GB300 40-Foot Intelligent Computing Data Center Mobile Facility (8+ 3 Models) Solution Document

- Class B Data Center Standard-



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I. Project Design Documentation

1 、 Based on the ultra-high-density AI computing capabilities of the NVIDIA GPU architecture, the solution employs eight GB300 liquid-cooled servers and three additional power-density cabinets rated at 20 kW each;

2 、 Use 4 0-foot standard high cabinet container;

3 、 Based on the spatial layout, provide maximum IT cabinet redundancy; implement N+1 redundant configuration for supporting facilities and redundant key CDU components;

4 、 For a single-side application using a dry cooler, provide an independent single-side CDU;

5. Operating Environment-10 – 40 °C

II. Heat Source Description

1 、 GB300 liquid-cooled server: typical full-load power consumption per rack ≈ 120 kW; under normal mode or light load conditions, actual power consumption typically ranges from 100 kW to 120 kW; for the GB300 server's AI workload at its maximum training model test, the designed maximum total heat output is 150 kW.

2 、 This solution uses the designed peak data as the maximum heat exchange rate; with a design of 8 units per 40-foot container, the total power consumption is 150 kW × 8 = 1.2 MW;

3 . Additionally, three air-cooled cabinets with a power density of 20 kW are installed; their total power consumption is 60 kW;

III. Project Description

Objective of the Proposal: This proposal aims to provide, at the optimal cost, within a 40-foot high cabinet, infrastructure for the stable operation of 8 cabinets/GB300 and 3 cabinets/20 kW high-density computing servers (8 + 3) in an environment ranging from-10 °C to 40 °C; the server hardware itself is not included. To ensure the stable operation of the facility; Overall Layout: A compact single-row horizontal layout is adopted, with N + 1 redundancy.

01. Environmental Adaptation

To ensure that the system operates reliably under all types of outdoor climatic conditions, all equipment, structural materials, and environmental monitoring sensors shall be uniformly designed in accordance with

Basic Industrial Standard (-10 °C to 45 °C)

Conduct model selection to ensure environmental adaptability.

02. Cooling medium requirements

Both the primary side (from the dry cooler to the CDU plate heat exchanger) and the secondary side (from the CDU to the server) use the same circulating medium: a **25% ethylene glycol aqueous solution (freezing point ≤ -10 °C)**. In view of variations in fluid viscosity, the system design flow rate should be increased by approximately 13% relative to that based on deionized water, and the system head should be increased by 20% to ensure effective heat dissipation.

03. Thermal Insulation Design

The overall enclosure of the container incorporates a **100 mm thick high-density insulation layer** to enhance thermal insulation performance. For critical valve components, sensors, and other parts susceptible to low-temperature effects, small heaters are integrated internally or optimized air duct designs are employed to effectively prevent condensation from forming when the equipment is started at low temperatures.

IV. System Workflow Description (Power Supply and Heat Dissipation)

Power Supply Process · Ensuring Sustainable Supply

By adopting a dual power-supply architecture of "grid power + energy storage," a continuous power supply system with millisecond-level switching is established, ensuring zero risk of downtime for core computing hardware.

critical patch:

Grid power connection → enters the energy storage buffer unit → is converted into clean AC power via the PCS (converter) → is dynamically distributed by the precision power distribution cabinet → and directly supplied to all computing power equipment. In the event of a grid power interruption, the system's built-in battery pack will achieve **a delay-free, millisecond-level seamless takeover**, ensuring the continuous and stable operation of computing power services.

Heat Dissipation Process · High-Efficiency Split Cooling

1. Core Heat (approx. 96%) — Liquid-Cooled Primary Loop

To address the high-density heat flux generated by the GPU/CPU, a three-stage liquid cooling solution comprising a cold plate, a cabinet-based CDU, and a dry cooler is adopted. The liquid carries the core heat away through the cold plate and is transported via the main pipeline to the outdoor dry cooler, where it exchanges heat with ambient air, enabling highly efficient heat transfer and serving as the primary heat dissipation mechanism of the system.

