°LAUDA

NEW

PROFESSIONAL TEMPERATURE CONTROL SOLUTIONS

for biotechnology

°FAHRENHEIT. °CELSIUS. °LAUDA

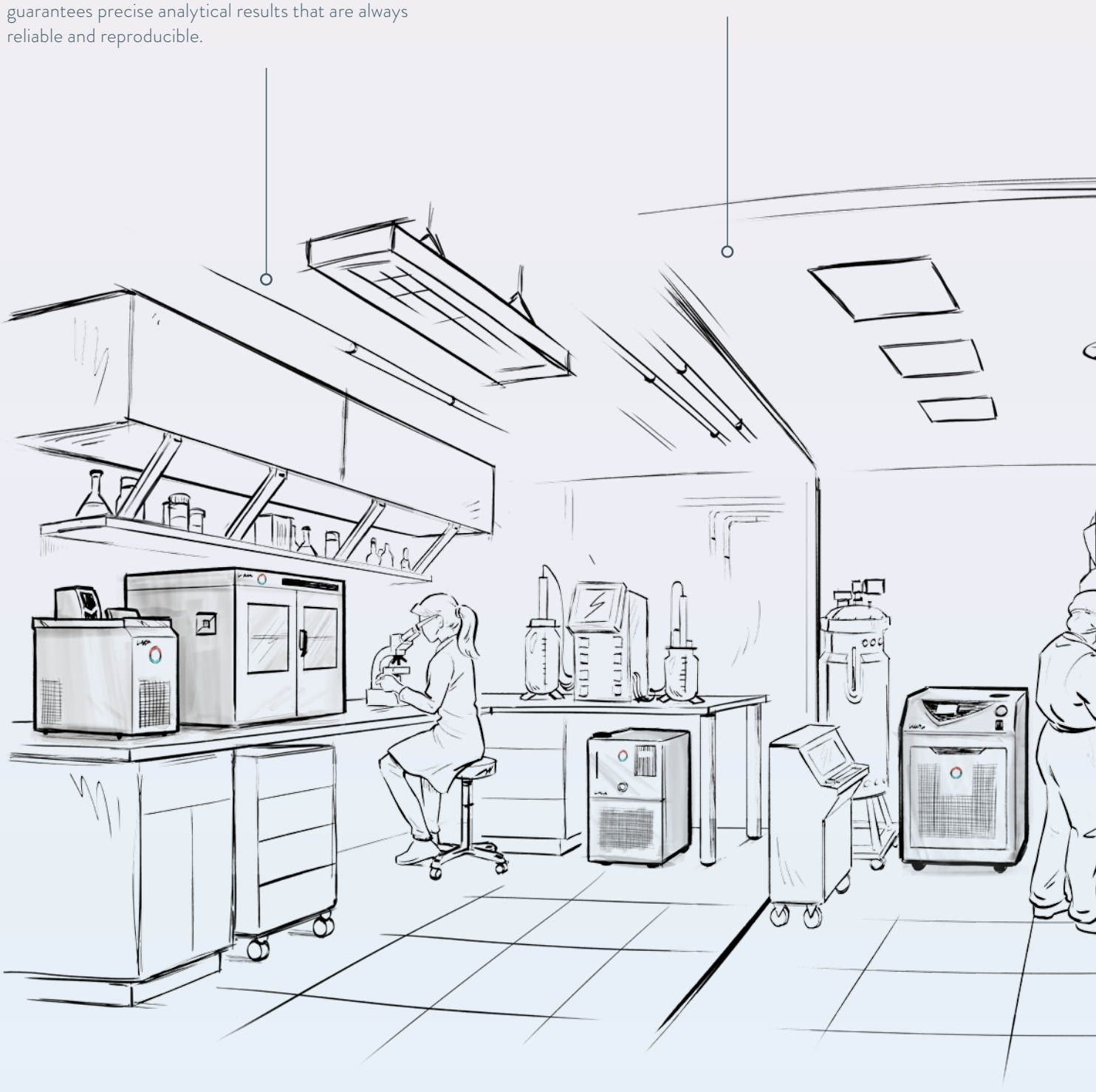
TEMPERATURE CONTROL SOLUTIONS FOR BIOTECHNOLOGY

Research and development
Biotechnological innovations require extensive pioneering work and modern research and development laboratories, independent of whether these innovations involve bio-pharmaceuticals, bio-based materials or novel foods such as cultured meat.

LAUDA laboratory equipment makes work in the molecular biology and biochemical laboratory easier and guarantees precise analytical results that are always reliable and reproducible.

Scale-up
Scaling the bioprocess is a significant challenge along the path to achieving production scale. When selecting suitable bioreactor systems and an appropriate process environment, it is imperative that an adequate yield and degree of quality are ensured.

LAUDA offers established solutions for controlling the temperature of different bioreactor types and sizes.

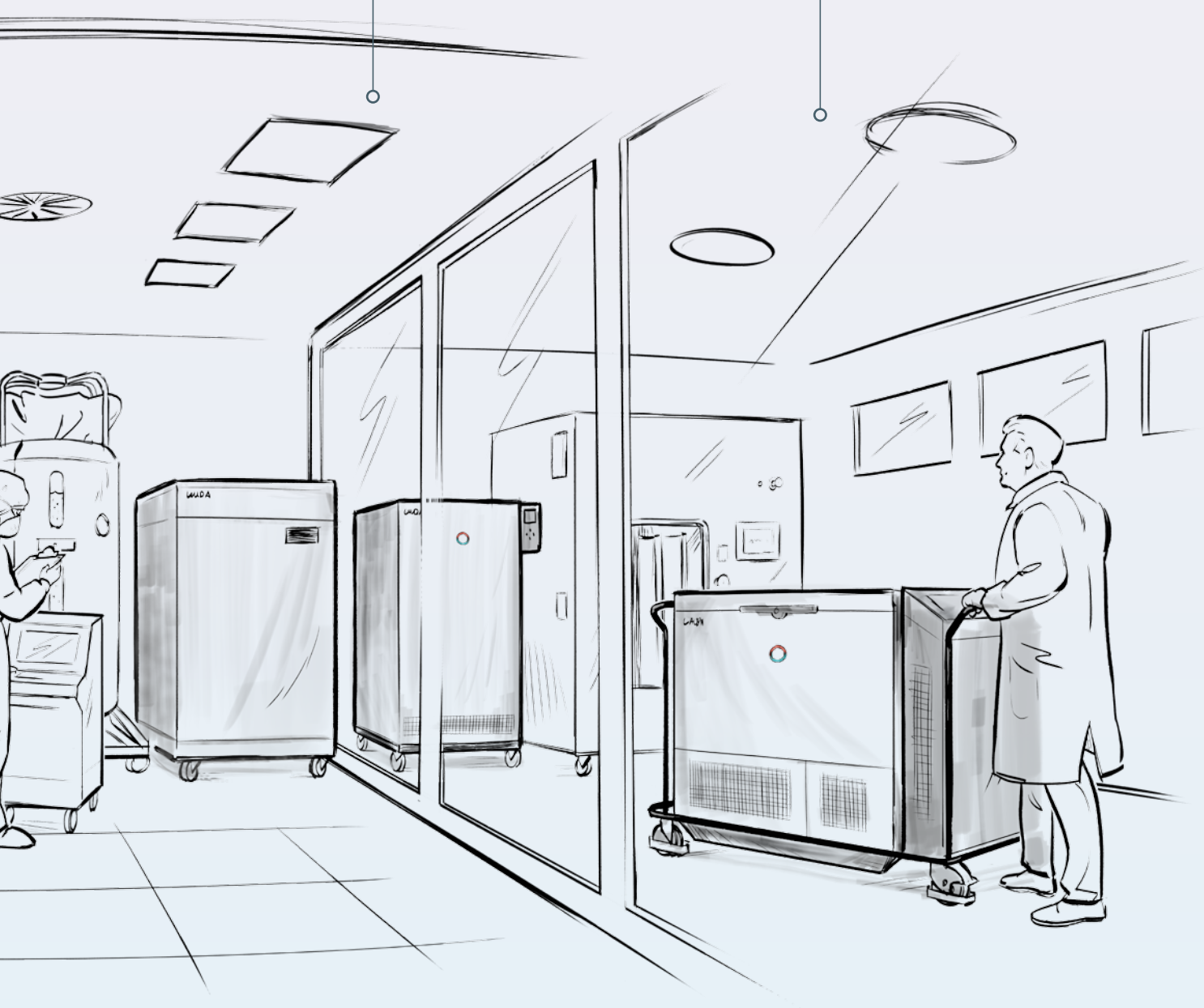


Production
The large-scale manufacture of biotechnological products places significant demands on process control. Precise temperature control is just as important as sophisticated sensor technology and fast communication.

