EUROPE

EU F-Gas Regulation

This guidance is for organisations affected by the 2014 EU F-Gas Regulation (517/2014). The F-Gas Regulation creates controls on the use and emissions of fluorinated greenhouse gases (F-Gases) including HFCs, PFCs and SF6. The 2014 EU F-Gas Regulation replaces the 2006 Regulation, strengthening all of the 2006 requirements and introducing a number of important new measures. A crucial aspect of the 2014 Regulation is the introduction of the phase down in the supply of HFCs within the EU market. [4]

European Union -consist of **28 member countries (**Belgium, Germany, France, Italy, Luxembourg, the Netherlands, Austria, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the UK)

The baseline for the HFC phase down process is the average consumption of HFCs on the EU market during the years 2009 to 2012. Under the 2006 EU F-Gas Regulation, all producers, importers and exporters of F-Gases had to report annual data for quantities of bulk HFCs. The baseline is calculated in terms of "CO2 equivalent2 ". The baseline amount is 183 million tonnes CO2 equivalent.

Bans for New Products and Equipment [5]

Market Sector	Product Description	Scope of banned F-Gases	Start Date
Refrigeration	Non-confined direct evaporation systems	All HFCs and PFCs	Jan. 1,2007
	Domestic refrigerators and freezers	HFCs with GWP > 150	Jan. 1,2015
	Refrigerators and freezers for commercial use (hermetically sealed)	HFCs with GWP > 2,500	Jan. 1,2020
		HFCs with GWP > 150	Jan. 1,2022
	All stationary refrigeration equipment5	HFCs with GWP > 2,500	Jan. 1,2020
	Multipack central systems for commercial use with a cooling capacity above 40kW 6	HFCs with GWP > 150	Jan. 1,2022
Air conditioning	Moveable, hermetically sealed air-conditioning	HFCs with GWP > 150	Jan. 1,2020
	Single split systems containing 3 kg or less	F-Gases with GWP >750	Jan. 1,2025

HFC Phase-down Schedule [4][6]

