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GPU Server Operating Temperature and Altitude Limits Guide

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Executive Summary

A GPU server fits a site only when its exact configuration, the altitude-adjusted inlet air condition, the humidity and dew point, and the rate of temperature change are all inside limits that the vendor has documented in writing for that configuration. Published environmental limits, warning thresholds and measured no-throttle capacity are different evidence, and a buyer's file usually mixes all three. This report, written by an independent AI infrastructure engineering advisory (GPU Smith) for procurement engineers, colocation operators and edge-site owners, sets out a worksheet that returns one of three outcomes per configuration: **confirmed**, **outside limit** or **unresolved**.

The worksheet matters because published limits arrive at different scopes. On 15 November 2026 the **NVIDIA DGX B300** user guide listed an inlet air temperature of **10 to 35°C** (docs.nvidia.com), while the same vendor's best-practices deck lists 35°C as a general figure (docs.nvidia.com) but stricter maxima of **30, 25 and 20°C** for altitude rows ending at 1,000, 5,000 and 10,000 feet, all marked as estimated (docs.nvidia.com). The deck also states a maximum supply air temperature of 30°C in its ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) table (docs.nvidia.com). The deck's altitude rows qualify the headline range. A site at 1,800 m (5,906 ft) that peaks at 28°C falls under the 20°C row by plain reading, so it is outside limit on that reading, pending OEM confirmation of the governing row for the configuration.

Where a vendor publishes a linear rule, the arithmetic is simple but the base point is not. The **Dell PowerEdge XE9680** reduces its 35°C ASHRAE A2 maximum by 1°C per 300 m above 900 m (www.dell.com), giving **32.0°C** at 1,800 m. Cisco and HPE print a derating of about 1°C per 305 m beside sea-level ratings (www.cisco.com) (shop.vb.net), which gives 29.1°C if applied from sea level. Lenovo's GB300 NVL72 rack lists a maximum altitude of 1,524 m (pubs.lenovo.com), so 1,800 m is outside its limit before temperature is considered.

Warning thresholds are not headroom. Dell's iDRAC (integrated Dell remote access controller) warning threshold for NVIDIA and AMD GPUs is 38°C (www.dell.com), above the 35°C continuous maximum, and reaching it may cause the GPUs to reduce power (www.dell.com). Bressner lists its Gen4 3U-SDS rugged

server at -10 to 50°C and notes that these temperature ranges may require GPU or CPU throttling (shop.bressner.de).

The recommended disposition is to accept an installation envelope only against a signed OEM (original equipment manufacturer) submittal that names the chassis revision, GPU, CPU, drive, fan and power-supply arrangement, cooling medium, altitude rule and humidity limits. Any open conflict stays unresolved, and tests run only inside the approved envelope.

Introduction and Background

GPU Smith is an independent private AI infrastructure engineering consultancy that advises on enterprise GPU procurement, power and cooling, networking and air-gapped deployments. It does not manufacture servers or sell cooling plant, so this reference is written from a buyer's engineering position: what can be proven from vendor documents before an order is placed, and what must be asked of the vendor. It prescribes no new cooling plant, generic junction-temperature target or universal throttling benchmark.

The practical question is straightforward. A procurement team holds a quote for an eight-GPU air-cooled server, and a site owner holds measured conditions: a summer rack inlet temperature, an elevation, a humidity profile and a cooling-fault plan. The decision is whether the two fit, what must change, and what must be clarified in the contract before the installation envelope is accepted.

Three facts make that harder than reading a brochure. First, the limit applies to the air entering the equipment, not the room setpoint. NVIDIA's DGX B300 safety text warns that in a closed or multi-unit rack the operating ambient may be greater than room ambient (docs.nvidia.com), and Supermicro's manual carries the same caution (www.supermicro.com). Second, altitude lowers air density. NASA describes density as decreasing with altitude (www.grc.nasa.gov), and a constant-speed fan moves a constant volume but a falling mass of air (www.electronics-cooling.com). Vendors respond with derating rules, maximum altitudes and, in some cases, discrete altitude rows. Third, printed ranges depend on configuration. Lenovo states that its SR680a V3 complies with ASHRAE Class A2 only with certain thermal restrictions (pubs.lenovo.com), and Dell publishes a thermal restriction matrix that narrows applicability by processor, GPU and drive arrangement (www.dell.com).

