



CoolIT
systems™

Rack DCLC™

Reliable Direct Liquid Cooling for the
world's most demanding Data Centers

Unlocking Data Center Potential with Rack DCLC

CoolIT Systems Rack DCLC™ solutions manage challenging heat loads and deliver the high density, efficiency and performance requirements of today's demanding compute environments.



Performance

Facilitate peak performance for higher powered or overclocked processors



Density

Enable 100% utilization of rack and data center spaces



Efficiency

Benefit from a significant reduction in total data center energy consumed



Savings

Generate immediate and measurable OpEx benefits and reduce overall TCO



Scalability

Meet fluctuating demands through the ability to modify data center capacity



Acoustics

Relieve employees from the disruption of loud server fans

Efficiently Cooling the Modern Data Center

Manage rising heat loads with industry leading Direct Liquid Cooling technology

CoolIT Systems rack-based Direct Liquid Cooling technology, Rack DCLC™, uses the exceptional thermal conductivity of liquid to provide dense cooling to targeted areas. By integrating Rack DCLC, dependence on fans and expensive air handling systems is drastically reduced. This enables higher rack density, overall reduced power use and peak performance potential. Supported by options for data centers with or without facility water hook up, any server in any rack can be liquid cooled, and can immediately benefit from measurable OpEx savings.



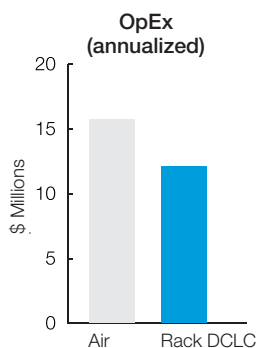
CoolIT Systems' patented Split-Flow Coldplates

are solid copper components which deliver superior performance for today's high thermal density processors.

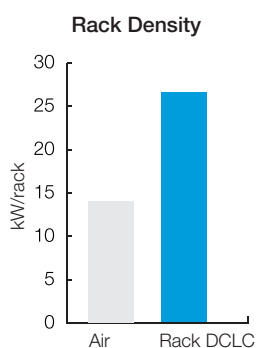
The key differentiator of the Passive Coldplate Loop, Split-Flow design uses microchannel architecture to minimize pressure drop, maximize coolant flow, and direct the coolest liquid to the hottest area of the processor first.

CoolIT's low-profile coldplates are easily integrated into extremely compact blade architectures, and allow for optimal performance.

Eliminate chilled water requirements and reduce OPEX by 22% with warm water cooling



22% REDUCTION
Operating Expenses



80% INCREASE
Rack Capacity

ASHRAE W4 (2°C-45°C) warm liquid cooling eliminates the need for chilled water supply, delivering a rapid ROI. The initial cost of integrating liquid cooling is quickly offset by several factors:

- High-density solutions require less data center equipment (racks, switches, etc.), lowering overall CapEx
- W4 Direct Liquid Cooling reduces OpEx by an average of 22%

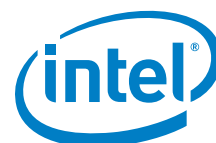
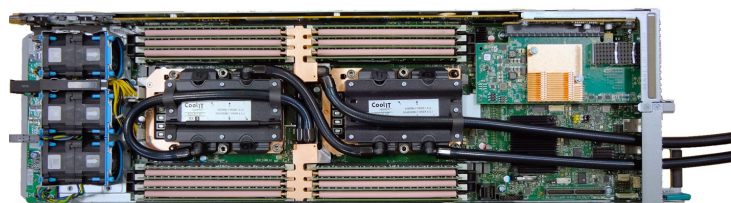
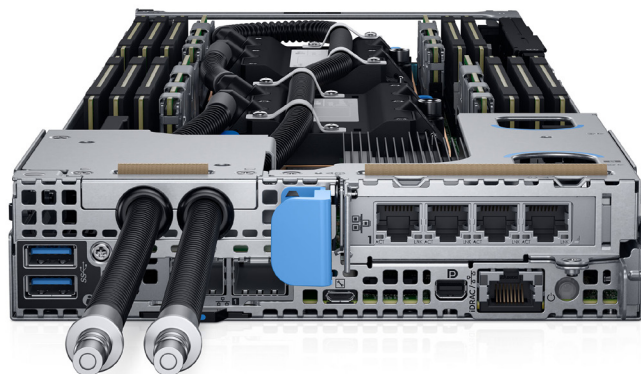
Readily Available Liquid Cooled OEM Servers

Factory-installed, warranty-certified Rack DCLC server solutions

Through established engineering partnerships with today's leading server manufacturers and data center operators, we help our customers efficiently manage the increasing heat loads of modern data center environments. As the recognized liquid cooling technology provider of choice for server manufacturers around the world, CoolIT offers factory-installed solutions with Hewlett Packard Enterprise, Dell EMC, Intel and Supramicro systems and various ODM-direct servers.



