

More Than Just Spinning: ACT Sustainability Label for Eppendorf Benchtop Centrifuges

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Executive Summary

Eppendorf is committed to accountability, consistency and transparency – the three tenets of the ACT® label – to reduce its environmental impact and provide its customers with high-quality, sustainable products. In addition to the various products Eppendorf offers, including ULT freezers, consumables, and pipettes, two Eppendorf benchtop centrifuges are certified with the ACT label. This label scores a product’s total environmental impact with respect to multiple sustainability factors, such as manufacturing, packaging, energy consumption, and recyclability. Eppendorf Centrifuge 5910 Ri and Centrifuge 5427 R are the first Eppendorf centrifuges to receive the ACT label, which is issued by My Green Lab®.

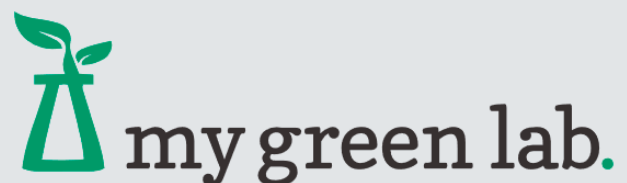


Centrifuge 5910 Ri

Introduction

The nonprofit organization My Green Lab aims to continuously and permanently improve sustainability in research laboratories by developing standards that foster greener labs and lab products. Originally a local organization founded in 2013 by Allison Paradise, a neuroscientist turned environmental activist, My Green Lab has rapidly grown into an international agent for change around the world. The nonprofit describes itself as “run for scientists, by scientists” and has joined the broader laboratory community, comprising vendors, designers, energy providers and others, to help lead the way toward creating a world in which all research projects reflect the highest standards of social and environmental responsibility. One of the major challenges My Green Lab faces with respect to adoption of its improved standards is persuading the scientific community to make the many

behavioral changes necessary for achieving sustainability in research labs. Implementation of My Green Lab standards is overseen by outside third parties.



For more information, please visit www.mygreenlab.org.

Both worlds: Industry and academia

Organizations around the world are increasingly recognizing sustainability in the laboratory as an important topic. Large, global pharmaceutical companies, for example, have established sustainability programs to analyze their internal processes with the aim to make changes to boost efficiency as well as to weigh the influence of their behavior and processes on sustainability. The goal of many of these programs is to benefit society and the environment while at the same time positively impact the profitability of the business.

My Green Lab offers a broad range of programs to help organizations improve their environmental health and resource utilization, including:

- > **My Green Lab Certification** is the worldwide standard for laboratory sustainability best practices.
- > **Green Chemistry** mainstreams green chemistry into curricula, research and manufacturing.
- > **Freezer Challenge** serves as an international competition aimed at reducing the environmental impact of cold storage.
- > **The ACT label** resembles a nutrition label and shows how products “rate” in various sustainability-related categories.
- > **The Center for Energy Efficient Laboratories (CEEL)** conducts research into energy-efficiency options for laboratory equipment.
- > **My Green Lab Ambassador** is a free, online program that provides an introduction to laboratory sustainability and how to suggest change within laboratories.

My Green Lab also closely cooperates with I2SL, the International Institute for Sustainable Laboratories: www.i2sl.org/index.html

James Connelly, the CEO of My Green Lab, states:
»The focus of My Green Lab’s mission is to build a culture of sustainability through science. We offer a suite of leading-edge programs to transform the life science industry through sustainability, including Green Lab Certification, Lab Product Certification (the ACT label), and student and professional education. Our programs not only significantly reduce the environmental impact of science, they inspire similar changes in the culture and private lives of the millions of people who spend their time working in labs.«

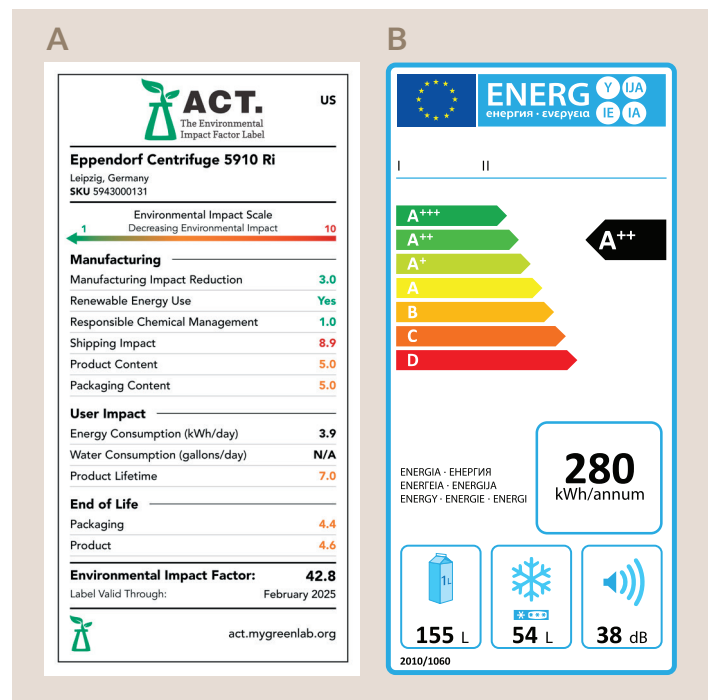


Figure 1: A: Sample ACT Environmental Impact Factor Label
B: Sample of an EU Energy Label established by European Union Directive