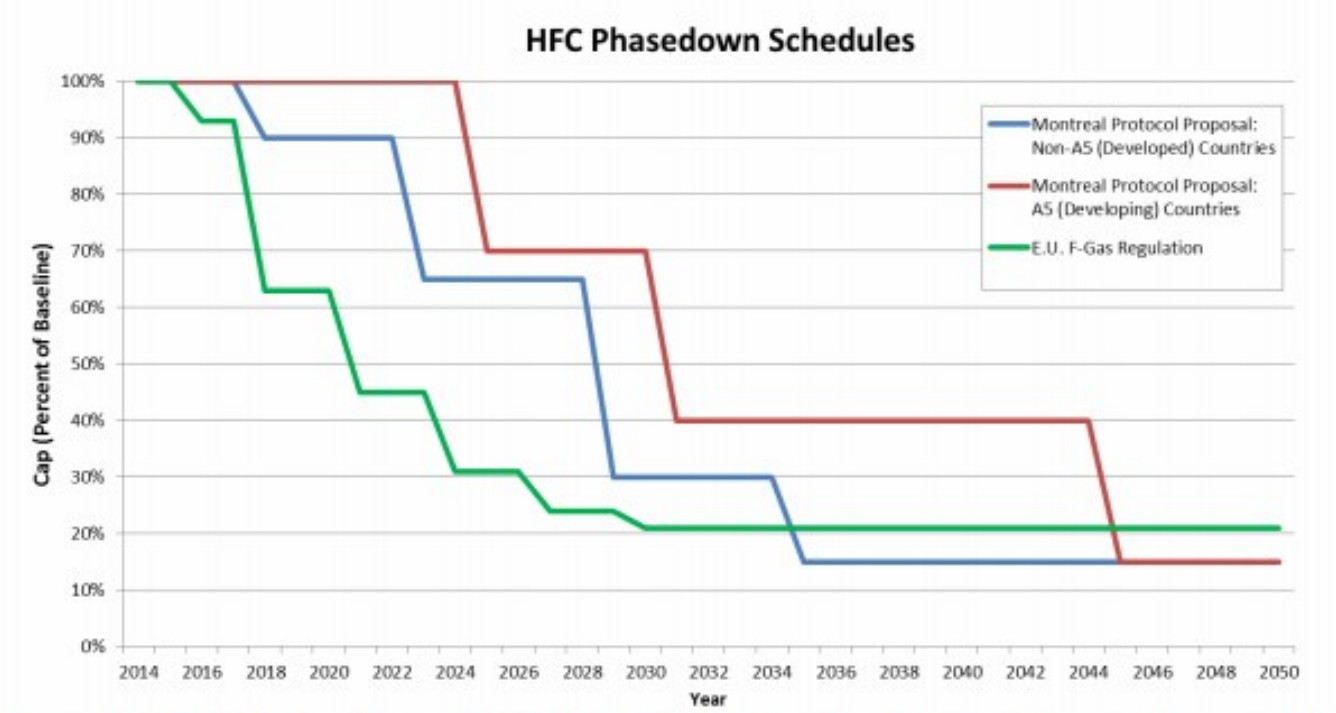
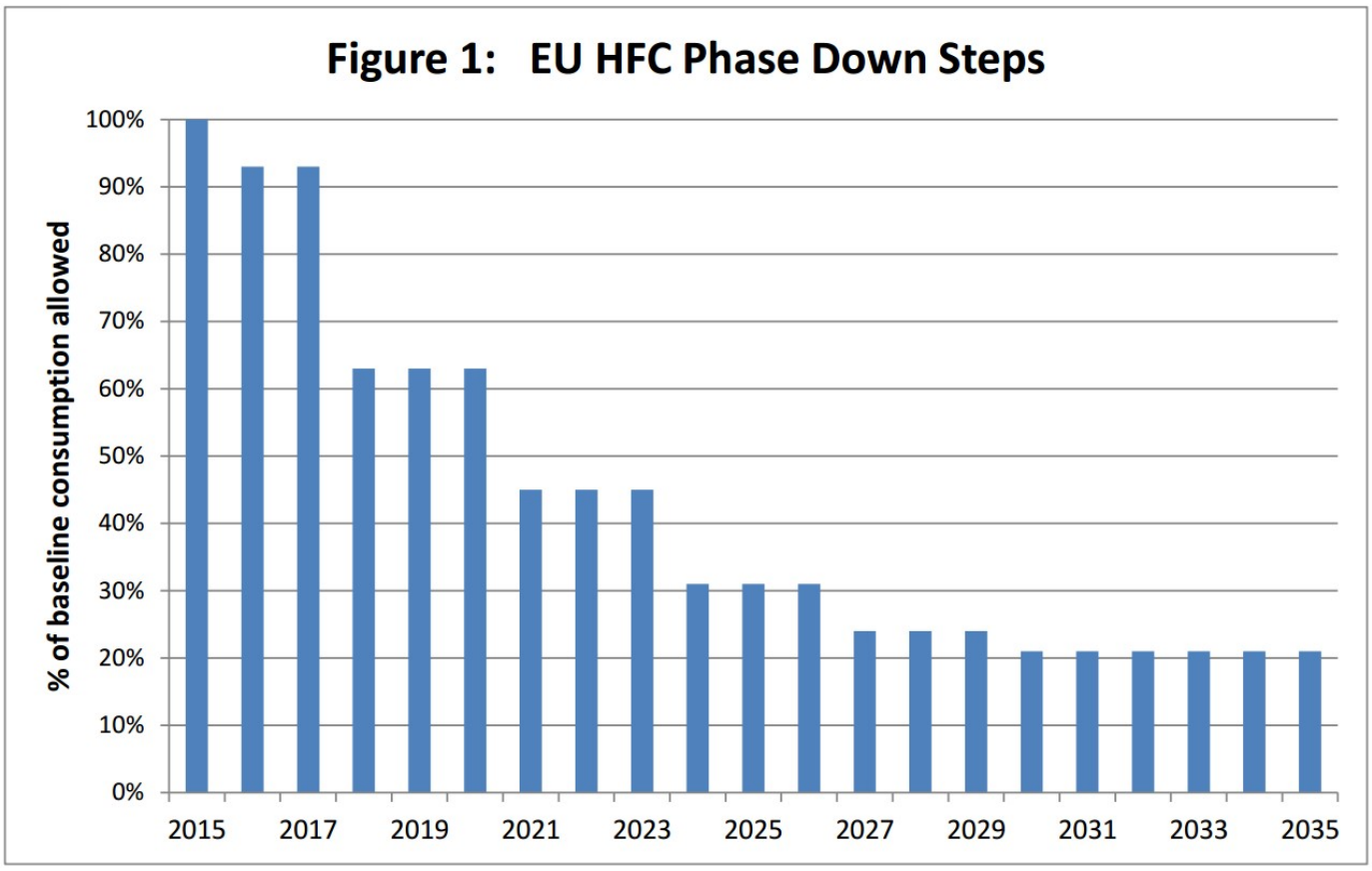


