



What is a greenhouse gaz ?

Greenhouse gases (GHGs) are gases that absorb infrared radiation emitted by the Earth's surface, reflect it back to Earth and contribute to the greenhouse effect. The increase in the concentration of these gases in the atmosphere contributes to global warming. Greenhouse gases such as water vapor (H₂O), carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and ozone (O₃) are naturally present in the atmosphere.

Many industrial processes and human activities also generate greenhouse gases. These gases are in the form of substances or mixtures of substances such as Hydrofluorocarbons (HFC), Chloro-Fluorocarbons (CFC), Perfluorocarbons (PFC) and Sulfur Hexafluoride (SF₆) mostly found in refrigerating systems (freezers, cold rooms, air conditioning...).

Among these coolants, one can distinguish inorganic fluids, hydrocarbons and halogenated hydrocarbons. Most of these fluids contribute largely to global warming.

Table 1 below shows the nomenclature of some refrigerants (a non-exhaustive list):

Désignation	Name	GWP
INORGANIC COMPOUNDS		
R717	→ Ammonia	< 1
R718*	→ Water	-
R744*	→ Carbon Dioxide	1
INORGANIC COMPOUNDS		
<i>Hydrocarbons</i>		
R170	→ Éthane	6
R290*	→ Propane	3
R600a	→ Isobutane	3

<i>Halogenated hydrocarbons (CFC)</i>		
R11	→ Trichlorofluorométhane	4750
R12	→ Dichlorofluorométhane	10900
<i>Hydrochlorofluorocarbons (HCFC)</i>		
R22	→ Chlorodifluorométhane	1810
R141b	→ 1,1-dichloro-1-fluorométhane	630
R142b	→ 1-chloro-1,1-difluorométhane	2310
<i>Hydrofluorocarbons (HFC)</i>		
R32	→ Difluorométhane	675
R125	→ Pentafluoroéthane	3500
R134a	→ 1,1,1,2-tetrafluoroéthane	1430
R143a	→ 1,1,1,- trifluoroéthane	4470
R152a	→ 1,1-difluoroéthane	124

*Alternative fluids to the most dangerous gases

The international nomenclature designates refrigerants by the letter R (refrigerant) associated with two or three numbers (for example : R22-chlorodifluoromethane, R 744-carbon dioxide, R125-pentafluoroethane).

The Global Warming Potential (GWP) allows comparisons of greenhouse effect powers between different gases. Precisely, it measures the amount of energy an emission of 1 ton of a designated greenhouse gas will absorb over a given period - generally 100-year - compared to an emission of 1 ton of carbon dioxide (CO₂). To identify which gas has the largest impact on the climate, scientists reason in terms of « CO₂ equivalent CO₂-eq» with the following calculation:

$$\rightarrow 1 \text{ ton of CO}_2 \text{ equivalent of a gas (TCO}_2\text{eq or TeqCO}_2) = 1 \text{ ton of the gas} \times \text{GWP of the gas}$$

Which regulation for greenhouse gases ?

To control and reduce the emissions of fluorinated greenhouse gases (F-gases) - including hydrofluorocarbons (HFCs) - the European Union has adopted the so-called F-Gas Regulation.

Thus, F-Gas regulate the conditions of use and establishes quantitative limits (quotas) for a number of goods and equipment containing Hydrofluorocarbons (HFCs). This regulation has also led to the ban on HydroChloroFluoroCarbons (HCFCs) and ChloroFluoroCarbons (CFCs) since 2015.

In addition, F-Gas plan the ban and limitation of HydroFluoroCarbons (HFCs) over three time frames:

2020	2022	2030
<p>Marketing ban of fluids with a GWP >2500</p> <p>→ For new cooling equipment (except for -50°C applications).</p> <p>→ Prohibition to recharge equipment loaded with fluid with a GWP >2500 and a charge >40TeqCO₂ (except for -50°C applications)</p> <p>Example of fluids with a GWP>2500 : R404a ; R422D; R422A; R507</p>	<p>Marketing ban of fluids with GWP>150</p> <p>→ New marketed hermetically sealed equipment.</p> <p>→ New centralized multi-station equipment for commercial purpose with a power > 40 kW and GWP > 150 with the exception of the primary circuit with a GWP < 1500 for cascade installation. (Only CO₂/R134a will remain allowed for cascade installations)</p> <p>Example of fluids with a GWP between 150 and 2500 : R134 ; R407f ; R407c ; R410a ; R452a</p>	<p>Prohibition to recharge or use any refrigerant system with a GWP > 2500</p> <p>y compris avec un fluide régénéré</p>

In research laboratories, refrigerants affected by the F-Gas regulation can be found mainly in freezers, ice machines, cold rooms and air conditioning systems.

What does the French law says?

