June 2019 Volume 73 Number 6
www.iheem.org.uk

IHEEM

health estate journal

hej

JOURNAL OF THE INSTITUTE OF HEALTHCARE ENGINEERING AND ESTATE MANAGEMENT

Making the best choice with chillers and boilers

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Making the best choice with chillers and boilers

Russ Baker MInstR, director, UK&I Hire, at ICS Cool Energy, a specialist in the hire and sale of chillers and boiler hire and the provision of smaller temporary HVAC units, considers some of the key challenges posed by the F-Gas Regulation, and highlights the importance of forward planning when considering the mobilisation of chillers and boilers in healthcare settings. He also highlights the obligations on owners of refrigerant systems, and considers the financial and other benefits of 'hire *vs.* buy'.

The temperature control industry – like many important industrial and engineering sectors – is governed by stringent regulations and laws. One of the most important for the temperature control arena is the F-Gas Regulation, the latest update to which came into force on 1 January 2015 – a complicated regulation designed to lower the amount of greenhouse gas released into the environment by phasing down the use of hydrofluorocarbons (HFC) gases in line with the EU 2050 Low Carbon roadmap.

Healthcare engineering personnel need to be fully up to speed with the regulation, and to note the importance of applying regulatory guidance to all chiller and air-conditioning refrigeration systems across the healthcare estate.

What is 'F-Gas'?

Let me firstly set out what constitutes an 'F-Gas', and some of the surrounding implications:

- An F-Gas is any fluorinated greenhouse gas, commonly abbreviated to HFC or PFC, which had several industrial uses alongside being used as a refrigerant.
- All refrigeration equipment owners must be compliant with the 2014 EU F-Gas regulation – EU 517/2014.
- While they offer excellent refrigerating properties, F-Gases all have very high Global Warming Potential (GWP).
- Alongside the Ecodesign for Energy-Related Products Regulations 2010 (ErP), the F-Gas Regulations are a significant component of the EU '2050 Low Carbon Roadmap'.

What is GWP?

GWP is 'Global Warming Potential', and all substances have a GWP in the form of a number, which is representative of its potential as a greenhouse gas by comparing it to CO_2:

Example:

- GWP of CO_2: 1.
- GWP of refrigerant R404A: 3922.

This means that every kg of R404A released into the atmosphere has the same greenhouse effect as 3,922 kg of CO_2.

HFC phase-down

In Europe, we are now embarked on a HFC Phase-down programme which runs from 2015 to 2030 (Fig. 1). During phase-down, the amount of HFCs placed on the market will be gradually reduced to around 21% of the starting figure by 2030. This will be achieved by applying a quota system which considers the GWP as well as the mass of refrigerant, so if a quota holder has an allocation of 100,000 tonnes CO_2e (CO_2 'equivalent'), the physical amount of refrigerant equates to 48 tonnes R410A (GWP 2088), or 70 tonnes R134a (GWP 1430).

Russ Baker.

The Phase-down chart (Fig. 2) shows the reductions in terms of percentages, and the first major drop is from 2017-2018, where the availability is down to 63% of the starting figure. If, at the start, the average GWP was 2,000, then by 2018, the average GWP should be down to 1,260.

By choosing low GWP refrigerants for new equipment, and by avoiding or converting from high GWP options, the overall average GWP will quickly reduce.