2. Secondary Heat Load (approximately 4%) — Air-Cooled Auxiliary Circulation

To address the residual heat generated by the dispersion of IT cabinets, ambient heat, and heat from auxiliary equipment, precision indoor air conditioning is employed for environmental temperature control. The air conditioning system draws hot air from the equipment room, exchanges heat with the outdoor air via the outdoor unit, and then exhausts the air, thereby maintaining a stable overall ambient temperature in the equipment room.

IV. System Workflow Description (Monitoring and Summary)

03 Monitoring Workflow · Full-Domain Intelligent Control

Full-domain sensing · Real-time data acquisition

Sensors deployed throughout the facility collect multidimensional operational data—including electricity, water, temperature, and smoke—in real time, achieving comprehensive coverage without blind spots.

Data Aggregation · Centralized Analysis

All collected data are centrally routed to the power and environmental monitoring cabinet, where built-in algorithms perform real-time diagnostic analysis of the system status.

Automatic Adjustment · Anomaly Alert

Automatically monitor the operating status of equipment; issue early alerts during anomalies and automatically initiate emergency procedures to ensure stable computing power.

Summary of the System's Core Values

Power Supply Assurance: Uninterrupted Power

Establish a stable power supply and distribution system to ensure the continuous, stable, and secure delivery of power to high-density computing equipment.

Heat Dissipation Support: Dual Path

By integrating liquid cooling and air cooling as two independent heat-transfer pathways, it efficiently removes the heat generated during equipment operation and maintains a constant, optimal temperature.

Intelligent Regulation: Self-Safeguarding

The three major processes work in close coordination to form a self-sustaining system with "perception–analysis–action" capabilities, providing comprehensive support for the GPU cluster.

IV. System Workflow Overview (Detailed Architecture of the Liquid Cooling System)

—— System Architecture · Core Components · Key Parameters

1. Overall System Architecture Design

It adopts a mature and reliable two-stage liquid-cooling architecture comprising "cold plate + CDU + outdoor dry cooler." Through independent primary and secondary fluid circuits, it enables efficient heat transfer and exchange. The architecture supports cabinet-level modular deployment and can be flexibly scaled according to computing density, ensuring that a single point of failure does not affect the operation of the overall system, while providing high reliability and maintainability.

2. Analysis of Core Component Functions

•**CDU (Coolant Distribution Unit):** Serving as the "heart" of the liquid-cooling system, it is responsible for the precise distribution of coolant flow and regulation of water temperature, enabling independent temperature control and flow monitoring for different cabinets;

•**Cold plate:** Closely conforms to the server's high-power-consuming core components (CPU/GPU) and rapidly dissipates heat through internal heat channels;

•**Dry cooler/Cooling tower:** Located at the end of the system, it utilizes a natural cooling source to dissipate heat from the circulating fluid into the atmosphere, thereby enabling the recycling and reuse of the cooling medium;

•**Circulation pump unit:** Provides stable power, ensuring that the cooling medium maintains an appropriate flow rate throughout the entire circuit and thereby guarantees heat dissipation efficiency.

3. Key Technical Parameters and Indicators

•**Medium and temperature zone:** High-purity deionized water or a 25% ethylene glycol solution shall be used; the server inlet water temperature shall be maintained at 38–45 °C, and the outlet water temperature shall be ≤48–55 °C;

•**Heat dissipation capacity:** The heat dissipation capacity of a single cabinet can reach up to 150 kW, meeting the thermal requirements of high-density intelligent computing clusters;

•**Energy efficiency metrics:** The PUE can be reduced to below 1.2, significantly outperforming the standards for traditional air-cooled data centers;

•**Safety indicators:** System operating pressure is maintained within 0.2–0.4 MPa; a multi-stage leakage monitoring and protection mechanism is provided to ensure electrical safety.

