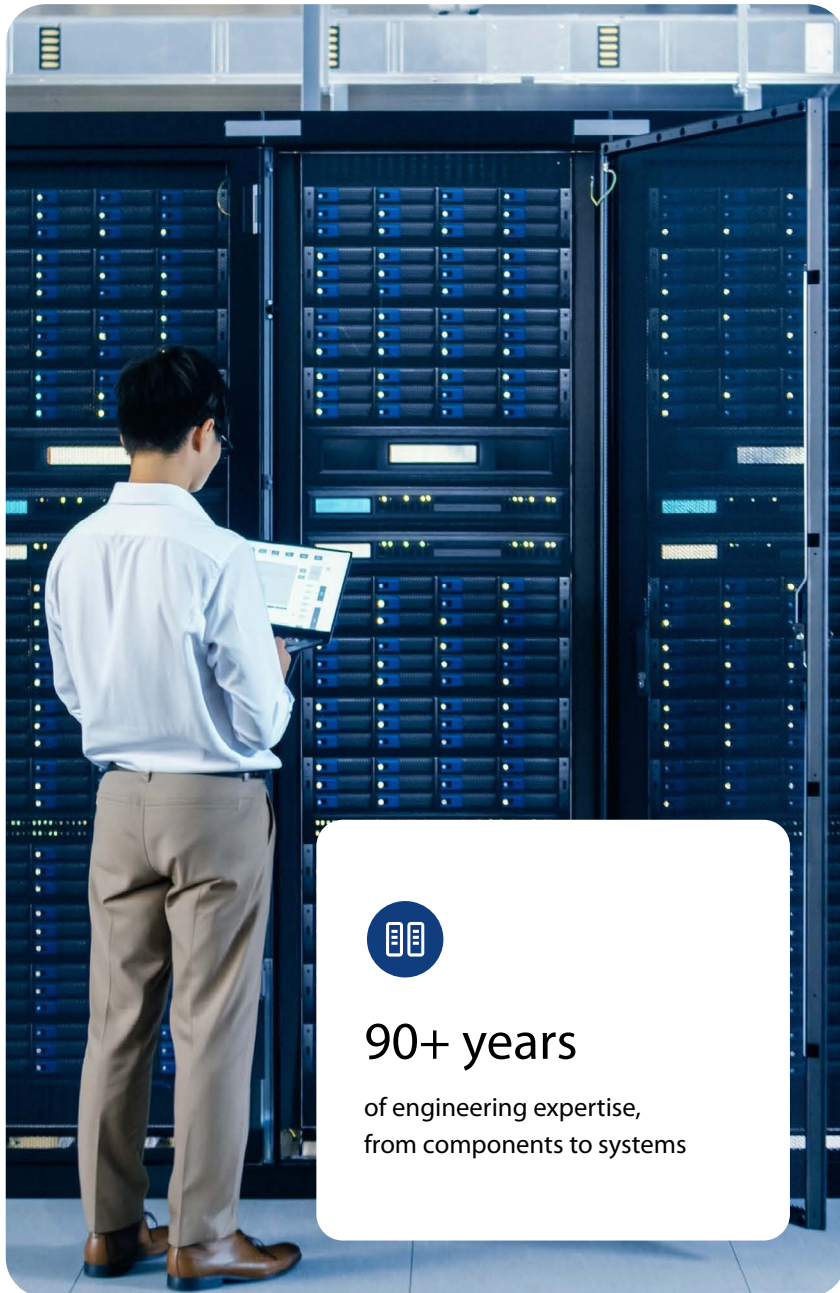


You run the data. **We keep it cool.**

As data center power densities increase, thermal management becomes a critical design parameter.

Danfoss has the technological solutions and expertise to cool datacenters effectively. From air to liquid-cooled, and to power management. The heat generated in the facilities can efficiently be recovered and re-used to heat buildings or feed into a district energy grid. That is how we engineer a better future.





90+ years

of engineering expertise,
from components to systems

Cooling architectures for high-density data centers

Data center cooling architectures are evolving in response to increasing rack densities and changing workload profiles.

Rack densities now commonly exceed 20–40 kW per rack—and rise further for AI workloads—placing greater demand on cooling architectures to:

- ✓ Remove higher heat loads
- ✓ Maintain stable inlet conditions
- ✓ Adapt to dynamic and varying workloads

As a result, cooling is no longer a supporting utility. It becomes a design parameter that directly impacts performance, efficiency, and scalability.