LAUDA process thermostats offer maximum precision in temperature control and are easy to integrate into any process environment.

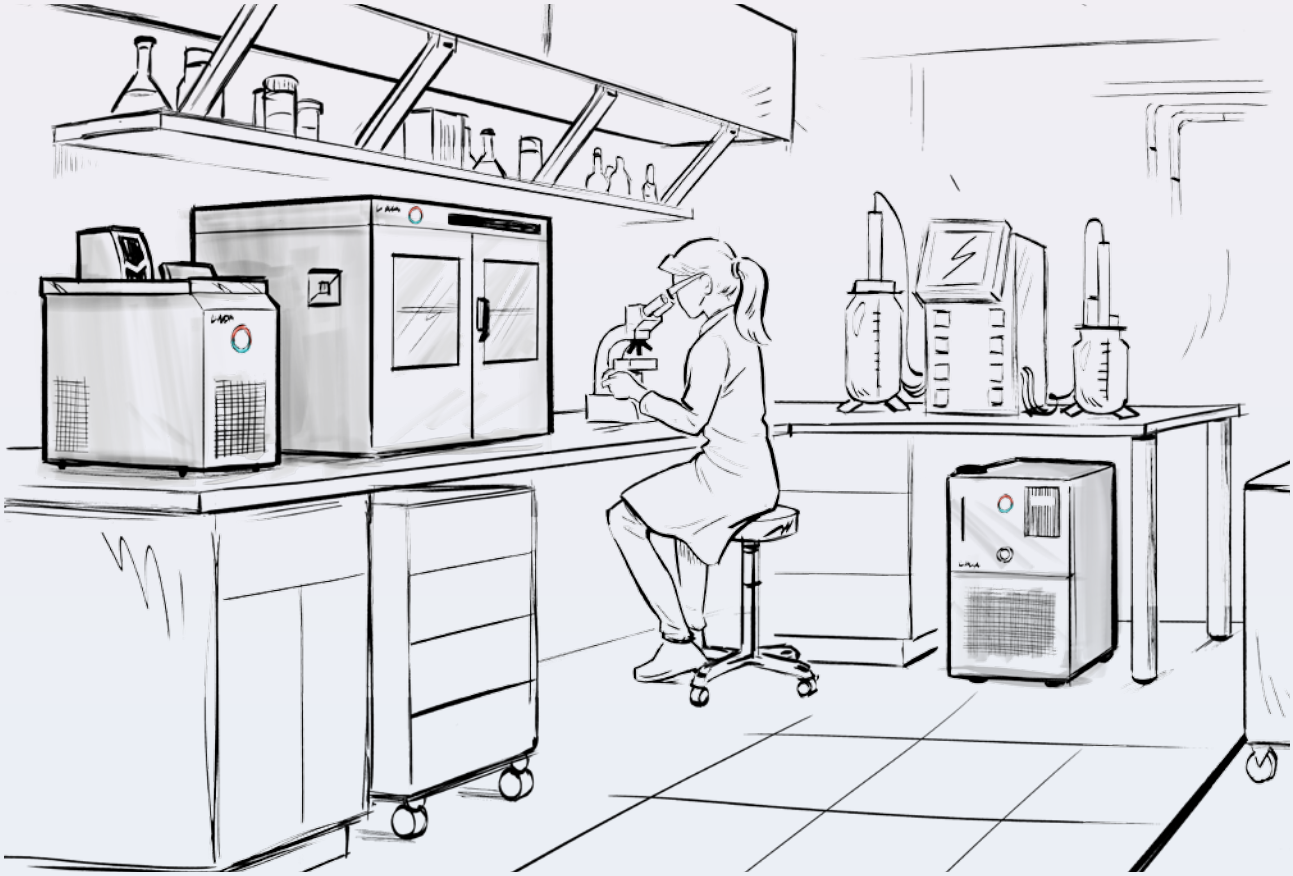
Ultra low temperature applications
Correct handling and storage are crucial to maintaining the stability and effectiveness of biotechnological products such as antibodies, gene therapies and vaccines. Freeze and thaw protocols as well as storage in ultra low temperatures as low as −86 °C are essential.

LAUDA offers extremely powerful process thermostats for freeze and thaw applications, tried and tested ultra low temperature upright freezers and chest freezers as well as a mobile innovation in deep-freeze logistics.

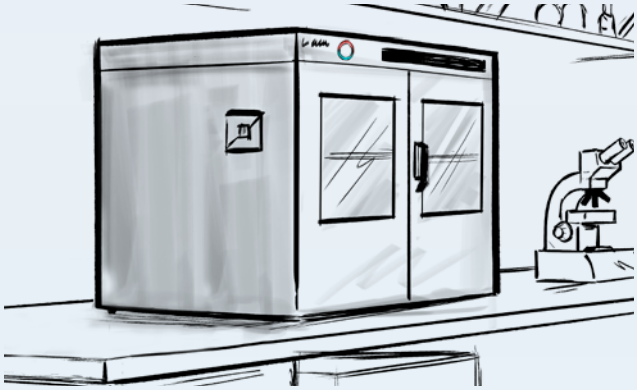


RESEARCH AND DEVELOPMENT
Application areas

Standard operations in the laboratory
The success of scientific experiments depends to a large extent on careful preparation and precise execution. LAUDA offers an extensive selection of devices for sample preparation and temperature control – both internal and external.



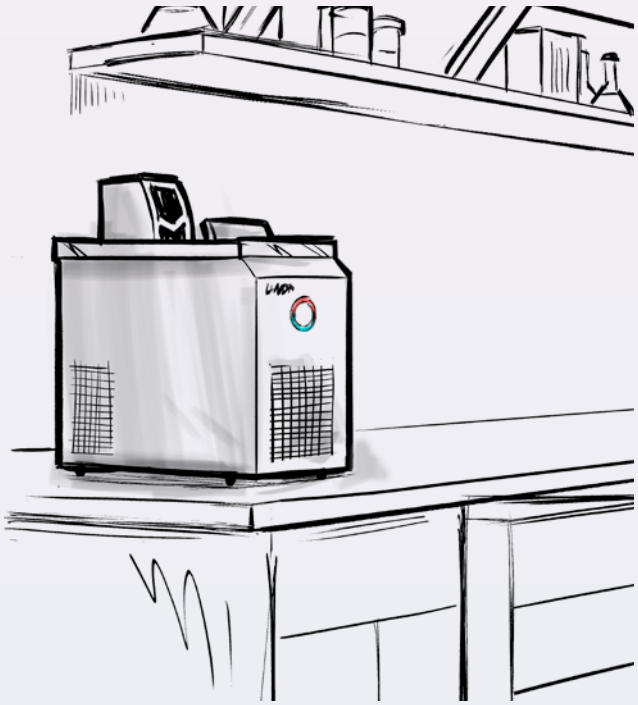
SHAKING AND INCUBATION



Together with temperature control, shaking is one of the standard operations involved in the production of suspensions, staining and hybridizing or when performing extractions, for example, and can be extremely varied.

