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FiberHome Telecommunication Technologies Co., LTD
No.6, Gaoxinsilu, Wuhan, Hubei, China
www.fiberhome.com

Phase Change Liquid Cooling Solution

Phase Power, High-Efficiency Cooling

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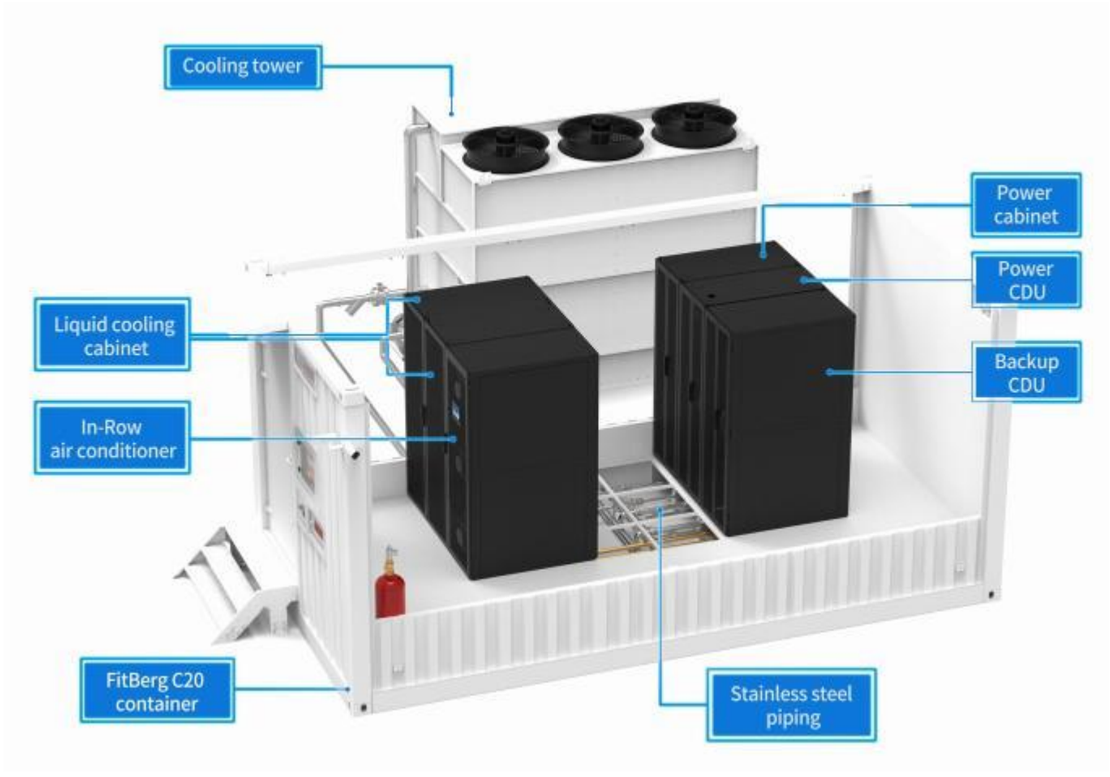
Solution Introduction

Phase-change liquid cooling solution is a high-efficiency thermal management technology that absorbs and transfers the substantial heat generated by equipment through the phase-change process of a liquid—specifically, evaporation and condensation. Its key distinction from conventional liquid cooling (which relies solely on convective heat transfer via water or coolant flow) lies in the utilization of latent heat of phase change, resulting in an exponential improvement in heat dissipation capacity.

In this solution, the primary cooling loop adopts a "co-sourced air–liquid" design, sharing a common outdoor cold source. Indoors, a hybrid cooling approach is employed—combining phase-change liquid cooling with supplemental air cooling.



Solution Features

- Superior Heat Dissipation Capacity

  The heat transfer enabled by latent heat of vaporization is significantly higher than that achievable via sensible heat exchange in single-phase working fluids; consequently, the required refrigerant flow rate—and thus pump power—is substantially reduced.

- Exceptional Temperature Uniformity

  Near-isothermal operation minimizes localized hot spots, ensuring consistent chip performance.

- Leak-Safe Design

  The refrigerant exhibits extremely low electrical conductivity and exists as a gas at ambient temperature; in the event of a leak, it rapidly vaporizes without contacting or damaging electrical components.

