Coolshift

TERO
EST. 1982

CO_2 Chillers & Heat Pumps

Cooling and Heating with the Natural Refrigerant CO_2

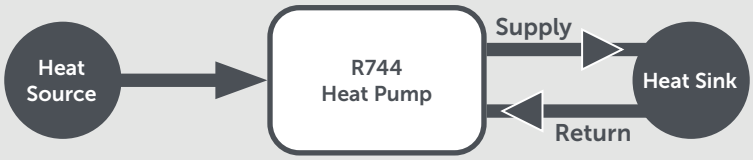
CO_2 in Heat Pumps and Chillers

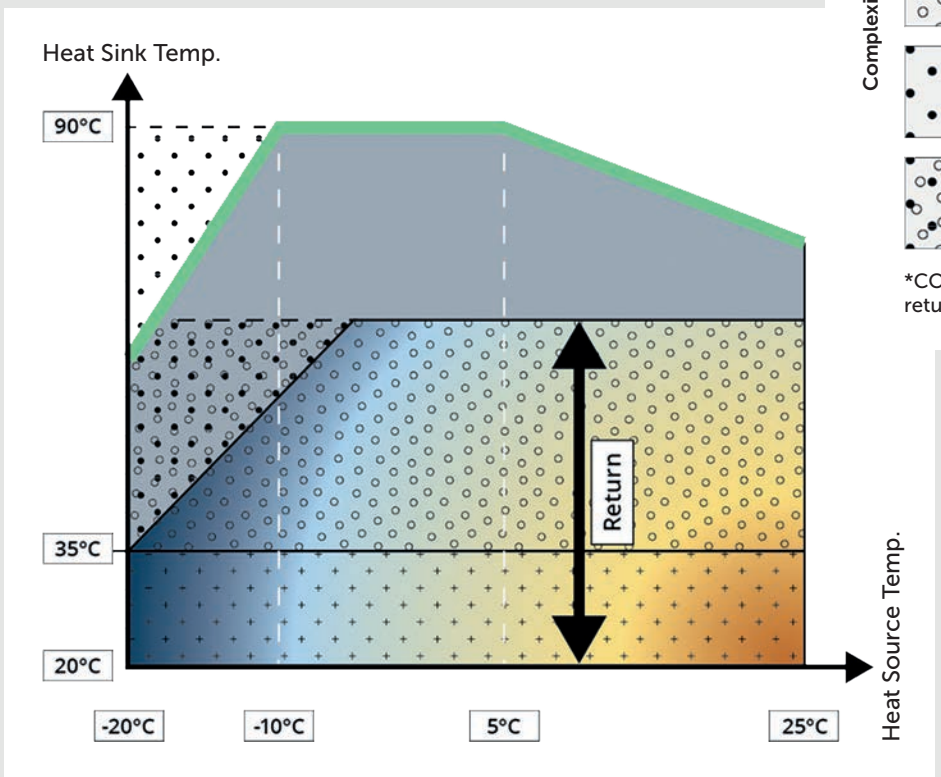
WHY does it make sense?

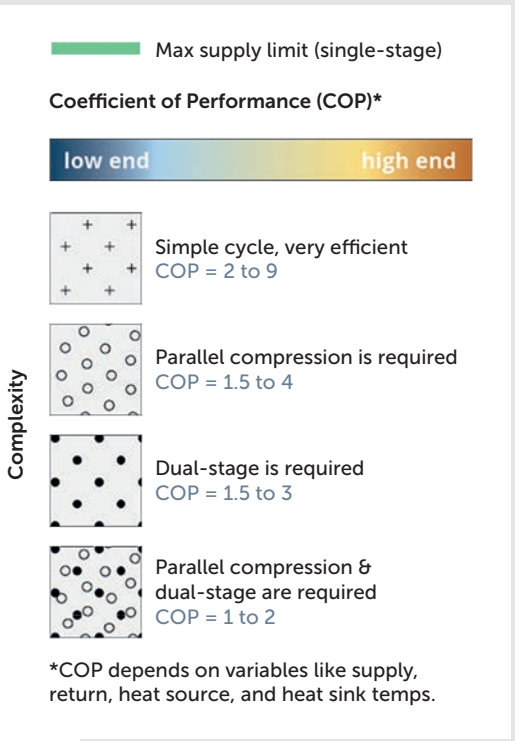
CO_2 is a safe choice for efficient and future-proof investments.

WHEN does it make sense?

The use depends on the supply temperatures and temperature differences of your project – we are happy to advise you!







Legal Regulations

F-gases such as HFCs and HFOs are subject to gradual bans and restrictions. Many countries are already prohibiting refrigerants with high GWP. HFO refrigerants with low GWP, on the other hand, are criticized for their PFAS contamination and potentially toxic decomposition products.

Since heat pumps have a lifespan of 15 to 20 years, synthetic refrigerants pose a long-term risk and lead to high retrofit costs. CO_2 is a safe choice for a future-proof investment.

Safety

CO_2 is non-flammable, non-toxic, and odorless, making it suitable for use in residential and commercial areas. Compared to other natural refrigerants, special requirements for machine room design are not necessary.