PowerEdge C6420 is purpose-built for high performance, hyperscale work-load. Featuring 4 nodes in a 2U form factor, this robust server leverages CoolIT Systems' Rack DCLC RX1 Passive Coldplate to support Intel® Xeon® Scalable Processors (Skylake) for increased performance, energy efficiency, and extremely high rack-level density for today's modern data centers.



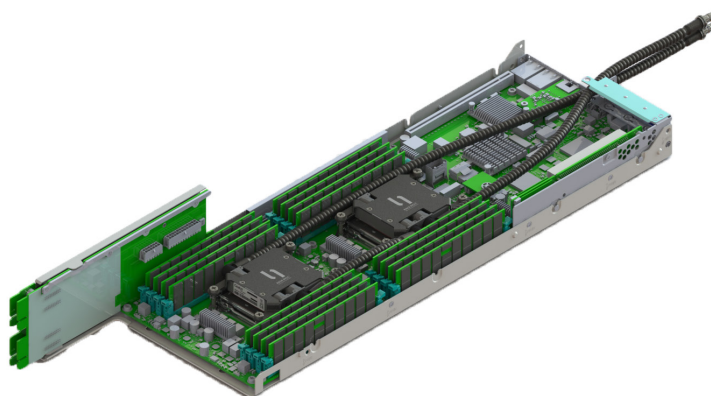
Buchanan Pass (Compute Module HNS2600BPB)

manages 85%+ of the total server heat load produced by the dual Intel® Xeon® Scalable Processors (Skylake), Voltage Regulators, and Memory with CoolIT's Rack DCLC Passive Coldplate Loop, providing customers with an extremely dense, energy efficient and easily servicable data center solution.



Hewlett Packard Enterprise

Apollo 2000 enables maximum data center potential using CoolIT Systems Rack DCLC. The custom-built liquid cooling solution, which is integrated into each of the four HPE ProLiant XL170r Servers within the HPE Apollo 2000 System, employs CoolIT's R4 Passive Coldplate and patented Split-Flow design to significantly enhance overall performance and efficiency.



Modular Solutions for Any Application

Three flexible modules to configure a cooling solution for your unique requirements

Whether you are an OEM or Hyperscale data center operator looking for products that enable your technology to perform at its peak, or a data center operator needing reliable products to reduce energy costs and OpEx, CoolIT Systems modular Rack DCLC platform is equipped to support any server, rack configuration and data center environment. Utilizing Rack DCLC's three module approach, customers work directly with CoolIT's engineering experts to select components specific to their needs. It's as easy as 1,2,3.



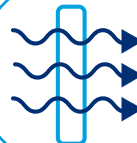
Selection 1: Passive Coldplate Loop

Liquid cool any combination of CPU, GPU and RAM components within any server. Rack DCLC Passive Coldplate Loops are mounted in the server to capture heat and include passive coldplate(s), tubing and quick disconnects while allowing the servers to remain hot-swappable and easy to service.



Selection 2: Rack Manifold

Rack DCLC Rack Manifold's manage liquid distribution between Coolant Distribution Units and any number of Passive Coldplate Loops. Customizable to suit any server or rack environment, Rack Manifold's are incredibly reliable and robust, utilizing a stainless steel body and all-metal quick disconnects.



Selection 3: Coolant Distribution Unit (CDU)

CoolIT Systems' Rack DCLC product line offers a variety of CDUs depending on load requirements and availability of facility water, including CHx (liquid-to-liquid), AHx (liquid-to-air) and custom options. Featuring a centralized pumping system, heat exchanger and advanced control system, each CDU isolates the facility liquid loop from the rack liquid loop.