Danfoss supports this transition with a portfolio that spans:

- Hybrid, air and liquid cooling technologies
- White space and gray space applications
- Component-level and system-level integration

The objective is not only to remove heat, but to manage it efficiently, reliably, and, where possible, reuse it.

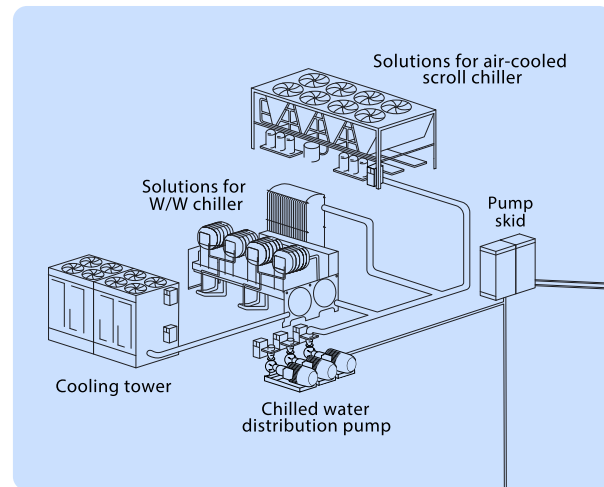
From chip-level cooling to energy management and heat reuse

Danfoss provides technologies and application expertise that support data center performance across the full thermal and energy chain—from heat generation at chip level to heat rejection and reuse.

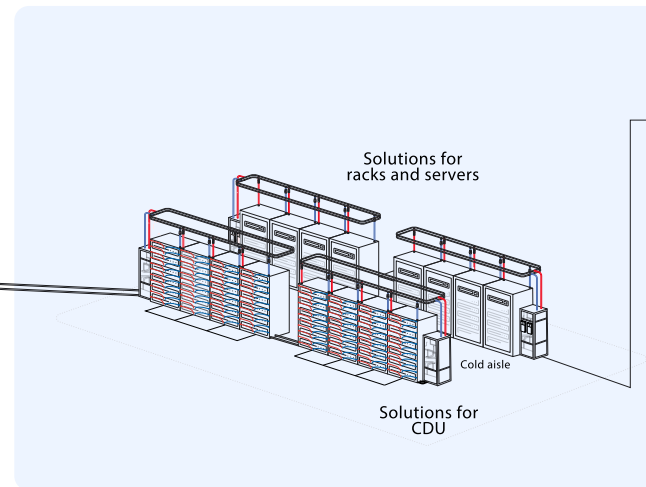
Solutions for every data center environment:

- New builds and retrofits
- Edge, enterprise and hyperscale data centers
- AI, GPU and CPU workloads
- Global-scale infrastructure

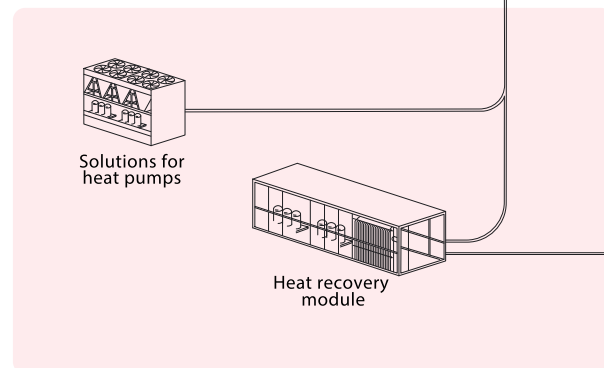
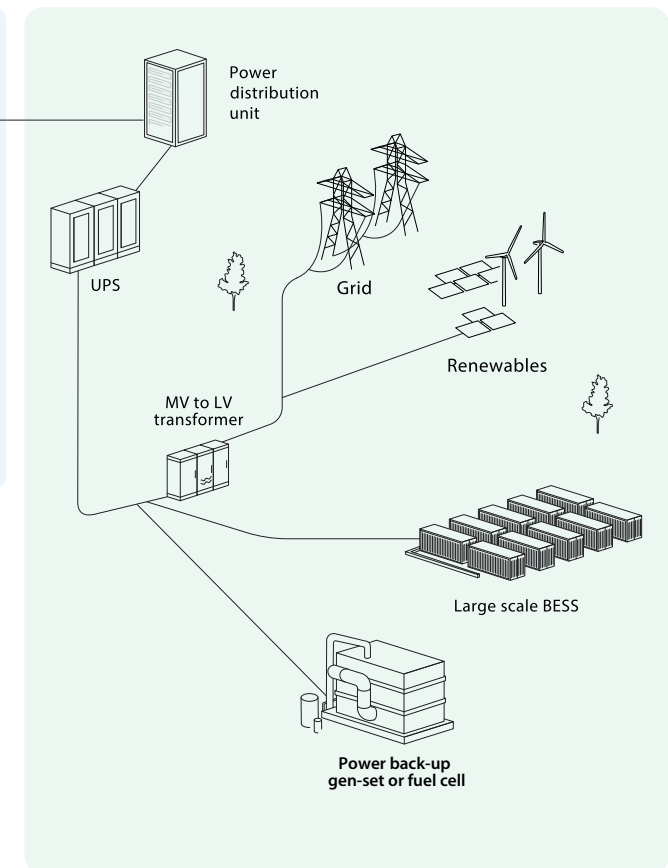
Cooling infrastructure (gray space)