In risk assessment, CO_2 represents a safe and reliable solution.

Performance

CO_2 as a refrigerant offers numerous advantages in heat pumps and chillers:

- **High efficiency:** CO_2 systems achieve a higher coefficient of performance (COP) at low ambient temperatures and low water return temperatures.
- **High temperature delta (ΔT):** CO_2 enables a greater temperature difference between supply and return, allowing for smaller pipe diameters and lower pumping costs.
- **High temperatures:** CO_2 heat pumps can reach water supply temperatures of up to 90°C while maintaining high efficiency.
- **Fewer adjustments to heating systems:** Due to the higher ΔT and high temperatures, fewer modifications to the existing heating system are needed when switching to a CO_2 heat pump.

CO_2 not only delivers optimally matched performance but also reduces installation and operating costs.

WHERE is CO_2 particularly beneficial?

CO_2 Heat Pumps are especially suitable for applications requiring high supply temperatures (up to 90°C), large temperature differences, efficient hot water generation, and sustainable waste heat utilization in industries, commercial buildings, and district heating systems. For applications with high supply temperatures but low temperature differences, the energy efficiency is lower compared to other natural refrigerants.

CO_2 Chillers are particularly well-suited for applications with year-round operation – for example, in industrial processes, data centers, and commercial buildings. In cooling-only applications with little or no operation in winter, efficiency is lower compared to other natural refrigerants.

Advanced Refrigeration Systems & Heat Pumps by TEKO, Frigopol, and Vitalis.

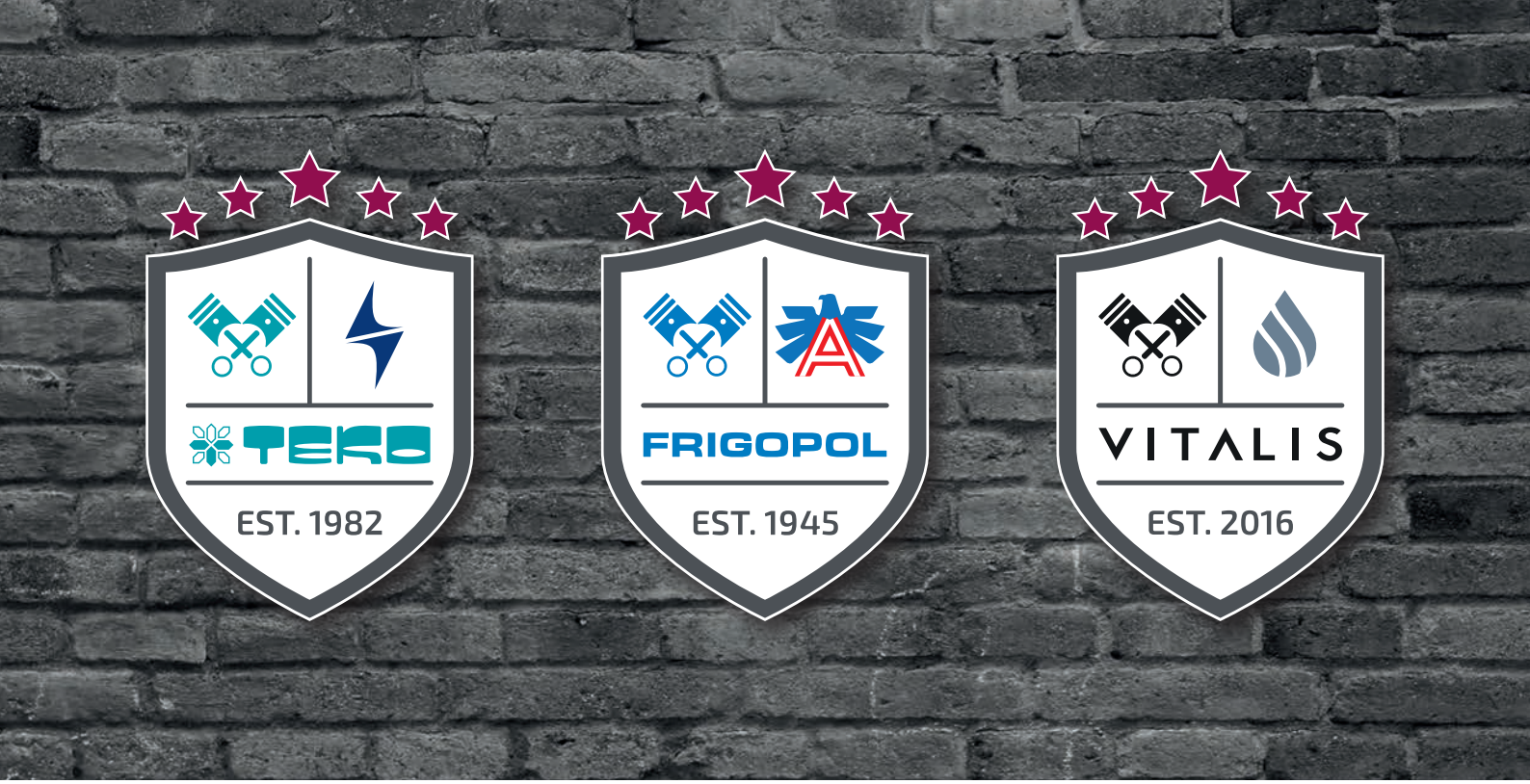
Strong Partners for Your Cooling & Heating Requirements

With the COOLSHIFT series, TEKO, in collaboration with Frigopol from Austria and Vitalis from Canada, offers a versatile product line in the field of CO_2 chillers and heat pumps. This partnership combines years of experience to provide practical, efficient, and sustainable solutions for various applications.

