



BALANCED AND RELIABLE COOLING INFRASTRUCTURE FOR DATA CENTERS

Engineering solutions that ensure hydraulic balance, low ΔP design, and pressure stability for uninterrupted data center operations.

www.tanpera.com.tr

FOR DATA CENTER COOLING INFRASTRUCTURES

Reliability, Stability, and Energy Efficiency

The digital economy must operate without interruption. From cloud services to financial transactions, from artificial intelligence applications to everyday communication, billions of processes take place in data centers every second.

For this reason, data centers are critical infrastructures that must operate 24/7, 365 days a year without downtime.

In these facilities, cooling systems are not merely auxiliary components that provide temperature control.

Cooling infrastructure is a critical system that directly determines:

- The safety of IT equipment
- Operational continuity
- Energy consumption
- Total cost of ownership

Even minor pressure imbalances, hydraulic issues, or performance losses in cooling systems can lead to increased server temperatures, higher energy consumption, and elevated operational risks.

Therefore, mechanical infrastructure solutions used in data centers must be designed based on the principles of high reliability, hydraulic stability, and predictable performance.



WHY DO DATA CENTER OWNERS AND OPERATORS CHOOSE TANPERA?

Tanpera solutions are designed not merely as equipment, but as critical infrastructure components that ensure operational reliability in data center cooling systems.

Operational Continuity

In continuously operating data centers, temperature and pressure stability are critical. Tanpera solutions minimize system fluctuations, supporting uninterrupted operations.

Energy Efficiency

Systems designed based on the low pressure drop (Low ΔP) principle reduce pump energy consumption and enable more efficient operation of the cooling infrastructure.

System Reliability

With a CFD-supported design approach, hydraulic flow balance is optimized, ensuring that equipment operates at its intended design conditions.

Predictable Performance

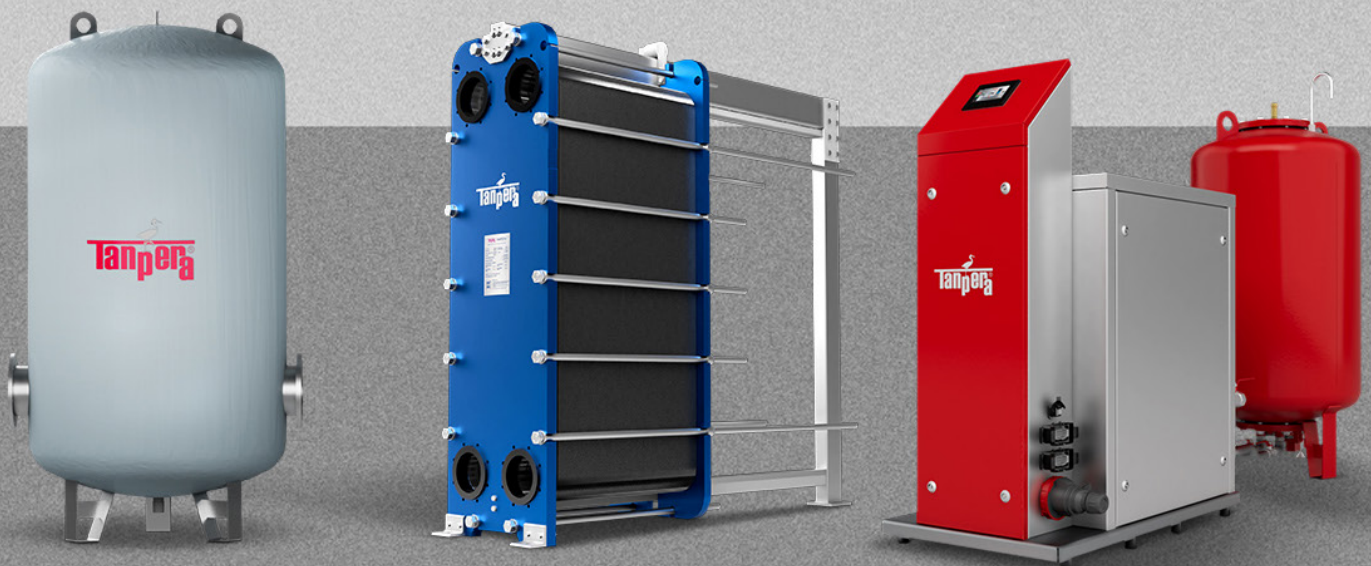
Through specially engineered heat exchangers and validated system designs, reliable alignment is achieved between design values and real-world performance.

