°LAUDA

HEATING AND COOLING SYSTEMS
FROM –150 TO 550 °C

°FAHRENHEIT. °CELSIUS. °LAUDA.

THE COMPLETE SPECTRUM OF PERFECT TEMPERATURE CONTROL

In accordance with the principle of ‘Modular Engineering’, LAUDA plans and builds process cooling units, heat transfer units and secondary circuit units precisely in accordance with the customer’s wishes: process-oriented, precisely in accordance with the regulations, and with compliance with the strictest of safety standards. LAUDA installations heat and cool within the temperature range of −150 to 550 °C, with an accuracy of up to one tenth of a degree Celsius. In order to meet the constantly growing requirements of temperature control systems, modern LAUDA Heating and cooling modules can be extended and modified flexibly.

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TAILOR-MADE HEATING, COOLING AND FREEZING FROM –150 TO 550 °C

Expert advice – right from the start
At LAUDA we know that the right temperature is crucial to the quality of the end product. Right from the start, you can rely on highly competent specialists and individual advice.

Common element – modular engineering
Exact project planning and modular engineering are the key to your tailor-made system. In close consultation with you, we design and develop exactly the solution you need.

Tailor-made systems – highest quality standards
The best planning is useless if the implementation is faulty. Our experienced production specialists know exactly how your specific wishes and requirements for Heating and cooling systems can best be implemented.

Optimum interaction – LAUDA Plug & Play
Since the Heating and cooling systems consist of ready-to-connect skids, all they have to do is 'dock on' on site – transport, placement and installation are already taken into account during planning, resulting in quick commissioning times.

Test run – putting things through their paces
All systems are tested in the LAUDA testing facility before delivery. In this way, we make sure that everything is working perfectly – and that you are delighted with the quality of our services.

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

LAUDA

Areas of application by industry

AUTOMOTIVE INDUSTRY

In the automotive sector, temperature control is mainly found in test and inspection rigs and material tests. All automobile components are exposed to particularly high temperature fluctuations. This is why component testing on special test benches is so essential. The replication of environmental conditions such as high or low temperatures is an important part of material testing.

Typical fields of application

- Test and inspection rigs
- Material tests

BIOTECHNOLOGY

In biotechnology, temperature control is essential when it comes to the quality of the research and production results. During the operation of bioreactors, constant temperatures are crucial to the success of the process. For storage or the transport of products, precise freezing processes are required.

Typical fields of application

- Bioreactors
- Preparation of test specimens
- Freezing processes

CHEMICAL INDUSTRY

Many of the processes in the chemical industry, in which temperature plays an important role, are found in the field of process engineering and reactor temperature control. In temperature control processes in reactors, typical applications include chemical reactions, syntheses, polymerization or crystallization.

Typical fields of application

- Reactor temperature control
- Process engineering

PHARMACEUTICAL INDUSTRY

In the pharmaceutical industry, temperature control processes range from research to production scale. In order to achieve high quality products, temperature control systems must control the process in an external reactor reliably. Furthermore, continuous validation of the processes must be ensured through a high level of automation.

Typical fields of application

- Reactor temperature control
- Process engineering

SEMICONDUCTOR INDUSTRY

In the production of semiconductors and the testing of electronic components, there are numerous processes that must be precisely temperature controlled. These include, for example, metal organic chemical vapor deposition (MOCVD) in semiconductor coating as a preliminary stage in LED production. Other typical temperature-dependent inspections in the semiconductor industry are stress tests for function and load testing, environmental simulations and in-circuit tests of electronic assemblies.

Typical fields of application

- Process temperature control
- Component testing

AEROSPACE INDUSTRY

Temperature simulations and temperature-dependent material tests play an important role in the aerospace industry. Cyclical temperature stress tests ensure fault-free operation of the components used, even under extremely fluctuating external conditions.