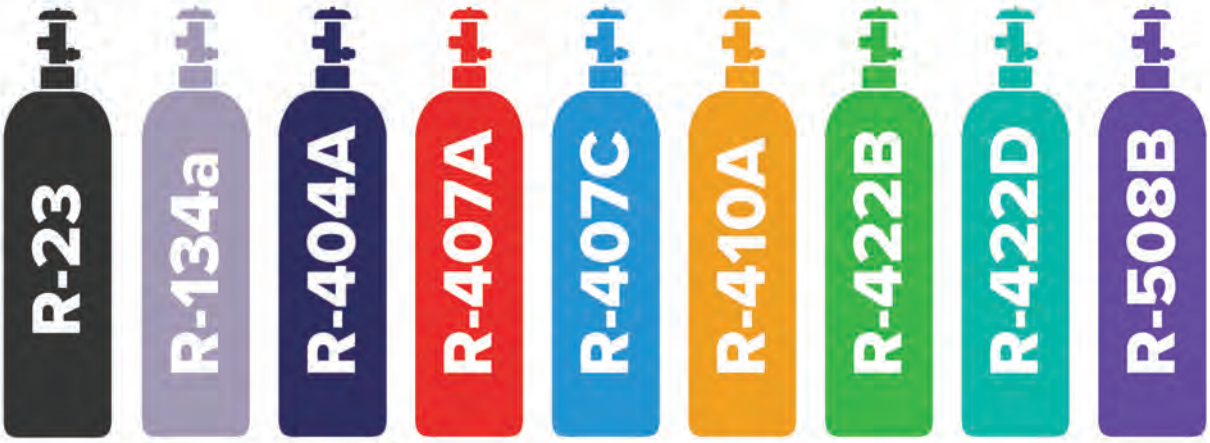

Figure 1: The latest colour coding used for the various HFC refrigerant gases.

Key obligations of owners of refrigerant systems

It is the obligation of any organisation or owner of refrigerant systems to prevent refrigerant leakages by:

- Ensuring that refrigerant leak tests are carried out at the necessary frequency.
- Making sure that any refrigerant leaks are repaired without delay.
- Ensuring proper recovery during repair/maintenance and at end of life.
- Maintaining proper records of F-Gas usage for every machine.

Another obligation on such personnel is containment, necessitating the undertaking of regular refrigerant leak tests by a competent and F-Gas certified technician from a certificated company. The frequency of leak tests is determined by the CO_2e of the weight of the refrigerant charge, as in Table 1.

If a fixed leak detection system is installed, the leak check frequency is halved; thus a three-monthly frequency for testing becomes six-monthly.

A chiller with 25 kg R410A (2088) will require six-monthly leak checks, whereas a chiller with 25 kg R134a (1430) needs 12-monthly leak checks.

- Refrigerant leak repairs – Where a leak is found, it must be repaired 'without delay', or the chiller safely decommissioned, and the remaining charge recovered.
- Refrigerant leak detection – Operators of equipment with an F-Gas charge in excess of 500 tonnes of CO_2e need to ensure that the equipment has an automatic leak detection system which will alarm in the presence of an F-Gas leak. The leak detection system must be checked and calibrated at least every 12 months.

Refrigerant recovery

The Regulation prohibits the release of any F-Gas into the atmosphere. The owner must ensure that the refrigerant is properly recovered by a certificated operative into a designated 'recovery' container. Recovery is necessary at the end of the refrigerant's life, and may be necessary on occasions during the lifetime of the equipment to facilitate repair, maintenance, or a charge check.

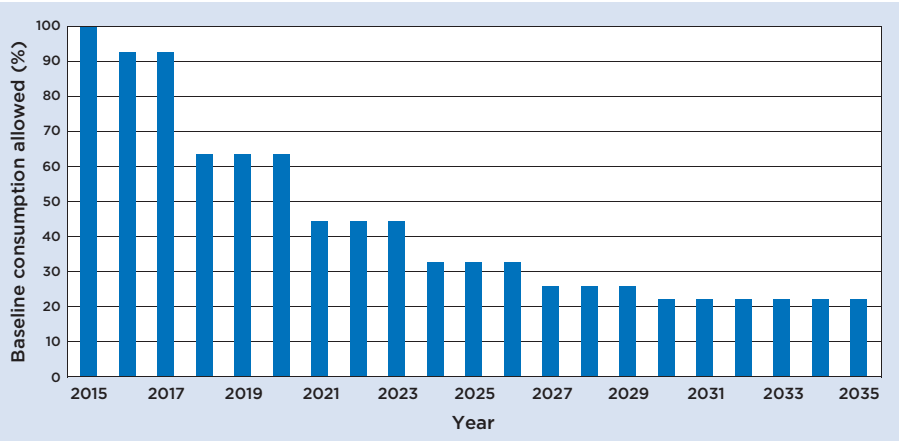

Figure 2: EU HFC Phase-down steps.