IV. System Workflow Description (Local Environment)

——— Analysis of Typical Climate Data and Cooling Strategies in Texas

Special Note: Typical Climate Data for Dezhou

- **summer:** Average temperature: 18–25 °C; maximum temperature: 32–35 °C; relative humidity: 70–85%.
- **winter:** Average temperature: 2–6 °C; minimum temperature: –5–8 °C; relative humidity: 80–90% (rainy and humid).

Design Values (commonly Used Standards)

- **temperature range:** -10℃ ~ +40℃ | **Relative humidity:** RH 10–95% | **Wet-bulb temperature:** 28℃

Overall Conclusions and Strategies

Based on the analysis of the aforementioned historical climate data, this solution adopts a combined cooling approach of " **dry cooler + wet cooling pad**." Its heat dissipation capacity is sufficient to meet the entire heat exchange demand of the liquid cooling system, while still providing ample redundancy under extreme operating conditions. Consequently, there is no need for an additional liquid-cooling backup heat-exchange system, which effectively reduces system complexity and cost.

V. Key PUE Indicator

Systematic name	Power dissipation(kW)	Energy consumption share	PUEprice
Core IT server equipment	1306.5	86.0%	-
Liquid cooling heat dissipation system	116.98	7.7%	-
Auxiliary air-cooling system	36.46	2.4%	-
High-and low-voltage electrical systems	44.06	2.9%	-
Low-voltage systems, security, and fire protection	13.67	0.9%	-
Lighting and other miscellaneous items	1.52	0.1%	-
Total energy consumption	1519 2kW	100%	PUE = 1.16

VI. Module Cabinet Parameters

Sequence	Module Name	Quantity	External dimensions (width × depth × height)	Core functional parameters (covering the full operating range from –10 °C to 40 °C)
1	Fire extinguisher cabinet (FIRE)	1 cabinet/2 bottles	600mm × 1200mm × 2200mm	- Design concentration: 9%. - Fire suppression dosage: Based on the net volume of the protected area of 76 m^3, the chemical charge shall be ≥ 46 kg. Storage cylinder: 90 L steel cylinder, operating temperature range from –20 °C to +50 °C, equipped with a pressure gauge and a safety pressure relief device.
2	Precision power distribution cabinet	1 unit	1000mm × 1200mm × 2200mm	Main input: 4000 A/3P,380 V; main circuit + bypass ATS output: 250 A; UPS: 2 × 32 A; air conditioner: 2 × 32 A; CDU: 32 A; etc.; total of 6 monitoring circuits; smart meter; 7-inch touchscreen
3	Rack-mounted CDU	1 unit	1200mm×1200mm×2200mm	Flow rate ≥ 45 m^3/h; inlet/outlet temperatures: 50/40 °C; primary side connected to a dry cooler (37/32 °C); total power consumption: 2,400 kW; responsible for liquid cooling for 8 IT cabinets.
4-7	IT liquid-cooled cabinet	8 units	600mm × 1400mm × 2200mm	Single cabinet power consumption: 150 kW; total power consumption: 1,200 kW; liquid-cooling heat dissipation: 95% of heat; flow rate: 6.5 m^3/h per cabinet; inlet and outlet water temperatures: 40 °C inlet / 50 °C outlet; ΔT = 10 °C; server configuration: GB300 server per cabinet
8-9	Inter-row air conditioning for fluorine pumps	2 units	600mm × 1200mm × 2200mm	Single-unit cooling capacity: 60 kW (cooling mode, 45 °C ambient); total capacity: 120 kW; air delivery rate: 9,000 m^3/h per unit; EC variable-frequency fan Temperature control: 22–25 °C ± 0.5 °C
10	ITcabinet	3 units	600mm × 1200mm × 2200mm	Power consumption per cabinet: 20 kW; total: 60 kW Air-cooled: 6.5 m^3/h per cabinet flow rate Configure server/cabinet
11	Primary air system	1 set (intake and exhaust air)		- Airflow: 500–2,000 m^3/h; - Motor power: 1.5 kW; - Heating section: 5 kW; - Exhaust section: 1.2 kW

VII. Basic Technical Parameters

Key Performance Indicators

product model: LL-Block408

Container internal dimensions: 11850 × 2142 × 2585 mm(L×W×H)

IT Cabinet Configuration: GB300 server cabinets: 8 units + 20 kW across 3 cabinets

Single cabinet supported power: ≤ 1260 kW (high power-density design)

Cabinet physical specifications

External cabinet dimensions: 600 × 1400 × 2200 mm (L×W×H, including liquid collection chamber)

Available IT space: Single cabinet, 47U standard installation space, compatible with mainstream servers

compatibility: Supports the deployment of various standard IT devices, including high-density computing and storage solutions.