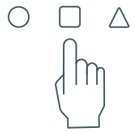
Typical fields of application

- Material testing
- Temperature simulation

LAUDA HEATING AND COOLING SYSTEMS
Planning components

Common element – modular engineering
Your tailor-made solution is created by combining proven components appropriate to the required application. Precise planning and exact project engineering of all interfaces ensure that the setpoint and actual values match. Each individual LAUDA planning component has been proven many times over and undergoes continuous further development. In this way, we can guarantee a high quality standard.

1. SPECIFY THE APPLICATION



For which application area do you require the heating and cooling system?

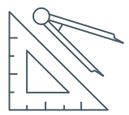
2. DEFINE THE TEMPERATURE RANGE

Which temperature ranges must be covered?

3. ASSEMBLE THE MODULES

Field-tested individual system modules are configured to provide an adaptable modular system.

4. CONFIGURE THE UNIT



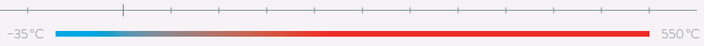
The tailor-made unit is planned and built.

CONSULTING SERVICES

A LAUDA engineer accompanies you every step of the way to an individual solution, right up to start-up.

LAUDA UNIT TYPES
Overview

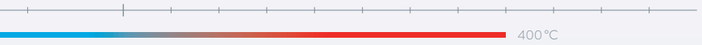
HEAT TRANSFER UNITS



LAUDA heat transfer units always consist of the electric heater module and a maximum of one additional heat exchanger module (cooler). Depending on the required outflow temperature, either thermal oil, water or water/glycol is used as the heat transfer fluid. LAUDA heat transfer units use electrical heaters and generate a temperature-controlled liquid flow. In this version, or in combination with a process cooling unit, a Heating and cooling system is created with an extended working temperature range.

Series	
ITH	ITH Ex
ITHW	ITHW Ex

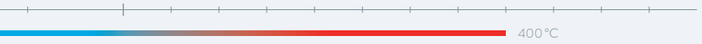
PROCESS COOLING UNITS



Process cooling units are active refrigeration systems for temperature control of various consumer circuits. They have single-stage refrigeration circuits or dual-circuit cascade refrigeration systems and are water or air-cooled.

Series	
SUK	SUK Ex
DV	DV Ex
KH	KH Ex

SECONDARY CIRCUIT UNITS



Secondary circuit units use thermal energy from existing steam, thermal oil, cooling water and brine networks. The controller enables the automatic extraction of the energy required for heating and cooling from the respective primary system, either via heat exchangers or by direct feed-in of the heat transfer fluid.

Series	
TR	TR Ex
KP	KP Ex

EXPLOSION-PROOF UNITS

Almost every industry that works with liquids has an area with a potentially explosive atmosphere. Only systems which meet the strictest explosion protection guidelines may be used here. All unit types for heating and cooling are tested for installation in Ex zone 1 or 2 according to the Explosion Directive 94/9/EC (ATEX).

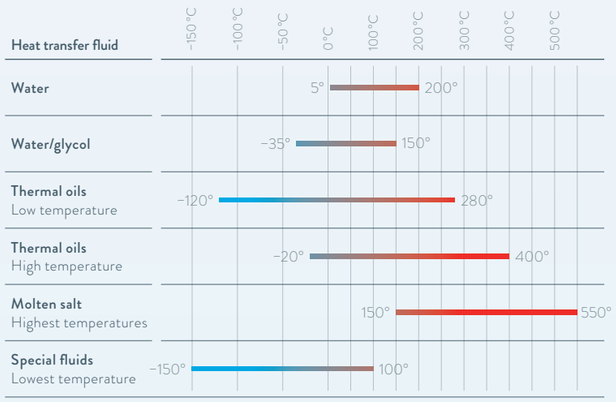
HEAT TRANSFER FLUIDS
General information

Important factors for selecting the optimum temperature control system

1. The temperature range for the required application must be specified.
Ideally, some details about the process and the equipment should already be available. The maximum and minimum heat transfer fluid temperatures are not only determined by the temperature profile of the actual process: Only with the corresponding performance record as well as the type and geometry of the equipment can the required temperature differences on the heat transfer surfaces be determined. These differences are required for energy transfer – the temperature range of the heat transfer fluid should therefore be extended upward and downward accordingly.

