

# Refrigerant Emissions and Leakage ZERO Project



## OTHER GUIDES

Pocket guide to good leak testing

Illustrated guide to 13 most common leaks

Designing out leaks – design standards and practices

Leakage matters – the service & maintenance contractor's responsibilities

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# Leakage matters: the equipment owner's responsibilities



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# Leakage matters: The equipment owner's responsibilities

The Institute of Refrigeration, working with the Carbon Trust, brings you REAL Zero – Refrigerant Emission and Loss Zero. The aim of this project is in the title – zero refrigerant loss. The project offers practical assistance to everyone involved in purchasing, designing, installing, servicing, maintaining and owning refrigeration equipment to help them reduce leaks.

**Leaking refrigeration and air conditioning systems cost you more to run, damage the environment and are less reliable.**

On a national and international level, the combined environmental and financial impact of refrigerant leakage is significant. It is therefore no wonder that end users are beginning to change the way they think about refrigerants. Until recently, refrigerants have been regarded as a consumable and regular expenditure item – a bit like topping up the oil in your car. However, end users are now starting to value their refrigerant stock as part of their asset base, which needs to be protected.

## 1. Refrigerants and the environment

HFC and HCFC refrigerants have a major impact on the environment and can leak from systems at an unacceptably high rate if left unchecked.

- HCFCs such as R22 deplete stratospheric ozone and are being phased out.
- HCFCs and HFCs are powerful greenhouse gases and thus contribute to adverse climate change.

Refrigerant	R134a	R409A	R407C	R22	R410A	R408A	R404A
<b>GWP relative to CO<sub>2</sub> (110<sup>th</sup> ITH)</b>	1300	1540	1650	1700	1980	3020	3780

In addition, systems with insufficient refrigerant charge use more power than necessary, thus increasing their indirect CO<sub>2</sub> emissions. Leaking systems also have a high cost of service and associated downtime.

## 2. Your legal responsibilities

As an end user of refrigeration or air conditioning (RAC) equipment, you are responsible for complying with the Fluorinated Gas (F Gas) Regulations because you are the operator of the system. The aim of the F Gas Regulations is to reduce leakage of HFC type refrigerants. In brief, the regulations require that you:

- Leak test systems with between 3 and 30 kg of refrigerant charge at least once a year, and systems with more than 30 kg twice a year.
- Fit permanent leak detection to systems with more than 300 kg of charge.
- Log leak tests and refrigerant usage.

- Use engineers qualified to the F Gas Regulations standard to carry out this work.

More detailed information about this regulation and the regulation covering the phase out of HCFCs (the Ozone Depleting Substance Regulation), which also introduces a minimum frequency of checking for leaks of HCFC refrigerant, is provided in a guide titled “R22 Phase Out and F-Gas Regulations” available from [www.ior.org.uk](http://www.ior.org.uk)

F Gas support can also provide practical information:

<http://www.defra.gov.uk/environment/air-atmos/fgas/index.htm>

According to the F Gas Regulations the person having control of the equipment containing the refrigerant i.e. “the operator”, typically a company, is responsible for compliance. The Regulation defines the operator as follows:

“Operator means the natural or legal person exercising actual power over the technical functioning of the equipment and systems covered by this regulation”.

This includes:

- Free access to the system, and the possibility to grant access to third parties
- The control over the day-to-day functioning/running e.g. takes the decision to switch it on or off
- The power to decide on technical modifications e.g. to have checks and repairs carried out

### 3. Why leaks occur and how to reduce them

Many factors affect leakage, for example:

- System design and the components used.
- The type of joint and the quality of brazing.
- How pipes are routed, supported and clipped.
- Vibration elimination.
- The quality of pressure and leak testing during commissioning.
- The age of equipment and the environment it works in.
- Standard and suitability of service and maintenance.

The “Illustrated Guide to 13 Common Leaks” is available from REAL Zero which provides information about the most common leakage points. It is a useful reference document to target actions to reduce leakage.

