

Hydrocarbon Cooling in Eppendorf Benchtop Centrifuges

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Executive summary

Global warming and its consequences pose one of the greatest challenges of our time. Fluorocarbons, which, until recently, had been used in cooling systems such as air-conditioners and in laboratory centrifuges and freezers, contribute to global warming when released into the atmosphere. To protect our planet for future generations, laboratory equipment also needs to switch to using more environmentally friendly, “green” coolants – e.g., hydrocarbons. As one of the very first manufacturers to do so, Eppendorf now uses hydrocarbon cooling in its new Centrifuge 5427 R. It’s the first centrifuge in our portfolio that cools with a natural refrigerant – to protect your samples – and the planet.



Centrifuge 5427 R

Introduction

Sustainability discussions have so far focused primarily on the energy consumption of devices. But this is only one part of the story, and now the type of cooling liquid a device uses is receiving more and more scrutiny. After all, refrigerants can have a global warming potential when released into the atmosphere.

Hydrofluorocarbons

The phaseout of ozone-depleting chlorofluorocarbon refrigerants (CFCs) began over three decades ago following international agreement on the Montreal Protocol. CFCs have, in part, been replaced by alternative compounds known as hydrofluorocarbons (HFCs) – in particular R508b, R404a, and R134a. But despite not impacting the ozone layer, HFCs still have a high global warming potential (GWP), with R134a, for example, possessing a GWP of 1,430. This means that 100 grams of this substance has the same GWP as 143 kilo grams of carbon dioxide (CO₂) equivalent.

Hydrocarbons

Hydrocarbons (HCs) are recognized as “green” or natural coolants for use in centrifuges as well as freezers, and their GWP is more directly equivalent to CO₂. The two most common HCs are propane and ethane – known as R290 and R170, respectively – and R290 is in widespread use in large commercial cooling systems. Due to their superior efficiency and performance, hydrocarbon cooling liquids can be used in significantly smaller quantities than classic HFCs in a similar system. Both R290 and R170 have, as a result, been identified by the US Environmental Protection Agency’s Significant New Alternatives Policy (EPA SNAP) program as substitutes for ozone-depleting substances and constitute approved coolants for use in refrigerated laboratory instruments such as centrifuges or even ultra-low-temperature freezers.

Hydrocarbons in the USA

In 2005, [the California Global Warming Solutions Act of 2006 \(AB32\)](#) required that the Air Resources Board determine the statewide greenhouse gas emissions level in 1990. Further on, the act required that the Air Resources Board approves a statewide greenhouse gas emissions limit which equals the 1990 level to be achieved by 2020.

This limit is equal to the 1990 level. This limit is an aggregated statewide limit without sector- or facility-specific focus.

In 2016, [the Senate Bill 32, California Global Warming Solutions Act of 2006: Emissions Limit \(SB32\)](#) further intensified the limit: By 2030, California has to reduce statewide greenhouse gas emissions by an additional 40% below the value of 1990. This goal also includes a drastic reduction of HFC cooling liquids. The American Innovation and Manufacturing Act of 2020 (AIM Act) was enacted on [December 27th, 2020](#). The AIM Act mandates the phasedown of HFCs by 85 percent from historic baseline levels by This phasedown is consistent with the U.S. schedule under the Kigali Amendment to the Montreal Protocol. To and consumption through an allowance allocation program, (2) facilitating sector-based transitions to next-generation technologies, and (3) issuing certain regulations for purposes of maximizing reclamation and minimizing releases of HFCs from equipment.

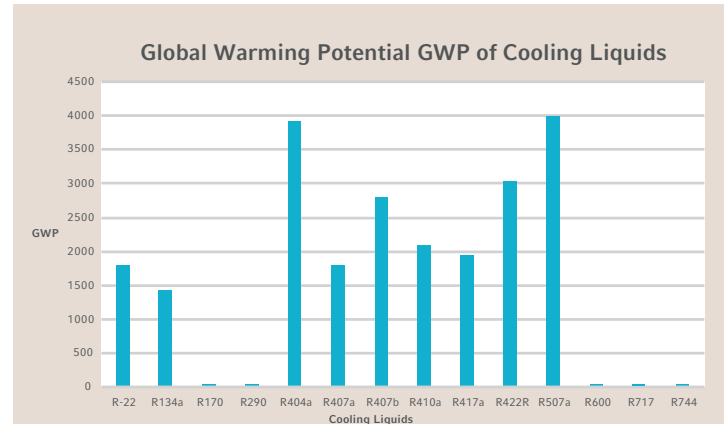
To achieve the first part, the phasedown of HFCs through an allowance program, EPA established the HFC Allocation Program in the Allocation Framework Rule. The [AIM Act](#), which was included in the Consolidated Appropriations Act, 2021, directs EPA to phase down production and consumption of HFCs in the United States by 85 percent over the next 15 years. A global HFC phasedown is expected to avoid up to 0.5° Celsius of global warming by 2100.