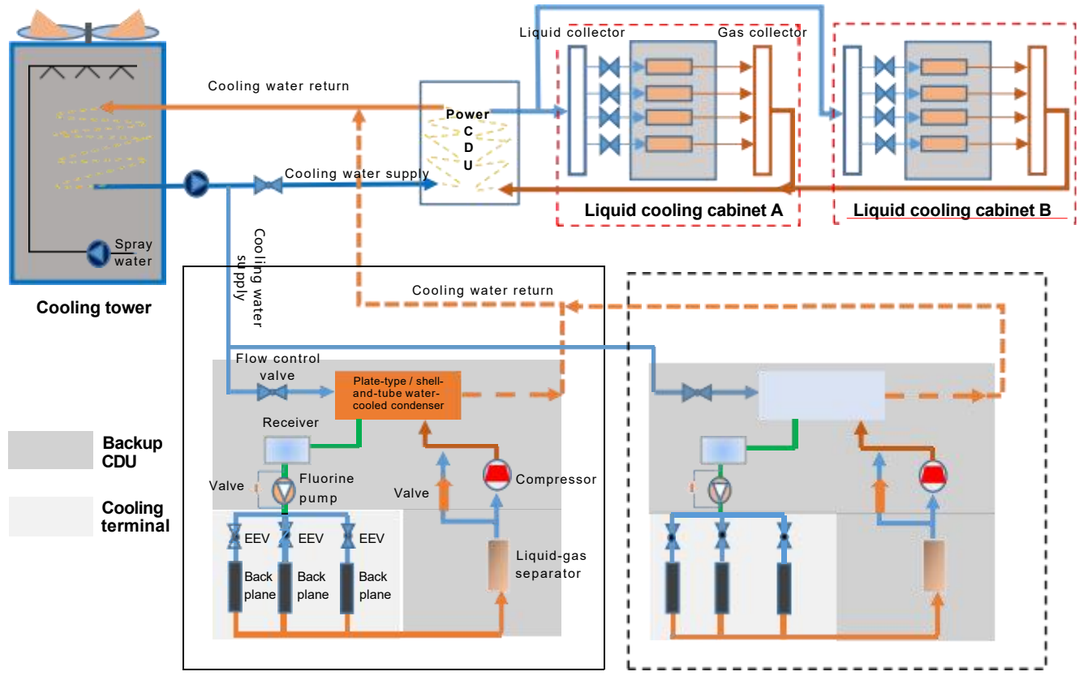
- High Material Compatibility

  The refrigerant demonstrates excellent compatibility with common metals—including stainless steel, copper, and aluminum—minimizing corrosion risk.

- Clean System Architecture

  The refrigerant is a pure substance, and the system incorporates a desiccant filter—ensuring long-term fluid purity and markedly reducing risks of tube blockage or corrosion.

Schematic Diagram



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Power CDU

Power CDU comprises four subsystems: the primary-side cooling system, the secondary-side refrigerant (fluorinated fluid) supply system, the refrigerant charging system, and the electrical control system. The system regulates primary-side water flow rate based on the inlet water temperature to precisely control the condensing temperature and pressure on the secondary side.

The secondary-side system connects to liquid-cooled cabinets and delivers phase-change cooling media to high-power components. Critical secondary-side pumping units—fluorinated fluid pumps—are configured in a 1+1 redundant arrangement (one active, one standby).

A high-efficiency stainless-steel plate heat exchanger enables thermal exchange between the secondary- and primary-side systems and serves as the core heat-transfer component of the CDU.

Refrigerant: R1234ze(E)

Power CDU

Backup CDU

Backup CDU comprises two subsystems: the primary-side cooling system and the secondary-side supplementary cooling system.

A plate heat exchanger enables thermal exchange between the secondary- and primary-side systems and serves as the core heat-transfer component of the CDU.

The secondary-side system connects to terminal air-conditioning units—such as power heat-pipe or power in-row cooling units—to provide supplemental cooling for the overall system. Key secondary-side power components include compressors and fluorinated fluid (refrigerant) pumps. The system automatically selects between compressor mode and pump mode based on the primary-side inlet water temperature: compressor mode is engaged when the primary-side water temperature is high; pump mode is activated when the primary-side water temperature is low.

Refrigerant: R410A

Backup CDU

Power CDU Technical Specifications

Item	Power CDU parameters			
Basic specifications	Heat exchanger	350kW	600kW	1000kW
	Dimensions (W x D x H)	600 x 1200 x 2200mm	800 x 1200 x 2200mm	900 x 1200 x 2200mm
	Weight	≤600kg	≤750kg	≤950kg
	Operating noise	≤72dB		
	Rated power	8kW	12kW	16kW
	Power supply	AC380V, 50/60Hz		
	Communication method	Modbus RTU/RS485		
Secondary-side parameters	Circulating medium	R1234ze(E)		
	Circulating flow rate	≥12m³/h	≥25m³/h	≥38m³/h
	Number of circulating pumps	1+1 backup		
	Supply liquid pressure	≥0.3MPa		
	Supply liquid temperature	≤45℃		
Primary-side parameters	Circulating medium	Softened water or ethylene glycol		
	Circulating flow rate	≥36m³/h	≥60m³/h	≥90m³/h
	Return liquid pressure	≥0.2MPa		
	Return liquid temperature	≤43℃		

Backup CDU Technical Specifications

Item	Backup CDU parameters
Operating conditions	Primary side inlet/outlet water temperature: 35° C/45° C; terminal return air dry-bulb/wet-bulb temperature: 35° C/21° C
Heat exchanger	100kW
Dimensions (W x D x H)	600 x 1200 x 2000mm
Power supply	AC380V, 50Hz
Primary side inlet and outlet pipe	DN65
End-terminal air conditioner connecting pipe	⌀34.9

