

Regulation (EU) No 517/2014, also known as F-gas Regulation, entered into force Europe-wide on 1 January 2015. Our climate chambers use gases that are subject to this Regulation. This FAQ paper provides information on the contents of the Regulation, its impact on operators and our current activities and recommended action.

## GENERAL POINTS

### 1. What is the F-gas Regulation?

"The objective of this Regulations is to protect the environment by reducing emissions of fluorinated greenhouse gases (including refrigerants). Accordingly, this Regulation:

- a) establishes rules on containment, use, recovery and destruction of fluorinated greenhouse gases, and on related ancillary measures;
- b) imposes conditions on the placing on the market of specific products and equipment that contain, or whose functioning relies upon, fluorinated greenhouse gases,
- c) imposes conditions on specific uses of fluorinated greenhouse gases, and
- d) establishes quantitative limits for the placing on the market of hydrofluorocarbons."<sup>1</sup>

### 2. Why are climate chamber operators affected?

Climate chambers are cooled by refrigerants which consist of hydrofluorocarbons and are thus subject to the F-gas Regulation. As an operator of such a system, you are legally obliged to implement the Regulation in a technically correct manner.

### 3. Which refrigerants are affected?

The Regulation contains a classification system that specifies which refrigerants must be replaced due to their potentially detrimental properties. In the case of environmental simulation systems, this predominantly refers to R404A and R507.

Thanks to an exemption in the field of environmental simulation, R23, which is also used, is not affected (see 4.). R134a, which is used to some extent, is also exempted from the Regulation.

### 4. What relevance does the GWP value have?

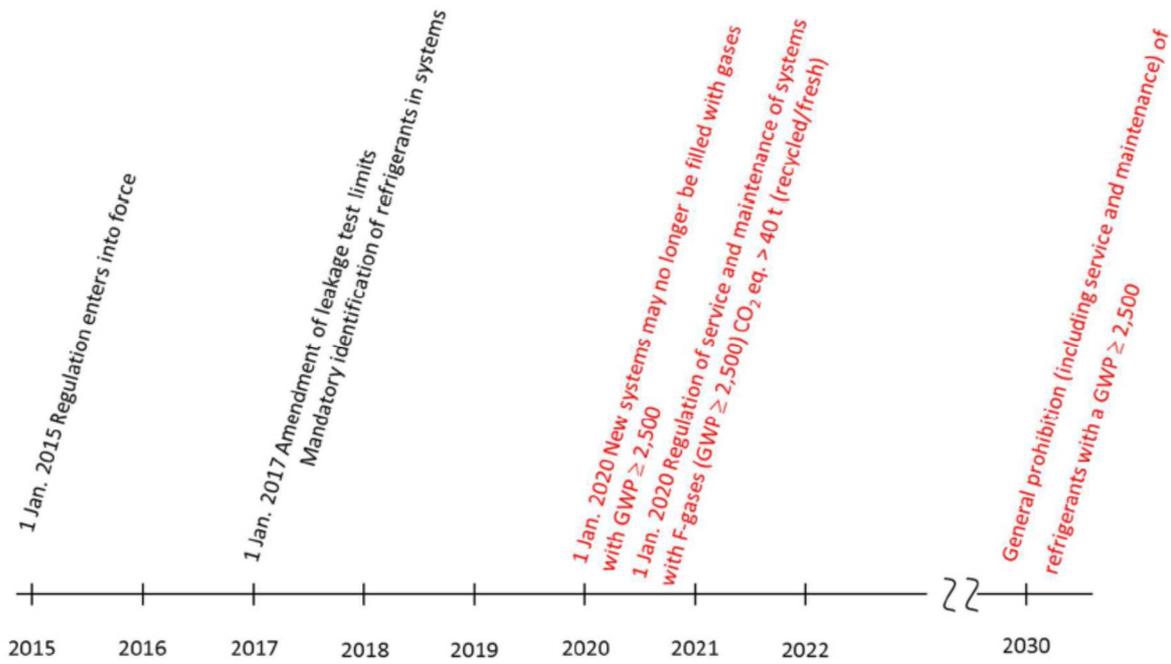
To determine the harmfulness of refrigerants, they are compared to the greenhouse gas CO<sub>2</sub>. The resulting value, which is referred to as GWP (Global Warming Potential), indicates the factor by which the substance's potential effect on global warming is higher than that of CO<sub>2</sub>. This is referred to as the CO<sub>2</sub> equivalent.

For example: R404A has a GWP of  $\approx 3,900$ , i.e. one kilogram of R404A that is released into the atmosphere has the equivalent harmful effect of  $\approx 3,900$  kg CO<sub>2</sub>.