Reduced Operational Risk

Pressure stability, air control, and hydraulic balance prevent cavitation, air ingress, and performance losses within the system.

Fast Service & Operational Assurance

With intervention within 24 hours and remote monitoring support, a reliable service infrastructure is provided for data center operations.



BUFFER TANKS

Why Are They Critical for Data Center Applications?



The Role of Buffer Tanks in Data Centers

Data center cooling systems must maintain temperature continuity under sudden load changes and chiller outage scenarios. At this point, buffer tanks:

- Provide thermal inertia, slowing down system response,
- Ensure continuity of chilled water during short-term interruptions,
- Contribute to more stable operation of the cooling infrastructure.

In data center applications, buffer tanks should not be considered merely as volumetric storage elements, but as critical components for hydraulic and thermal balancing.

Limitations of Conventional Buffer Tank Designs

In traditional buffer tank designs, internal flow geometry is often treated as a secondary consideration. This approach can lead to:

- Short-circuit flows within the tank,
- Formation of dead zones,
- Pressure losses caused by high local velocities,
- Lower-than-expected effective volume utilization.

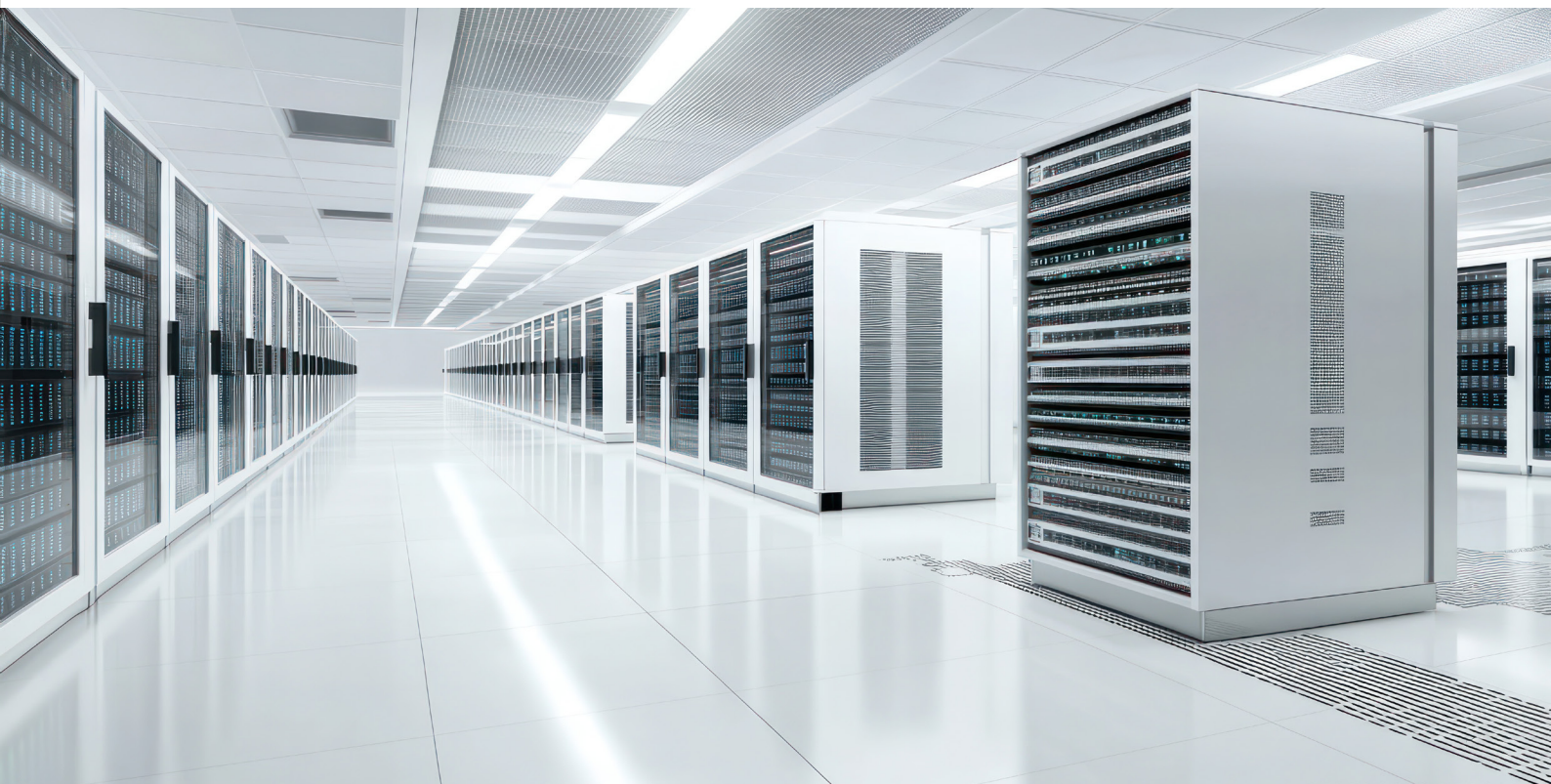
Such designs conflict with the low ΔP and high temperature stability requirements targeted in data center applications.