Temperature-Controlled Cooling System

Air conditioning configuration: Precision air-cooled split-type air conditioner (600×1200×2200 mm)

Cooling capacity: Single cabinet: 60 kW; total system: 120 kW (two-unit configuration)

Temperature control advantages: Precise temperature control effectively meets the heat dissipation requirements of high-density cabinets and ensures stable equipment operation.

Power Supply, Distribution, and Assurance

architectural design: Dual-input + dual-output redundant architecture enhances power supply reliability

Power supply standard: 380 VAC / 50 Hz (industrial-grade three-phase AC input)

UPSscheme: Deploy a UPS (Uninterruptible Power Supply) to ensure the continuous operation of critical business functions and provide protection against safe power outages.

Comprehensive Intelligent Monitoring

Multi-dimensional terminal: 15.6-inch local display + remote management via web browser/client/App

Comprehensive Perception: Provides end-to-end monitoring covering air conditioning, power distribution, UPS, temperature and humidity, liquid leakage, access control, fire protection interlocking, and other systems.

Smart Features: Battery inspection, 3D visualization, centralized multi-site control and management, GPS positioning, asset and capacity management

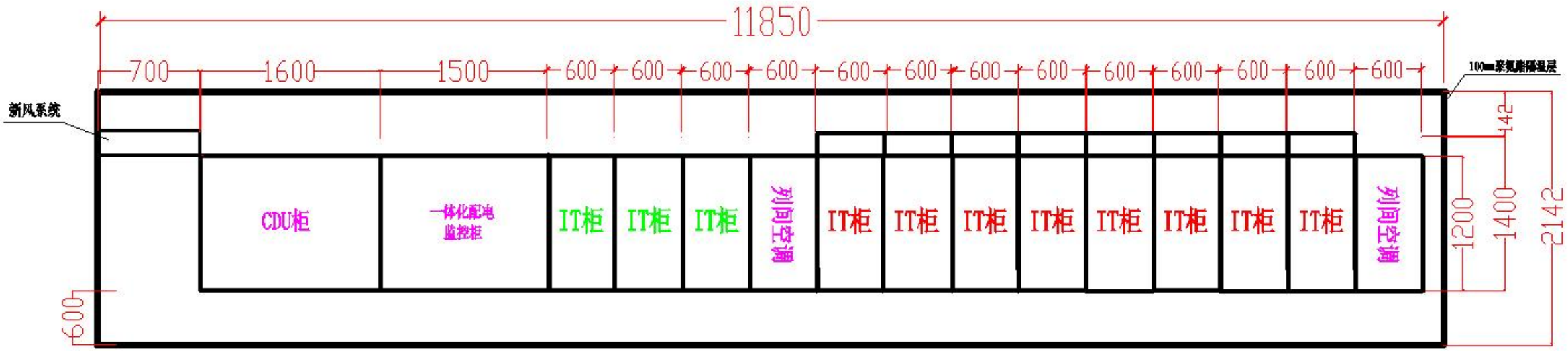
Fire Protection and Safety Systems

Firefighting Plan: Heptafluoropropane automatic fire suppression system: clean gas, no residue, and no damage to IT equipment.

trigger mechanism: Smoke/heat automatic trigger + manual button + fire system interlinked alarm

Supporting features: Post-disaster fresh-air exhaust system; early smoke detection system (optional)

VIII. Top-Down Plan View of the Interior of the IT Cabinet



VIII. Schematic Diagram of Liquid-Cooled Piping