LAUDA Varioshake shakers are available with an overhead rotating design in addition to the popular bidirectional and orbital shakers. Along with a wide variety of movement options, LAUDA also offers powerful shaking incubators and an extensive range of accessories.

PRECISION TEMPERATURE CONTROL

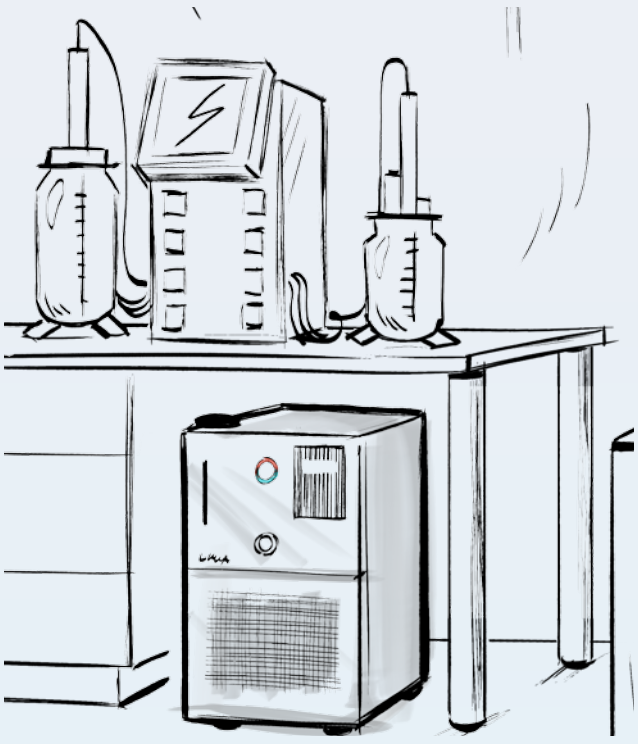


Internal
Water baths and bath thermostats are suitable for controlling the temperature of samples, for example, when incubating biochemical assays or thawing cells. One significant advantage is temperature stability when the sample throughput is high.

The well-known Alpha, ECO and PRO bath thermostats as well as the Hydro water and shaking water baths from LAUDA provide reliable assistance in every laboratory.

External
All-rounder: Many LAUDA constant temperature products are suitable for controlling the temperature of laboratory equipment and applications externally. Efficient technologies that can be used flexibly are indispensable in every laboratory.

FOCUS: TEMPERATURE CONTROL OF BENCHTOP BIOREACTORS



Benchtop bioreactors present a cost-effective solution for experiments before turning to larger systems. Some of the many advantages include easy cleaning and sterilization, and outstanding flexibility.

LAUDA's compact Microcool circulation chillers are suitable for single-walled vessels with a cold finger or double-walled vessels with an integrated heater or heating mat. The LAUDA PRO circulation thermostat is an impressive solution for heating external applications. Are you already familiar with the LAUDA bath thermostats such as the LAUDA ECO? Many LAUDA bath thermostats can also be operated externally and are suitable for controlling the temperature of smaller bioreactors.

RESEARCH AND DEVELOPMENT
The right equipment from LAUDA

LAUDA Varioshake
Shakers for gentle movement or intensive shaking in continuous operation

The ideal solution for a wide variety of laboratory applications.

- Speed adjustable in 1 rpm increments
- Extensive range of accessories for maximum flexibility

Orbital

Bidirectional / linear

Overhead

LAUDA Varioshake
Shaking incubators for simultaneous shaking and temperature control

Suitable for incubations as part of microbial fermentations and biochemical reactions.

- Compact, efficient and powerful
- Outstanding temperature stability of 0.2 K

LAUDA Hydro
Reliable and universal water baths

Efficient thawing of cells and temperature control of samples.

- Short heating times
- Outstanding temperature stability of 0.1 K
- Variants with shaking or circulating function

LAUDA Microcool

Compact circulation chillers for reliable continuous operation

Efficient cooling water supply for a wide range of laboratory applications.

- High-quality magnetically coupled pump
- Auto-start timer and auto shutdown function

LAUDA ECO

Heating and cooling thermostats for economical temperature control

Flexible temperature control in the bath or for external applications.

- Pump connections for temperature control in external applications
- Flow rate switch for internal/external circulation
- Option of extending with a range of interfaces and hydraulic accessories

LAUDA PRO

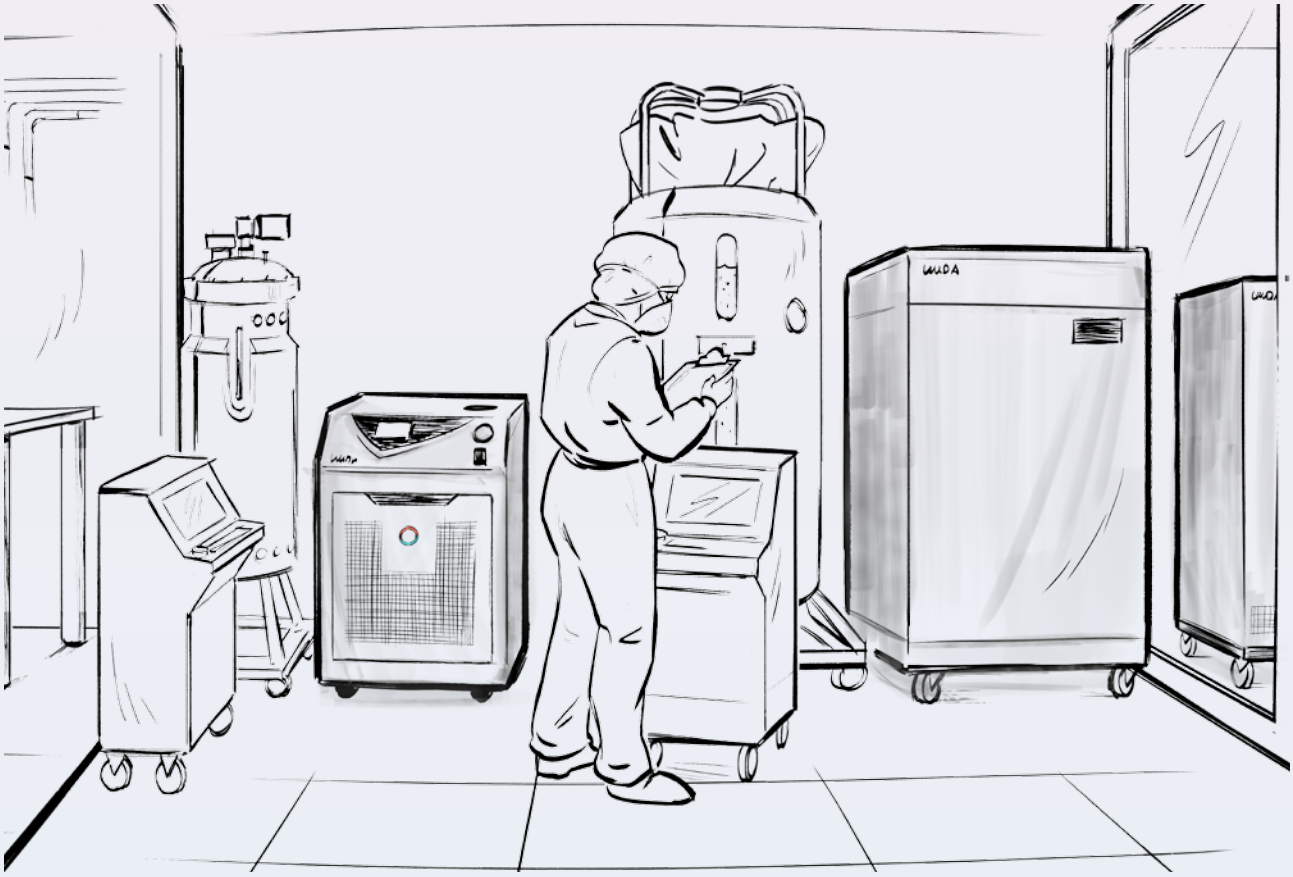
Compact circulation thermostats for professional temperature control

Dynamic heating and cooling in external applications.