Why Is Low Pressure Drop (ΔP) Critical?

In data center cooling systems, pressure loss caused by buffer tanks:

- Directly increases pump energy consumption,
- Affects the operating point of the entire hydraulic circuit,
- Can disrupt CFD-optimized system designs in real-world conditions.

For this reason, the primary objective in buffer tank design should be to achieve maximum effective volume utilization with minimum pressure drop.



Distributor Plate (Baffle) Design Approach

The distributor plate (baffle) design is an internal geometry approach that aims to ensure hydraulically symmetrical and controlled flow from inlet to outlet within the buffer tank.

In this design:

- Inlet and outlet nozzles are positioned opposite each other,
- Internal flow guides are used to extend the flow path,
- Flow is distributed uniformly throughout the tank volume.

However, the critical aspect for data center applications is not geometric symmetry, but achieving true hydraulic symmetry.

Advantages of CFD-Supported Baffle Design

CFD (Computational Fluid Dynamics) analysis is utilized in the internal design of Tanpera buffer tanks.

With CFD-supported design:

- Flow distribution is optimized,
- Pressure losses are minimized,
- Flow behavior inside the tank is analyzed to achieve the most efficient design.

Through this approach, Tanpera buffer tanks are optimized to deliver high efficiency in data center cooling systems.



Baffle Design and Data Center Operational Reliability

Buffer tanks with baffle design and low ΔP :

- Work in coordination with the pump-driven expansion system to maintain stable system pressure,
- Ensure that heat exchangers and pumps operate at their design points,
- Support the operational continuity that is critical for data centers.

In this context, the buffer tank should not be considered a passive component, but rather an active system stabilizer.

Conclusion

In data center applications, buffer tank design:

- Cannot be based solely on volume calculations,
- Must consider internal flow geometry and pressure drop.

Thanks to CFD-supported distributor plate (baffle) design:

- Low pressure drop is maintained,
- Temperature continuity is ensured,
- Overall system energy efficiency is improved.

This approach positions buffer tanks as a strategic component of data center cooling infrastructure.