Table 1: The frequency of leak tests.

Charge CO_2e	Leak check frequency
500 tonnes or more	At least every 3 months
50 to 499.99 tonnes	At least every 6 months
5 to 49.999 tonnes	At least every 12 months

Record-keeping

The owner must keep records relating to leak checks, F-Gas losses, and additions – whether dealing with virgin or reclaimed gas, end-of-life recovery, dates, and the identity of the company undertaking the work and its certificate number. Every machine should have its own record/log.

Training and certification

Anyone who undertakes any work on the equipment must hold a current F-Gas Category 1 certificate. Such work includes installation, servicing, maintenance, repair, leak checking, recovery, and decommissioning. The company that employs the certificated person must also be certificated and listed on a national register.

Labelling

All products and equipment which contain F-Gases must carry a label which meets with the requirements listed in the Regulation. The label must include:

- Confirmation that the equipment contains an F-Gas.
- The industry name for the F-Gas, or the chemical name if there isn't an accepted industry name.

From 2017 the label must also state:

- The mass of F-Gas in the equipment (in kg).
- Carbon dioxide (CO_2) equivalent mass of F-Gas in the equipment (in tonnes).
- GWP of the F-Gas.
- If the F-Gas is 'hermetically sealed' within a product, the label must also confirm this.

Finding F-Gas certified suppliers

ICS Cool Energy's F-Gas qualified service engineers will ensure that you are F-Gas-compliant. F-Gas compliance comes as

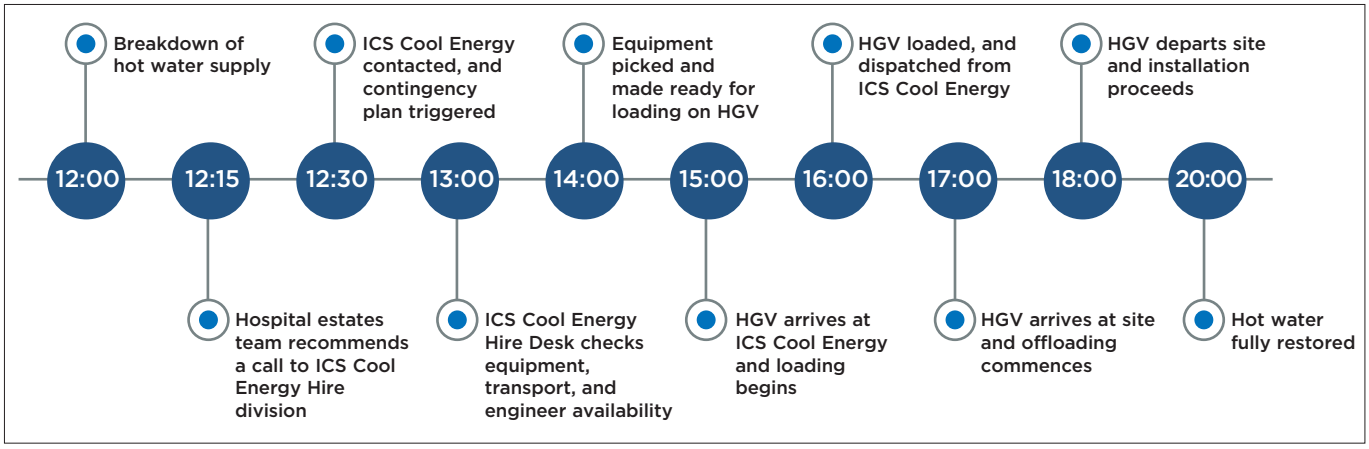

Figure 3: A timeline of ICS Cool Energy's work with a hospital to address the temporary loss of its hot water supply.

standard with every Planned Preventative Maintenance Programme undertaken, and the frequency of your F-Gas checks will be in line with your CO_2 charge.

Key Phase-down dates
Key High GWP Refrigerant Phase-down dates are as follows:

(Affects chillers)
Ban on new equipment with refrigerant with GWP >2500.

1 January 2020 (Affects chillers)
Service and maintenance ban of existing equipment with virgin refrigerants with GWP >2500 where charge is greater than 40 tonnes CO_2e. (Equates to 10 kg R404A).