- SmartCool system for energy-saving digital cooling control
- LAUDA Vario Flex pump with eight selectable output levels
- Ethernet, USB and Pt100 interfaces as standard
- Removable operating unit can be used as a remote control

SCALE-UP AND PRODUCTION
Application areas

Perfect temperature control
Compliance with strict acceptance criteria in the validated biotechnological process environment places high demands on the constant temperature equipment used. Even small discrepancies can result in the loss of batches which is both time-consuming and causes significant economic damage. LAUDA offers market-leading innovative solutions that eliminate the risks resulting from inaccurate temperature control.



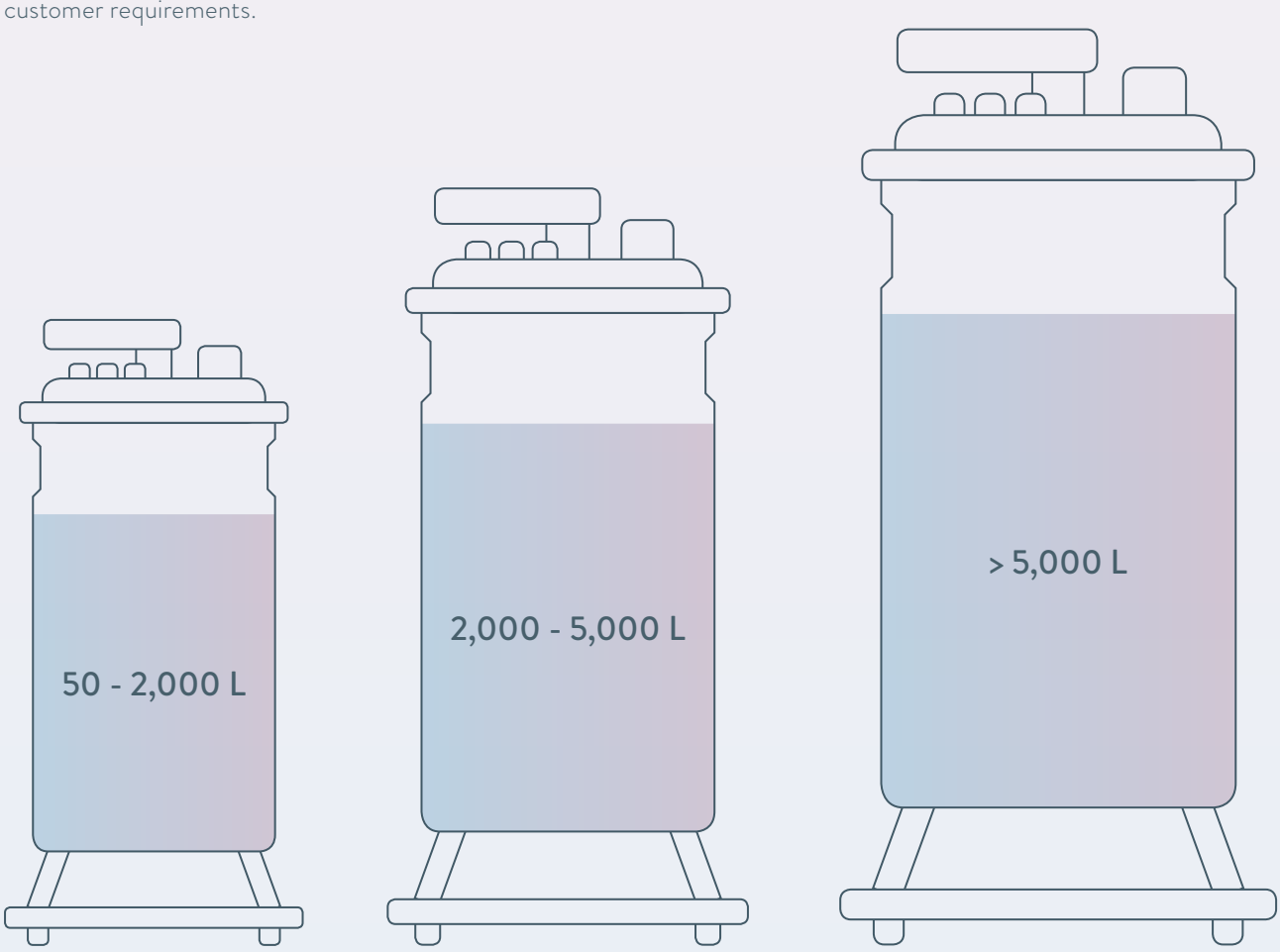
STAINLESS STEEL BIOREACTORS AND FERMENTERS

Stainless steel bioreactors and fermenters perform extremely well in permanent production processes for biopharmaceuticals, but also in the large-scale production of cultured meat. Available in all sizes, these devices boast individual equipment features and excellent process control.

SINGLE-USE BIOREACTORS AND MIXERS

Single-use technology offers a host of advantages in the production of biopharmaceuticals and also represents a suitable entry-level solution in the production of cultured meat and the fermentative production of recombinant animal proteins. Some of the advantages include no risk of contamination, simplification of time-consuming cleaning validation and low investment costs compared to stainless steel bioreactors.

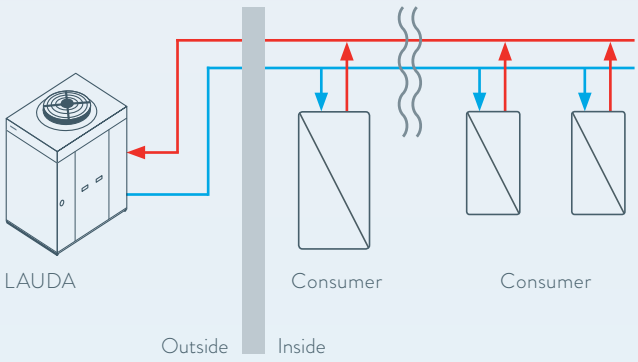
LAUDA is a complete one-stop supplier of precision temperature control solutions for stainless steel bioreactors and fermenters as well as single-use bioreactors and mixers. LAUDA offers everything from a single source with the established Variocool series for small to medium volumes, the innovative Ultratemp series for large volumes, and a modular system design for individual customer requirements.



COOLING WATER SUPPLY

The continuous supply of sufficient quantities of cooling water enables the smooth operation of water-cooled process thermostats, storage tanks and other consumers.

LAUDA Ultracool circulation chillers are particularly energy-efficient, scalable and flexible in operation.