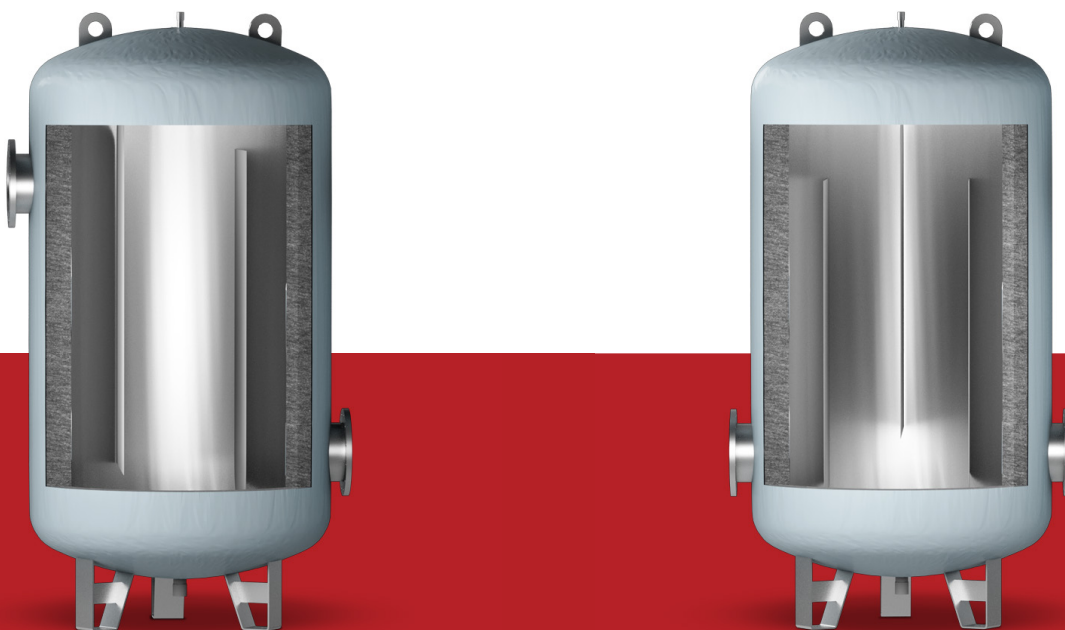


PLATE HEAT EXCHANGERS

Why Are They Critical for Data Center Applications?



The Critical Role of Heat Transfer in Data Centers

In data centers, cooling systems are not just about comfort—they are a fundamental component of operational continuity. Any performance loss or uncontrolled pressure increase in the cooling line can lead to:

- Reduced cooling capacity,
- Increased energy consumption,
- Exceeding temperature limits of critical IT equipment.

Therefore, heat exchangers used in data center applications must be high-performance, predictable, and verifiable.

Why Plate Heat Exchangers Are Preferred in Data Centers

Plate heat exchangers are widely preferred in data center cooling infrastructures due to the following advantages:

- High heat transfer coefficient,
- Compact structure and modular design,
- Fast response time,
- Low approach temperatures.

However, the key requirement for data center applications is achieving these advantages together with controlled pressure drop (ΔP).

Low ΔP and System Efficiency

In data center projects, pressure loss caused by heat exchangers:

- Directly impacts pump energy consumption,
- Determines the operating characteristics of the entire hydraulic system.

Therefore, when selecting plate heat exchangers, not only capacity but also the following must be considered:

- Design flow rate,
- Pressure drop limits,
- Flow regime.

The real-world performance of CFD-optimized buffer tank and pump-driven expansion system designs can only be preserved through the selection of low ΔP plate heat exchangers.



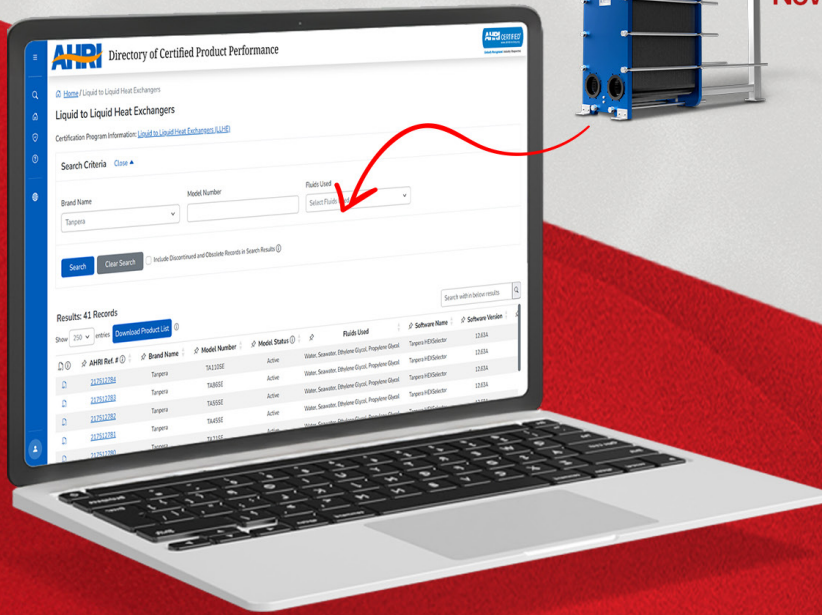
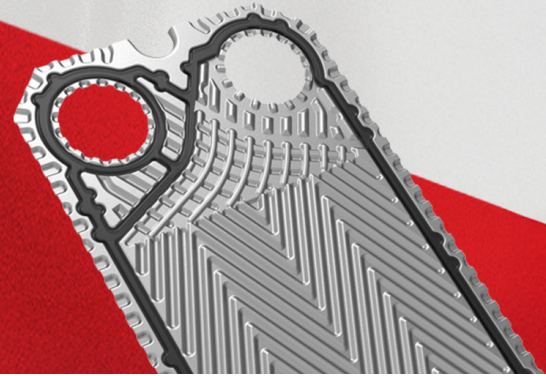
Our Plate Heat Exchangers

Now Certified with International AHRI Accreditation!