Coolshift – Your Benefits at a Glance

The COOLSHIFT series meets the growing demands for economical and environmentally friendly cooling and heating solutions. Our systems offer:

- **Sustainable technology:** CO_2 (R744) as a future-proof and eco-friendly refrigerant
- **High-efficiency chillers & heat pumps with easy operation:** Ideal for industrial, commercial, process cooling, and district energy applications
- **Flexibility:** Various system sizes ranging from 50 kW to megawatt-scale
- **Experience:** Trusted partners with comprehensive expertise



TEKO – Your Partner for Standardized Solutions

For over 40 years, TEKO has been developing standardized solutions for food refrigeration, commercial, and industrial cooling. With COOLSHIFT, we are expanding our portfolio to include reliable chiller and heat pump solutions for a wide range of applications.

Frigopol – Specialist in Customized Cooling Systems

Since 1945, Frigopol has been designing and manufacturing cooling systems for various applications. Their expertise in tailor-made refrigeration solutions makes Frigopol a key partner in the production of COOLSHIFT products.

Vitalis – CO_2 Technology from Canada

Since 2016, Vitalis has specialized in CO_2-based cooling and heat pump systems. Their product range includes chillers and heat pumps for district energy and industrial applications, as well as CO_2 refrigeration systems for food processing. With its integration into the group, Vitalis' expertise is now embedded into the COOLSHIFT series, while also enabling access to the North American market for the entire product range.

Global Collaboration & Knowledge Exchange

A key aspect of our cooperation is the continuous exchange of knowledge between the three companies. Through joint development projects and technology transfer, teams from all three companies work closely together. Additionally, TEKO employees are now actively working at Frigopol and Vitalis to leverage synergies and bring innovations to market even faster.

Efficient solutions for a wide range of applications

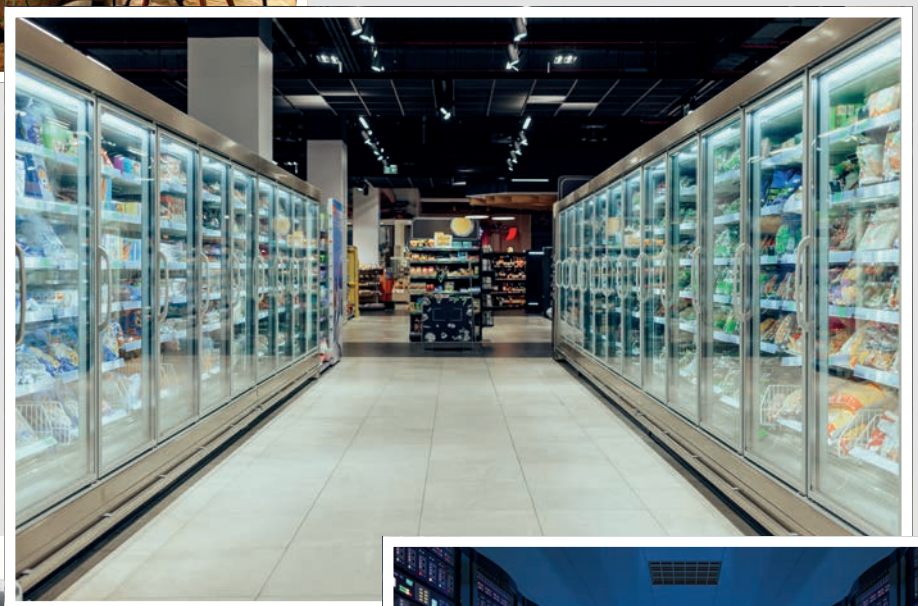
COOLSHIFT CO_2 chillers and heat pumps stand out for their high efficiency and flexible applications. They are ideal for heating and cooling buildings as well as providing hot water for a wide range of applications. At the same time, they deliver process heat, ensuring continuous comfort and optimal energy savings.

Wide Range of Applications

Thanks to cutting-edge technology, COOLSHIFT solutions can be used in various sectors:

- **Building air conditioning & heating**
  Residential buildings / Supermarkets & Hypermarkets / Shops & Offices / Restaurants & Hotels / Ice rinks / Wellness, Spa & Swimming areas / Greenhouses
  Industrial & process cooling
  Commercial cold storage / Food processing / Breweries / Winemaking / Pharmaceutical industry / Shock freezing & Freeze-drying
- **Data centers & server cooling**
- **Local & district heating networks**
  Residential complexes / University campuses /

With their precise temperature control, COOLSHIFT chillers and heat pumps offer an optimal combination of comfort, cost-efficiency, and sustainability. They are a forward-looking solution that meets diverse needs while helping to reduce operating costs in the long term.