## 4. Specifications for equipment design, installation, service and maintenance



Leakage can be reduced over the operating life of a plant, by detailed specification, design and installation as well as appropriate service and maintenance. So:

- Design systems in accordance with EN378 and ensure they are compliant with the PER. REAL Zero Guide “Designing out leaks: design standard and practices” has more details.
- Provide enough time for good quality installation and commissioning – this is vital to long-term refrigerant containment.
- Ensure brazers are competent – the industry standard brazing qualifications include a brazed test piece which is sectioned to examine filler penetration.
- Specify the pipe layout and routing accurately to ensure that pipe work is correctly supported and includes vibration elimination.
- Where possible, design in easy access to joints and components.
- Identify joints and components on scaled isometric pipe layouts.
- Ensure that major components such as compressors and packs are mounted so that vibration is isolated.
- Specify a maintenance regime that includes appropriate leak testing – see the next section for information about maintenance contracts and contractors.

**A major cause of leakage is poor installation and inadequate commissioning due to insufficient time. Make sure you allow enough time so this essential aspect of the system can be carried out properly.**

Life cycle costing is a useful tool for comparing options for new systems and checking the cost effectiveness of replacing old equipment. The latter is especially important – for many old systems it is impossible to totally eliminate leaks and therefore the environmental and financial costs associated with leakage.

## 5. Your service and maintenance contract

An essential element to leakage reduction is employing the right contractor on the most appropriate contract to maintain your equipment. Refrigerant leakage can occur at anytime throughout the lifetime of a plant so a diligent contractor is essential in advising on ways to avoid it.

Contracts typically fall into four categories and their impact on leakage reduction needs careful consideration. The below table separates refrigerant leakage from other requirements and needs to be a balanced with all the pros and cons:

Type of contract	What's included	Advantages	Disadvantages
Labour and maintenance (semi comprehensive)	Excludes all refrigerant	Possibly the best option as the contractor concentrates on maintenance and will make suggestions about your plant knowing that he does not have to pay for refrigerant.	You do not have total control over the budget and contractor management is essential
Fully comprehensive	Should include refrigerant though some contracts specifically exclude refrigerant due to its cost	Appears the highest cost option, but could be the most cost effective. If the contractor is paying for the refrigerant there is a high emphasis on leak reduction as this increases the contractor's profit	The older your equipment is the higher the cost will be to factor in the 'insurance' of high refrigerant leakage rates.
Maintenance only	Refrigerant chargeable	A good option on new plant where the emphasis is on maintenance and refrigerant leakage should be minimal	Careful consideration needs to be given to the control of refrigerant expenditure.
Pay as you go	Refrigerant chargeable	A good option on new plant where the emphasis is on maintenance and refrigerant leakage should be minimal	Careful management of the contractor is required. This looks like the cheapest option, but you pay for everything so the more the contractor supplies you, the more money he will make.

## 6. Criteria for selecting a contractor

Once you have decided the best option for your business, tender the work to a minimum of three contractors and ask for quotes based on more than one of the above options regardless of your preferred option. As part of the tender process ask them to pre qualify by sending you evidence of the issues below and if you do not receive it do not proceed any further with that contractor. The items in **bold** are essential the others are desirable:

- Written environmental policy
- **Written health and safety policy**
- **Copies of risk assessments and task procedures**
- **Copies of COSHH assessments**
- **Evidence of engineer competencies:**
  - ⇒ **C&G 2078 (current) or 2079 (post July 2011) or CITB equivalent**
  - ⇒ Level 2 or 3 NVQ
  - ⇒ BRA or CITB Brazer certificates (optional for service engineers, mandatory for installation engineers)
- **Evidence of refrigerant management plans including F Gas-compliant refrigerant usage logs**
- Individual management membership of the IOR for those responsible for your refrigeration equipment
- Company membership of a trade association such as the British Refrigeration Association, HVCA or REFCOM
- Registration of engineers with ACRIB so that you can verify their refrigerant handling qualifications
- **From July 2009 all companies employing personnel handling F gases and wishing to purchase F Gas refrigerant will need to be registered with a body to be appointed by Government.**