IT cooling (white space)



Energy and power systems



Heat recovery and reuse

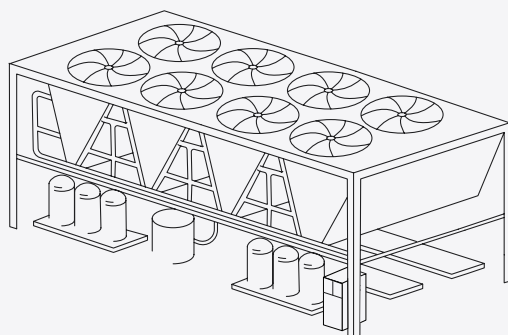
→ Air-based heat rejection

Air-cooled chillers reject heat from the cooling loop directly to ambient air and are widely used across a broad range of data center applications where simplified infrastructure is preferred.

Key system considerations:

- ✓ Ambient temperature conditions
- ✓ System design and sizing
- ✓ Part-load efficiency

Key portfolio highlights



Fixed and variable speed scroll compressors

- DSH/DSF • VZH/VZF
- DSG (Single or manifold)

Natural and low-GWP refrigerants and high efficiency



Turbocor oil-free centrifugal compressors

- TGS380/490

Magnetic bearing and built-in drive for unmatched efficiency



Valves, driers, sight glasses

ETS C/M/L/P series of electric expansion valves

Extensive portfolio of components



Brazed plate heat exchangers

Wide evaporator and economizer range

Innovative micro plate technology boosts heat transfer efficiency



Microchannel heat exchanger

Wide range of condenser coils

High heat-rejection efficiency with low fan energy, refrigerant charge, and footprint



System controller

Alsmart® programmable controllers and Software

Real-time control and cyber-secure operation



Superheat control and valve driver

- EKE 100 • EKF
- Precise superheat control



Variable frequency drives

- VLT® HVAC Drive FC 102

Condition monitoring for more uptime. Reliable up to 63°C.



Pressure, temperature, gas sensors

- DST P110 • AKS 11
- DST G series

Precision control and critical safety monitoring

→ Water-based cooling systems

Water-cooled systems provide higher efficiency and stable performance, particularly in large-scale or high-load environments.

Key system considerations:

- ✓ Efficient heat transfer
- ✓ Stable flow and temperature control
- ✓ Operation across varying load conditions
- ✓ Integration with cooling distribution and heat rejection systems

Key portfolio highlights



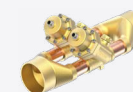
Turbocor oil-free centrifugal compressors

- TGS380/490
- Magnetic bearing and built-in drive for unmatched efficiency



Check and ball valves, shut-off valves, staging valves

- OFC • PTS • OFB
- Extensive oil-free ecosystem



Electric expansion valves

- ETS C/L/P series
- High capacity



Pressure, temperature, gas sensors

- DST P110 • AKS 11
- DST G series
- Precision control and critical safety monitoring



System controller

- Alsmart® programmable controllers and Software
- Real-time control and cyber-secure operation



Superheat control and valve driver

- EKE 100 • EKF
- Precise superheat control



Brazed plate heat exchangers

- Wide range of economizers for traditional or oil-free systems
- Compact, high-efficiency heat transfer with low refrigerant charge and low pressure drop.