Passive Coldplate Loop

Engineered to efficiently optimize server density and performance

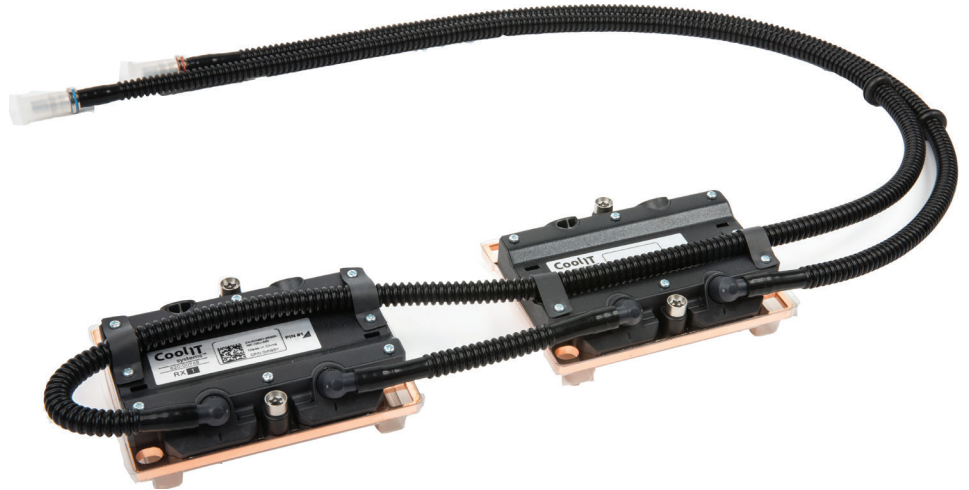


Liquid cool any number of heat producing components such as CPU, GPU and Memory within any server. Passive Coldplate Loops are mounted in the server to capture heat and include passive coldplate(s), tubing and quick disconnects while allowing the servers to remain hot-swappable and easy to service.

Coldplate Configurations:

- CPU only
- CPU & RAM
- GPU only
- GPU & RAM
- CPU, GPU & RAM

With customization available for VR, ASIC, FPGA and other server components.



Passive CPU Coldplates

Designed for Intel and AMD processors, CoolIT's range of Passive CPU Coldplates are managed by centralized pumping architectures and accommodate lower profile footprints such as 1U blades and other custom chassis.



R4 for Broadwell/Haswell



RX1 for Skylake



RD1 for EPYC

Passive GPU Coldplates

Designed specifically for NVIDIA and AMD graphics cards, CoolIT's full coverage Passive GPU Coldplates cool the GPU, RAM and power supply components while maintaining a low profile.



GP2 for Tesla V100 and P100

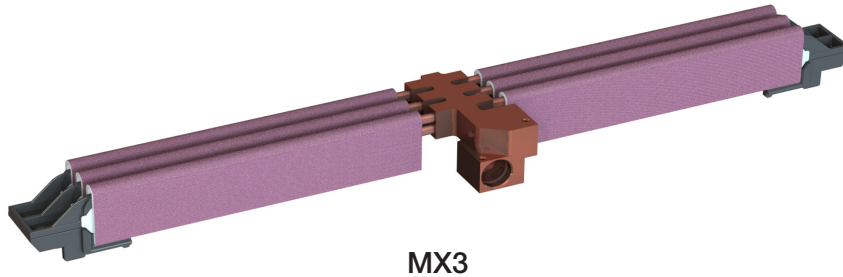


G1 for FirePro



Passive Memory Coldplates

CoolIT's innovative Passive Memory Coldplates are designed for use with any memory configuration. The cooling device itself is fixed to the chassis so that memory modules can be set in place and removed without needing to remove the coldplate. This design maximizes DIMM serviceability while maintaining near 100% heat capture of the memory heat.



MX3

Tubing

Reliable tubing connects every component within the Passive Coldplate Loop and contain liquid flowing through the system. CoolIT Systems offers two reliable, durable options for tubing both with ~1/4" (~6 mm) internal diameter.



**Fluorinated Ethylene
Propylene (FEP)**



**Chlorinated Isobutylene
Isoprene Rubber (CIIR)**

Quick Disconnects

CoolIT's 100% non-drip quick disconnects are made of metal to ensure long-lasting component reliability. Depending on server arrangement, manual-mate and blind-mate connections are available.

STÄUBLI



**Manual-mate
Quick Disconnects**



**Blind-mate
Quick Disconnects**

Rack Manifold

Safely manage liquid flow between Passive Coldplate Loops and CDUs



Customized to suit any server or rack environment, CoolIT Systems' Rack Manifolds are incredibly reliable and robust, utilizing a stainless steel body combined with 100% non-drip quick disconnects. Standard 42u and 48u configurations are readily available.



Rack Manifold

Built with reliable stainless steel and 100% non-drip, manual-mate quick disconnects, CoolIT's Rack Manifold can be installed horizontally or vertically for connection at the front or back of the rack.

