



26th Informatory Note on Refrigeration Technologies / January 2015

Overview of Regulations Restricting HFC Use Focus on the EU F-Gas Regulation

The IIR publishes Informatory Notes designed to meet the needs of decision-makers worldwide, on a regular basis. These notes summarize knowledge in key refrigeration-technology and refrigeration-application domains. Each note puts forward future priority developmental axes and provides IIR recommendations in this context.

Hydrofluorocarbons (HFCs) are greenhouse gases mainly used as refrigerants. Various agreements or regulations to limit their use and reduce their impact on the environment are being discussed. In some cases, they are already applied at global, regional and national levels. This is particularly true of the revised version of European Union “F-gases” Regulation which came into effect on 1 January 2015. It is essential for refrigeration equipment owners and managers to know the new requirements of this regulation in order to understand what to do in terms of maintenance, but also renewal or conversion of their facilities.

With this new Informatory Note focusing on the “F-gas” Regulation and our various publications, the IIR wishes to accompany refrigeration stakeholders in the actions they are taking to ensure compliance with regulatory changes relating to refrigerants.

This Informatory Note was prepared by Michael Kauffeld, President of IIR Commission B2, with the assistance of the IIR head office and was reviewed by several experts from the IIR network.



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Manmade global warming is a big challenge for our society today. It may, among other things, result in substantial arable-land and harvest losses with subsequent migration and potential for global instabilities. Fluorinated greenhouse gases, including CFCs, HCFCs and HFCs, have a significant impact on that climate change. It was recently estimated that they accounted for 12% of all radiative forcing of long-lived greenhouse gases (LLGHGs¹) caused by increasing greenhouse-gas levels since the beginning of the industrial revolution [WMO2011]. Due to the phase-out of CFCs under the Montreal Protocol, atmospheric concentrations of these gases are declining, while those of HCFCs and HFCs used as replacement fluids are rising rapidly [WMO2011]. HCFCs are dealt with by the various Montreal Protocol amendments and have been prohibited in new systems in the EU since 2000 leaving HFCs as the only fluorinated greenhouse gases permitted in the EU. HCFCs will also be banned in other countries: before 2020, in other developed countries and before 2030 in developing countries. While they do not deplete the ozone layer, many HFCs are potent greenhouse gases.

Emissions of HFCs (excluding HFC-23 by-product) currently contribute around 1% to global greenhouse gas emissions, but are growing by 8-9% annually and are likely to increase significantly in the future. This is due to their wide use as replacements for HCFCs and CFCs and because of rapidly increasing demand for refrigeration and air conditioning in emerging economies.

HFC Regulations worldwide

Different agreements or regulations designed to mitigate the use of HFCs and thus to reduce their impact on the environment are under discussion and in some cases already in application at global, regional and national levels.

On a global level, proposals with amendments to the Montreal Protocol aiming at including HFCs have been regularly presented by the United States, Canada, Mexico and Micronesia from 2010 onwards; the North-American amendment includes a gradual phase-down of production and consumption of 19 HFCs on a global-warming-potential (GWP)-weighted basis, with a consumption limited to 15% of the baseline by 2035 for developed countries and by 2045 for developing countries [EPA2014/1]. These proposals face opposition from several countries; however, they contributed to a growing awareness of the problems created by HFCs with strong greenhouse effects and stimulated the publication of regular reports on possible solutions. An increasing number of countries will very likely put into place actions limiting HFCs with strong greenhouse effects, whether international agreements are signed or not.

At the national level, several countries such as Denmark (2007), Austria, Sweden and Switzerland have already prohibited the use of HFCs in many applications. The recent initiative of the US Environmental Protection Agency should be mentioned as it proposed in July 2014 to phase-out high-GWP HFCs such as R404A and R507A in new and retrofit retail food refrigeration systems as early as 2016, to phase-out R134a in new stand-alone retail equipment by 2017 and in new motor vehicle air-conditioning systems by 2021 [EPA2014/2]. Likewise, Japan, which is currently reviewing the “Act on Ensuring the Implementation of Recovery and Destruction of Fluorocarbons concerning Designated Products” intends to request manufacturers and importers of fluorinated gases and refrigeration/air-conditioning systems to carry out an HFC phase-down by means of producing lower GWP refrigerants and deploying non-HFC refrigerants and low-GWP refrigerants [METI2013].