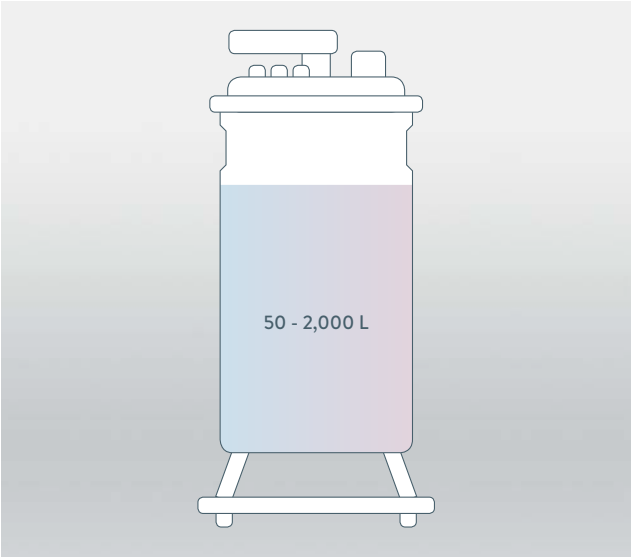


SCALE-UP AND PRODUCTION
The right equipment from LAUDA

LAUDA Variocool
Process thermostats for efficient temperature control of bioreactors and mixers with a volume of up to 2,000 liters

Precise temperatures for optimal growth
With an extensive range of features, LAUDA Variocool controls the temperature of complex bioprocesses in stainless steel single-use bioreactors and mixers or systems.

✓ Working temperature range: −20 to 80 °C
✓ Max. cooling capacity of 10 kW
✓ Max. temperature stability of 0.05 K
✓ High-performance sealless pumps
✓ Adjustable bypass for pressure limitation
✓ Air or water-cooled version

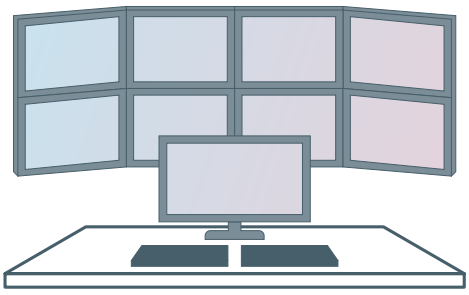


A range of variants
LAUDA Variocool is available with six output levels for all popular single-use bioreactors with a volume of up to 2,000 liters, and with a variety of individual customization options.

High energy efficiency
SmartCool system for energy-saving digital cooling control including automatic compressor control.

Control station operation
Modular interface concept for seamless process integration and the option of external temperature control via Pt100.

Mobile control
Control and process monitoring using the LAUDA Command app (iOS, Windows, Android).



NEW

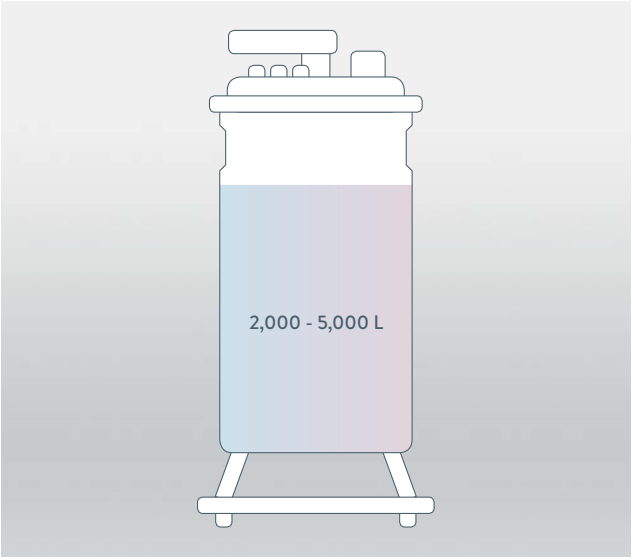
LAUDA Ultratemp

Process thermostats for the efficient temperature control of large bioreactor systems with a volume of up to 5,000 liters

The biotech solution

The new Ultratemp process thermostats enable efficient heating and cooling of bioreactors and fermenters with a volume of 2,000 to 5,000 liters – complementing LAUDA's portfolio in the upper performance range. Ideal for use with the latest generation of single-use bioreactors and conventional stainless steel bioreactors used in the production of alternative proteins, for example.

- ✓ High temperature stability of 0.5 K
- ✓ Working temperature range: −5 to 60 °C
- ✓ Outdoor installation (IP 54) possible
- ✓ Possible to connect external temperature probes
- ✓ LCD with menu guidance in plain text
- ✓ Stainless steel housing enables easy cleaning



Powerful and dynamic

Typical applications for the new process thermostats require a high heating and cooling capacity within a moderate temperature range. Large external volumes can also be heated up and cooled down again quickly with enormous outputs from 25 to 50 kW.

Robust and easy to clean

The process thermostats are available with protection level IP 54 as standard. The high-quality stainless steel housing makes surfaces easy to clean.

Application-optimized equipment

The new constant temperature equipment enables exact control to an external temperature within a working temperature range of −5 to 60 °C. The high temperature stability of ±0.5 K guarantees precision temperatures in the application.

Remote monitoring

Intuitive operation by controlling directly from the device or web server, and ready for the LAUDA.LIVE cloud-based, remote maintenance and monitoring system.

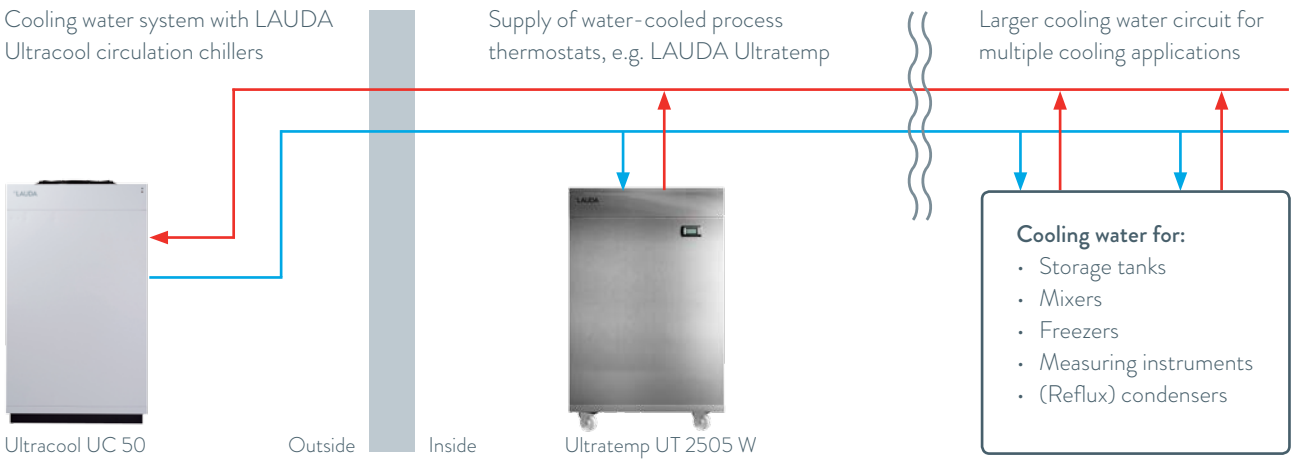
SCALE-UP AND PRODUCTION
The right systems from LAUDA

LAUDA Ultracool
Industrial circulation chillers for a variety of applications

Energy-efficient cooling, future-proof to the maximum
LAUDA Ultracool circulation chillers are suitable for the reliable supply of cooling water. Fully scalable and available with outputs ranging from 2 kW for the local supply, for example, of specific consumers or large devices with a maximum cooling capacity of 240 kW used for the central supply of cooling water.