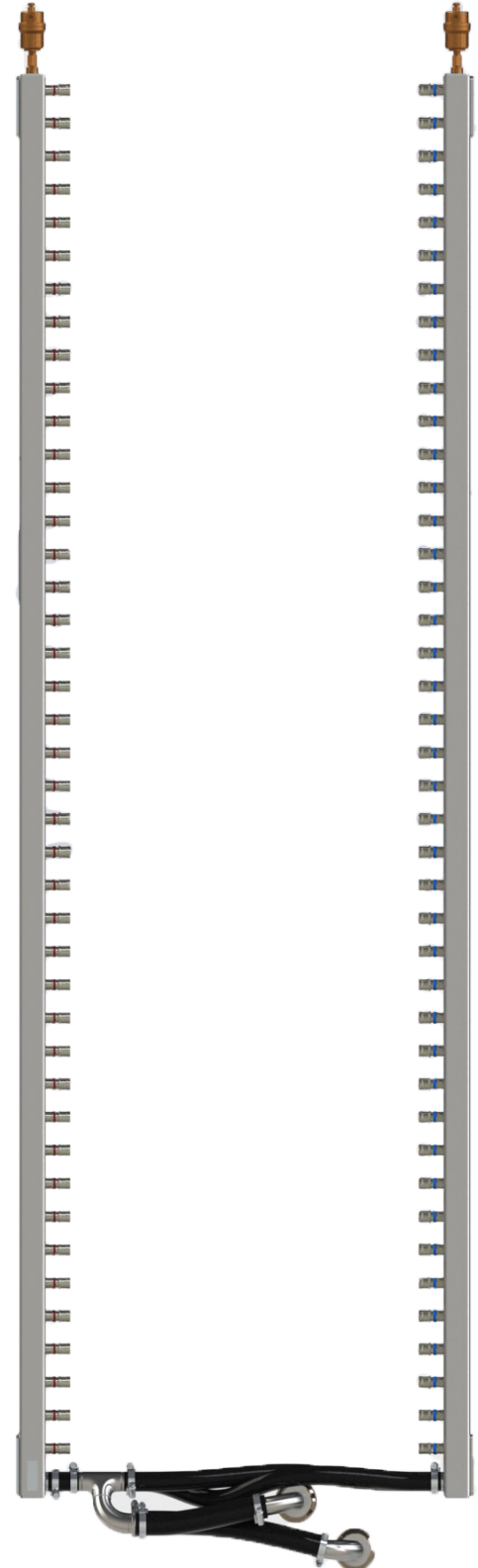
Key Features:

- Robust, stainless steel body for superior reliability
- Vertical or horizontal orientation
- 100% dry-break quick disconnect technology
- Color-coded plug and socket for hot (red) and cold (blue)
- Standard single and dual configurations available: 12u, 42u, 48u
- Customization available for unique environments
- Simple installation and serviceability
- Servers remain hot-swappable



Chassis Manifold

User-friendly Chassis Manifold design deploys 100% non-drip, blind-mate quick disconnects to integrate into blade-style chassis and accommodates small misalignments when connecting servers.



Coolant Distribution Unit (CDU)

High capacity, low profile heat exchanging systems



CoolIT Systems' Rack DCLC product line offers a variety of CDU's depending on load requirements and availability of facility water, including CHx (Liquid-to-Liquid), AHx (Liquid-to-Air) and custom options. Featuring a centralized pumping system, heat exchanger and Command2 Control System, each CDU isolates the facility liquid loop from the rack liquid loop.

Rack DCLC™ CHx

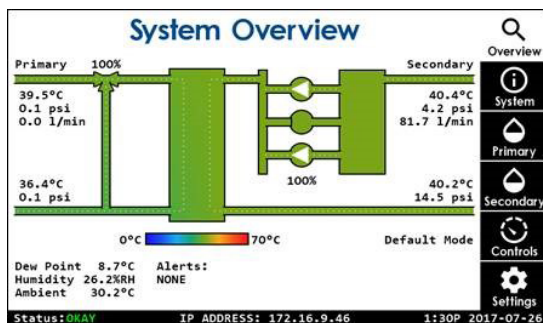
- Liquid-to-liquid CDU
- Requires facility water
- Includes plate-to-plate heat exchanger
- Centralized pumping
- Command2 Control System
- Manages dew point control

Rack DCLC™ AHx

- Liquid-to-air CDU
- Does not require facility water
- Includes radiator
- Centralized pumping
- Command2 Control System
- Utilizes hot aisle/cold aisle architecture