Coolshift

CO_2 Chillers & Heat Pumps

Sustainable. Efficient. Future-proof.
CO_2 solutions for cooling and heating with maximum performance –
because natural refrigerants are the only way forward.

COOLSHIFT CO_2 chillers and heat pumps provide an environmentally friendly and efficient solution for heating and cooling – with maximum energy efficiency. The systems are available in various configurations: chillers as air- or water-cooled versions and heat pumps in air/water, water/water, or air/air designs. They are offered in sizes M, L, and XL and can be installed both indoors and outdoors. The COOLSHIFT series covers a heating or cooling demand of up to 4 megawatts.

COOLSHIFT

- CO_2 chiller: air- or water-cooled
- CO_2 heat pump: air/water, water/water, or air/air
- Sizes M / L / XL

Equipment

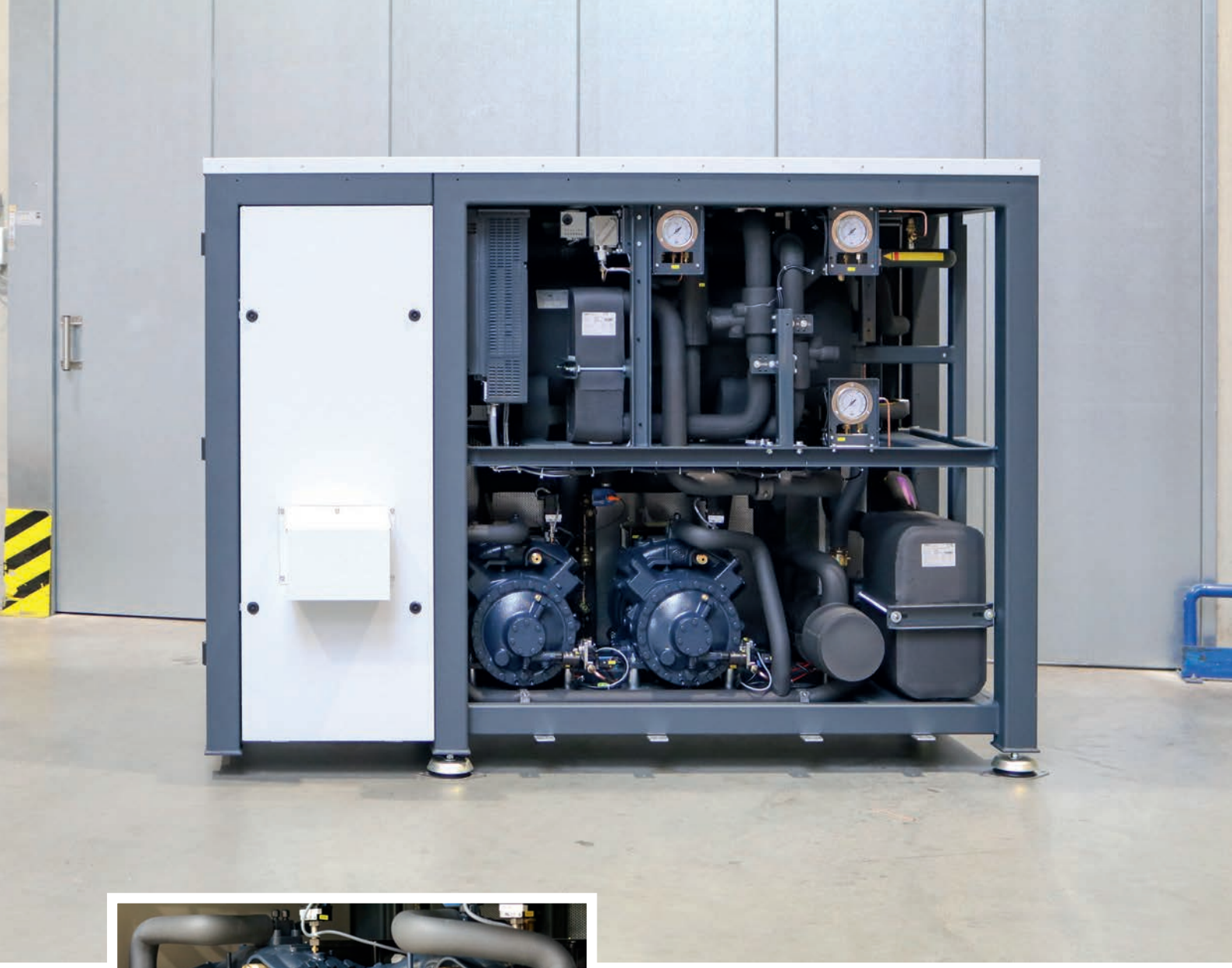
- Low-pressure ejectors
- Low-pressure oil system with refrigerant separator
- Efficient compressors (optional LSPM)
- Capacity control via inverter or cylinder deactivation
- Brazed plate heat exchangers
- Refrigerant receiver
- Active oil management (optional)
- Heat recovery (optional)
- Weather & soundproof housing (optional)
- Control systems: Wurm / Carel