- ✓ High temperature stability of 0.5 K
- ✓ Extended working temperature range: −10 to 35 °C
- ✓ High energy efficiency leads to low operating costs and rapid amortization
- ✓ Outdoor installation (IP 54) possible
- ✓ Numerous options and accessories ensure perfect adaptation to the task area

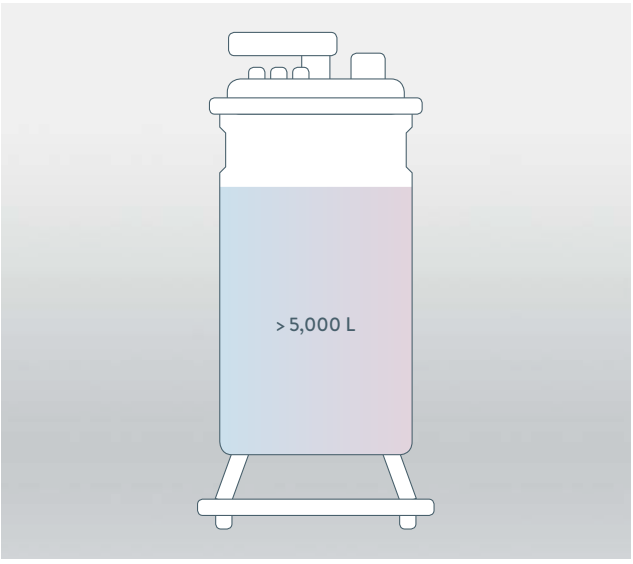
The impressive new generation of Ultracool circulation chillers meets the highest energy efficiency standards specified inthe European Ecodesign Directive. Integrated web server communication and the optional LAUDA.LIVE cloud solution guarantee full connectivity and smart processes.



LAUDA System engineering

Heating and cooling systems strictly according to customer specifications

Competent advice and detailed project planning
Project planning is our specialty. In accordance with the principle of ›modular engineering‹, LAUDA plans and builds systems precisely according to the customer's wishes: process-oriented, made-to-measure precisely in accordance with the regulations, and in line with the strictest safety standards and economic efficiency.



Customized systems – to the highest quality standard
Uncompromising component quality, performance-tested modules and complete documentation of material qualities and technical features – implemented by experienced production specialists.

Optimal interplay – LAUDA plug & play
The process cooling units only need to be connected on site – transport, incorporation and setup are already taken into account during the planning and lead to short commissioning times.

Test run – putting devices through their paces
Complete system test in LAUDA test field prior to delivery to ensure that the system is ready for use immediately after delivery, and that all performance parameters are reliably met.

Reliable service – close to you, worldwide
LAUDA process cooling units are designed for continuous, low-maintenance operation. Should you ever need support, we are there for you at all times.

LAUDA PLANT ENGINEERING EXPERTISE IN PRACTICE

Temperature control of Single-Use Mixers (SUMs) and bioreactors, up to 30,000 L capacity

Device overview – TR Unit

Powerful temperature control unit, for the highly accurate control of pharma/biopharma processes, without the need to employ refrigeration technology.

−20 °C 120 °C

- Heating using steam, using robust shell and tube heat exchanger
- Cooling via direct injection coupling, using existing primary energies for high thermal efficiency
- Product temperature control to within ±0.1 K
- Operation up to 120 °C, for sterilisation of bioreactors
- OPC Unified Architecture (OPC UA) communication interface to client DCS
- Powerful condensate return pump (6 m + lift)
- Compact design to minimise footprint
- Robust stainless steel frame and outer panelling
- Full function Factory Acceptance Test (FAT) prior to delivery, with unit certified leak-free over full working range
- Fully insulated and ready to use day-one

All components are manufactured, tested and certified to the following design standards:

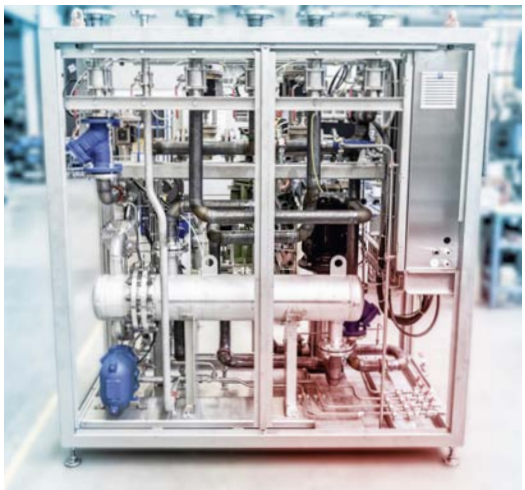
- 2014/68/EU (Pressure Equipment Directive)
- AD2000 (Merkblätter Pressure Equipment)
- 2006/42/EC (Machinery Directive)
- 2014/35/EU (Low Voltage Directive)
- 2014/30/EU (EMC Directive)
- DIN EN 60204-1 (Safety and electrical equipment of machinery)

Technical data

Device type	Working temperature range °C	Temperature stability ±K	Heater power max. kW	Cooling output at 20 °C kW	Nominal flow rate L/min	Protection level	Power consumption kW	Current consumption A	Dimensions (W x D x H) mm	Weight (empty) kg	Part number
TR Unit											
TR250HKi	−20 ... 120	0.1	30	50	67	IP54	3.4	5.4	1,000 × 1,800 × 2,170	800	LSI 100723
TR400HKi	−20 ... 120	0.1	200	250	333	IP54	6.2	9.9	1,000 × 1,800 × 2,170	1,000	LSI 100724
TR600HKi	−20 ... 120	0.1	250	250	500	IP54	8.4	13.5	1,000 × 1,800 × 2,170	1,200	LSI 100725

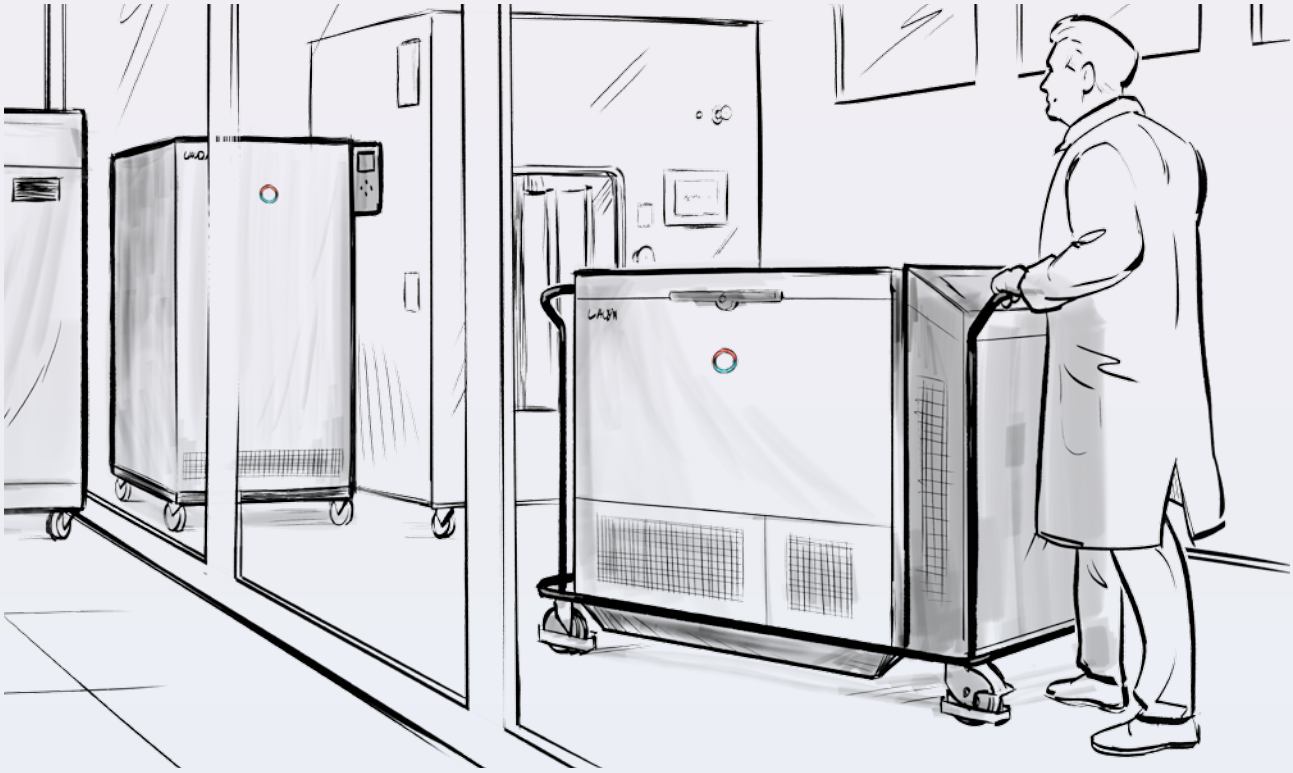
More powerful units can be provided on request and additional options can be selected, such as:

- Electrical heating in lieu of steam
- Incorporation of client-specific components
- GAMP 5/21CFR Part 11 (Audit Trail) compliance module
- US version
- Additional communication protocols



ULTRA LOW TEMPERATURE APPLICATIONS
Application areas

Precise and relentless
Controlled freezing and thawing as well as storage at temperatures as low as −86 °C are important for maintaining the integrity of biotechnological products, cells and pharmaceutical reference samples. LAUDA offers process thermostats for controlled freezing and thawing as well as solutions for ultra low temperature storage and logistics.



CONTROLLED FREEZING AND THAWING

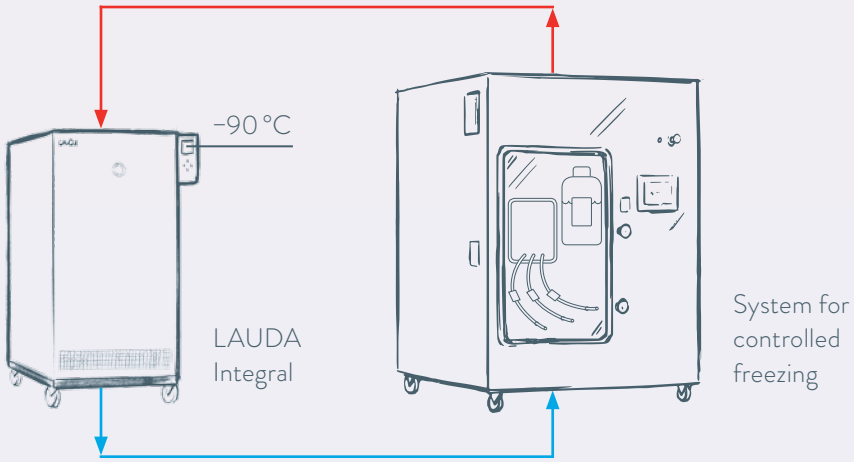
Freezing and thawing at defined cooling and heating rates has become an indispensable process in the treatment of valuable biopharmaceutical products. The process simplifies handling during essential transport phases and guarantees consistent product quality. Modern systems enable full integration into the process chain, a high level of automation and therefore increased safety and control.

Highest performance requirements for cooling
High cooling rates, rapid response times, and complex hydraulics at temperatures below −80 °C. The constant temperature equipment must be able to cool dynamically, and must feature powerful, variable pumps that can also handle high flow resistances.

Deep process integration
Reproducible results can only be guaranteed through a perfect connection between the constant temperature equipment and the freeze and thaw unit, as well as easy readability for monitoring and process optimization purposes.

The innovative flow principle and eight-stage Vario pump on the LAUDA Integral XT enable high dynamics, even with complex hydraulics.

Used for the controlled freezing of active pharmaceutical ingredients, the powerful LAUDA Integral reliably reaches temperatures as low as −90 °C.



ULTRA LOW TEMPERATURE STORAGE

Ultra low temperatures below −80 °C are essential for ensuring the stability, integrity and effectiveness of biopharmaceutical products and cells over a longer period of time. Any interruptions in the ultra low temperature storage of therapeutic proteins, genetic material, cell lines or reference samples represent an economic risk and a product risk and can lead to complicated checks and special approvals.

LAUDA Versafreeze upright and chest freezers offer safe storage of valuable samples and biopharmaceuticals.

DEEP-FREEZE LOGISTICS

Today, deep-freeze logistics in the biopharmaceutical industry rely on the use of latent heat accumulators (PCMs) or dry ice. However, both applications have serious limitations. While PCMs are only available for ultra low temperature applications to a limited extent, dry ice maintains the temperature at −78.5 °C through sublimation. Handling dry ice runs the risk of suffocation, frostbite and explosion. The continuous procurement of dry ice along with the implementation of measures to counter any risks also generate high running costs.

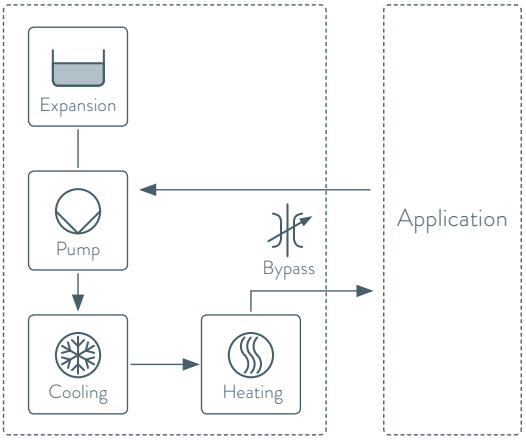
LAUDA Mobifreeze is the world's first ultra low temperature chest freezer that can be connected to the power supply or operated by battery. The solution eliminates the need for dry ice and PCMs, is ready for use at any time and enables flexible configuration of temperature settings for the relevant product. This means that transportation can take place under the validated storage conditions.

ULTRA LOW TEMPERATURE APPLICATIONS
The right equipment from LAUDA

LAUDA Integral XT
Process thermostats for dynamic temperature control during controlled freezing and thawing

Dynamic temperature control
LAUDA Integral XT is a powerful dynamic heating and cooling system. In combination with the eight-stage Vario pump and the adjustable bypass for internal throughflow control, the system enables steady and gradual temperature control, and high flow rates during the freezing and thawing phases.

- ✓ Ultra low temperatures as low as −90 °C
- ✓ High dynamics
- ✓ Powerful eight-stage pumps generate the appropriate pressure and volume flow
- ✓ Cooling capacities up to 25 kW



The cold oil flooded flow system with a small active volume guarantees dynamic cooling and heating, even in the most demanding applications.

Future integrated
Fit for the future and ready for LAUDA.LIVE: LAUDA Integral thermostats can be flexibly integrated into various communication scenarios thanks to the integrated web server, monitoring and control via PC or mobile devices, and the modular interface concept.

Renowned quality
The product line LAUDA Integral has proven itself in a wide variety of industries and applications for over 25 years. It incorporates technical refinements such as the cold oil overlay principle, which guarantees dynamic temperature control over wide temperature ranges.

User-friendly operation
Softkey control directly on the device, remote control via the touch display or mobile devices mean that it has never been easier to control your constant temperature applications according to your requirements: LAUDA Integral process thermostats determine the best control parameters for the application at the touch of a button, and the temperature control media can be selected to ensure optimum use of the liquid.

You need an individual design?
LAUDA system engineering has years of experience in planning modular heating and cooling equipment for freeze and thaw applications – entirely according to customer requirements.