2. Next, the question of the heating or cooling source must be clarified.
Regardless of the final module selection, the customized unit will belong to one of the three LAUDA unit families. Therefore, it must be determined whether an existing medium should be used via heat exchanger in a secondary circuit unit for heating or cooling,and whether a heat transfer unit with electric heating, or a process cooling unit with refrigeration compressors is required.

How do the heat transfer fluids differ from one another?
heat transfer fluids differ primarily in the possible temperature range. Water is the best-known and most frequently used temperature control medium. With regard to the high specific heat capacity of almost 4.2 kJ/kgK, water is the ideal heat transfer fluid. By adding antifreeze agents such as glycol, the temperature range can be extended to −35 °C. However, the high steam pressure that occurs at over 100 °C is often a disadvantage of aqueous heat transfer fluids. For temperature ranges between −120 °C and 400 °C, organic heat transfer fluids or silicone oils must be used. If importance is attached to residue-free evaporation, as with thermal testing of sensitive electronic components, fluorinated liquids are also used.

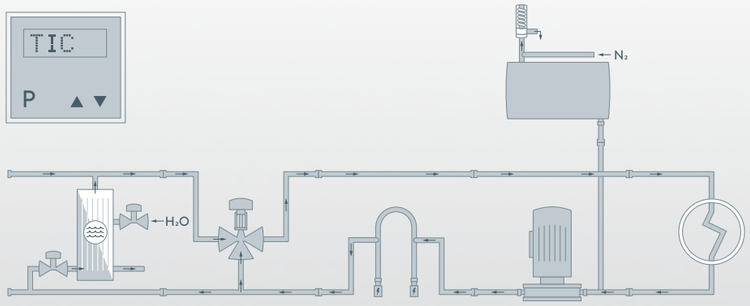


LAUDA heating and cooling systems and heat transfer fluids
In these closed systems, pressure blanketing and inertization (nitrogen) can be enabled through connection to compressed air or nitrogen. In this way, heat transfer fluids can be used in considerably wider temperature ranges than with open systems without pressure blanketing.

We would be pleased to recommend a suitable heat transfer fluids for your temperature control system at **www.lauda.de**

LAUDA MODULES
General information

Technical refinements and innovations
Technical refinements and innovations are standard at LAUDA, as well as economical and customer-specific solutions with sophisticated project engineering and a comprehensive, modular and adaptable range of heating and cooling systems. As modern manufacturing processes require ever wider temperature ranges, systems today are operated as far as possible with only one heat transfer fluid – as it were, with no switch-over. Precise coordination of equipment, process and temperature control system minimizes process times and energy consumption. Seamless integration of the temperature control system into the process control system is one of the most important prerequisites for comprehensive process validation – it creates the decisive conditions for high-quality end products.



Modular representation of a heat transfer unit. All modules can be exchanged and supplemented.

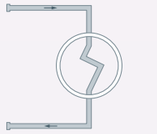
LAUDA container units
Operational safety in all weathers: LAUDA container units, the optimum outdoor solution. The container units from LAUDA heating and cooling systems are always in demand when the technology set-up space has to be located outside the building. The container itself is temperature controlled and therefore withstands the most diverse climate conditions.

Process-optimized control system
In complex systems, feedback signals for each sensor and actuator may be required. Through logical linking of the inputs and outputs, operating phases are initiated with pinpoint accuracy and monitored intelligently. This provides a strong advantage when it comes to the high demands on operational safety.