Centralized Pumping Architecture

- Superior performance and reliability advantage over distributed pumping systems
- Enables low profile solutions to support all server and blade configurations
- Passive coldplates maintain appropriate flow distribution across all processors
- No moving parts = drastically fewer failure points than distributed pumping system
- Easy maintenance



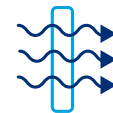
Command2: Adaptive and Intelligent Control Systems

- Built-in autonomous controls and monitoring
- Sophisticated safety features
- Comprehensive system reports (SNMP, Email, System Logging)
- Touch Screen and Web Interface interaction
- Advanced alerts (Leak Detection, High Pressure/Temperature, Low Fluid)
- Master/slave protocol allows multiple CDUs to be linked and controlled as one

Manage up to 100kW cooling capacity per rack with warm water cooling

Rack DCLC™ CHx750

Row-based liquid-to-liquid CDU which manages a network of IT cabinets



Rack DCLC CHx750 manages the distribution of clean, treated coolant to and from a network of IT cabinets. This stand-alone CHx accepts ASHRAE W4 warm facility water and can support 750kW of processor load per network.

The CHx750 CDU is customizable to fit various data center environments. Standard equipment groups offer N+1 redundancy, and when deployed can provide tier 4 resiliency.

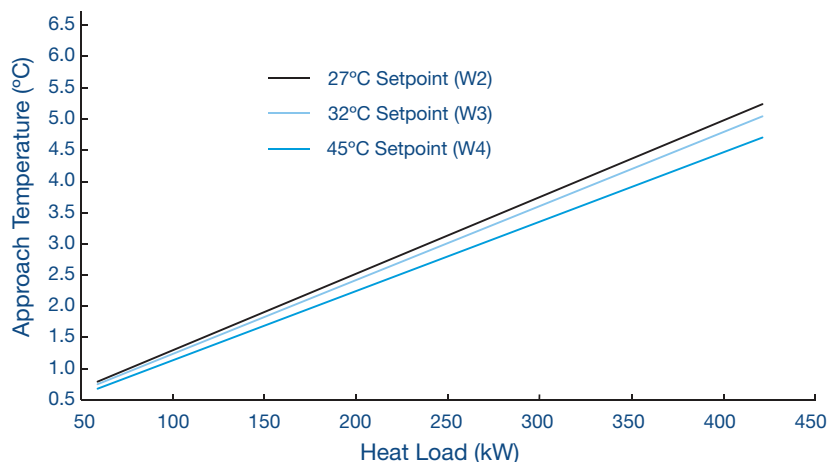
Key Features

- Manages 750kW of cooling capacity per network
- ASHRAE W4 warm water cooling
- Redundant centralized pumps
- Command2 Control System (Webserver, Modbus, SNMP)
- 7" LCD screen with touch functionality
- Internal leak detection system
- Stand-alone solution
- Integrated fill-pump
- 50micron filtration to secondary loop
- All stainless steel pipe-work
- High flow and heat transfer capability

Key Benefits

- Warm water cooling reduces the need for chillers
- Quick and easy installation and service
- Significantly reduces OpEx
- Reduces the need for CRACs
- Isolates high pressure facility water from racks
- Serviceable onsite - no down time for maintenance
- High temperature return water can be used for heat re-use

CHx750 Performance



Cooling Capacity (@ 30°C facility liquid)	750kW
Power Consumption (Max)	7.4kW (both pumps running)
Racks per Solution	5-20
Facility Liquid Integration	Yes



Rack DCLC™ CHx80

Rack-mount liquid-to-liquid CDU which manages a single IT cabinet



Rack DCLC CHx80 supports today's most demanding HPC requirements. Capable of managing 80kW+ of heat load in a remarkably small 4U of space per rack, this system provides cooling for 100 servers or more.