ULTRA LOW TEMPERATURE APPLICATIONS
The right equipment from LAUDA

LAUDA Versafreeze
Upright and chest freezers cooling to temperatures as low as −86 °C

Tailor-made solutions for secure, long-term storage
LAUDA Versafreeze deep-freezers enable the safe storage of valuable samples at temperatures as low as −86 °C. Versafreeze devices set new standards through a combination of decades of experience and consistent further development.

- ✓ Working temperature range: −40 to 0 °C or −86 to −50 °C
- ✓ **Upright freezers:** Refrigeration compartment volume of 129 to 731 liters, 129 L model for under counter installation
- ✓ **Chest freezers:** Refrigeration compartment volume of 205 to 754 liters

Pioneering technology
High-performance vacuum insulation protects against cold loss and minimizes energy consumption during continuous operation. A tightly laid cooling coil ensures a rapid freezing rate as well as excellent temperature homogeneity and stability.

Future-proof
The use of future-proof natural refrigerants enables trouble-free operation of the devices in the long term.

Safe samples
Long thawing times and maintaining the display and alarm functions over a period of up to 35 hours ensure maximum safety of the samples. The integral data logger and password protected access rights provide maximum data integrity and security.

Flexible
LAUDA Versafreeze deep-freezers offer flexible loading options to optimize utilization of the refrigeration compartment, guaranteed by an extensive range of accessories that includes storage systems, boxes, grid segmentations and an external data logger. LAUDA also offers additional safety cooling using CO_2 or LN_2 as well as alternative water cooling of the cooling unit, which are available as optional extras.

NEW

LAUDA Mobifreeze

Mobile chest freezer with powerful lithium iron phosphate battery

The world's first mobile, battery-powered, ultra low temperature chest freezer

The LAUDA Mobifreeze chest freezer is the world's first freezer that can be used for internal factory transport and road logistics. It completely eliminates the need for dry ice and latent cold accumulators (PCM). Can be used flexibly for biopharmaceutical production and filling as well as in research institutes, clinics, laboratories and biobanks.

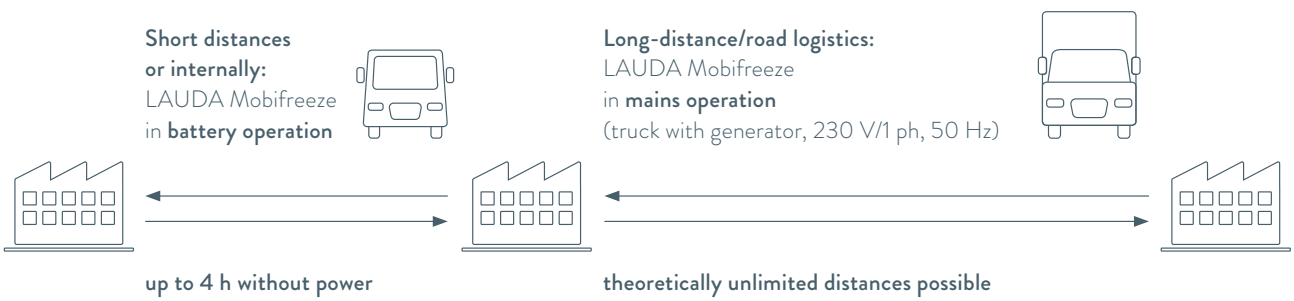
- ✓ Working temperature range: −86 to −50 °C
- ✓ Up to four hours of battery life at −80 °C
- ✓ Refrigeration compartment volume of 270 liters
- ✓ High-grade vacuum insulation ensures high temperature stability (±3 K)
- ✓ Easy-running heavy-duty casters and dead man's brake guarantee perfect maneuverability and safety
- ✓ Designed for harsh logistics environments

Safe
Unlike dry ice, there's no risk e. g. of frostbite or suffocation.

Plug & Play
Mobifreeze switches between mains and battery operation fully automatically.

Simple
No time-consuming planning of packing units or usage time as is the case with dry ice and PCMs.

Cost savings
Replaces expensive dry ice and PCMs. Shortens and simplifies handling processes.



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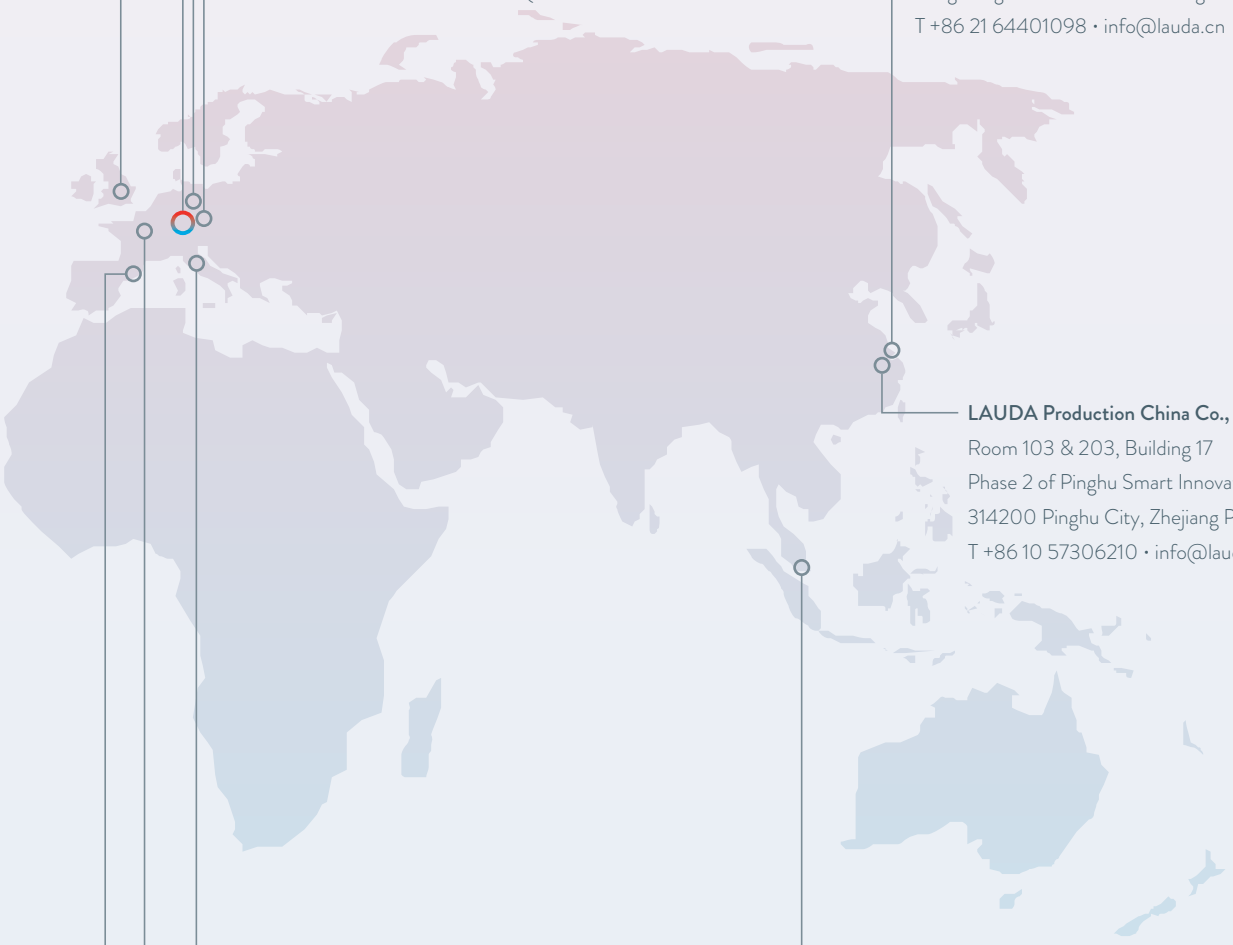

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