Design your system concept with the LAUDA module configurator at **www.lauda.de/hks**

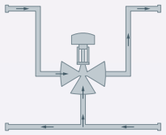
LAUDA MODULES
Overview

BASIC MODULES



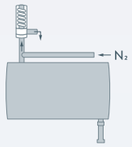
External application
The control result depends on the object to be controlled and is taken into account during the planning phase

Controller
Temperature control means avoiding fluctuations and controlling temperature processes.

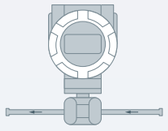


Three-way valve
Where steady regulation is particularly required, the three-way valve is capable of mixing two flows exactly.

Pump
Pumps are responsible for circulation of the heat transfer fluid.

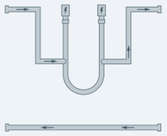


Expansion vessel
Expansion vessels can be atmospherically open, pressure blanketed, inerted or designed as a membrane vessel.

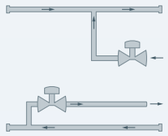


Volumetric flow controllers
These are responsible for flow control

EXPANSION MODULES



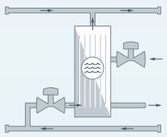
Electric heaters
Electric heaters are used where heating with steam or other media is not possible.



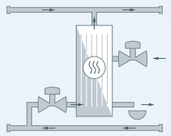
Direct media coupling
Coupling without a heat exchanger can be energetically advantageous if the same medium is used in the primary system.

Heat exchangers
Heat exchangers are always used when heating or cooling energy of various media is to be used.

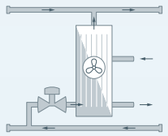
Versions:



Heating or cooling with fluid media

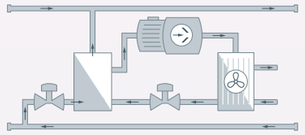


Heating with steam

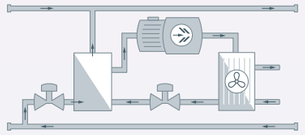


Heating or cooling with air

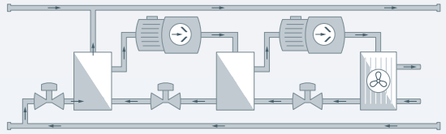
AIR-COOLED REFRIGERATION MODULES



Single stage compressor
Single stage refrigeration system with air-cooled condenser for generating temperatures from −35 to 20 °C.

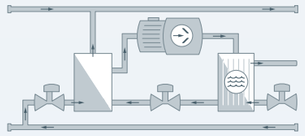


Single stage compressor
Single stage refrigeration system with air-cooled two stage condenser for generating temperatures from −50 to 20 °C.

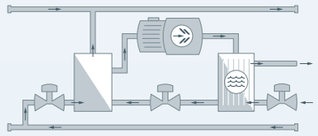


Two stage cascade refrigeration system
Two stage cascade refrigeration system with air-cooled condenser for generating temperatures from −100 to 20 °C.

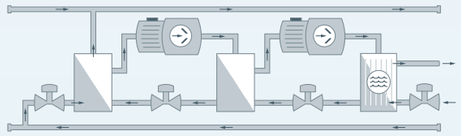
WATER-COOLED REFRIGERATION MODULES



Single stage compressor
Single stage refrigeration system with water-cooled condenser for generating temperatures from −35 to 20 °C.



Single stage compressor
Single stage refrigeration system with water-cooled two stage condenser for generating temperatures from −50 to 20 °C.

