

Centrifuges



What does the term F-gas mean and why is it important for selecting a centrifuge?

Refrigerated centrifuges are designed to maintain the integrity of temperature-sensitive samples. Using fluorinated gases in refrigerants leads to a high global warming potential (GWP), which are harmful greenhouse gases for the environment and contribute significantly to climate change. F-gas alternatives or low-GWP refrigerants help reduce environmental impact and meet legal requirements.

Background on F-gas compliance

F-gas is the term for fluorinated greenhouse gases used in various industrial applications such as refrigeration equipment, chillers, air conditioners and heat pumps. F-gas includes hydrofluorocarbons (HFCs) like R134a, R449a, R513a and R404a, currently used in refrigerated centrifuges, refrigerated shakers and chillers.

Many F-gases have a high GWP and have negative environmental impacts. The European Union and United States have released regulations across many different industries to help reduce F-gas usage in the coming years to combat their effects.

Countries worldwide are implementing regulations to control F-gas emissions, often aligning with the EU's stringent F-Gas Regulation and the Montreal Protocol's Kigali Amendment. On February 7, 2024, the European Union adopted the F-Gas Regulation EU 2024/573 to introduce the gradual phase-out and reduction of fluorinated greenhouse gases. With Implementing Regulation EU 2024/2729, the EU has granted an exemption for laboratory centrifuges until December 31, 2028. The US Environmental Protection Agency (EPA) has a similar mandate, under the American Innovation and Manufacturing Act of 2020 and Technology Transitions Program.

Thermo Fisher Scientific is focused on driving innovations to help ensure compliance with these upcoming F-gas regulations and to reduce environmental impact while continuing to support the performance, quality, and safety standards.

Table 1. Comparison of GWP of natural, synthetic, and hydrofluorocarbon (HFC) refrigerants.

Name	GWP	Refrigerant class
R744	1	Natural (CO ₂)
R290	3	Hydrocarbon (HC)
R1234yf	4	Hydrofluoroolefin (HFO)
R449A	1,396	Hydrofluorocarbon (HFC) / Hydrofluoroolefin (HFO)
R134a	1,430	Hydrofluorocarbon (HFC)
R410A	2,088	Hydrofluorocarbon (HFC)
R404A	3,922	Hydrofluorocarbon (HFC)



How do different refrigerants compare?

HFC refrigerants are powerful greenhouse gases with significant GWP. Thermo Fisher Scientific is in the process of phasing out the use of these refrigerants and are replacing them with more sustainable, natural refrigerant alternatives that have a significantly lower GWP.

The Thermo Scientific™ X and S Series Refrigerated Centrifuges utilize R290, a non-HFC alternative that has a lower GWP as compared to refrigerant options commonly used in refrigerated centrifuges (Table 1). R290 is a natural refrigerant that breaks down into carbon dioxide and water and does not release any polyfluoroalkyl substances (PFAS) byproducts into the environment. Studies have shown that synthetic low GWP refrigerant blends, like R1234yf, yield byproducts like TFA that may have adverse environmental impacts.¹

CO₂ is another more sustainable natural refrigerant option with a low GWP (1) and is utilized in the Thermo Scientific™ LYNX™ Superspeed Centrifuges, as well as Thermo Scientific™ Cryofuge™ and BIOS Large-Capacity Centrifuges. Due to the large scale nature of the CO₂ refrigeration system, you will see this as the preferred solution utilized in larger platform centrifuges.

Similarly, you may notice that individual household refrigerators and freezers are also transitioning to natural refrigerants utilizing R290 and that the large scale refrigerator and freezer cases you may find in your local grocery store utilize CO₂ technology.

GreenCool Technology

Thermo Scientific™ GreenCool™ Technology enhances cooling efficiency, reducing the overall energy consumption in the Thermo Scientific X and S series general purpose, LYNX superspeed, Cryofuge, BIOS centrifuge platforms (Table 2). Due to the various performance features of each platform, Thermo Fisher Scientific has tailored the GreenCool technology type to best match each centrifuge platform.

Table 2. Refrigerants used in Thermo Scientific Centrifuges

Centrifuge model	GreenCool type	Refrigerant	Reduced energy consumption	Power consumption*		Improved cooling performance
				Previous model	With GreenCool technology	
X and S series General Purpose	GreenCool HC	Hydrocarbon R290	Up to 6%	1,850 W	1,750 W	yes
LYNX 4000 and 6000 Superspeed	GreenCool CO ₂	CO ₂ R744	Up to 13%	4,600 W (Sorvall LYNX 4000) 4,800 W (Sorvall LYNX 6000)	4,200 W	yes
Cryofuge Large Capacity	GreenCool CO ₂	CO ₂ R744	Up to 14%	5,400 W	4,600 W	yes
BIOS 16 Bioprocessing	GreenCool CO ₂	CO ₂ R744	Up to 14%	5,400 W	4,600 W	yes
BIOS A Bioprocessing	GreenCool CO ₂	CO ₂ R744	Up to 15%	6,400 W	5,400 W	yes

*Energy use measured for a 1-hour run at maximum spin speed and compared to previous model.

Summary

In conclusion, F-gas compliance is the future of all refrigeration products, including centrifuges, to help ensure a more sustainable future. It is important to factor in the greater environmental benefits, energy savings, and performance when selecting a centrifuge.

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The larger scale floor model centrifuges utilize GreenCool technology with CO₂ as refrigerant ("GreenCool CO₂") and the more compact benchtop and floor standing models utilize GreenCool technology with HC refrigerant ("GreenCool HC").

GreenCool HC technology

GreenCool HC technology, in addition to being less hazardous, is more energy efficient in comparison to HFC refrigerants like R134a, which are commonly used in most current refrigerated centrifuges on the market. The Thermo Scientific™ X4TR Centrifuge has a 6% lower energy consumption compared to the legacy Thermo Scientific™ Sorvall™/ Multifuge™ X4R Pro Centrifuge that utilizes traditional R134a HFC refrigerant.

Additionally, R290 is known for its excellent thermodynamic properties and exceptional energy efficiency compared to R1234yf, as documented in comparative analysis studies testing the performance of these refrigerants in various industrial applications.²

GreenCool CO₂ technology

GreenCool CO₂ technology uses the natural refrigerant CO₂ with a GWP of 1 for LYNX, Cryofuge, and BIOS series floor-standing centrifuges, which is 1,397 times less impactful to the environment compared to previous technologies. In addition to the improvements in sustainability, these centrifuge lines weigh less and generate less noise, enhancing the laboratory environment. The innovative cooling system leads to better energy efficiency, saving up to 13% of energy with LYNX centrifuges, 14% with Cryofuge and BIOS 16, and 15% with BIOS A centrifuge models. The LYNX centrifuge also achieves a greater rotor speed at 4 °C. All these advantages enhance the lab environment and result in a more efficient workflow.

References

1. R1234yf degrades into PFAS: <https://pubmed.ncbi.nlm.nih.gov/29381347/>. Accessed 02 Sep 2025.
2. R290 vs R1234yf comparative study: <https://www.sciencedirect.com/science/article/abs/pii/S0735193324004706>. Accessed 02 Sep 2025.