## 7. Leakage reduction skills

The REAL Zero project has highlighted the need for refrigeration engineers to have additional skills to advise equipment owners on ways to reduce refrigerant leakage. These additional skills would allow engineers to:

- Advise how to minimise leakage in new and existing plant through appropriate design, installation and maintenance.
- Survey and leak test existing plant and identify areas where improvements can be made to reduce leak potential, for example by replacing certain components and specifying an appropriate leak test regime.
- Outline legal requirements and responsibilities such as those under the F Gas and ODS Regulations, and provide information on effective and practical compliance.
- Audit compliance and maintenance on a site-by-site basis.



**For details of advisers who can help with refrigerant management and leakage reduction strategies – see [www.realzero.org.uk](http://www.realzero.org.uk)**

The relevant training material is being prepared under the REAL Zero project on behalf of the Carbon Trust.

## 8. Servicing and maintenance of your equipment

### Seven golden rules for refrigerant leakage reduction

1. Draw up a tender document which identifies what work is included and on what basis; if necessary employ and independent consultant to advise on this.
2. Interview as many potential contractors as possible (who have passed the pre-tender screening process).
3. If appropriate, include capital works related to leakage reduction in the service and maintenance contract to provide an incentive to carry out improvements which will reduce leakage. **Note** – high cost improvements or replacements should always be tendered separately.
4. For large sites or multi site organisations consider appointing more than one contractor (but ensure there is a clear division of work). This will give you greater flexibility if you need to re-allocate contracts and stop contractors becoming complacent.
5. Give potential contractors access to the refrigeration equipment to ensure they are able to tender to your exact requirements.
6. Include refrigerant leakage reduction as a key performance indicator and ask the contractor to demonstrate a strategy for leakage reduction.
7. Award a contract for more than one year's duration to provide an incentive to the contractor to invest in leakage reduction; this is especially important for comprehensive contracts.

## 9. Your obligation to manage refrigerant strategically

A system that is well specified, designed, installed and maintained should not suffer any significant leakage during its lifetime.

Employ a contractor who firmly believes in the need to reduce all refrigerant leakage and understands the impact of leakage on system efficiency and energy costs. Ensure through accurate refrigerant reporting that your contractor identifies and repairs all leaks and use this knowledge and experience to correct the potential for leakage on other systems. Play a key part in monitoring and discussing refrigerant leakage with your contractor and be willing to invest in improvements where necessary.



**Remember:  
If you don't  
measure it you  
can't manage it!**

If your contractor is providing refrigerant usage records to comply with the F Gas Regulations, make sure you analyse the reports and take appropriate action where necessary. This type of reporting can easily identify systems that have a high leakage rate over a period and be used to benchmark for improvement. Sample reports and calculator tools are available from the REAL Zero website.

Refrigerant containment should be a priority for everyone who designs, builds, uses or maintains refrigeration or air conditioning systems. If we want to continue to have the best choice of refrigerants in the future, we must ensure that refrigerant is

contained within the system. **If the refrigerant is contained within a system its environmental impact is negligible.**

## 10. References and sources of further information

- F Gas Regulations – EC 842/2006 Regulation of the European Parliament and of the Council on Certain Fluorinated Greenhouse Gases
- R22 Phase Out and F-Gas Regulations available from [www.ior.org.uk](http://www.ior.org.uk)
- Guidance from F Gas Support available at [www.defra.gov.uk/fgas](http://www.defra.gov.uk/fgas)
- BS EN378:2008 Refrigerating systems and heat pumps – Safety and environmental requirements available from [www.bsigroup.com](http://www.bsigroup.com)
- Pressure Equipment Regulations 1999 (SI 1999/2001) and The Pressure Equipment (Amendment) Regulations 2002 (SI 2002/1267)
- The British Refrigeration Association Joining of Copper Pipework for Refrigeration Systems – [www.feta.co.uk](http://www.feta.co.uk)