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<sup>1</sup> Article 1 Chapter 1 of Regulation (EU) No 517/2014 of the European Parliament and the Council of 16 April 2014.

5. From which date onwards will the Regulation affect operators?



**As of 1 January 2017:**

**All new and existing systems** are subject to the amended regulations for leakage tests. Depending on the CO<sub>2</sub> equivalent of the respective refrigerant, leakage tests may be mandatory with immediate effect – even in the case of smaller fill quantities. The following table shows the limits above which leakage tests will be mandatory in the future:

Refrigerant	GWP	Max. refrigerant charge without the need of a leakage test
R134a	1430	3,5 kg
R449A	1397	3,58 kg
R452A	2141	2,34 kg
R404A	3920	1,28 kg
R407F	1705	2,93 kg
R507	3990	1,25 kg
R23	14800	0,34 kg

All new and existing systems with refrigerant volumes above the forenamed limits must be tested for leak tightness at regular intervals.

**As of 1 January 2020:**

Refrigerants in **new systems** may not exceed a GWP of 2,500. Regulation (EU) No 517/2014 does not specify any limits regarding the fill quantity. Devices and systems that generate test chamber

temperatures below -50 °C are exempted; these systems generally use the refrigerant R23 which is not covered by the Regulation.

**Existing systems** may continue to operate after 2020, irrespective of the refrigerant used. The exception are systems that use R404A in a fill quantity above 10 kg: When serviced, they must be refilled with recycled R404A.

**Until 31 Dec. 2029:**

**Existing systems**, using 10 kg or less of refrigerant R404A may be refilled with fresh, i.e. new R404A when they are serviced.

**As of 1 January 2030:**

**Existing systems** must be changed over to an alternative refrigerant when they are serviced.

6. Do I have to carry out additional leak checks?

As explained under 5, all systems that exceed a certain fill quantity are affected. Operators are responsible for commissioning and/or performing the leakage test. Depending on the refrigerant quantity, the test cycle may range between 3 and 12 months. Where automatic leakage systems are used, the intervals are twice as long.

Leak tightness tests must be carried out at or above the following refrigerant quantities:

Füllmenge (CO <sub>2</sub> Äquivalent)	Without automatic leakage monitoring	With automatic leakage monitoring
<b>5 t to 50 t</b> (R404A 1,25 kg to 12,5 kg) (R23 0,33 kg to 3,3 kg)	every 12 Months	every 24 Months
<b>50 t to 500 t</b> (R404A 12,5 kg to 125 kg) (R23 3,3 kg to 33 kg)	every 6 Months	every 12 Months
<b>&gt; 500 t</b> (R404A > 125 kg) (R23 > 33 kg)	every 3 Months	every 6 Months

7. Can automatic leakage monitoring help?

Leakage monitoring of cooling devices prevents undetected effluence of refrigerants and indicates leakages at an early stage. On principle, the installation of leakage monitoring systems does not replace leakage tests. However, the prescribed test cycle can be extended to twice its length.

8. What other formal consequences are there for operators?

Operators of refrigeration systems are required to have a comprehensive chain of evidence for the quantity of purchased refrigerant and its use. This comprises the duty to hold evidence and documentation regarding the entire life cycle of the system. One way of ensuring such documentation is the **weisstechnik®** log book which we provide free of charge.

**REFRIGERANTS BY WEISSTECHNIK®**

1. How much refrigerant is used in **weisstechnik®** systems?

**New systems or chambers manufactured after Jan 1<sup>st</sup> 2016:** The refrigerant quantity, the GWP and the CO<sub>2</sub> equivalent are all specified in the technical documentation of the respective system. Please do not hesitate to ask your contact at **weisstechnik®** for further information regarding the refrigerant quantity. Furthermore, the values can be found on the type plate of each system:

Typ Type						Baujahr Year of Constr.	
Geräte-Nr. Serial No.						Gewicht Weight	
Kältemittel Refrigerant	Menge Quantity	GWP 100 GWP 100	CO <sub>2</sub> -Äquiv. CO <sub>2</sub> -Equiv.	ND max. LP max.	HD max. HP max.	Standdruck Const. pressure	
R404A	10,00 kg	3.920	39,20 t	1			
R23	4,50 kg	14.800	66,60 t	2			
R404A	2,00 kg	3.920	7,84 t	3			
Nennstrom Nom. Current	Nennleistung Nom. Output		Spannung Voltage				
Zusatzinformation Additional info						Made in Germany	
Enthält fluoridierte Treibhausgase. Contains fluorinated greenhouse gases.						CE	