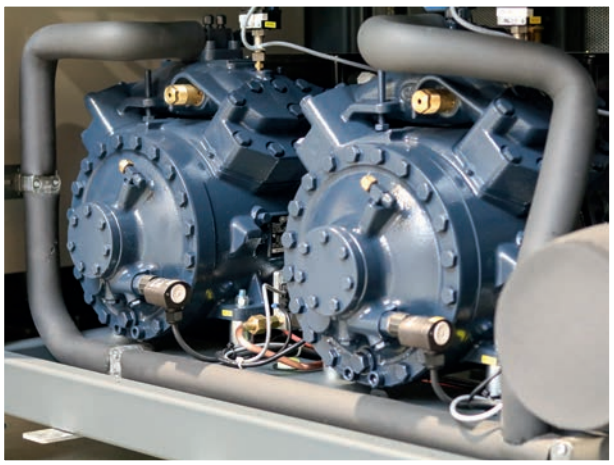
Performance & Efficiency

- Simultaneous cooling & heating
- Up to 8 K ejector lift – reduced compressor consumption
- High supply temperatures in heat pump mode up to 90°C
- Optimal efficiency at low return water temperatures
- Climate- & environmentally friendly

Pressure Levels

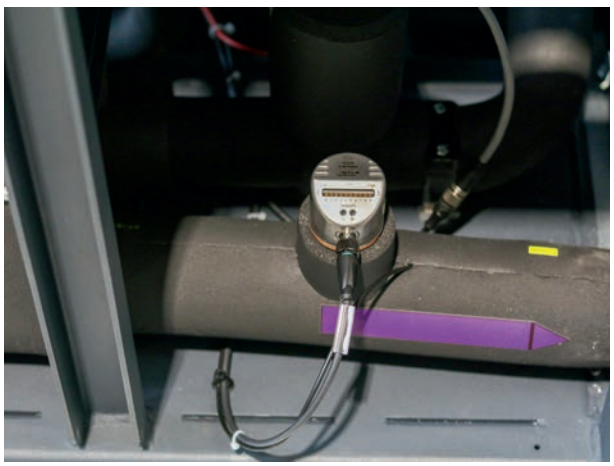
- 90 bar low pressure
- 130 bar high pressure





Cooling
up to **180 kW**

Heating
up to **300 kW**



Technical Data

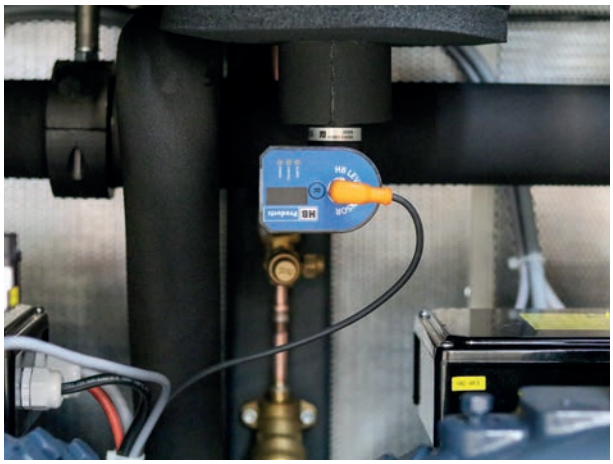
Heating capacity max.	300 kW
Cooling capacity max.	180 kW
Refrigerant	R 744
COP Heating *	3,5
COP Cooling **	2,63
Number of compressors	2
Compressor type	Semi-hermetic
Hot water supply	up to 90°C
Hot water return	<50°C
Chilled water production	-10°C to 20°C
Capacity control	12,5-100%
Water connections	DN32-DN65
Dimensions L x W x H (without casing)	2,700 x 880 x 1,960 mm
Sound pressure level (10.0 m) indoor install.	42-58 dB(A)
Sound pressure level (10.0 m) outdoor install.	33-49 dB(A)
Communication protocol	Modbus TCP & RTU

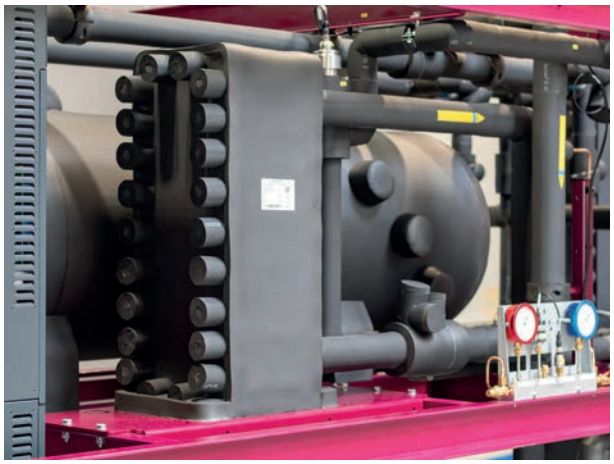
* Chilled water 4/8°C, hot water 35/45°C
** Chilled water 6/12°C, ambient air 35°C