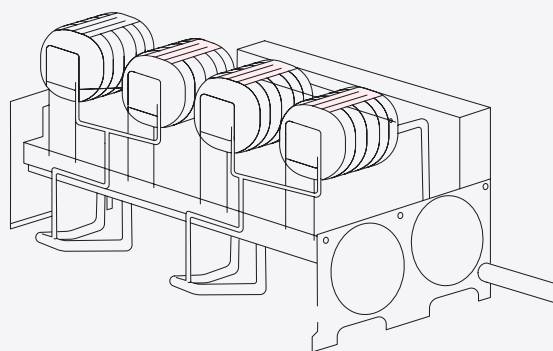
Variable speed drives

- iC7-HVACR
- iC7-HVACR ULH
- Save energy. Achieve high reliability with 3-5% THDi



Variable frequency drives

- VLT® HVAC Drive FC 102
- Save OPEX and CAPEX with unique back-channel cooling



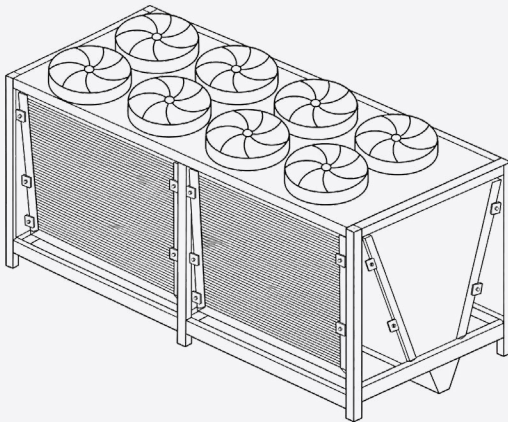
→ Cooling strategies for free cooling systems

Free cooling and adiabatic systems reduce reliance on mechanical cooling by leveraging ambient air and evaporative processes.

Key system considerations:

- ✓ Climate and ambient conditions
- ✓ Water and energy optimization
- ✓ Integration with mechanical cooling systems

Key portfolio highlights



Microchannel heat exchangers

Square header manifold design for free cooling
Simplifies free cooling system design and installation with one flexible manifold configuration



Gasketed plate heat exchangers

Extensive portfolio
High-efficiency, low-pressure-drop, and easy-to-service design. Ideal for maximizing free-cooling performance and uptime



High-pressure valves

VDHT
Stainless steel solenoid valves provide optimal adiabatic cooling with fine ultra pure water mist



High-pressure pumps

PAHT
Highest energy efficiency and reliability for adiabatic cooling and humidification solutions



Water nozzles

- Slimline
 - HX
- Fine water atomization

→ Air handling and airflow management

CRAH units, fan walls, and rooftop air handling systems distribute conditioned air between cooling infrastructure and the IT environment.

Key system considerations:

- ✓ Airflow control and containment
- ✓ Energy-efficient fan operation
- ✓ Stable operation across varying IT loads

Key portfolio highlights



Microchannel heat exchangers

Folded evaporator design
Boosts performance in compact systems



System controller

Alsmart® programmable controllers and Software
Real-time control and cyber-secure operation