¹ The most important long-lived greenhouse gases (LLGHGs) are carbon dioxide, methane, nitrous oxide, CFC-12 and CFC-11.

Besides, taxes designed to discourage the use of HFCs exist in several countries such as Denmark, Spain, Norway and Slovenia, and are under consideration in a few others.

But it is in Europe, through the European Union's revised F-gas Regulation which came into effect on 1 January, 2015 [UE2014], that the most ambitious Regulation has been implemented, since it involves very significant actions from all the players in the refrigeration sector: equipment designers and manufacturers, installers, engineers, refrigeration technicians and end users of course. It is therefore important to know the requirements and immediate consequences of this Regulation. This is the point of this Informatory Note.

But the implications for managers and owners of refrigeration installations will also result in decisions to make on whether or not to renew or retrofit equipment and what most suitable alternatives to HFCs to choose. This important topic will be the subject of another Informatory Note.

The EU F-Gas Regulation

The European Commission has reviewed the European Union's (EU) Regulation on the Use of Certain Fluorinated Greenhouse Gases ("F-gas Regulation") and published on May 20, 2014 its "Regulation (EU) N° 517/2014 of the European Parliament and of the Council of 16 April 2014" [UE2014] on fluorinated greenhouse gases and repealing Regulation (EC) N° 842/2006. This new Regulation calls for a phase down of HFC consumption (figure 1), increased leakage control for systems containing high-GWP refrigerants, certain marketing bans as well as restrictions in service of existing plants with virgin F-Gases. Experts predict that the phase down schedule shown in Figure 1 will result in a severe shortage of high GWP HFCs leading to a two- to threefold increase in the cost of HFC refrigerants. The phase down schedule will probably create the biggest challenge, rather than the individual placing on the market prohibitions (See Appendix and Figure 2). Exceptions exist for equipment intended for application to cool products to temperatures below -50°C.