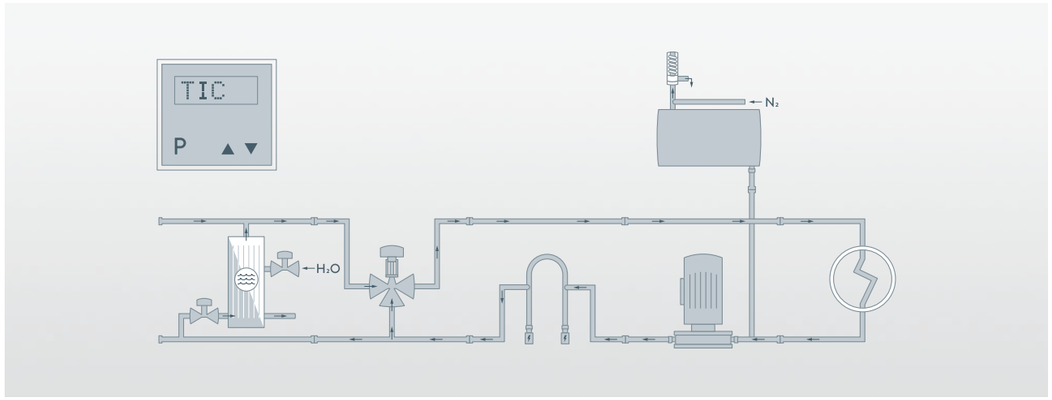


Two stage cascade refrigeration system
Two stage cascade refrigeration system with water-cooled condenser for generating temperatures of −100 to 20 °C.

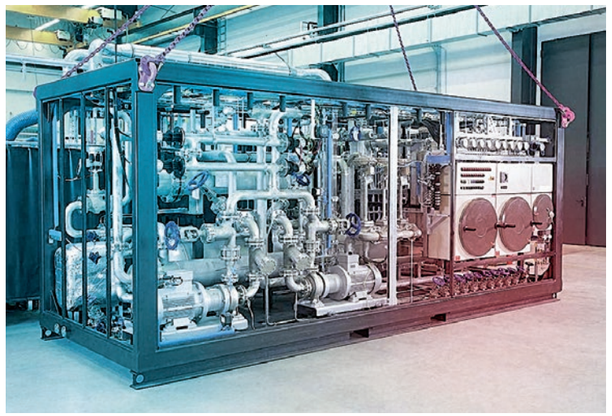
LAUDA HEAT TRANSFER UNITS

Application example ‘Thin film evaporator’

Temperature control of a thermal thin film evaporator
Depending on the required outflow temperature, heat transfer units use either thermal oil, water or water/glycol as the heat transfer fluids. Electrically heated, they produce a temperature controlled flow of liquid. Heating and cooling systems in the heat transfer unit line always consist of the electric heater module and a maximum of one additional heat exchanger module (cooler). In this way, also in combination with a process cooling unit, a Heating and cooling system is created with an extended working temperature range.



Example of a heat transfer unit ITH, developed with the LAUDA module configurator

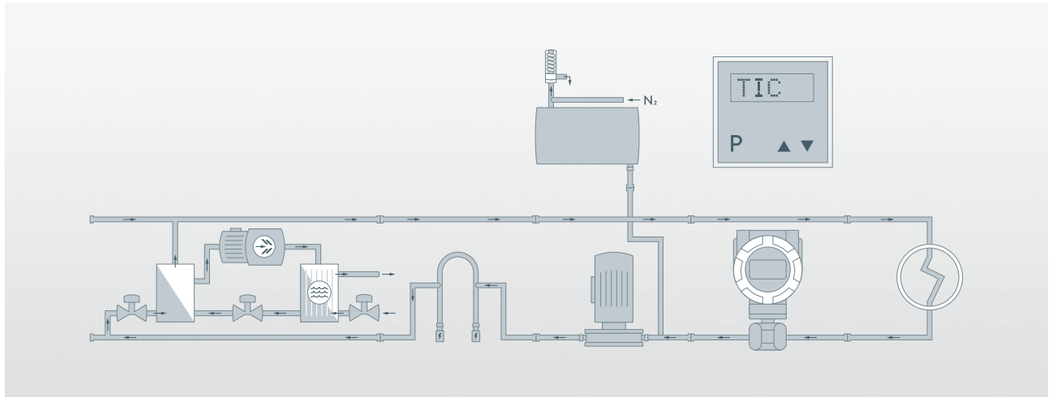


Explosion-proof units
Almost every industry that works with liquids has an area with a potentially explosive atmosphere. Only systems which meet the strictest explosion protection guidelines may be used here. All unit types for Heating and cooling are tested for installation in Ex zone 1 or 2 according to the Explosion Directive 94/9/EC (ATEX) .