Variable speed drives

- iC7-HVACR
- iC7-HVACR ULH

Save energy. Achieve high reliability with 3-5% THDi



Variable frequency drives

VLT® HVAC Drive FC 102
Save OPEX and CAPEX with unique back-channel cooling



Pressure and temperature sensors

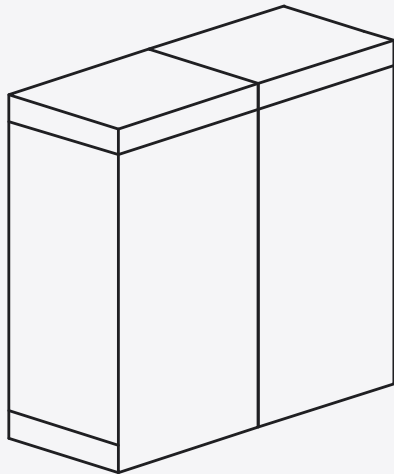
- DST P140
- MBT 3270

Precision control for smooth operation



Pressure independent control valves

AB-QM
Flow stability under all load conditions



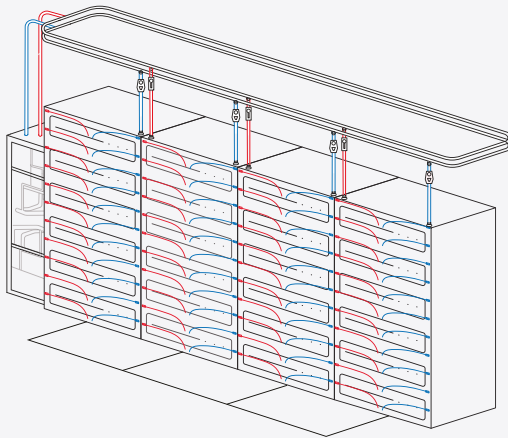
→ Fluid distribution within liquid cooling systems

The Technology Cooling System (TCS) distributes coolant between CDUs and IT equipment while maintaining stable thermal and hydraulic conditions.

Key system considerations:

- ✓ Flow balancing across multiple racks
- ✓ Pressure management within safe limits
- ✓ System integrity and leak prevention

Key portfolio highlights



Valve trains

CoolTrain™

- Customizable, ready-built, valve train reduces risk of leaks and downtime.
- Dynamic hydronic balancing and coolant flow control



Couplings

FD83 (dual-interlock coupling)

Reliable performance and minimal spillage during maintenance or service



Hoses

EHW194 and DC394
Durability, safety, ease of use



Pressure independent control valves and actuators

AB-QM with NovoCon®
Flow stability under all load conditions and (optional) data telemetry



Motorized isolation ball valves

AMZ 112
Remote, leak-free closure of the coolant circuit



Pressure and temperature sensors

- DST P140
- MBT 3560

Industry leading accuracy and fast response time

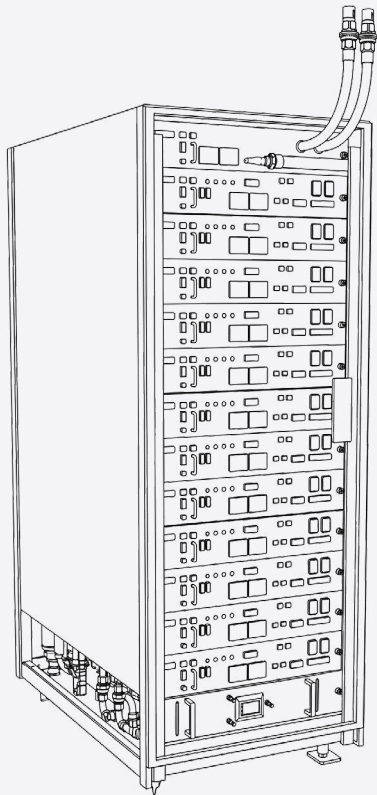
→ Cooling at chip and rack level

In-rack and direct-to-chip cooling solutions remove heat close to the source, supporting higher rack densities and reducing reliance on airflow-based cooling.

Key system considerations:

- ✓ Uniform flow distribution
- ✓ Stable pressure conditions
- ✓ Reliable fluid connections and monitoring

Key portfolio highlights



Couplings

UQD (quick disconnect coupling)

High flow rate and no spillage



Hoses

EHW194

Durability, safety, ease of use



Connectors

- UQDB (quick disconnect blind mate)
- BMQC (blind mate quick connector)

Misalignment compensation



System controller

Alsmart® programmable controllers and Software

Real-time control and cyber-secure operation



Pressure and temperature sensors

- DST P110 / P140
- MBT 3270 / 3560

Full stainless steel cleaned media interface



Harmonic filter

Danfoss Advanced Active filter AAF 007

Highly efficient active harmonic distortion on the grid side



Variable frequency drives

VLT® Midi Drive FC 280

Integrated harmonic mitigation and power factor correction (PFC)

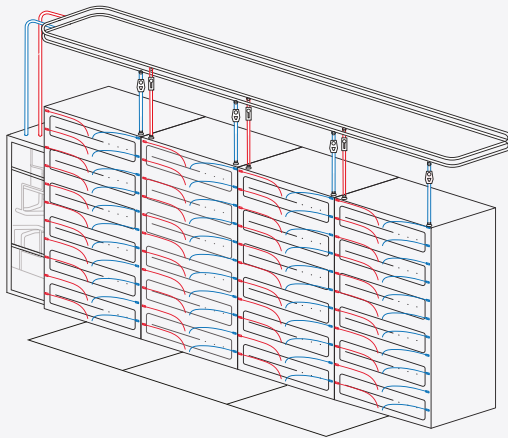
→ Rack level heat removal

Rear door heat exchangers remove heat directly at the rack level by transferring it from air to water before it enters to room environment.