Performance Certification Program for
Liquid to Liquid Heat Exchangers



PERFORMANCE CERTIFICATION AGREEMENT FOR
PRIVATE BRAND MARKETER (PBM)



Importance of AHRI Certification for Data Centers

In data center projects, discrepancies between design values and real-world performance represent significant operational risks. AHRI certification ensures that plate heat exchangers are not only theoretically designed but also independently tested and verified in critical parameters such as:

- Heat transfer capacity,
- Pressure drop (ΔP),
- Approach temperatures.

In data center applications, AHRI certification:

- Reduces design risk,
- Accelerates consultant approval processes,
- Eliminates performance-related uncertainties at the early stages of the project.

In this context, AHRI is not merely a quality label, but a tool for engineering validation.

Performance Certification Program for
Liquid to Liquid Heat Exchangers



PERFORMANCE CERTIFICATION AGREEMENT FOR
PRIVATE BRAND MARKETER (PBM)



Performance Guarantee and Operational Assurance

In data centers, heat exchanger performance must be maintained not only during initial commissioning but throughout continuous operation.

With AHRI-certified plate heat exchangers:

- Committed heat transfer capacity,
- Maximum pressure drop limits,
- Approach temperatures

are clearly defined and guaranteed in measurable terms.

Through this approach:

- The design operating point of pumps and cooling systems is preserved,
- Unexpected increases in energy consumption are prevented,
- Operational uncertainties for data center operators are eliminated.

As a result, performance guarantee transforms the heat exchanger from a simple piece of equipment into a critical component of system continuity in data center projects.

Material Quality and Long Service Life

In data center applications, heat exchangers operate under continuous and long-term conditions. Therefore:

- Plate material (AISI 316L, AISI 304, etc.),
- Gasket material (resistance to high temperatures and chemicals),
- Manufacturing and assembly quality

are critical factors for ensuring long service life and low maintenance costs.

Conclusion

Plate heat exchangers are not merely heat transfer equipment in data center cooling systems; they are critical design components in terms of:

- Energy efficiency,
- Hydraulic balance,
- System reliability,
- Long-term operational continuity.

When AHRI-certified, low ΔP optimized, and high-quality plate heat exchangers are integrated with pump-driven expansion systems and buffer tank solutions, they provide a reliable and sustainable cooling infrastructure for data centers.

NOVA PUMP-EXPANSION SYSTEM

Why Is It Critical for Data Center Applications?



Critical Importance of Cooling Systems in Data Centers

Data centers are facilities that must operate continuously, with extremely low tolerance for disruptions. Even minor pressure imbalances, air ingress, or cavitation in cooling systems can trigger a chain reaction leading to:

- Equipment failures,
- Loss of cooling capacity,
- Operational risks and potential downtime.

Therefore, in data center cooling systems, not only capacity but also pressure stability, air control, and long-term operational reliability must be considered as fundamental design criteria.

Limitations of Conventional Expansion Systems in Data Centers

Traditional (static) expansion tanks:

- Passively balance system pressure,
- Cannot respond instantly to elevation differences and load changes,
- Cannot always prevent negative pressure at critical points.

This leads to the following risks in data center applications:

- Micro air ingress and oxygenation,
- Corrosion and sludge formation,
- Cavitation risk in pumps,
- Performance degradation in heat transfer equipment.

What Is the NOVA Pump-Expansion System?

PGS is not just a system that balances pressure—it actively manages it.

Key features:

- Continuous monitoring via pressure sensors,
- Pump-controlled pressure regulation,
- Instant adaptation to system load and temperature changes.

With this structure, a continuously positive and stable pressure regime is maintained in data center cooling systems.



Location-Sensitive Pressure Control

The most critical advantage of PGS for data centers is its ability to provide location-sensitive pressure control.

- The pressure reference is determined based on the most hydraulically critical point in the system.
- This ensures that no negative pressure occurs anywhere in the system, even under the most unfavorable conditions.

Results:

- Air ingress into the system is prevented,
- Cavitation risk is eliminated,
- Equipment lifespan is extended,
- Maintenance requirements are reduced.

PGS and Operational Continuity in Data Centers

Cooling systems in data centers typically operate under:

- High flow rates,
- Low ΔP targets,
- Continuously variable load conditions.

Within this operating regime, PGS:

- Dampens pressure fluctuations,
- Ensures stable operation of pumps and heat exchangers,
- Preserves the real-world performance of CFD-optimized low ΔP designs.

In this context, the pump-driven expansion system is not merely an expansion solution, but can be considered as a safeguard of the entire system.