Fig.1. Type plate of an environmental simulation chamber  
(mandatory values from Jan 1<sup>st</sup> 2016)

The chamber given here has a refrigeration system installed which contains of 3 circuits total. As none of the cycles contains a CO<sub>2</sub> equivalent < 5t each one of circuits needs to be leak checked regularly. The refrigerant charge of the low stage circuit (Fig.1; Pos. 2) equals > 50 t CO<sub>2</sub>, therefore this circuit only needs to be leak checked every 6 months. The other two circuits (Fig.1; Pos. 1+3) equal less than 50 t CO<sub>2</sub> but more than 5 t, therefore a yearly leak check is necessary.

**Existing systems chambers manufactured before Jan 1<sup>st</sup> 2016:** Information regarding the refrigerant quantity is specified on the system's type plate:

Typ / Auftrag Type / Order	<input type="text"/>						
Geräte-Nr. Serial No.	<input type="text"/>			Baujahr Year of construction	<input type="text"/>		
Kältemittel Refrigerant	R-404A	1 kg	1	ND max. LP max.	bar g	HD max. HP max.	25 bar g
Kältemittel Refrigerant	R-23	0,25 kg	2	ND max. LP max.	bar g	HD max. HP max.	25 bar g
Systemplan Nr. System Orag. No.	<input type="text"/>			Standdruck Constant pressure	<input type="text"/>		
Spannung Voltage	<input type="text"/>			Nennleistung Nominal output	<input type="text"/>		
Schaltplan Wiring Diag. No.	<input type="text"/>			Nennstrom Nominal current	<input type="text"/>		
	Made in Germany						
Enthält vom Kyoto-Protokoll erfasste fluorierte Treibhausgase Contains fluorinated greenhouse gases covered by the Kyoto Protocol						<b>CE</b>	

Fig.2. Type plate of an environmental simulation chamber  
(mandatory values until Jan 1<sup>st</sup> 2016)

Each refrigeration circuit is listed separately. The example given above describes two circuits, the Pre-Cooling stage (Fig.2, Pos.1) and the Low-Cooling stage (Fig.2, Pos.2). The chamber described by the type plate above would contain the following CO<sub>2</sub> equivalents:

Pre-Cooling stage (PC):

$$m_{CO_2,PC} = GWP_{R404A} \times m_{R404A} = 3920 \times 1 \text{ kg} = 3920 \text{ kg}$$

Low Cooling stage (LC):

$$m_{CO_2,LS} = GWP_{R23} \times m_{R23} = 14800 \times 0,25 \text{ kg} = 3700 \text{ kg}$$

In this example both circuits would contain < 5 t CO<sub>2</sub> equivalent, therefore a leak check according to the limits given in EU legislation 517/2014 would not be necessary.

On top of this, you can find the quantity used in the system's technical documentation which is included in the delivery. Should you not be in possession of the technical documentation, please request a copy from your contact at **weisstechnik**<sup>®</sup>.

### 2. Our alternatives to R404A:

#### a. Existing systems: R452A (GWP of 2,141):

R452A was developed as an alternative for low temperature applications and is below the required GWP limit. Its thermodynamic properties largely correspond to R404A. As regards all **weisstechnik**<sup>®</sup> systems, R452A is suitable as a direct replacement (so-called drop-in).

Similar to R404A, R452A is neither flammable nor toxic. Changes in the safety review are thus not necessary either for existing or for new systems.

#### b. New systems including and after ClimeEvent: R449A (GWP 1,397):

Its very low GWP makes R449A the first choice as substitute refrigerant in **weisstechnik**<sup>®</sup>'s forward-looking strategy. However, since the thermodynamic performance figures deviate from R404A, adjustments of the refrigeration technology are necessary to guarantee the systems' extensive performance range. The use of R449A is thus expedient in new systems only.

Again, R449A is neither flammable nor toxic. Changes in the safety review are thus not necessary either for existing or for new systems.

### 3. Do the alternative refrigerants have any disadvantages?

Due to their low market spread, alternative refrigerants currently have a higher purchase price. However, in the course of the Europe-wide conversion to the new refrigerants, prices will assimilate.

The performance parameters of the new alternative refrigerants are different from R404A. To meet the high performance requirements of our systems, adjustments of the refrigeration technology are necessary. These adjustments have been tested in great detail over the last few years, both in internal and in field tests. There will be no loss of performance.

The new alternative refrigerants meet the published performance parameters of the **weisstechnik**<sup>®</sup> systems.