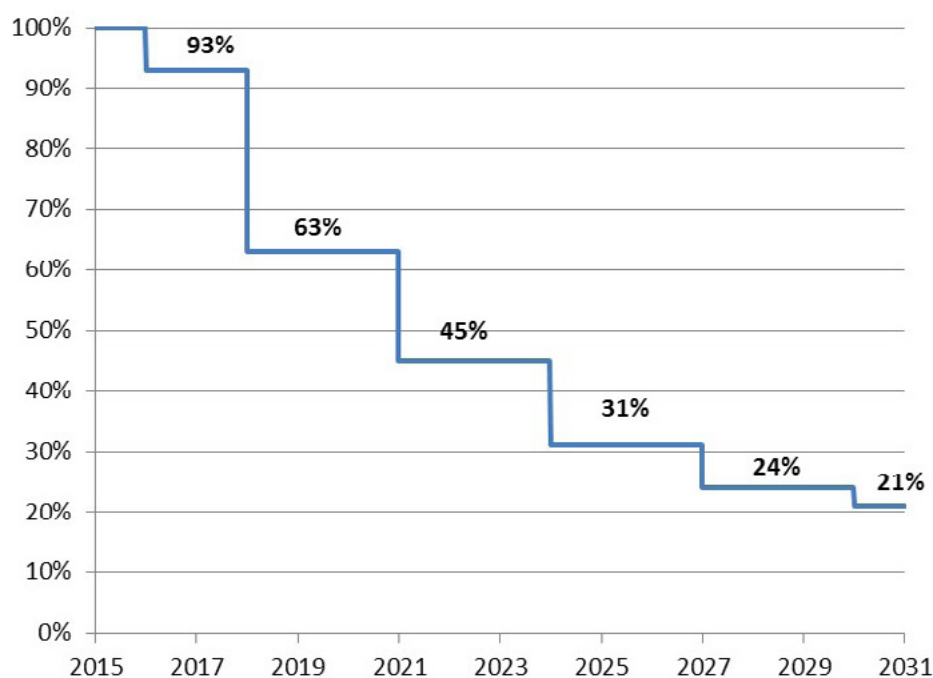


Figure 1: Phase-down schedule of the EU F-Gas Regulation based on the annual average of the total quantity (aggregated quantities of all types of hydrofluorocarbons, expressed in tonne(s) of CO₂ equivalent) placed on the EU market during the 2009-2012 period.

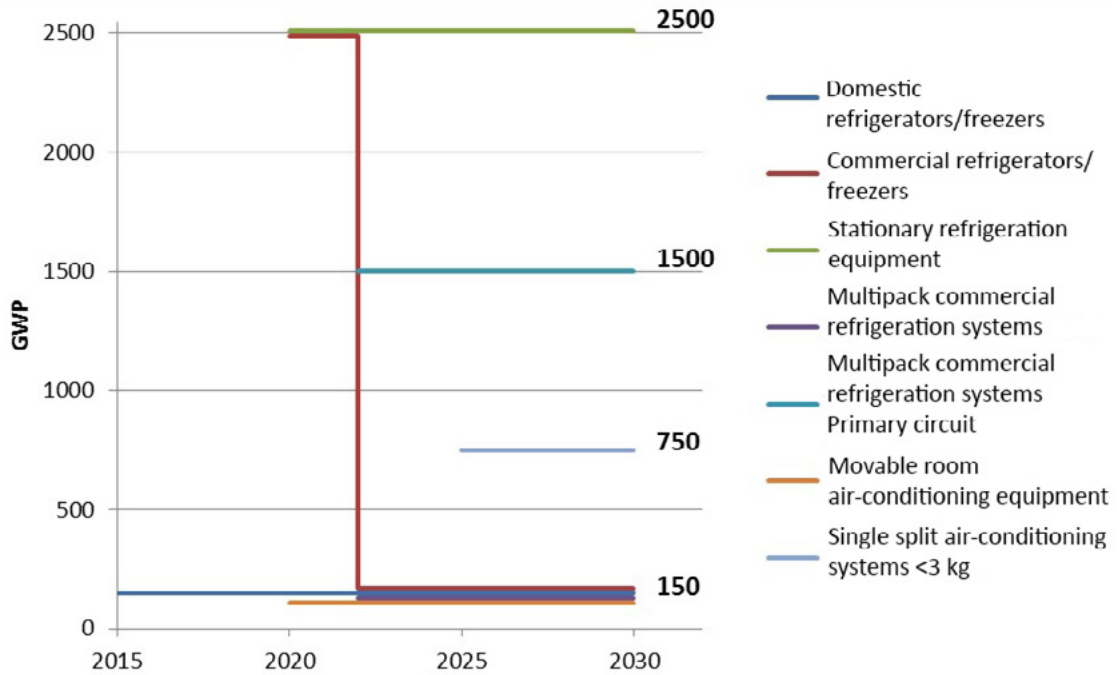


Figure 2: Marketing bans (Annex III of EU F-Gas Regulation).

Figure 3 shows how individual, commonly used refrigerants are affected by the new F-Gas Regulation. In addition to the marketing bans of certain refrigeration and air-conditioning systems (Annex III of the F-Gas Regulation), the use of fluorinated refrigerants with a GWP of 2500 or more, to service refrigeration equipment with a charge of 40 tonnes of CO₂ equivalent or more, will be prohibited starting 1 January 2020 (Article 13). This article will mainly concern R404A and R507A since applications for product temperatures below -50°C are exempted (R23 systems).