Reflected in the name: The ACT label scoring system

The ACT label considers accountability, consistency and transparency when evaluating the manufacturing, energy consumption, water usage, packaging and end-of-life disposal of products and provides an easy, intuitive way to evaluate the sustainability of a given product. Products are scored and validated on the basis of different environmental impact factors (EIFs). Each product's EIF is rated on a scale from 1 to 10, with 1 indicating the least environmental impact and 10 the highest. The independent organization Sustainability Made Simple Collaborative (SMSC) scores the product's data, which My Green Lab then verifies and publishes.

The ACT label serves, in principle, as a sustainability scoring card. Reading the ACT label is simple: The lower the score, the lower the product's impact on the environment.

The label can be read like a nutrition label or like the European performance card for a washing machine or dishwasher. The ACT label shows how products "rate" in various sustainability-related categories by assigning a score and uses a color-coding system that ranges from green to red to indicate a low or high score.



Figure 2: ACT Environmental Impact Factor logo of My Green Lab® organization

Eppendorf centrifuges and sustainability

In 2023, the Eppendorf Centrifuge 5910 Ri and Centrifuge 5427 R became the first centrifuges worldwide to receive the ACT label. More centrifuges in the Eppendorf portfolio are to follow.

Centrifuges perform an essential function in life science laboratories where they are heavily used. This is especially the case for bigger multipurpose centrifuges that are shared among a multitude of different users. Operating them for most of the workday entails a great deal of energy consumption, which is, of course, one important aspect of sustainability. Refrigerated centrifuges are usually cooled for most of the day, even when not in use, so they are a key piece of equipment to consider when looking at a laboratory's energy consumption.

Energy consumption is, however, just one aspect to consider when examining the environmental footprint of centrifuges in the laboratory. The ACT label therefore also reviews a broad range of sustainability factors to determine the overall environmental impact of laboratory centrifuges. In the following, we address a variety of these factors, including energy savings, longevity, ergonomics, and cooling liquids.

Energy savings

Centrifugation involves two significant power-consuming steps: temperature management of the chamber and acceleration of the rotor. Cooling, performed by a compressor system, is mandatory for many high-value samples. A weak cooling system does save energy, but it may put samples at risk due to insufficient temperature control and the experiment may have to be repeated.

To reduce power consumption, Eppendorf centrifuges feature various energy-saving functions, depending on the centrifuge model:

- > **An eco-shutoff function** switches off the continuous cooling function of refrigerated models after a period of inactivity (usually after one, two, four or eight hours), resulting in lower overall energy consumption (for example, 37% less for Centrifuge 5430 R overnight) and extending the compressor's lifetime.
- > **The standby function** switches the centrifuge into sleep mode (for example, by switching off the display) after a defined period of inactivity.
- > **Reduced weight:** The fixed-angle rotors of our multipurpose centrifuges (50 mL conical rotors and bigger) are hollow to reduce their weight. This makes them easier for users to handle as well as reduces power consumption during acceleration as less weight needs to be put in motion.
- > **Optimized design:** Most swing-buckets in our multipurpose centrifuges are now round instead of rectangular, which results in lower energy consumption (up to 48% less energy with rotor A-4-72 versus rotor A-4-62 in Centrifuge 5810 R).

Longevity and ergonomics

A reliable centrifuge should last for many years. The equipment’s longevity is an essential criterion in calculating the sustainability of laboratory instruments. High-quality parts and a robust design ensure years of trouble-free use at the bench. However, to ensure the longevity of our centrifuges, we do not leave it at that: We perform long-term stress tests on various functions such as lid opening and closing as early as during the R&D phase to ensure the longevity of the materials we use in our products. Eppendorf centrifuges enjoy a wide reputation as long-lasting equipment — some centrifuges made in the early 60s are still up and running in laboratories!

Ergonomics are also an important part of sustainability: Intuitive handling, low noise levels, low loading heights and light rotors all contribute to excellent ergonomics in a sustainable centrifuge that users can effortlessly operate for many years into the future.

