STAR REFRIGERATION

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Smart Thinking

Topic

F-Gas Regulations – What you Need to Know

Author

Rob Lamb
Group Sales and Marketing Director

The effects of the F-Gas Regulations on refrigeration gas production, equipment, service and maintenance

Refrigerant Gas costs set to increase by 20% – Effects of the F-Gas Regulations on refrigeration gas production, equipment, service and maintenance.

New European Union (EU) regulations will dramatically affect the cost and availability of synthetic refrigerants with high global warming potential. As Europe begins its scheduled phase down of selected HFC gases, there is a need for food manufacturers, temperature controlled storage and distribution firms and other process industries to take a long term, strategic view of their refrigeration systems in order to mitigate significant future financial costs.

Phase Down

As the phase down of HFC gases with high global warming potential takes place over the next 15 years, there will be a rapid increase in cost and a marked decline in their availability.

Refrigerant manufacturers have been allocated quotas for the HFC gases they can produce and supply within Europe. These quotas are measured in terms of carbon equivalent rather than kg, with the target to cut the current levels down to 63% by 2018, 45% by 2021 and 21% by 2030.

Over the past fifteen years, the refrigeration industry has seen the gradual phase out of synthetic, ozone-depleting refrigerants. From January 2015 the last of these HCFC gases, including R22, were banned in Europe.

HFC refrigerants have been widely used as replacement gases for CFCs and HCFCs, but are now the focus of the EU's F-Gas Regulations. Gases such as R404A and R507 have been found to have a high global warming effect and are currently the subject of a 15-year phase out programme. need to be aware that these gases are at risk in the near future.

The new F-Gas regulations set out the phase down timeframe for HFCs and impose greater requirements for leak testing.

In addition to production phase downs, product and service bans will come into effect over the next seven years. These include a complete ban from 2020 on the use of virgin R404A and R507 gases for stationery refrigeration systems with a charge greater than 10kg.

The F-Gas regulation affects your business

Do you know the level of risk of the gases you are using? High risk refrigerants over the next five years will become harder to source, and more expensive as they will be in high demand.

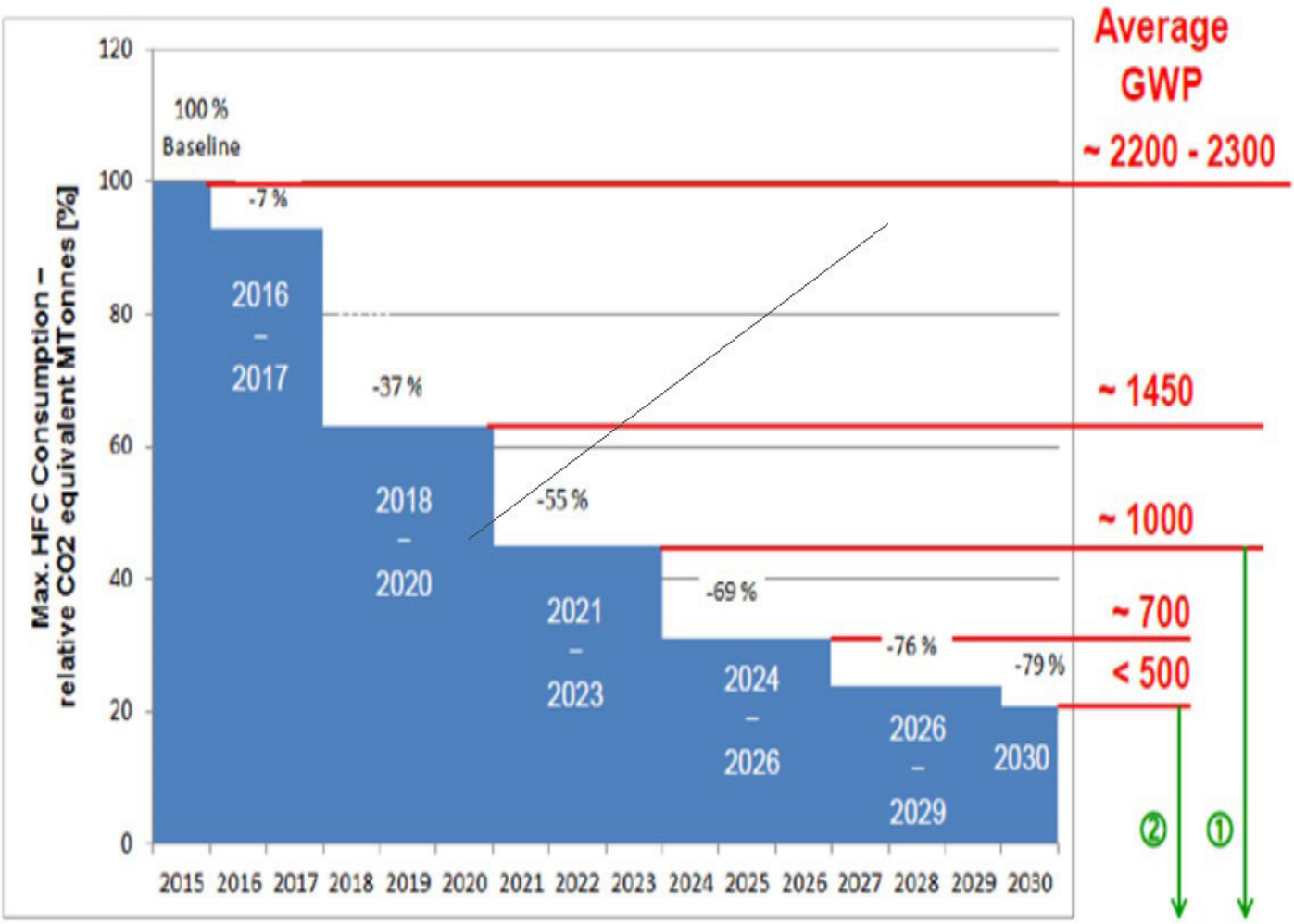
Users of refrigeration systems that operate on HFCs need to be aware that these gases are at risk in the near future. The message from Europe is clear: HFC refrigerants are not a viable long term solution and refrigeration plant operators should look to invest in futureproof cooling systems to avoid escalating costs and ensure uninterrupted business operation.