In France, the regulation concerning refrigerants is based on the environmental Code (articles R.543-75 to R.543-123) as well as on an executive order of February 29th,2016 regarding some refrigerants and fluorinated greenhouse gases. The order mentioned above introduces, among other measures, the obligation for owners of equipment containing either more than 2kg of HCFC or more than 5TeqCO₂ of HFC or PFCs, to carry out an air tightness control at the time of commissioning and to renew these controls periodically under conditions specified in the order. These controls must be carried out by a technician of a certified company.

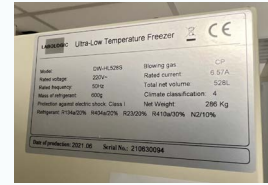
The frequency of these tests is reported in the following table:

Category of Fluides	Refrigerant charge in the equipment	Frequency of controls without leak detection system	Frequency of controls with leak detection system	
HCFC	→ 2 kg ≤ refrigerant charge < 30 kg	12 months		
	→ 30 kg ≤ refrigerant charge < 300 kg	6 months		
	→ 300 kg ≤ refrigerant charge	3 months		
HFC, PFC	→ 5 téq.CO ₂ ≤ refrigerant charge < 50 téqCO ₂	12 months	24 months	
	→ 50 téq.CO ₂ ≤ refrigerant charge < 500 téqCO ₂	6 months	12 months	
	→ 500 téq.CO ₂ ≤ charge	Mobile equipment	3 months	6 months
		Fixed equipment		6 months
	Fixed equipment with exception mentioned in Part III article 3 of thr order of 2016	3 months		

Note that the EU regulation number 517/2014 provides an exemption for equipment and apparatus both hermetically sealed and containing less than 10 TeqCO₂. This kind of equipment is therefore not subject to the leak test provided it is labelled « hermétiquement scellé » or « hermetically sealed ».

How to know which equipment is concerned by the systematic leak test ?

To do this, you must first check the type of gas and its quantity. These two informations are indicated on a plate, usually behind the equipment, and allow to calculate the TeqCO₂ of the gas.



Find also the GWP of the gas. Calculate the TeqCO₂ according to the formula :

→ **Ton CO₂ equivalent of a gas = quantity of the gas x GWP of the gas.**

You may also find some Teq CO₂ calculators online for various refrigerants.

Examples of calculation: the GWP of the refrigerant R134a (see table 1) is 1430. If the charge of the equipment for this gas is equivalent to 3 kg, the TeqCO₂ of this gas will be lower than the 5TeqCO₂ threshold. In this case, this equipment is not concerned by the periodic inspection described in the order of February 29th, 2016. However, the equipment containing the same gaz loaded with a 3.5 kg charge will have an equivalent of 5TeqCO₂. In these case – and if not labelled- « hermetically sealed » - a mandatory leak test must be carried out once a year without permanent leak detector system installed or every two years if equipped with such a detector.

On some newer freezers, the TeqCO₂ may be directly indicated on the plate.

In all cases, it is important to know the gas load and the commissioning year of refrigerating equipment.

Cold rooms, air conditioning systems

For all cooling equipment (cold rooms, air conditioning, heat pumps) a leak detection system equipped with an alarm signal must be installed and checked once a year as soon as it contains greenhouse gases with a load equal or more than 500TeqCO₂. The leak detection system must analyze the following parameters : pressure, temperature, electric current of the compressor, coolant liquid levels, and volume of charge.

A register must be open recording parameters of the leak detection system:

- name of fluids for which the permanent leak detection system is suitable ;
- list of maintenance provided to keep it in good working conditions ;
- results of the checks carried out and, if nécessaire, the corrective measures to be taken.



In any case, for such equipment, periodic checks are required. The need to undertake leak tests or to install a leak detector may be assessed regarding the type of gas and its TeqCO₂.

In the future, what are the obligations for installers and users ?

Although the regulation has set the progressive replacement of high GWP refrigerants by some with a lower GWP, it is not to minor the obligations for installers and users. First, installers must provide all necessary user's manuals, specify what to do in case of a malfunction and inform users on the hazards regarding the loaded gas and the use of the equipment.

Regarding the user, following a risk assessment, they will provide the appropriate hazard labelling and they will also implement procedures in case of an incident or an accident (mainly on large equipment). If necessary, set up information and training for personnel working on the equipment, especially toward risk of asphyxiation or high pressure (CO₂ at 150 bar) and for fire risk concerning flammable halogenated hydrocarbons.

Ultimately, the tightness (air leak) of the installation must be checked by a certified company with a frequency provided by regulations and if so, set up a periodic verification of the leak detector depending on its type.

References:

- ↘ The F-Gas regulation (517/2014/EU)
- ↘ The environmental code R.543-75 to R.543-123
- ↘ The Order of February 29, 2016 amended on July 17, 2019 on certain refrigerants and fluorinated greenhouse gases.
- ↘ «Refrigerants» June 2020 INRS