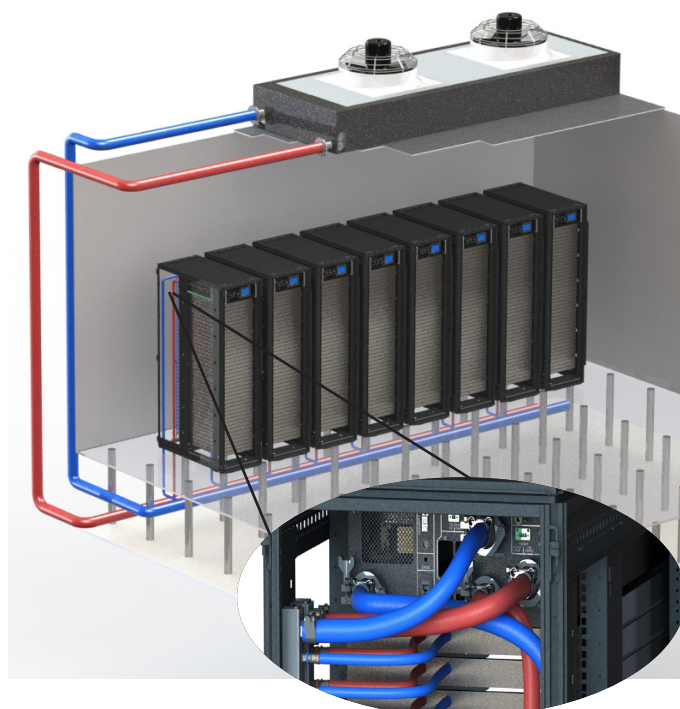
The CHx80 is an extremely efficient CDU that uses ASHRAE W4 warm water to manage processor and component heat. As a result, users can expect a significant reduction in data center OpEx.

Key Features

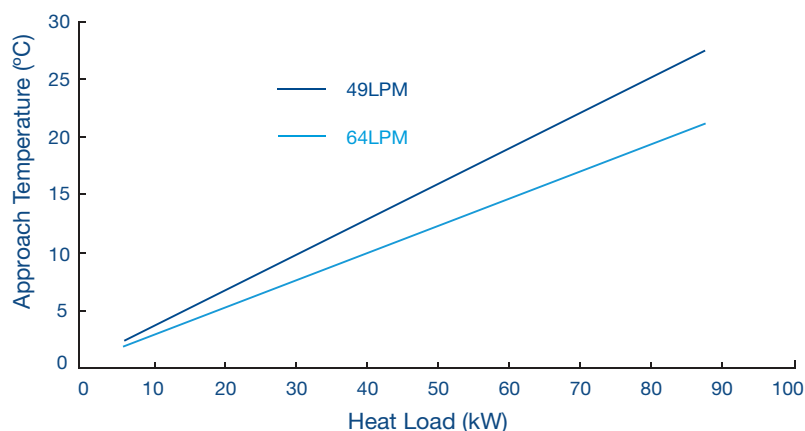
- Manages 80kW+ cooling capacity per rack
- ASHRAE W4 warm water cooling
- Redundant centralized pumps
- Dry-break quick disconnects
- 4.3" LCD screen with touch functionality
- Command2 Control System (Webserver, Modbus, SNMP)
- Internal and external leak detection system
- 4U rack mount chassis

Key Benefits

- Warm water cooling reduces the need for chillers
- Manages 100+ servers per rack
- Quick and easy installation and service
- Uses only 652W
- Can be located anywhere in a rack
- High temperature return water can be used for heat re-use



CHx80 Performance



Cooling Capacity (@ 30°C facility water)	80kW
Power Consumption (Max)	652W @ 115VAC
Racks per Solution	1
ROI (months)	1-6
Facility Water Integration	Yes

Rack DCLC™ CHx40



Rack-mount liquid-to-liquid CDU which manages a single IT cabinet

Rack DCLC CHx40 manages the distribution of coolant and heat exchange within a single IT cabinet. This 2U CHx accepts ASHRAE W4 warm facility water and manages 40kW+ of processor load per rack.

Key Features

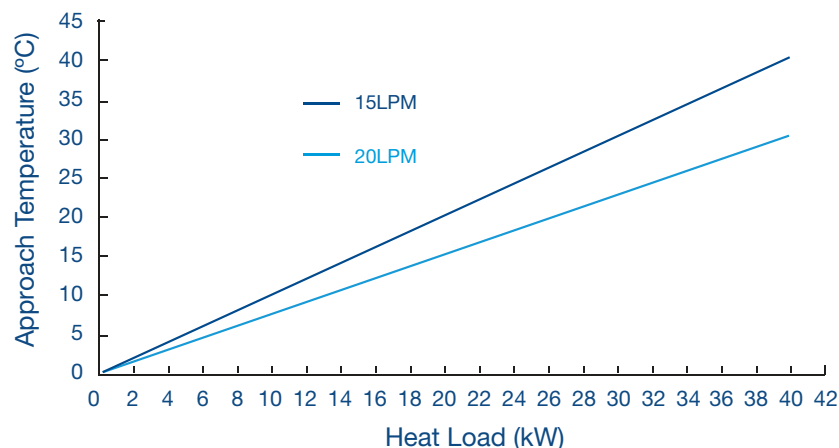
- Liquid-to-liquid heat exchanger
- Manages 40kW+ cooling capacity per rack
- ASHRAE W4 warm water cooling
- Command2 Control System (Webserver, Modbus, IPMI, SNMP)
- 4.3" LCD screen with touch functionality
- Internal leak detection system
- Dry-break quick disconnects
- 2U rack mount chassis