Compact design with high performance

Application Areas

- Building air conditioning & heating (e.g. multi-family houses, hotels & hypermarkets)
- Industrial cooling
- Process cooling & heating (e.g. breweries, winemaking)
- Data centers / Server cooling





Cooling
up to **450 kW**

Heating
up to **600 kW**

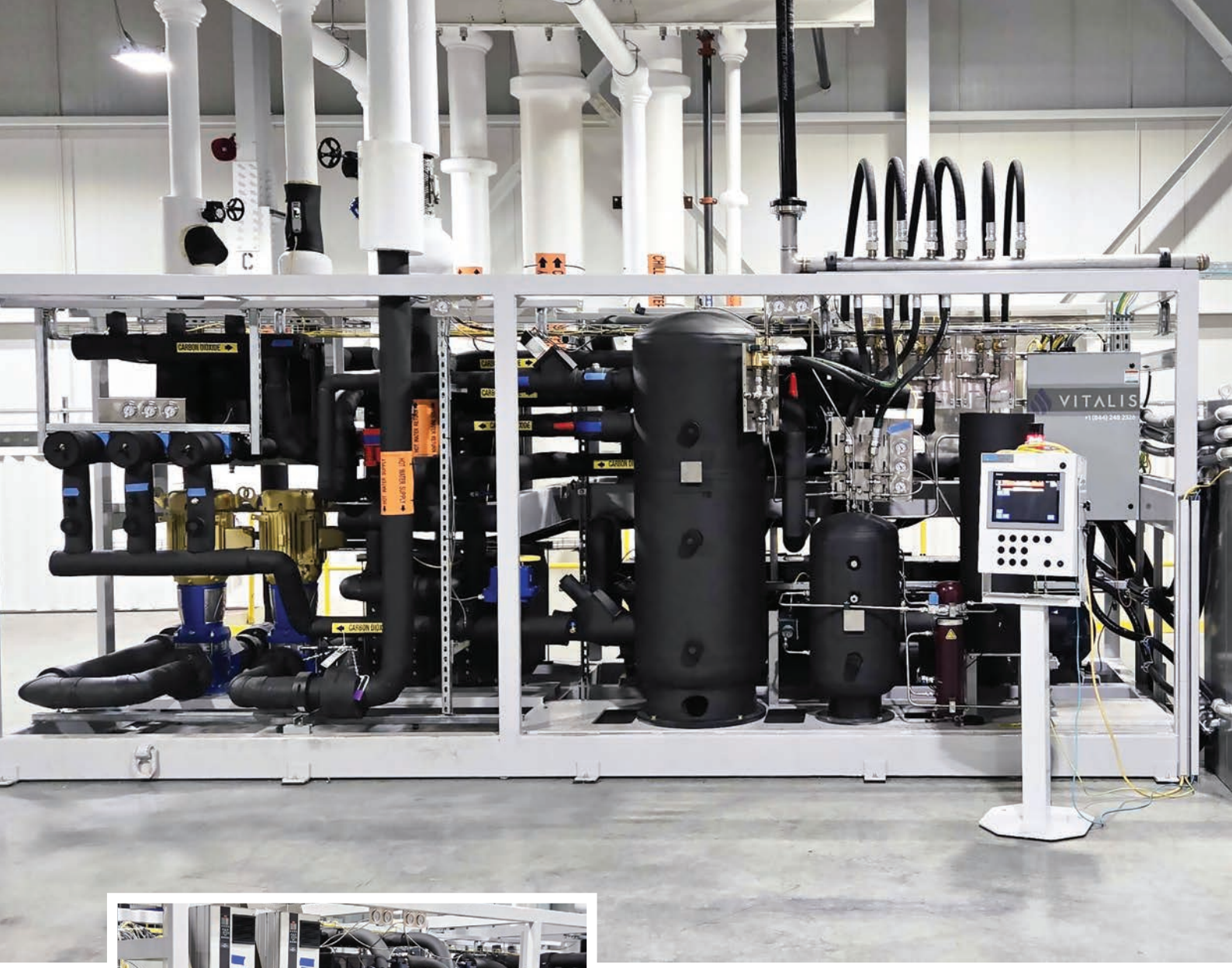
Technical Data

Heating capacity max.	450 kW	600 kW
Cooling capacity max.	350 kW	450 kW
Refrigerant	R 744	
COP Heating *	3,68	
COP Cooling **	2,85	
Number of compressors	3	4
Compressor volume	Semi-hermetic	
Hot water supply	up to 90°C	
Hot water return	<50°C	
Chilled water production	-10°C to 20°C	
Capacity control	8-100%	
Water connections	DN65-DN125	
Dimensions L x W x H (without casing)	4,090 x 1,200 x 2,055	4,900 x 1,200 x 2,260
Sound pressure level (10.0 m) indoor install.	38,4-63,4 dB(A)	39,5-64,5 dB(A)
Sound pressure level (10.0 m) outdoor install.	38,4-54,4 dB(A)	39,5-55,5 dB(A)
Communication protocol	Modbus TCP & RTU	