Figure 1.1: HFC phasedown schedules for North American Montreal Protocol proposal and European F-gas regulation



HFC EU Phase-down Program Schedule	
1-Jan-15	Entry into force of the new Regulation
1-Jan-15	Phase-down stage 1
	100% of annual average quantity placed on EU market in the period 2009-2012
1-Jan-16	Phase-down stage 2
(→ 31 Dec. 2017)	93% of annual average quantity placed on EU market in the period 2009-2012
1-Jan-17	Leak checks now apply also to: • Equipment containing less than 3kg but at least 5 tonnes CO_2-eq of fluorinated greenhouse gases • Hermetically sealed equipment containing less than 6kg but at least 10 tonnes CO2-eq of fluorinated greenhouse gases
1-Jan-17	Deadline for Commission's report on EU legislation on training for safe handling of alternative refrigerants
1-Jul-17	Deadline for Commission's report on possible alternatives for multipack centralized refrigeration systems
1-Jul-17	Deadline for Commission's report assessing the quota allocation method
1-Jan-18	Phase-down stage 3
(→ 31 Dec. 2020)	63% of annual average quantity placed on EU market in the period 2009-2012 (minus amounts exempted for use)
1-Jan-20	Ban refrigeration equipment with a minimum charge size of 40 tonnes CO_2-equivqalent with refrigerant ≥2500 GWP, except equipment intended for deep freezing (below - 50°C)
1-Jan-20	Ban on service and maintenance of refrigeration equipment with a minimum charge size of 40 tonnes CO_2-equivqalent with refrigerant of ≥2500 GWP
1-Jul-20	Deadline for Commission's report on possible alternatives for new single split air conditioning systems
31 Dec. 2020	Deadline for Commission's report on the availability of hydrofluorocarbons on the Union market
1-Jan-21	Phase-down stage 4
(→ 31 Dec. 2023)	45% of annual average quantity placed on EU market in the period 2009-2012 (minus amounts exempted for use)
1-Jan-22	Ban on multipack centralised refrigeration systems for commercial use with ≥40kW capacity and with refrigerant ≥150 GWP, except in the primary refrigerant circuit of cascade systems where refrigerant ≥1500 GWP may be used
31 Dec. 2022	Deadline for Commission's report on the effects of the new F-gas Regulation
1-Jan-24	Phase-down stage 5
(→ 31 Dec. 2026)	31% of annual average quantity placed on EU market in the period 2009-2012 (minus amounts exempted for use)
1-Jan-25	Ban on single split air-conditioning systems containing less than 3kg of fluorinated greenhouse gases, that contain, or that rely upon for their functioning, fluorinated greenhouse gases with GWP of 750 or more
1-Jan-27	Phase-down stage 6
(→ 31 Dec. 2029)	24% of annual average quantity placed on EU market in the period 2009-2012 (minus amounts exempted for use)
1-Jan-30	Phase-down stage 7
	21% of annual average quantity placed on EU market in the period 2009-2012 (minus amounts exempted for use)
1-Jan-30	Reclaimed or recycled refrigerant ≥2500 GWP cannot be used any longer to service or maintain refrigeration equipment with a minimum charge of 40 tonnes CO_2-eq