Key Benefits

- Warm water cooling reduces the need for chillers
- Manages 40+ servers per rack
- Dramatically increases CPU/GPU density
- Reduces the need for CRACs
- High temperature return water can be used for heat re-use



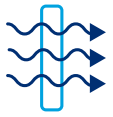
CHx40 Performance



Cooling Capacity (@ 30 °C facility water)	40kW
Power Consumption (Max)	110-120W
Racks per Solution	1
ROI (months)	1-6
Facility Water Integration	Yes

*Approach temperature is the difference between the ambient air intake and the liquid supply temperature to the server.

Rack DCLC™ AHx10



Rack-mount liquid-to-air CDU which manages a single IT cabinet

The newest addition to CoolIT Systems Rack DCLC™ product line is the AHx10, a compact 5U, rackmount CDU capable of managing 7kW at 25°C ambient air temperature. This product expands to a 6U and 7U configuration (via the available expansion kit) that manages up to 10kW of heat load.

The AHx10 supports front to back air flow management and is compatible with CoolIT Rack Manifolds and Passive Coldplate Loops. The system allows users to deploy high density liquid cooled servers inside existing data centers without the requirement for facility liquid. The AHx10 is the perfect solution to manage cooling for HPC racks within an existing facility.



Fig. 1: Rack DCLC AHx10 (5U configuration)



Fig. 2: Rack DCLC AHx10 (7U configuration)

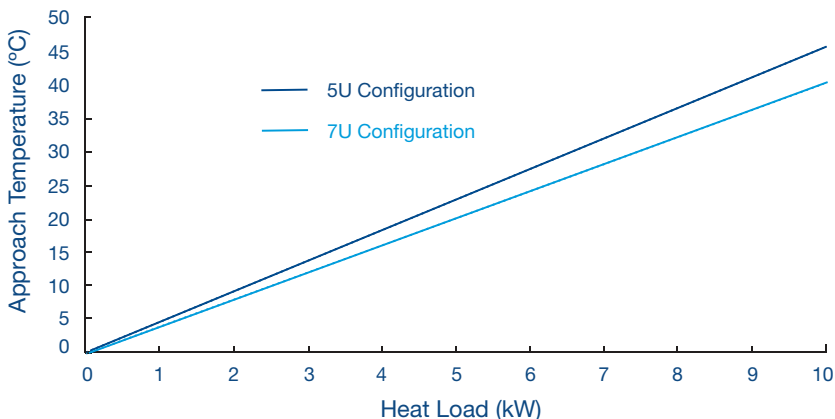
Key Features

- Liquid-to-air heat exchanger
- Manages 7 - 10kW cooling capacity per rack
- Redundant pumping
- Compact 5U, rackmount appliance
- 6U or 7U expansion kit available
- Command2 Control System
- LCD touch display for quick user interface
- Rackmount appliance – support cold to hot aisle configuration

Key Benefits

- Does not require facility water
- Allows for dramatic density increase and rack utilization
- Quick and easy installation and service
- Control and monitoring from LCD or via several network protocols
- System can be located at any level within the rack

AHx10 Performance



Power Consumption (Max)	720W
Racks per Solution	1
Facility Water Integration	No

*Approach temperature is the difference between the ambient air intake and the liquid supply temperature to the server.

Rack DCLC™ AHx2

An essential factory burn-in tool for OEMs and System Integrators



CoolIT Systems Rack DCLC™ AHx2 is a compact, easy to transport liquid-to-air CDU designed to enable factory server burn-in when liquid is not present in the factory. It functions as an important tool for customers wishing to validate Rack DCLC technology with a small number of servers.

AHx2 provides Direct Liquid Cooling to four Rack DCLC enabled servers during the burn-in process, and reduces the need for additional infrastructure. AHx2 is a liquid-to-air heat exchanger which dissipates heat from the coolant in the server loop to the ambient environment, and accompanies the servers through the entire burn-in process.