* Chilled water 4/8°C, hot water 35/45°C
** Chilled water 6/12°C, ambient air 35°C

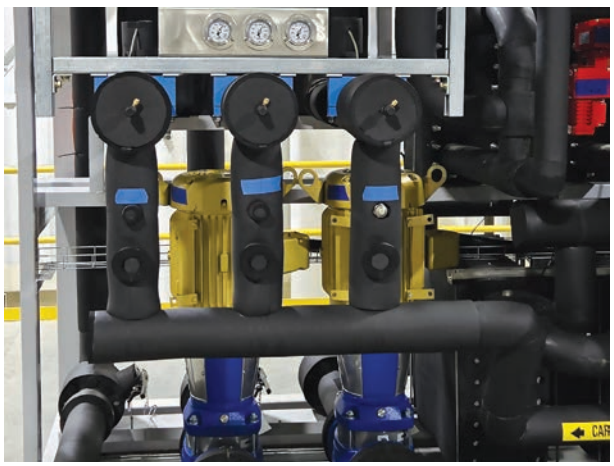
Application Areas

- Building air conditioning & heating
- Industrial cooling
- Process cooling & heating (e.g. breweries, winemaking)
- Data centers / Server cooling
- Local & district heating networks



Cooling
up to **1,5 MW**

Heating
up to **2 MW**



Technical Data

Heating capacity max.	up to 2 MW
Cooling capacity max.	up to 1,5 MW
Refrigerant	R 744
Number of compressors	as required
Compressor type	Semi-hermetic
Hot water supply	up to 90°C
Hot water return	<50°C
Chilled water production	-40°C to 20°C
Capacity control	3-100%
Water connections	as required
Dimensions L x W x H (without casing)	as required
Sound pressure level (10.0 m) indoor install.	as required
Sound pressure level (10.0 m) outdoor install.	as required
Communication protocol	Modbus TCP & RTU / SCADA system

Application Areas

- Building air conditioning & heating
- Industrial cooling
- Process cooling & heating (e.g. breweries, winemaking)
- Data centers / Server cooling
- Local & district heating networks

Decarbonization of a Low-Temperature District Energy System

How a CO_2 Heat Pump Helps a University in British Columbia Reduce Campus Emissions by 815 Tons per Year

The University of British Columbia Okanagan (UBCO) has ambitious decarbonization goals and plans to modernize its thermal energy networks. The university's low-temperature district energy system (LDES) distributes water at temperatures between 8°C and 25°C through uninsulated PVC pipes to hydraulic heat pumps in the connected buildings. These heat pumps extract heat from the LDES water circuit for heating or reject heat for cooling. During imbalanced thermal loads, the system is supported by gas boilers, a connection to the medium-temperature district energy system (MDES), geothermal energy, and cooling towers. The annual heating demand of the LDES is 14,267 GJ, with almost 70% of the load occurring at outdoor temperatures between -5°C and 5°C.

The Challenge: Replacing Gas Boilers with a Future-Proof Solution

UBCO aims to reduce campus greenhouse gas emissions by 65% by 2030 compared to 2013 levels. Since gas boilers are the largest emission source, their use must be drastically reduced. Heat pumps offer an energy-efficient solution for electrifying heating and cooling loads. However, conventional refrigerants such as HFCs pose a challenge due to their high global warming potential (GWP) and increasing regulatory restrictions.

R744 (CO_2) is a sustainable alternative with a GWP of 1: it is non-toxic, non-flammable, regulation-compliant, and offers excellent thermodynamic efficiency.

The Solution: A CO_2 Air-to-Water Heat Pump from Vitalis

A 1.5 MW COOLSHIFT air-to-water heat pump was installed in the UBCO, serving as the primary heat source for the LDES. The system operates mostly in subcritical mode, ensuring high efficiency and low operating costs.

During the summer months, the heat pump operates in transcritical mode, acting as an additional cooling source, while high-efficiency cooling towers remain the primary cooling source.

Expected Results:

- Reduction of 815 tons of CO_2 per year
- Replacement of 430,000 m^3 of natural gas
- Delivery of 14,000 GJ of heat (98.4% of LDES demand)
- Coverage of 99.9% of cooling demand
- Annual average COP values of 3.5 (heating) and 3.6 (cooling)
- Scalability up to 2.5 MW capacity

With this project, UBCO takes a major step toward campus decarbonization and achieving its climate goals by 2030. The innovative CO_2 technology not only enables a reduction in fossil fuel use but also ensures a long-term, cost-efficient, and sustainable energy supply.