Key system considerations:

- ✓ Airflow management across racks
- ✓ Water flow stability
- ✓ Heat exchanger effectiveness

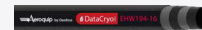
Key portfolio highlights



Couplings

FD83 (dual-interlock coupling)

Reliable performance and minimal spillage during maintenance or service



Hoses

EHW194

Durability, safety, ease of use



Pressure independent control valves

AB-QM

Flow stability under all load conditions



Microchannel heat exchangers

Wide range of free cooling/evaporator coils for RDHX applications

High heat transfer with low air-side pressure drop, reducing fan energy and unit footprint.

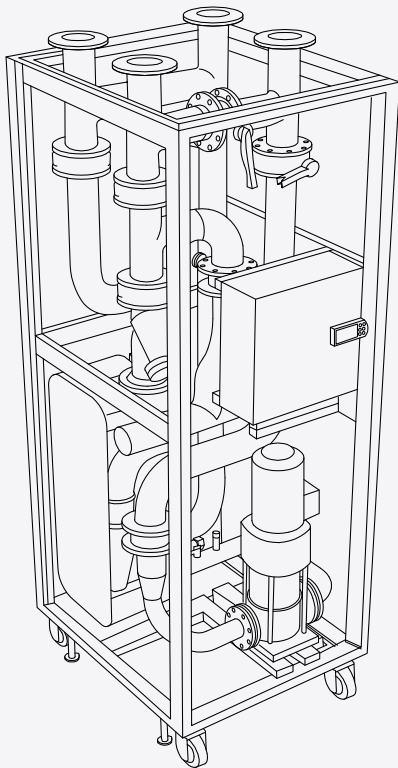
→ Interface between IT cooling and facility systems

CDUs manage heat transfer between the IT cooling loop and the facility water system while maintaining controlled operating conditions for liquid-cooled IT equipment.

Key system considerations:

- ✓ Stable flow and pressure control
- ✓ Efficient heat exchange between loops
- ✓ Temperature stability under varying loads

Key portfolio highlights (for in-row and in-rack CDUs as well as for outside server)



Brazed plate heat exchangers
Extensive portfolio
Covering CDUs up to 1.3 MW in a single unit



Gasketed plate heat exchangers
Extensive portfolio
Engineered for high-capacity 2 MW+ CDUs and large scale liquid cooling systems with very low approached temperature.



System controller
Alsmart® programmable controllers and Software
Real-time control and cyber-secure operation



Variable speed drives
• iC7-HVACR
• iC7-HVACR ULH
Save energy. Achieve high reliability with 3-5% THDi



Pressure and temperature sensors
• DST P110 / P140
• MBT 3270 / 3560
Industry leading accuracy and fast response time



Pressure independent control valves and actuators
• AB-QM + NovoCon®
• AFQM2 + AME 655-1
Hydronic flow control and (optional) data telemetry



Couplings
FD83 (dual-interlock coupling)
Reliable performance and minimal spillage during maintenance or service



Shut-off valves
VFY
Leak-free closure of CDU sections



Pressure controllers
VFG + AFP 2
Outside of CDU mounted alternative for PICVs

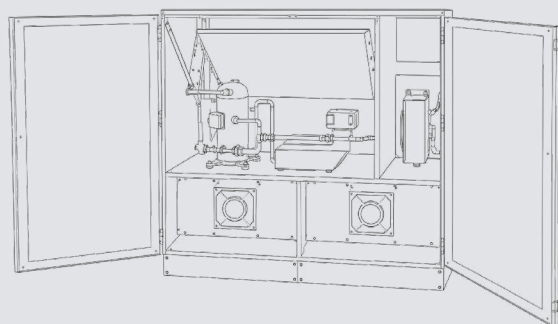
→ Direct expansion cooling systems

CRAC units provide cooling using a direct expansion (DX) refrigeration cycle, delivering conditioned air directly to the IT environment.