F-gas emissions to be cut by two-thirds by 2030 in the EU [1]

Fluorinated gases ('F-gases') are a family of man-made gases used in a range of industrial applications. Because they do not damage the atmospheric ozone layer, they are often used as substitutes for ozone-depleting substances. However, F-gases are powerful greenhouse gases, with a global warming effect up to 23 000 times greater than carbon dioxide (CO2), and their emissions are rising strongly.

- The European Union is therefore taking regulatory action to control F-gases as part of its policy to combat climate change.
- A first F-gas Regulation was adopted in 2006 and succeeded in stabilising EU F-gas emissions at 2010 levels.
- A new Regulation, which replaces the first and applies from 1 January 2015, strengthens the existing measures and introduces a number of far-reaching changes. By 2030 it will cut the EU's F-gas emissions by two-thirds compared with 2014 levels.
- This represents a fair and cost-efficient contribution by the F-gas sector to the EU's objective of cutting its overall greenhouse gas emissions by 80-95% of 1990 levels by 2050.
- The expected cumulative emission savings are 1.5 Gigatonnes of CO2-equivalent by 2030 and 5 Gigatonnes by 2050. The latter number is more than the CO2produced by a billion return flights from Paris to New York.
- The new legislation will stimulate innovation and green growth and jobs by encouraging the use of green technologies based on less climate-harmful alternatives.

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What F-gases are used for [1]

- F-gases are used in several types of products and appliances, mainly as substitutes for ozone-depleting substances such as chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and halons which are being phased out under the Montreal Protocol and EU legislation.
- Hydrofluorocarbons (HFCs) are used in various sectors and applications, such as refrigerants in refrigeration, air-conditioning and heat pump equipment; as blowing agents for foams; as solvents; and in fire extinguishers and aerosols.
- Perfluorocarbons (PFCs) are typically used in the electronics sector (for example for plasma cleaning of silicon wafers) as well as in the cosmetic and pharmaceutical industry. In the past PFCs were also used in fire extinguishers and can still be found in older fire protection systems.
- Sulphur hexafluoride (SF6) is used mainly as an insulating gas, in high voltage switchgear and in the production of magnesium and aluminium.
- The availability of climate-friendly alternatives to F-gases has been thoroughly assessed in studies carried out for the Commission and other bodies.

EU Refrigerant Alternatives [6]

Market Sector	Equipment Type	Current HFC			Alternatives			Comments
		Name	GWP	Safety	Name	GWP	Safety	
Domestic Refrigeration	Refrigerators / freezers	134a	1,430	A1	HCs 1234yf	3 to 5 4	A3 A2L	HCs already dominant in domestic refrigerators. HFCs with GWP>150 banned from January 2015
Commercial refrigeration	Small hermetic	404A 134a	3,922 1,430	A1 A1	HCs CO_2 1234yf 1234ze	3 to 5 1 4 7	A3 A1 A2L A2L	HCs suited to small systems (<0.15 kg) and already used in many systems. CO_2 has been trialled in large bottle coolers. HFOs 1234yf and 1234ze may be well suited to chill applications requiring large refrigerant charge.
	Condensing units	404A 134a	3,922 1,430	A1 A1	407A 407F 134a 450A 513A 448A 449A XL40 L40 CO_2	2,107 1,825 1,430 601 631 1,386 1,397 246 285 1	A1 A1 A1 A1 A1 A1 A1 A2L A2L A1	Alternative to 404A, frozen Alternative to 404A, frozen Alternative to 404A, chill Alternative to 134a or 404A, chill Alternative to 134a or 404A, chill Alternative to 404A, frozen Alternative to 404A, frozen Alternative to 134a or 404A, frozen or chill Alternative to 134a or 404A, frozen or chill CO_2 operates at very high pressure
	Central pack systems	404A 134a	3,922 1,430	A1 A1	See alternatives for condensing units			Due to impact of Service Ban (which bans maintenance with virgin HFC 404A from 2020), 404A must be avoided in new systems with immediate effect. CO_2 may become the dominant refrigerant in this market – there are already several hundred systems operating in UK supermarkets.