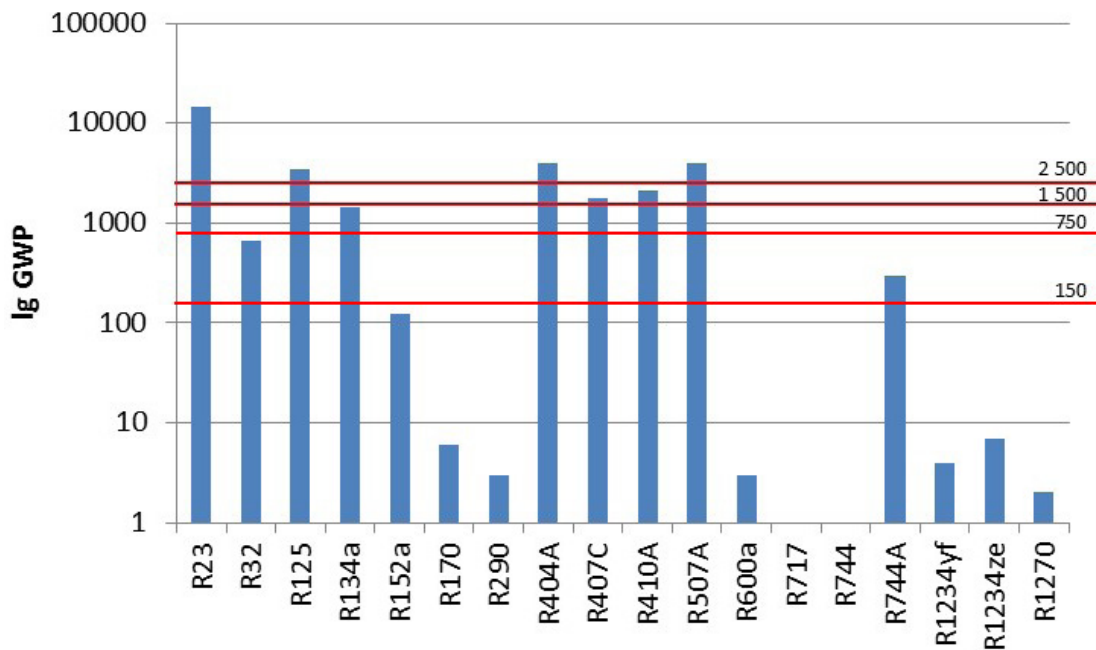


Figure 3: EU F-Gas Regulation threshold values and GWP of various refrigerants on a logarithmic scale.

In addition, the new EU F-Gas Regulation calls for regular leak checks based on tonnes of CO₂ equivalent, which encourages designs with small refrigerant charges.

Table 1 shows a summary of Article 4 of the F-Gas Regulation.

Table 1 - Leak checks according to Article 4 of the new F-Gas Regulation compared to previous leak check schedules.

	at least every 12 months *		at least every 6 months *		at least every 3 months *	
	Old	New	Old	New	Old	New
	F-Gas Regulation		F-Gas Regulation		F-Gas Regulation	
	more than 3 kg F-Gas	more than 5 t CO ₂ eq. **	more than 30 kg F-Gas	more than 50 t CO ₂ eq.	more than 300 kg F-Gas	more than 500 t CO ₂ eq.
R23	3 kg	0.34 kg	30 kg	3.4 kg	300 kg	34 kg
R32	3 kg	7.41 kg	30 kg	74.1 kg	300 kg	741 kg
R134a	3 kg	3.5 kg	30 kg	35 kg	300 kg	350 kg
R404A	3 kg	1.26 kg	30 kg	12.6 kg	300 kg	126 kg
R407C	3 kg	2.82 kg	30 kg	28.2 kg	300 kg	282 kg
R410A	3 kg	2.40 kg	30 kg	24.0 kg	300 kg	240 kg
R507A	3 kg	1.26 kg	30 kg	12.6 kg	300 kg	126 kg
R1234yf	3 kg	1,250 kg	30 kg	12,500 kg	300 kg	125,000 kg

* time intervall doubled where a leakage detection system is installed

** lower limit 10 tonnes CO₂ equ. for hermetically sealed systems

Mandatory Leakage detection over 300 kg (Old) and over 500 t CO₂ eq. (New)

“Old” F-Gas Regulation: EU Regulation 842/2006

“New” F-Gas Regulation: EU Regulation N° 517/2014

Systems containing more than 500 tonnes CO₂-equivalent (right column of table 1) must be equipped with a leakage detection system (Article 5).