Record Keeping

The new F-Gas regulation demands all companies keep comprehensive records of all gases and refrigerants used and details of any leakages. You must record:

- Quantity and type of gas installed
- Quantity of gas added*
- Whether gas is recycled/reclaimed
- Quantity of gas recovered
- Identity of who carried out the work
- Dates and results of leakage tests

- Measures taken to recover and dispose of refrigerant at end of life
- Copies kept for 5 years by operators and contractors



The expected phase-down timeframe for HFCs.

Installation, maintenance, service and leakage

The regulation also strengthens the requirement for the use of certified personnel. It is complsory for contractors to train staff working on refrigeration systems and carrying out one or more of the following tasks:

- Installation/service/maintenance
- Repair
- Decommissioning
- Leak checking
- Recovery

More information on F-Gas training and certification at http://www.i-know.com/f-gas-certification-and-training-city-and-guilds-2079.aspx

Equipment and Service Bans

The phase down of certain refrigeration gases is accompanied by bans on non-sustainable equipment. The table below shows which products and refrigerants are affected:

Product/Equipment	Year	Refrigerant affected
Refrigerators and freezer for commercial applications (hermetically sealed) using HFCs with GWP ≥ 2500	2020	R404A, R507, R417B, R422D
As above but HFCs with GWP ≥ 150	2022	R134a, R407A/C/F, R410A, R417A, R427A
Stationary refrigeration using HFCs with GWP ≥ 2,500 except below -50°C	**2020**	**R404A, R507, R417B, R422D**
Multipack centralised refrigeration equipment ≥ 40kW using fluorinated gases with GWP ≥ 150 (cascade systems GWP < 1,500 permitted)	***2022***	***R404A, R507, R417B, R422D, R407A/C/F, R410A, R417A, R427A (R134a permitted in cascade)***

There will also be a ban on the servicing of equipment with a charge of more than 40 tonnes CO2-eq from 2020: this affects refrigerants with a GWP ≥ 2,500. Between 2020 and 2030 it will be possible to use reclaimed or recycled refrigerant with a GWP ≥ 2,500.

Whilst refrigerant suppliers are busy developing new blended synthetic gases with lower global warming potential, there are long-established, natural alternatives, including CO2 and ammonia. Both refrigerants can achieve great efficiencies and are safe to use when managed by trained personnel. In

addition, the use of advanced technologies such as low charge ammonia systems further reduces refrigerant related concerns, with charges reducing up to 90% (for an example of how this is achieved see the Brakes case study).

High Risk	Medium Risk	No Risk
R404A	R134a	HFO
R507	R407A/C/F	HFO/HFC
R417B	R410A	Ammonia
R422D	R417A	CO_2
	R427A	HC

Don't take risks!

Refrigerant	GWP	Minimum Charge Size (kg)
R404A	3922	10.20
R422D	2729	14.66
R507	3985	10.04

Plan for the future

Businesses need to start preparing for the future now – remember implementing change as soon as possible is likely to save you money in the future. There are a number of options available for users of HFC refrigeration systems: keep what you have got, gas retrofit, secondary conversion or a replacement plant using synthetic or natural refrigerants. Each has its benefits but also its challenges:

Option 1 – Keep what you've got and see what happens in the future

This is by far the lowest cost option but also the riskiest. Even if existing equipment is retained, steps should be taken to address 'leaky' components. Thought should also be given to whether low cost options are available to reduce refrigerant charge without affecting performance. Checks should be made to ensure the necessary leak detection measures are in place. At some point in the future, a drop in alternative refrigerant may be available for the equipment, but this is not guaranteed. This gas change may require costly modifications which result in loss of capacity and/or efficiency.