Key system considerations:

- ✓ Airflow management
- ✓ Efficient operation across varying load conditions
- ✓ Compressor efficiency

Key portfolio highlights



Variable-speed scroll compressors
• VZN • VZH
High condensing temperatures capability



Electric expansion valves
ETS C/M series
Flow control at part-load



Microchannel heat exchangers
Wide range of evaporator and condenser coils
Boosts efficiency while cutting fan power, refrigerant charge, noise, and footprint.



Pressure, temperature, gas sensors
• DST P110 • AKS 11
• DST G series
Precision control and critical safety monitoring



Brazed plate heat exchangers
Water-cooled condenser range
Wide range of medium pressure refrigerants



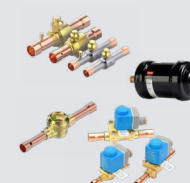
System controller
Alsmart® programmable controllers and Software
Real-time control and cyber-secure operation



Superheat control and valve driver
• EKE 100 • EKF
Precise superheat control



Variable frequency drives
VLT® HVAC Drive FC 102
Improve uptime with integrated condition monitoring



Line components
Ball valves, Filter driers, Check valves, Sight glasses, Solenoid Valves, ACB and KP pressure switches

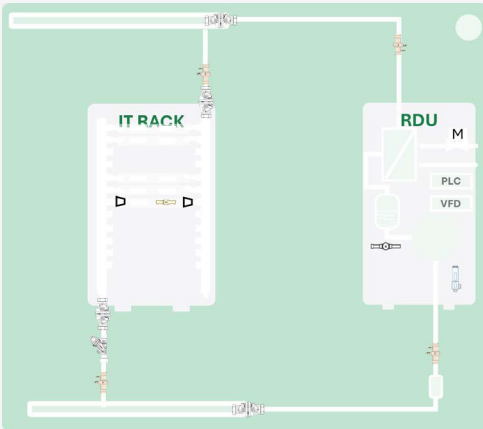
→ Two-phase liquid cooling

Two-phase liquid cooling removes heat directly at the server or rack, enabling high-density computing. Danfoss combines cooling, flow control and sensing technologies to support reliable architectures from rack to facility loop.

Key system considerations:

- ✓ Precise pressure and temperature control
- ✓ Stable phase-change management
- ✓ Leak detection and fluid monitoring
- ✓ High-flow distribution and scalable control

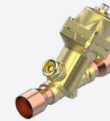
Key portfolio highlights



Sense and monitor

- DST P110 • DST G-series • AKS 12
- AKS 4100 • LLS 4000

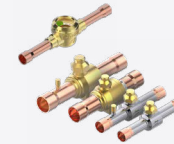
High pressure temperature level and gas liquid leak monitoring.



Control and regulate

- ETS • AKVP • EKE • KVR • TXV solutions

Electronic expansion, pressure and flow control for stable two-phase operation



Protect and service

- GBC • NRV • DCR • SFA
- MP54 / KP • SGP

Reliable isolation, check valves, filtration and safety components



Thermal management

Brazed plate heat exchangers – liquid-to-refrigerant solutions

Compact heat exchangers designed for efficient heat transfer between cooling loops



Connect and distribute

- FD83 • DataCryo DC005
- 5400 Series

High-flow connections and hoses designed for reliable liquid cooling infrastructure

→ Power conversion

Danfoss technologies support power conversion across the full energy chain, from grid interface and BESS integration to fuel cells, generators, microgrids, and future 800 VDC distribution architectures.

Key system considerations:

- ✓ Maximize efficiency for AC/DC and DC/DC conversion
- ✓ Maintain stability under dynamic AI loads
- ✓ Integrate BESS, fuel cells, and generators
- ✓ Enable grid-interactive and microgrid operation

Key portfolio highlights



Grid converters and DC/DC converters

iC7-Hybrid

Enhance performance, save costs, broad grid compliance.



DCGuard® protection device

VACON® NXP
DCGuard®

Rapid-response short-circuit protection for DC grids



String and centralized PCS

iC7-Hybrid

Versatile outdoor-ready power conversion system, IP65



MVAC-LVDC solid-state transformers (800 VDC / 1500 VDC)