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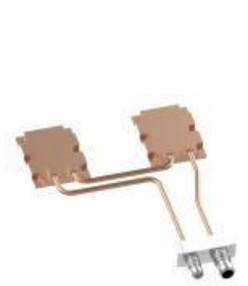
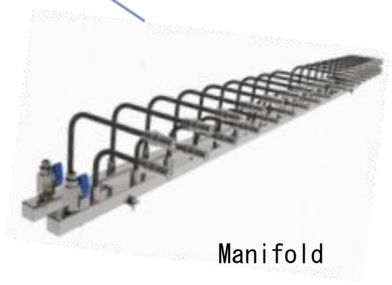
Liquid Cooling Cabinet

Liquid cooling cabinets consist primarily of cabinet enclosures, manifold piping, and power distribution systems. Each liquid-cooled server installed inside the cabinet is connected to the manifold via dedicated liquid-cooling flexible hoses—ensuring optimal thermal dissipation performance.



Liquid cooling plate

Quick connector



Manifold

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Liquid Cooling Cabinet Technical Specifications

Item	Liquid cooling cabinet parameters			
Basic specifications	Model	FitLcs CAB6220A022-A FitLcs CAB6222A022-A FitLcs CAB6225A022-A	FitLcs CAB6220A040-A FitLcs CAB6222A040-A FitLcs CAB6225A040-A	FitLcs CAB6220A048-A FitLcs CAB6222A048-A FitLcs CAB6225A048-A
	Support power	50kW	100kW	200kW
	Width (W)	600mm	600mm	600mm
	Depth (D)	1200mm	1200mm	1200mm
	Height (H)	2000/2200/2500mm	2000/2200/2500mm	2000/2200/2500mm
	Installation space (1U≈44.45mm)	42U/47U/54U	42U/47U/54U	42U/47U/54U
	Cabinet flow	35L/min	62L/min	125L/min
	Cabinet pressure drop	≤150kPa	≤150kPa	≤150kPa
Server	Server specifications	2U/4U	2U/4U	2U/4U
Quick connector	Quick connector specification	≤10kW, VAF06 (Liquid) / VAF09 (Gas) ; ≤20kW, VAF09 (Liquid) / VAF14 (Gas) ;		
	Quick connector pressure drop (single pair)	≤10kPa		
Manifold	Cross-section	DN20 (Liquid) / DN25 (Gas)	DN25 (Liquid) / DN35 (Gas)	DN35 (Liquid) / DN50 (Gas)
	Height	1800/2000/2300	1800/2000/2300	1800/2000/2300
	Manifold pressure drop (single)	≤15kPa		
	Number of branch circuits	20/23/26 (Customization)	20/23/26 (Customization)	20/23/26 (Customization)
PDU	Number of servers	20/23/26 (Customization)	20/23/26 (Customization)	20/23/26 (Customization)
	PDU power supply	380V//3ph/50Hz		
	PDU specifications	4 PDUs; Single 10-hole/12-hole/13-hole (Customization)		

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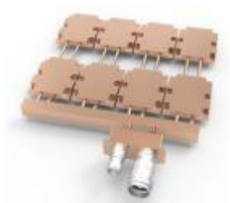
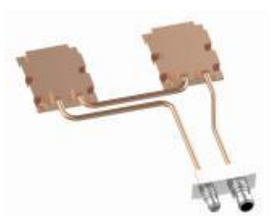
Accessory Technical Specifications





Liquid cooling plate

相变液冷套件		
NO.	Name	Specifications
1	Cold plate material	Copper
2	Pipe material	Copper tube or stainless steel tube
3	Joint material	SUS304 stainless steel
4	Circulating medium	R1234ze(E)
5	Pressure resistance performance	≥2.0MPa
6	Heat transfer thermal resistance	≤0.015℃/W
7	Power per CPU	≥1500W

Manifold

Manifold		
NO.	Name	Specifications
1	Main pipe cross-section	≤50kW, DN20 (Liquid)/DN25 (Gas) ; ≤100kW, DN25 (Liquid)/DN35 (Gas) ; ≤200kW, DN35 (Liquid)/DN50 (Gas) ;
2	Main pipe length	500-2200mm
3	Main pipe material	SUS304 stainless steel
4	Number of channels	10-20 channels optional, customizable
5	Branch interface	Internal thread
6	Pipe pressure rating	≥2.5MPa

Hose+Quick connector		
NO.	Name	Specifications
1	Hose specification	1/4~5/8 optional
2	Hose material	EPDM、PTFE
3	Quick connector specification	DN06, DN09, DN14, DN17 two-phase flow connectors, customizable
4	Quick connector material	Stainless steel

Note: The above parameters are for reference only. For detailed parameters, please contact our technical staff.