Safety classification: A = non-toxic B = toxic 1 = non-flammable 2L = mildly flammable 2 = flammable 3 = highly flammable

Market Sector	Equipment Type	Current HFC			Alternatives			Comments
		Name	GWP	Safety	Name	GWP	Safety	
Industrial Refrigeration	DX systems	404A 407C 22 134a	3,922 1,774 1,810 1,430	A1 A1 A1 A1	407A 407F 134a 450A 513A 448A 449A XL40 L40 CO_2	2,107 1,825 1,430 601 631 1,386 1,397 246 285 1	A1 A1 A1 A1 A1 A1 A1 A2L A2L A1	Alternative to 404A, low temperature (LT) Alternative to 404A, LT Alternative to 404A, medium temperature (MT) Alternative to 134a or 404A, MT Alternative to 134a or 404A, MT Alternative to 404A, LT Alternative to 404A, LT Alternative to 134a or 404A, LT and MT Alternative to 134a or 404A, LT and MT CO_2 operates at very high pressure, LT and MT
	Large pumped systems	22 404A Ammonia	1,810 3,922 0	A1 A1 B2	Ammonia CO_2	0 1	B2 A1	Ammonia should be considered for large industrial applications. It is already widely used in food and drink sectors. CO_2 may also be applicable to large industrial systems.
	Industrial chillers	134a Ammonia	1,430 0	A1 B2	Ammonia 1234ze 1233zd	0 7 4	B2 A2L A1	Ammonia is well established in this market 1234ze can be used in place of 134a 1233zd can be used for low pressure chillers
Transport refrigeration	Trucks and trailers	404A	3,922	A1	CO_2 452A 407F 448A 449A	1 2,140 1,825 1,386 1,397	A1 A1 A1 A1 A1	Not many alternatives yet on the market. Road transport will probably require an A1 refrigerant (non-flammable). CO_2 is being trialled and may become dominant. Currently the other options all have a fairly high GWP
	Small vans	404A	3,922	A1	For 404A, see trucks / trailers			Not many options yet tested
		134a	1,430	A1	450A	601	A1	