1 January 2020 (Not chillers)
Ban on movable room air-conditioners with refrigerant with GWP >750.

1 January 2022 (Not chillers)
Ban on new hermetic and multi-pack centralised systems over 40 kW capacity with refrigerant with GWP >150.

(Not chillers)
Ban on refrigerators & freezers for the storage, display, or distribution of products in retail and foodservice (commercial use) with refrigerant with GWP >150.

(Not chillers)
Ban on single split air-conditioning systems containing less than 3 kg refrigerant with GWP >750.

1 January 2030 (Affects chillers)
Ban on the use of refrigerants, recovered, reclaimed, and/or recycled with GWP >2500 for service and maintenance.

Moving to low GWP refrigerants

As well as taking care of your F-Gas compliance and obligations, our service engineers can convert your existing plant to low GWP refrigerants, meaning that you can rest assured that you are compliant with all refrigeration-associated legislation, and benefit from reduced operating and maintenance costs. ICS Cool Energy can support you with low GWP refrigerant selection; our highly qualified technical team can support and guide with work on any new refrigeration plant when maintaining or planning for future systems.

HVAC contingency planning – minimising your risk of failure

All healthcare estates/engineering teams need to have in place HVAC contingency plans in order to minimise the impact of failure of any key plant on their healthcare facility's continuing operation. If comfort cooling or heating (HVAC), or hot water (DHW) supply are disrupted, it is essential that a back-up plan has been prepared to support all services while repair or replacement of failed chillers or boilers is made. Follow these steps to protect your operation against the impact of chiller or boiler downtime:

1. Estimate the true costs of unplanned downtime – don't just review the cost of repairing equipment. If your equipment is unrepairable, or a part is not available immediately, you could run into days, weeks, or even months of downtime. The severity of the failure may have a critical effect across the hospital site.
2. Research the likely causes of disruption to your HVAC systems. Identify the potential causes of HVAC system failure, such as extreme weather, power outages, vandalism, accidental damage, or equipment failure, and rank them by probability. This will help you to further understand the level of risk and provide you with scenarios to be prepared for.
3. Undertake a critical equipment audit and create an asset list. Understanding which equipment on site is critical, as well as the areas within your healthcare facility where HVAC or DHW must not be compromised, will ensure that you have the right focus when power or equipment fails. You will also need to address any current performance problems with your equipment, and create an asset list, so that you have a reference point that your team can access when they need to fix or find a replacement. The list should include both all manufacturers' details, and product serial numbers.
4. Survey your site to understand any logistical considerations. Your healthcare facilities may be in a listed building, or have very limited access. It is important that your equipment partners and maintenance team are aware of any logistical issues which may complicate or delay maintenance work or equipment replacement.
5. Create a plan for standby equipment. Now that you have clearly identified which equipment you can't afford to be without, you need to know how you will go about avoiding downtime.

An ICS Cool Energy engineer undertaking complete electrical testing on a chiller ready to hire.

> Identify the potential causes of HVAC system failure, such as extreme weather, power outages, vandalism, accidental damage, or equipment failure, and rank them by probability

Emergency chillers on site after a sudden breakdown, supporting an MRI scanner and cancer ward.

You can approach this in a number of ways, depending on available capital, technical 'fixability', and how much time you can or can't afford to lose when disaster strikes. Firstly, you can purchase standby equipment to remain on site, ready to be deployed immediately. This will not only require capital expenditure, but will also necessitate ensuring that the equipment it is well maintained, compliant, and regularly checked.

Secondly, you could keep hired equipment on your site on a long-term hire discounted agreement, and have your system adapted so it is ready to accept, meaning no downtime whatsoever. Hiring, rather than purchasing the equipment, would save the cost and time of any additional maintenance, and afford full flexibility in size and positioning.

Thirdly, you could work with your specialist equipment provider to hire precisely the equipment you need at a moment's notice. A good temperature control equipment provider will have undertaken a survey of your site, kept an inventory of the critical equipment you need, ensured that it keeps stock of that equipment, and will deliver, install, and commission it for you within agreed timescales.