Cooling liquids

Refrigerated and cooled centrifuges use compressors and cooling liquids to maintain the required temperature in their rotors and the samples being centrifuged. To counteract global warming, the European Union F-gas regulation (EU_517/2014) calls for hydrofluorocarbons (HFCs), a group of cooling liquids that have been in common use, to be replaced in the stationary and movable cooling systems

of new equipment over the midterm. According to the regulation, existing instruments may continue to be used (and serviced) without any limitations. As a first step toward achieving a green future, Eppendorf has already reduced the amount of hydrofluorocarbons that we use in our centrifuges wherever possible (for example, a 30% reduction in Centrifuge 5430 R).

All major centrifuge suppliers, including Eppendorf, have devoted R&D capacities to develop products that use green, future-proof cooling liquids like propane and ethane.

Because of the high kinetic energy produced by centrifuges and the strict safety regulations that apply to these instruments because of that, centrifuge producers need to step up research efforts to more broadly use flammable coolants like propane and ethane (commonly found in ULT freezers) in their products. With the new generation of Centrifuge 5427 R, Eppendorf has created the company’s first centrifuge containing a green cooling liquid: propane. This new model features all the functionality our customers have come to love about its predecessor, but is now equipped with a new compressor and additional safety features to ensure smooth usage while cooling with the use of more environmentally friendly propane. Additional Eppendorf centrifuge models that use similar green coolants will follow.

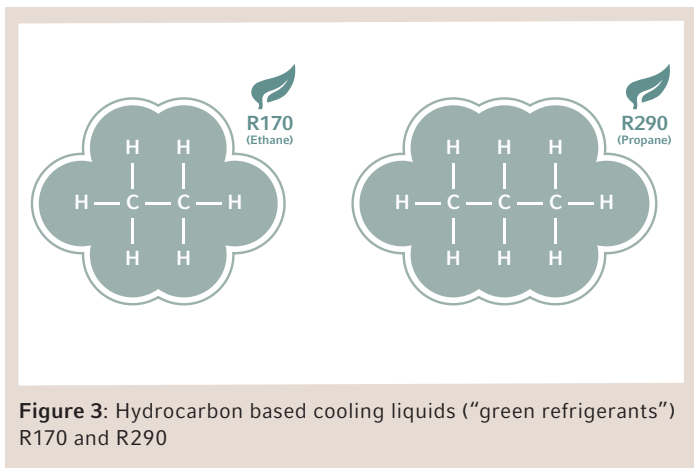


Figure 4: Centrifuge 5427 R

Figure 3: Hydrocarbon based cooling liquids (“green refrigerants”) R170 and R290

Act label scoring factors

The ACT label evaluates a number of factors to arrive at a score for a given product, ranging from manufacturing practices through to the environmental impact of shipping a product. The following provides more detailed information about each of the scoring factors.

Manufacturing impact reduction considers the activities and initiatives a company has started in its production facilities in recent years in order to reduce the environmental impact of its manufacturing processes. This can include retrofitting buildings, updating or adding new heating systems, adding new production machines, or even providing further training of staff. This factor also addresses the handling of waste.

Renewable energy use examines the type of power supplied to the manufacturing facility. According to the My Green Lab team, a “yes” for this scoring factor requires having a dedicated green power contract for company facilities. Like most Eppendorf production facilities, our centrifuge manufacturing sites based in the United States and Germany are driven by 100% renewable power from external sources.

This scoring factor also looks at the handling of chemical reagents during production. A product must comply with EU RoHS/REACH (given for EU-based companies), and companies as a whole shall have ISO 14001 certification or similar documentation. The listed Eppendorf centrifuge factories have dedicated ISO 14001 certifications, similar to the Eppendorf SE as mother company. In addition, chemical substances like refrigerants must be free of CMRs, PBTs, HCFCs, CFCs, and GHS category 1 hazards as well as red-listed chemicals. Eppendorf complies with all of these criteria.

Shipping impact assesses how the product is transported from the production facility (in this case, located in Germany) to the country where the product is used, for instance, the United States. The concept is based on reducing shipment distances and applies to a broad range of products. In terms of food, for example, preferring local production makes sense. For specialized products like laboratory equipment, where only a few facilities worldwide can produce the equipment, this looks different: Shipment, including over long distances, cannot be avoided as this equipment is needed globally.

This scoring factor also considers the type of transport used in shipping as it, too, has an impact: Larger, heavy centrifuges in particular should be shipped by cargo ship only as this method uses less energy. Transportation by cargo plane is neither environmentally (CO₂) nor economically (cost) sustainable.

Product content as a scoring factor focuses on the recycling of raw materials used in manufacturing and specifically examines the proportion of raw materials recycled. Determining the recycling share of metal used in manufacturing is especially challenging: Steel and copper, for example, are melted in large vessels to which material from iron or copper ore (iron for new steel, copper ore for copper) and recycled steel or copper are added. It is difficult to ascertain exactly what percentage of new or recycled material ends up in the metal sheets used to manufacture a particular product. Averages and assumptions are used as the actual amount varies.