Danfoss Lytos

Simplify power architecture and reduce infrastructure costs



Enclosed indoor and outdoor power conversion systems not included

iC7-Hybrid

Reliable and efficient power conversion in difficult operating condition

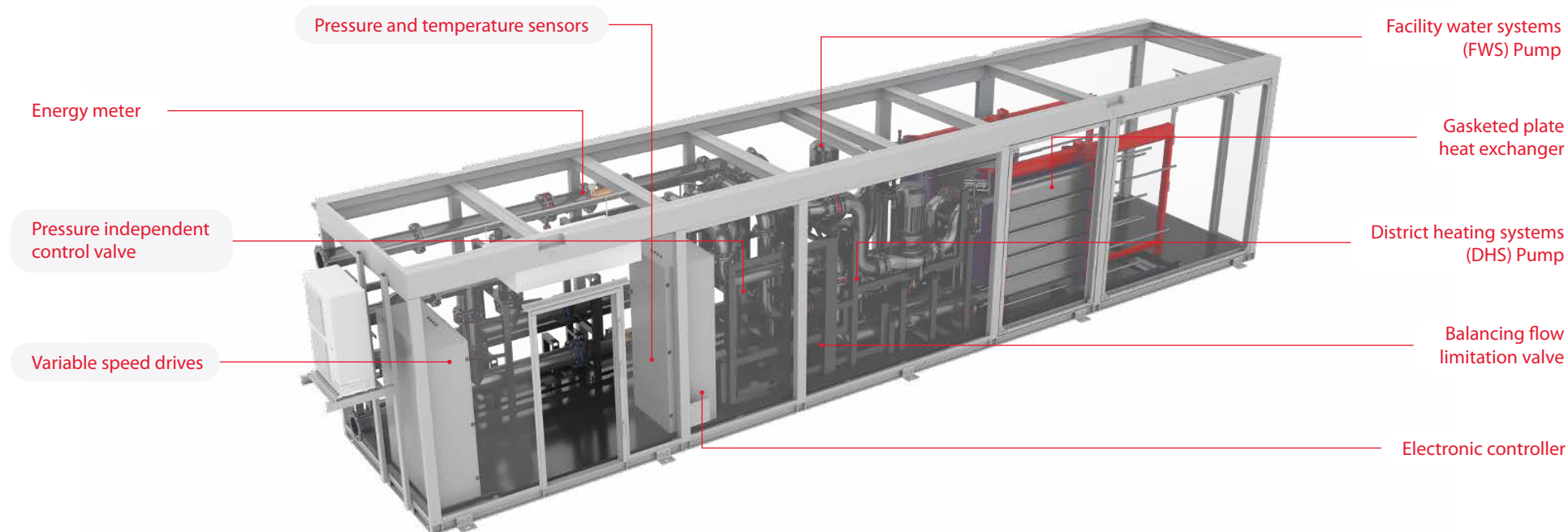


➔ Recovering data center heat

From cooling to heat reuse. Data center heat doesn't have to be wasted. With integrated thermal systems, Danfoss technologies enable the recovery, transfer, and reuse of excess heat—helping turn data center operations into a source of useful energy for buildings, district heating, and industrial processes.

Key system considerations:

- ✓ Temperature levels required for reuse
- ✓ Matching heat supply and demand
- ✓ Stable integration with heating systems



Type	Capacity	Maximum temperature (primary)	PN Class (primary)	Maximum flow (primary)	Control type	PN Class (secondary)	Maximum flow (secondary)
HRS 5,5 MW	5500 kW	50°C	PN 16	218 m3/h	Electronic	PN 16	218 m3/h
HRM 5,5 MW							



Engineering, testing and application expertise for evolving data center cooling

As data center architectures evolve, cooling systems must adapt to higher rack densities, changing workloads and increasingly demanding efficiency requirements.

Danfoss combines broad technology expertise with application knowledge, system testing and global engineering capabilities to help customers develop and optimize cooling solutions for next-generation data centers.

From component selection and system design to simulation, testing and validation, we work with customers and partners to:

- Optimize system performance
- Validate new cooling architectures
- Reduce engineering and integration risk
- Improve energy and thermal efficiency
- Accelerate time to market

Danfoss 360 tool

With our extensive portfolio, we offer a powerful combination of expertise, product and options that will enhance your system designs.



Test. Validate. Optimize. Application Development Centers

Danfoss Application Development Centers provide an environment for simulation, modeling, system testing and engineering collaboration.

They enable customers and partners to evaluate technologies and system configurations under representative operating conditions - helping turn engineering concepts into validated

Partner with Danfoss to engineer the data center of tomorrow.

Explore our solutions, connect with our experts and start your next project with Danfoss.

 www.danfoss.com/datacenters