Decarbonization of a Paint Shop

CO_2 Water-Source Heat Pump for an Automotive Paint Process Requiring Simultaneous Heating and Cooling

The Challenge

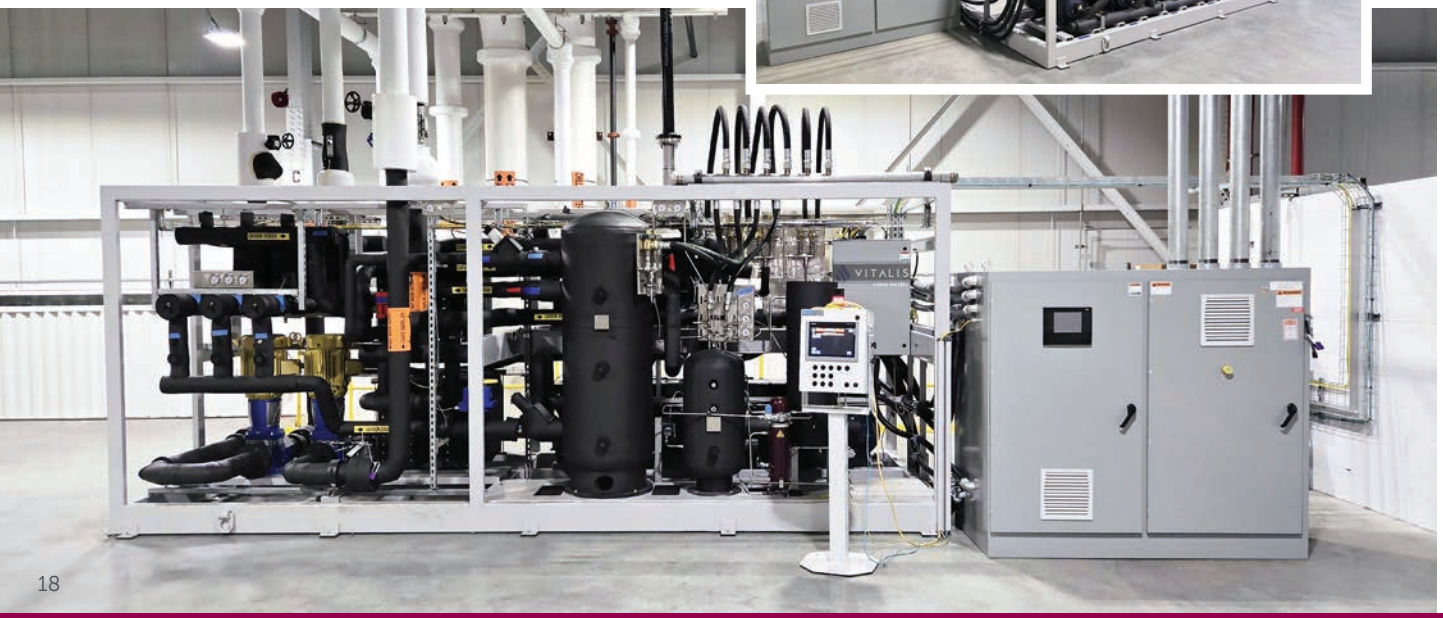
A provider of turnkey industrial solutions aimed to assess the decarbonization potential of a large automotive paint shop in Michigan. The facility has significant heating and cooling demands from its painting process – approximately 30 MW each –which are currently supplied by gas boilers and chillers. The goal was to initiate a pilot project to evaluate the feasibility, sustainability, and efficiency of heat pump technology for this application and similar industrial processes.

The Solution: A CO_2 Water-to-Water Heat Pump from Vitalis

A COOLSHIFT XL CO_2 water-to-water heat pump was selected due to its ability to simultaneously provide heating and cooling, as well as its high temperature lift on the heat sink.

The system is designed with parallel compression and can deliver hot water above 82°C. Under optimal operating conditions for this application, it can provide up to 2.5 MW of thermal energy (1.5 MW heating capacity and 1 MW cooling capacity), supplying 68,000 liters per hour of hot water at 63°C and 91,000 liters per hour of chilled water at 7°C, with a combined COP of over 5.

Currently the largest heat pump of its kind in North America, this system will significantly reduce greenhouse gas emissions and represents an initial step toward replacing the remaining boilers and chillers in the facility.



Efficiency Improvement Through Ejector Lift

CO_2 Water-to-Water Heat Pump for Heating an Office and Warehouse Building

The Challenge

Utilizing available groundwater for an environmentally friendly and energy-efficient heating supply for an office and warehouse building, including the replacement of the old oil heating system.

The Solution: A CO_2 Water-to-Water Heat Pump from TEKO

The COOLSHIFT M water-to-water heat pump uses groundwater as a heat source. For this purpose, two well drillings were carried out south and north of the warehouse. The heat pump heats the entire warehouse using concrete core activation. The office spaces, entrance area, and sanitary facilities are heated via underfloor heating. The entire roof area of the new building is equipped with a photovoltaic system, which supplies the heat pump with converted solar energy.

By utilizing partially flooded evaporation and an ejector lift, the heat pump achieves a COP of 4.7. With a source water supply temperature of 8°C and a sink water supply temperature of 42°C, the system provides 77 kW of heating capacity. The ejector lift recovers otherwise unused expansion energy, achieving an efficiency increase of 8-15%.

By combining the use of the natural refrigerant CO_2, ejector technology, and fundamental energy sources groundwater and solar energy, the heating of the building is implemented in an efficient and sustainable manner.

TEKO Refrigeration

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