LAUDA PROCESS COOLING UNITS

Application example ‘Test benches’

Conditioning of test benches in the automotive industry
LAUDA process cooling units, of the SUK series, consist of compressor, pump, expansion vessel, evaporator, volume flow controller and condenser. Depending on the lowest working temperature, single stage (down to −35 °C) or two stage compressors (down to −50 °C), are used. At very low temperatures down to −100 °C, two cooling systems in cascade connection are used. The performance of the refrigerant condenser, cooled with cooling water or air, is controlled continuously and precisely by the injection control. If several compressors are used, an incremental switch ensures energy-saving, low-wear, partial load operation (automatic compressor control). With an electric heater or steam-heated heat exchanger, temperatures from −100 to 150 °C can be achieved. Pre-cooling with on-site brine or air can be easily implemented using the modular system. Depending on the application, a cold accumulator can be advantageous.



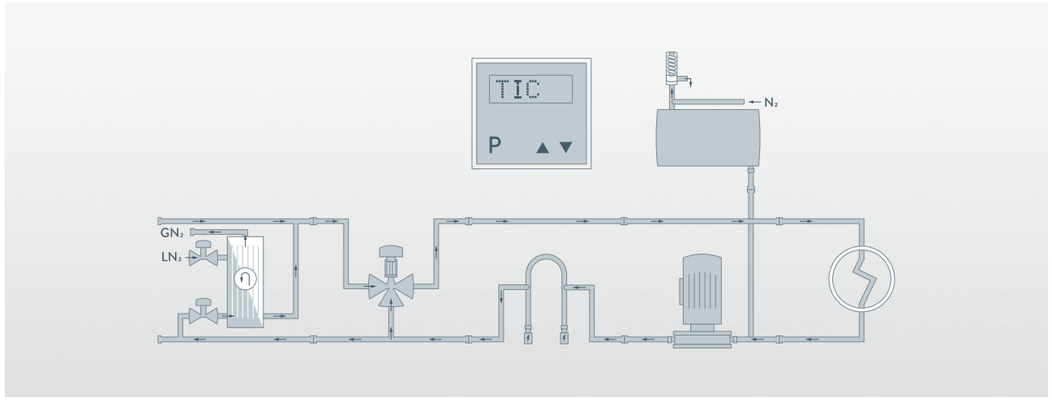
Example of a process cooling unit DV, developed with the LAUDA module configurator.

Thermal insulation
Good thermal insulation is essential for exact temperature control. Whether thermal conductivity, thermal transmission coefficient or thermal resistance – all the heating and cooling systems are specially designed to meet your requirements and delivered with suitable insulation.

LAUDA SECONDARY CIRCUIT UNITS

Application example ‘Low temperature synthesis’

High purity grades for high demands
LAUDA Heating and cooling systems from the secondary circuit unit line of the KP series (Kryopac) always consist of the circulation pump, expansion vessel, electric heater modules and the special Kryopac system – a heat exchanger that was specially developed to vaporize liquid nitrogen. With this system, you can control low-temperature reactions reliably. This heating technology comes from the proven modular system of the heat transfer units. The Kryopac units produce a temperature-controlled liquid flow and are delivered as a compact, fully insulated, ready-to-connect system with control cabinet, completely pre-tested at the factory. Freezing problems in the heat exchangers are a thing of the past. Standard heat transfer fluids can be cooled down virtually to the solidifying point.



Example of a Kryopac unit DV, developed with the LAUDA module configurator.

Quality and safety on site
The pre-delivery factory acceptance test in our own test facility ensures that LAUDA Heating and cooling systems are tested precisely according to the customer’s specifications and instructions. This guarantees that the systems are manufactured in the required quality and are fully functional. This factory acceptance test is carried out together with the customer.

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