As of 2015, more than 50% of the steel produced in Europe is based on recycled material, and 90% of the steel found in products was collected at the end of a product’s lifetime. For copper in Europe, 44% stemmed from recycled sources and 70% of the copper in products was collected. For aluminum, which is used to produce centrifuge rotors, the following figures apply: Of the approximately 4.3 million metric tons of aluminum found in products in the EU at the end of their lives, nearly 3.0 million metric tons were collected and recycled; that is a rate of 69%. In the transportation and construction sectors, 90% of the material used had been recovered in 2018.

For more information please visit:
<https://eu-recycling.com/Archive/26491>

When Eppendorf mills aluminum rotors and bores holes during production of its centrifuge rotors, it collects all the fragments that result. This swarf constitutes a high-grade resource for recycling.

In some countries, the term “waste-free production” is used to describe an environmentally friendly improvement that moves away from the practice of sending waste to a landfill (waste to dump) toward burning (waste to energy) and ultimately recycling (waste to raw material). Some manufacturers are currently making this claim about recent improvements to their manufacturing practices. Eppendorf has already been engaging in waste-free production at its centrifuge manufacturing facilities as a standard practice for many years now.

The scoring factor **packaging content** considers the carbon footprint of product packaging and its recyclability. The cardboard used in our centrifuge packaging is made from at least 70% recycled material depending on the specific source of the material. This figure is reflected in published data: In the European Union, nearly 100% of fiberboard is recycled. The German corrugated fiberboard industry consortium states that Germany’s corrugated fiberboard contains at least 80% of recycled fiberboard.

The packaging for a large multipurpose or high-speed centrifuge (109 kg to 260 kg) must be able to properly protect a large-volume instrument during shipment. Significantly reducing material poses a big challenge as the device must, of course, safely arrive at its destination without any damage to the instrument or to the people transporting it. Eppendorf and other centrifuge suppliers could potentially increase future environmental savings by using cardboard with higher ratios of recycled material (as far as packaging stability allows for – due to technical reasons, packaging of very heavy devices needs approx. 30% fresh fiber cardboard to ensure stability), low-density polyethylene (LDPE) with recycling content for the dustcover film, and biodegradable foam for cushioning.

Water consumption is another factor considered in ACT label scoring. No water is consumed when a centrifuge is used. Eppendorf recovers up to 95% of the water involved in the centrifuge production.

Product lifetime is examined as part of scoring and the topic is generally much discussed as proving the lifetime of a product is challenging: A 10-year-old instrument could, for example, remain boxed for 9.5 years and only be used for six months, so it would look like new in its 10th year. In contrast, a workhorse that performed its job for 10 years might begin showing the first signs of wear at that point. High-quality centrifuges that receive proper maintenance and service can operate for 10 years or longer.

Packaging end of life is a scoring factor that pertains to packaging after the product has been shipped. Collecting and recycling all of the packaging is recommended. Cardboard and wooden pallets are commonly recycled, whereas dustcovers made of LDPE film and cushion foam are more specialized materials to recycle. Providing recommendations and descriptions can support users in improving the recycling of packaging materials.

Even the highest-quality instruments will eventually reach their **product end of lifetime**. Large instruments like centrifuges comprise many different materials that all need to be recycled sustainably. Eppendorf recommends users to check with their Eppendorf partners, their local waste disposal service, or their facility management team to learn about available recycling options for their organizations. Eppendorf centrifuges last for many years, but if they need replacement, all local requirements for disposal of these instruments do, of course, need to be fulfilled. We strongly recommend contacting a certified local recycling partner with experience in instruments that use active cooling. Keeping it local reduces the impact of transportation, and turning to a certified partner ensures the cooling liquids are removed and recycled safely and sustainably and in compliance with local regulations.

Summary

The ACT certification process requires carrying out an in-depth review of a company's sustainability programs and examining all the environmental factors related to a given product. Necessarily lengthy, the process derives many insights and brings to light areas for improvement. Eppendorf supports My Green Lab's mission to achieve "accountability, consistency and transparency" in the life sciences and strives to reduce the company's environmental impact. Receiving ACT label certification for Centrifuge 5910 Ri and Centrifuge 5427 R is a demonstration of Eppendorf's ongoing commitment to the planet and the people on it.

But there is still more work to be done. Eppendorf knows what it means to "go green" and is focusing on continuously developing new features and technologies that reduce the use of raw materials and energy consumption and minimize the company's environmental impact.

None of these challenges can be solved quickly or easily, and all demand a community approach and consistent effort to listen to one another and work together. Supporting organizations like My Green Lab is an important step along this journey. Focusing on the environment will ultimately provide a more sustainable future for everyone.

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 approximately 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.

Your local distributor: www.eppendorf.com/contact

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