhouse Gases and Ozone Regulations. F-Gas Support is also working with Regulators to promote compliance. It is being run on behalf of Defra and the devolved administrations by Local Government Group (LG Group formerly the Local Authorities Coordinators of Regulatory Services (LACORS)) and SKM Enviro.