So the refrigerant charge of the system in terms of CO₂ equivalent tons is one of the key elements in this Regulation.

References

[UE2014]: Regulation (EU) N° 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) N° 842/2006

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.150.01.0195.01.ENG

[WMO2011]: World Meteorological Organisation (WMO) Greenhouse Gas Bulletin N° 7, 2011

[EPA2014/1]: 2014 North American Amendment Proposal to Address HFCs under the Montreal Protocol <http://www.epa.gov/ozone/intpol/mpagreement.html>

[EPA2014/2]: SNAP Regulations-Proposal to prohibit certain high-GWP HFC alternatives <http://www.epa.gov/ozone/snap/Regulations.html>

[METI2013]: Cabinet Decision on the Bill for the Act for Partial Revision of the Act on Ensuring the Implementation of Recovery and Destruction of Fluorocarbons concerning Designated Products http://www.meti.go.jp/english/press/2013/0419_01.html

Appendix

Individual Placing on the market prohibitions referred to in Article 11 (1), listed in Annex III of EU Regulation N° 517/2014

10. Domestic refrigerators and freezers that contain HFCs with a GWP of 150 or more		1 January 2015
11. Refrigerators and freezers for commercial use (hermetically sealed equipment)	that contain HFCs with a GWP of 2500 or more	1 January 2020
	that contain HFCs with a GWP of 150 or more	1 January 2022
12. Stationary refrigeration equipment, that contains, or whose functioning relies upon, HFCs with a GWP of 2500 or more, except equipment intended for applications designed to cool products to temperatures below -50°C		1 January 2020
13. Multipack centralised refrigeration systems for commercial use with a rated capacity of 40 kW or more that contain, or whose functioning relies upon, fluorinated greenhouse gases with a GWP of 150 or more, except in the primary refrigerant circuit of cascade systems where fluorinated greenhouse gases with a GWP of less than 1500 may be used		1 January 2022
14. Movable room air-conditioning equipment (hermetically sealed equipment which is movable between rooms by the end user) that contain HFCs with a GWP of 150 or more		1 January 2020
15. Single split air-conditioning systems containing less than 3kg of fluorinated greenhouse gases, that contain, or whose functioning relies upon, fluorinated greenhouse gases with a GWP of 750 or more		1 January 2025



Recommendations

- Reduction of emissions through containment of refrigerants and best practices is one option in this context. The 24th IIR Informatory Note “Containment of Refrigerants within Refrigeration, Air-Conditioning and Heat Pump Systems” presents important technical elements to take into account when designing systems.
- Reducing the HFC charge of refrigeration and air-conditioning systems is another option facing owners and operators of refrigeration and air-conditioning systems via the new F-Gas Regulation. The 25th IIR Informatory Note “Refrigerant Charge Reduction in Refrigerating Systems” provides all necessary information on this option.
- The third option is using substances with low or zero-GWP. This is the long-term technical option for eliminating the influence of HFCs on climate change. Commercially available examples include: ammonia, carbon dioxide, hydrocarbons such as propane and isobutene, water, unsaturated HFCs, lower GWP HFCs than currently used refrigerants such as R32, or low GWP mixtures containing unsaturated HFCs.
- Not in-kind technologies such as air in an air cycle for low temperature applications, Helium in Stirling machines and various ad-and absorption systems may also be considered.

The IIR, through its various publications, wishes to assist stakeholders in the refrigeration sector in their actions related to regulatory changes concerning refrigerants.