Operational Assurance and Service Approach

In data center projects, not only the technical solution but also service speed and continuity commitment are of critical importance.

Pump-expansion system solutions are supported with:

- Service intervention within 24 hours,
- Remote monitoring and fault diagnostics,
- Redundant component approach.

This structure helps minimize operational risks for data center operators.

Conclusion

The NOVA pump-driven expansion system plays a critical role in data center cooling applications in terms of:

- Pressure stability,
- Air control,
- Equipment protection,
- Long-term operational reliability.

When integrated with CFD-optimized low ΔP designs, the pump-driven expansion system stands out as an essential component of a sustainable, reliable, and uninterrupted cooling infrastructure in data centers.



SERVICE AND OPERATIONAL SUPPORT

Buffer Tanks · NOVA Pump-Expansion System (PGS) · Plate Heat Exchangers



Periodic Maintenance
and Repair



Commissioning



After Sales
Services



Spare Parts
Supply

The Critical Importance of Service in Data Centers

No matter how strong the technical design is, service speed and intervention capability are key determinants of operational continuity in data center projects. Even minor disruptions in cooling systems can lead to:

- Exceeding temperature limits,
- Increased risk for IT equipment,
- Higher likelihood of operational downtime.

Therefore, in data center infrastructures, the service approach must be proactive and guaranteed, rather than reactive.

Intervention Guarantee Within 24 Hours

For our buffer tank, pump-driven expansion system, and plate heat exchanger solutions, we provide a guaranteed intervention—either on-site or remote—within 24 hours in case of failures, performance degradation, or emergency notifications.

This guarantee ensures:

- Protection of critical data center operations,
- Elimination of uncertainty and waiting times,
- Minimization of operational risks for operators.

Comprehensive Service Solutions

Buffer Tank Service Support

- Distributor plate (baffle) inspection and flow verification,
- Pressure drop (ΔP) and hydraulic performance evaluation,
- Temperature continuity and thermal behavior analysis.

NOVA Pump-Expansion System (PGS) Service

- Pressure sensor and control algorithm verification,
- Location-sensitive pressure reference validation,
- System analysis against negative pressure and air ingress.

Plate Heat Exchanger Service

- Heat transfer performance verification,
- Pressure drop and approach temperature measurements,
- Gasket, plate, and sealing condition assessment.

Remote Monitoring and Preventive Intervention

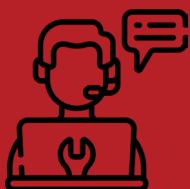
In applicable projects:

- System pressure,
- Temperature values,
- Performance trends

can be monitored remotely.

This enables:

- Early detection of potential issues before escalation,
- Planned maintenance and preventive intervention,
- Minimization of emergency service requirements.



Spare Parts and Continuity Approach

In data centers, spare parts availability is as critical as service response time. In this context, we provide:

- Stocked spare parts for critical components,
- Fast supply and replacement planning,
- Periodic inspection services after commissioning.

Single Point of Service – System Approach

For buffer tanks, pump-driven expansion systems, and plate heat exchangers:

- A single point of contact,
- Coordinated service management,
- System-based evaluation are ensured.

This approach focuses on protecting the entire cooling infrastructure rather than performing component-based interventions.

Conclusion

In data center projects, service is:

- Not merely a support function,
- But an integral part of system design.

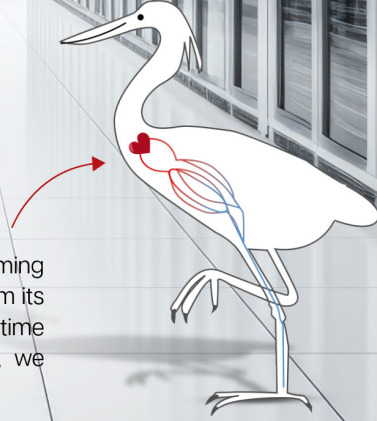
With a 24-hour intervention guarantee, expert technical teams, and a system-based approach:

- Operational risks are minimized,
- Continuity of the cooling infrastructure is ensured,
- A reliable and sustainable service model is provided for data center operators.

Reliable Solutions for Data Centers

Reliable heat management and pressure control solutions for uninterrupted data center operations

By effective heat transfer between the blood coming from its heart at 40°C and the blood returning from its feet at 1°C, it can stay in cold water for a long time without freezing. Using these natural principles, we design our engineering marvel heat exchangers.



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