Option 2 – Gas Retrofit

For relatively recent plant installations, a gas retrofit provides a medium term solution and avoids investment in an entirely new system. Alternative HFC and HFC/HFO refrigerant blends are available or being field tested for retrofit to existing system. These have GWPs that aren't subject to the 2020 service ban and therefore provide some degree of certainty in the future. Depending on the style of system and the current/retrofit gases, there may be cost implications as well as changes in efficiency and capacity. As with Option 1, attempts should be made to reduce refrigerant charge, particularly as the new refrigerant is likely to be many times more expensive per kg. When considering this option, a detailed plant survey should be carried out to determine the suitability of available gases and what measures need to be taken with the existing equipment.

Option 3 – Secondary Fluid Conversion

One option often overlooked is the possible conversion of the existing, direct refrigeration system to cool a secondary fluid that can then be circulated out to the point of cooling. The secondary fluid could be water or glycol, but consideration should also be given to the use of a volatile fluid such as CO2. In most cases, the existing pipework and heat exchangers at the point of cooling will need to be replaced, resulting in a significant cost but without the need to replace the compressor(s) and condenser(s). The resulting system will have 80% to 80% less primary refrigerant and could mean that a service ban is avoided from 2020. The lower primary refrigerant suction temperature and need to pump a secondary fluid will typically increase power consumption and reduce capacity. As with Option 2, a detailed survey is recommended to review the suitability of the system to conversion and what works will be necessary.

Option 4 – Replacement Equipment

This final option is recommended where the existing plant isn't in a suitable condition for Options 1 to 3. In this case, transition refrigerants such as R407F are available, but consideration should also be given to natural refrigerants such as ammonia and carbon dioxide. Ammonia has zero GWP and CO2 a GWP of one, meaning that they aren't affected by the F-Gas regulation. This means that both can offer a long term solution and are available over a range of applications and capacities.

Replacement equipment options by refrigerant

When it comes to replacement equipment options, synthetic refrigerants perform well but can slightly increase running costs. https://www.youtube.com/watch?v=yax4lD_xnWE

F-Gas Training & F-Gas Certification

This video shows a refrigeration, air conditioning and heat pump engineer going through the tasks involved in the actual City & Guilds 2079 F-Gas Certification assessment in preparation for the exam. The tasks carried out involve brazing a piece, charging refrigerant into the system, identifying the refrigerant, pressure test, leak test and evacuation of the system. This practical session was carried out at Star Refrigeration's Glasgow branch.

Following EU legislation, it is a legal requirement for engineers handling, recovering, supplying, installing, manufacturing, maintaining, servicing or having ownership of refrigeration, air conditioning and heat pump equipment containing HFC refrigerants to be F-Gas certified.

Synthetic Refrigerants

- R134a lowest GWP for chill
- R407A/F lower GWP options for freezers
- Possible use of R32 at low temperature
- Slightly higher capital cost vs R404A/R507
- Look at small, low charge systems
- Consider EC fans, EEVs and inverter motors

Natural gases such as ammonia have been successfully used as refrigerants for over 100 years. Ammonia has no global warming effect and offers high efficiency, long term availability and low cost per Kg. The use of carbon dioxide as a refrigerant is also growing in popularity due to its relatively low global warming potential. Here's what you need to know:

Natural refrigerants – Ammonia

- Suited for systems > 100kW
- Chill, freezer and two stage options
- Secondary chillers
- Established technology
- Higher efficiency than HFCs
- Zero GWP
- Higher capital cost
- Flammable and toxic
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Natural refrigerants – CO2

- Suited for systems < 200kW
- Chill, freezer and two stage options
- Similar performance to HFCs
- Higher operating pressure
- Higher capital cost
- GWP = 1
- High grade heat recovery available

Natural refrigerants are a long term solution for companies affected by the F-Gas regulations. The initial capital cost of a plant that operates on a natural refrigerant may be higher, but the lifecycle cost of running the system is key. Those who continue to operate cooling systems with HFCs are facing the risk of escalating running costs in the short to medium term.

For more information and support in selecting the way forward for your refrigeration system, contact Rob Lamb at rlamb@star-ref.co.uk.

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Star Refrigeration

Thornliebank Industrial Estate, Nitshill Rd, Thornliebank,
Glasgow G46 8JW

Tel: 0141 638 7916 star@star-ref.co.uk

@StarRefrig

www.star-ref.co.uk

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