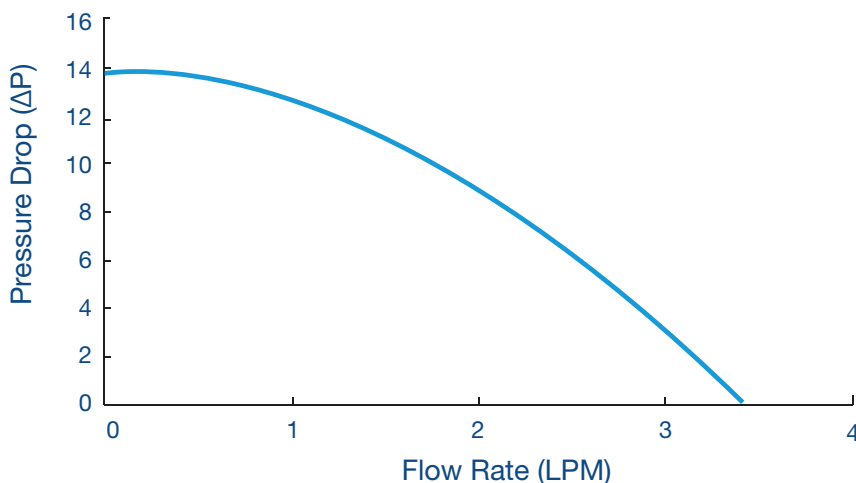
Key Features

- Liquid-to-air heat exchanger
- 2kW cooling capacity with 25°C approach temperature
- Manage four Rack DCLC enabled servers simultaneously
- Compact size allows the unit to sit on top or beside a server chassis during operation
- Carrying handle and rubber feet for safe transportation and storage
- Non-marking skid pad allows the unit to safely sit on top of a server chassis
- Status light to indicate correct unit operation

Key Benefits

- DCLC enabled servers can be thermally tested during the factory burn-in process, without additional expensive liquid cooling infrastructure
- System travels with the server through factory burn-in process
- Inexpensive solution for DCLC enabled server burn-in
- Quick and easy installation and operation

AHx2 Pump Performance



Case Studies

Customer: Canadian Hydrogen Intensity Mapping Experiment (CHIME)

Objective: Enable high-density GPU-intensive servers within containerized data center



Canada's newest and largest radio telescope, the Canadian Hydrogen Intensity Mapping Experiment (CHIME), formally launched on September 7, 2017 at the Dominion Radio Astrophysical Observatory.

HPC Setup

- 256 General Technics GT0180 custom 4u servers across 26 racks
- 26 CoolIT Systems Rack DCLC™ CHx40 CDUs
- Stainless steel Rack Manifold modules in each rack, featuring dry-break quick disconnect technology
- Liquid cooled components:
 - CPU: Intel® Xeon® Processor E5-2620 v3
 - GPUs: Dual AMD FirePro S9300x2



Results

- 100% of total IT load managed by liquid cooling
- 183kW total heat load managed
- Significantly lowered data center OpEx
- Reduced noise pollution

"We chose to work with CoolIT Systems because their solutions are modular and robust, and as a result the most flexible and efficient for our situation. With the custom liquid cooling solution, we can drastically reduce CHIME's energy consumption and squeeze additional processing out of the GPUs."

Dr. Keith Vanderlinde, University of Toronto

Customer: Poznan Supercomputing and Networking Center

Objective: Double compute capacity within existing infrastructure and floor space



HPC Setup

- 1.8 petaFLOPS cluster
- 2 CoolIT Systems Rack DCLC™ CHx650 CDUs
- CPU, RAM and VRM Passive Coldplate Loops
- 30kW per rack
- 40 - 45°C primary fluid supply temperature
- Huawei E9000 chassis
- Huawei CH121 server
- 1,232 Huawei blade servers across 19 racks



Results

- 85% of total IT load managed by liquid cooling
- 75% fan speed reduction
- Waste energy reused to heat surrounding buildings
- Ranked on TOP500 and Green500 lists
- Greenest supercomputer in Poland



"Reducing energy usage and lowering operating costs are permanently on our checklist when planning for new High Performance Computing clusters. Liquid cooling is the most efficient way to achieve our objectives and we are seeing excellent results and reliability from the combined Huawei and CoolIT Systems cluster."

Radoslaw Januszewski, IT Specialist, PSNC





Efficiently cooling the world's
most powerful Data Centers



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Call our liquid cooling experts today for more information: 1-866-621-2665