This proposed rule is the first regulation under the AIM Act to address HFCs, which are potent greenhouse gases commonly used in refrigerators, air conditioners, and other applications. This proposed rule would set the HFC production and consumption baseline levels from which reductions will be made, establish an initial methodology for allocating and trading HFC allowances for 2022 and 2023, and create a robust, agile, and innovative compliance and enforcement system.

Currently, there are no requirements to stop using any specific equipment currently in use.

Hydrocarbons in Europe

In April 2014, the European Union announced a midterm ban of all non-hydrocarbon-liquids for new cooling systems (EU)



Global warming potential

Each greenhouse gas has a GWP value. This value reflects the climate impact of a kilogram of emissions compared with the same mass of carbon dioxide (CO₂). The GWP value is calculated and published by the Intergovernmental Panel on Climate Change (IPCC) using a set time horizon. The values are updated periodically on the basis of scientific research.

No 517/2014, also known as F-gas-regulation.

This ban has been implemented by a step-wise reduction of the annual amount of newly produced or imported HFC-liquids in Europe. Producers as well as importing bodies of HFCs received reference quantity values based on their averaged annual quantities brought to market based on 2009 to 2012 (Article 16).

These allocated quotas have been reduced annually from 2015 (100% reference value) on. The major reduction of HFCs has been achieved between 2015 and 2019 by adapting newly produced cooling instruments to HCs. From

The placing on the market of products and equipment, including parts thereof, listed in Annex IV, with an exemption for military equipment, shall be prohibited from the date specified in that Annex, differentiating, where applicable, according to the type or global warming potential of the gas contained. By way of derogation from the first subparagraph, the placing on the market of parts of products and equipment required for repair and servicing of existing equipment listed in Annex IV is allowed provided that the repair or servicing does not result in:

- (a) an increase in the capacity of the product or equipment;
- (b) an increase in the amount of fluorinated greenhouse gas contained in the product or equipment; or
- (c) a change in the type of fluorinated greenhouse gas used that would lead to an increase of the global warming potential of the fluorinated greenhouse gas used.

The Annex IV of this regulation includes centrifuges in the category of Medical and Laboratory Equipment and a ban for the use of F-Gases in centrifuges was originally planned for 2025.

Exception for centrifuges (EU [\(2024/2729\)](#))

In October 2024, the EU Commission announced an exception from the rule for refrigerated laboratory centrifuges due to their critical role in medical and laboratory applications. Deviating from EU 2024/573, there is a time limited release for this equipment with a GWP > 150. This special release frame is from January 1st 2025 to December 31st 2028.

Safety

One concern about utilizing these hydrocarbon coolants, especially propane and ethane, is safety: Both HCs are flammable gases.

So, then: Just how safe are these gases and how safe are the instruments that use them?

In short, centrifuges using HCs are as safe as any other centrifuge that uses a traditional cooling agent. Eppendorf centrifuges with hydrocarbon cooling comply with the standard IEC 61010-2-011 (the International Electrotechnical Commission's safety requirements for electrical equipment for measurement, control and laboratory use – particular requirements for laboratory refrigerating equipment). This standard includes a range of safety measures to ensure no risk exists at any time, even if a rotor were to crash.

The Eppendorf Centrifuge 5427R employs a special ventilation concept when switched on.

All parts that may cause sparks have also been moved to the outside of the centrifuge with no connection to the interior and therefore, potential Propane build-up areas in case of a leakage (e.g., on-off switch, power cord, etc.).

All Eppendorf hydrocarbon centrifuges meet EPA requirements for placing clear warning text and symbols on instruments. Please contact your facility's safety officer to make sure the Eppendorf Centrifuge 5427 R is right for your lab.

Summary

Although the total carbon impact of a product requires a product carbon footprint analysis, the type of cooling liquids has an impact. Centrifuges that use hydrocarbon cooling liquids (for example, R290 and R170) are future-proof instruments that actively help you reduce your lab's greenhouse gas emissions and combat the threat of global warming.

For additional information, please visit:
www.eppendorf.com/sustainable-centrifuge

About Eppendorf

Since 1945, the Eppendorf brand has been synonymous with customer-oriented processes and innovative products, such as laboratory devices and consumables for liquid handling, cell handling, and sample handling. Today, Eppendorf and its more than 5,000 employees serve as experts and advisors, using their unique knowledge and experience to support laboratories and research institutions around the world. The foundation of the company's expertise is its focus on its customers. Eppendorf's exchange of ideas with its customers results in comprehensive solutions that in turn become industry standards. Eppendorf will continue on this path in the future, true to the standard set by the company's founders: that of sustainably improving people's living conditions.

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