Market Sector	Equipment Type	Current HFC			Alternatives			Comments
		Name	GWP	Safety	Name	GWP	Safety	
DX air-conditioning	Single splits	410A 407C	2,088 1,774	A1 A1	32 446A 447A XL41	675 460 582 466	A2L A2L A2L A2L	HFC 32 might dominate small single split market. Various HFO/HFC blends with GWPs in the 400 to 600 range also being developed (all A2L)
	Multi split / VRV / packaged	410A 407C	2,088 1,774	A1 A1	?			Potentially difficult market if non-flammable refrigerant required. If A2L is safe, then single split alternatives possible. If A1 required, currently no option available.
Air-conditioning chillers	Small	410A	2,088	A1	32	675	A2L	New HFO refrigerants are being trialled in a range of chiller sizes. 1234ze is used in chillers similar to current HFC 134a chillers. 1233zd is a low pressure refrigerant and is suited to large centrifugal chillers.
	Large	134a	1,430	A1	1234ze 1233zd	7 4	A2L A1	
Mobile air-conditioning	Cars and small vans	134a	1,430	A1	1234yf	4	A2L	HFC 134a will be banned via the MAC Directive
	Buses and trains	410A 134a	2,088 1,430	A1 A1	1234yf 450A 513A	4 601 631	A2L A1	For small sized systems HFO 1234yf may be suitable; its mild flammability must be considered. Large systems need A1 refrigerant – R450A or R513A may be suitable.
Aerosols	Technical aerosols	134a	1,430	A1	1234ze	7	A2L	1234ze has been successfully used in novelty aerosols
Foams	XPS	134a	1,430	A1	1234ze	7	A2L	1234ze in commercial use for some foam products
	PU and similar	245fa 365mfc	1,030 794	A1 A1	1233zd 1336mzz 1233xf	4 9 1	A2L A2L A2L	These HFOs are currently undergoing development and trials in a range of foam types.
Fire Protection	Flooding systems	227ea	3,220	A1	FK 5-1-12	1	A1	This fluoro-ketone (Novec 1230) has been used for a number of years and suits many HFC 227ea applications
Solvents	Industrial cleaning	4310mee	1,640	A1	HFOs NIK			Various HFOs are being trialled as solvents. Various "not-in-kind" alternatives available

Sources:

- [1] European Commission website: http://ec.europa.eu/clima/policies/f-gas/index_en.htm
- [2] EPEE (European Partnership for Energy and the Environment): http://www.epeeglobal.org/refrigerants/f-gas-regulation/
- [3] ACRIB (Air Conditioning and Refrigeration Industry Board): http://www.acrib.org.uk/Q6I12U60634
- [4] "EU F-Gas Regulation Guidance Information Sheet 28: The HFC Phase Down Process " : http://www.gluckmanconsulting.com/wp-content/uploads/2015/07/IS-28-The-Phase-Down-Process-v2.pdf
- [5] EU F-Gas Regulation Guidance Information Sheet 26: Bans for New Products and Equipment (http://www.gluckmanconsulting.com/wp-content/uploads/2014/12/IS-26-Ban-Summary.pdf)
- [6] "EU F-Gas Regulation Guidance Information Sheet 29: Low GWP Alternatives": http://www.gluckmanconsulting.com/wp-content/uploads/2015/07/IS-29-Low-GWP-Alternatives-v2.pdf
- [7] "REGULATION (EU) No 517/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006": http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014R0517

EU Refrigerant Policies and Regulations

- REGULATION (EU) No 517/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006
- EU F-Gas Regulation Guidance Information Sheet 29: Low GWP Alternatives – July 2015
- EU F-Gas Regulation Guidance Information Sheet 28: The HFC Phase Down Process
- EU F-Gas Regulation Guidance Information Sheet 26: Bans for New Products and Equipment
- EU F-Gas Regulation Guidance Information Sheet 1: Domestic Refrigeration
- EU F-Gas Regulation Guidance Information Sheet 2: Commercial Refrigeration
- EU F-Gas Regulation Guidance Information Sheet 3: Industrial Refrigeration
- EU F-Gas Regulation Guidance Information Sheet 4: Transport Refrigeration
- EU F-Gas Regulation Guidance Information Sheet 5: Stationary Air-conditioning and Heat Pumps
- EU F-Gas Regulation Guidance Information Sheet 6: Mobile Air-Conditioning
- EU F-Gas Regulation Guidance Information Sheet 14: Refrigeration, Air-Conditioning and Heat Pump Contractors
- EU F-Gas Regulation Guidance Information Sheet 16: Manufacturers and Importers of Refrigeration, Air-Conditioning and Heat Pump Equipment
- EU F-Gas Regulation Guidance Information Sheet 27: Flammability Issues
- EU F-Gas Regulation Guidance Information Sheet 25: Understanding CO2 Size Thresholds
- EU F-Gas Regulation Guidance Information Sheet 17: F-Gas Producers, Importers and Exporters
- EU F-Gas Regulation Guidance Information Sheet 18: F-Gas Wholesalers