6 Prepare your site. Prepare connection points for power, water, and air distribution ducting in advance, and determine whether the current electrical provisions are adequate for any additional or new equipment, such as a chiller or boiler.

7 Assign responsibilities and an action plan. Ensure that your team understands who is responsible for rolling out all aspects of your contingency plan, and has named contacts and details available of all suppliers likely to be involved in any breakdown or equipment replacement emergencies.

8 Review your contingency plan regularly. As your site changes, your contingency plan needs to be considered too.

9 Follow a regular chiller maintenance plan. As soon as you install and commission equipment on your site, you should be following a preventative maintenance plan. Alongside covering the maintenance of your equipment, this should also include system water analysis and any necessary treatment. With hard water often running through HVAC equipment, it is essential to keep the entire system well maintained.

10 Keep an inventory of all parts needed for your equipment. If you undertake your own HVAC maintenance, you need to know where you can get spares from, and the typical turnaround. If the parts are critical, it is worth keeping spares on site, so that you can replace immediately.

Due to a gas leak on a hospital's original coil, which is critical for the operation of its MRI scanner, ICS Cool Energy swiftly mobilised an emergency 80 kW chiller with a secondary pump. A plated stainless steel heat exchanger ensures that the primary side (demineralised water system) remains at peak performance.

Making a choice as to whether to hire or buy

One of the key dilemmas facing healthcare estates teams when it comes to chiller or boiler equipment is that of whether to purchase or hire, against the backdrop of potential unbudgeted capital expenditure. ICS Cool Energy provides the choice between the hire or purchase of chiller systems; each has its benefits and merits.

Hiring equipment within the healthcare environment is a route that some healthcare estates teams choose to follow, often as a result of limited capital and long-term decision making. In taking the decision to hire, the healthcare customer, say an NHS Trust, avoids outright purchase costs, and makes capital available for other immediate priority services. There are many other benefits to hiring, which you may not have considered. A hire solution also helps to minimise time and resource demands – a cost that is not always easy to quantify.

Long-term hire *vs.* buying

Among the benefits of long-term hire worth considering are the flexibility of being able to tailor temperature control as buildings are reconfigured, or should the size of a particular department or unit increase or decrease. All the equipment is taken care of – freeing you up to look after the future demand. Hire options can also mean more effective and clearer budgeting, removing the need for capital expenditure, and setting aside essential funds for maintenance and repairs.

The benefits of buying

While some NHS Trusts, for example, may prefer to hire, others may rather buy when capital becomes available. Purchasing brings its own merits, including:

- A system designed specifically for your needs – for specific temperatures, or with specific exhaust noise levels from chiller fans with low pressure loss and high noise reduction.
- Reduced long-term cost – it is likely that in the long-term you will pay less for the equipment, even though there is an upfront cost.
- 'Try before you buy' is often available for a limited period – giving you some degree of flexibility and the time to make sure the equipment meets your needs.
- Extended warranties and service packages – offered as part of a capital purchase, typically protecting you from additional costs outside of a service agreement for the first few years.
- Funding and finance available – helping to further reduce your costs. Schemes such as those from the Carbon Trust provide funding toward energy-efficient replacements or interest-free loans.

Understanding your needs

Understanding your particular requirements, and what works best for all areas – from Operations through to Finance – is the key to identifying the right solution for your needs. There is no 'one size fits all', which explains why our customers choose to partner with ICS Cool Energy – we can provide solutions that meet healthcare customers' precise requirements, drawing on expertise from all areas of our business – hire, sales, and service. hej

WE'LL KEEP YOUR FACILITIES, PATIENTS AND STAFF AT THE OPTIMUM TEMPERATURE

- Boiler plant up to 2MW for emergency heating and hot water supply or to provide cover during planned maintenance
- Chillers from 0.3kW to 4MW to provide cooling from MRI scanners through to complete building facilities
- Portable heaters and air conditioners to keep facilities at the required temperature

WHATEVER YOUR TEMPERATURE CONTROL NEED, OUR TECHNICAL TEAM CAN HELP 24/7.

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WE MAKE IT WORK

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