All sources were retrieved on 15 November 2026 unless a document states its own revision.

Definitions: Four Temperatures and Four Kinds of Evidence

Four temperatures that are often confused

A single number such as "35°C" can mean four different measurements. The worksheet records which one each source means.

- **Room setpoint:** the controller target for the room or cold aisle. A Lawrence Berkeley National Laboratory (LBNL) report states that air-cooled IT equipment depends exclusively on intake air temperatures for effective cooling (escholarship.org).
- **Rack inlet:** air at the front of the rack at a defined position, for example approximately two inches in front of the server (www.upsite.com).

- **Equipment inlet:** the value reported by the server's own inlet sensor. Useful for telemetry, but a different measurement from an independent calibrated sensor at the rack.
- **Component temperature:** GPU junction, memory or drive readings, governed by the vendor's thermal design and firmware. They are not an input to a site-fit decision, and this guide sets no junction-temperature target.

ASHRAE treats the equipment air inlet as the reference for compliance. The LBNL report describes sensor placement at the geometric center of the air intake of the top, middle and bottom racked equipment (escholarship.org).

Four kinds of evidence

Table 1 below separates the kinds of statement that appear in vendor and standards documents. The worksheet treats them as different evidence, never as substitutes.

Evidence type	What it states	Example from the sources	Worksheet use
Allowable (continuous operating) limit	Conditions under which the manufacturer designs and tests operation.	A federal energy-program deck defines the allowable envelope as where IT manufacturers test their equipment (www1.eere.energy.gov).	The only basis for "confirmed", and only inside its stated altitude range.
Recommended range	Guidance for reliability and efficiency, not a limit.	NVIDIA's deck lists recommended humidity as 41.9 °F to 60% relative humidity with a 59 °F dew point (docs.nvidia.com).	Context for design reserve; never extends the allowable limit.
Warning threshold	A sensor level at which firmware logs an event or acts.	Dell sets an iDRAC warning threshold of 33°C for Intel GPUs (www.dell.com), below the 35°C A2 maximum, and 38°C for NVIDIA and AMD GPUs (www.dell.com).	Never converted to usable headroom.
Claimed or observed no-throttle capacity	Performance without degradation at a stated temperature, or a measured site result.	Dell states that NVIDIA and AMD configurations support 35°C without performance degradation (www.dell.com); a supplier footnote says its range may require throttling (shop.bressner.de).	A vendor claim is one input. A site result counts only from a test inside the approved envelope.

Table 1 shows why a single column called "max temp" misleads. ASHRAE's position is that occasional short-term excursions into the allowable envelope are generally acceptable while prolonged operation near its extremes can reduce reliability and longevity (cibse.org). That applies to the allowable limit. Warning thresholds sit on a different axis, and a "no performance degradation" statement is a performance claim the vendor must substantiate for the specific configuration. Allowable-range testing is also a statement of functionality, not of reliability (www.ibm.com).

The Configuration Manifest and Source Hierarchy

What the manifest must name

A configuration manifest is a one-page record that ties a purchase line to the documents that govern it. Without one, a range from a different chassis or GPU baseboard can be applied by mistake.

- **Chassis and revision:** vendor, model, form factor, document revision and date. NVIDIA's best-practices deck is Version 1.0 dated 02-27-2026 (docs.nvidia.com). The deck's specification slide is for the B300; confirm with NVIDIA that it applies to the configuration purchased.
- **GPU and processor:** the DGX B300 user guide lists eight NVIDIA B300 Blackwell Ultra GPUs (docs.nvidia.com) and Intel Xeon Platinum 6776P processors. Dell's matrix lists separate rows by GPU board and per-GPU wattage (www.dell.com).
- **Drive and slot arrangement:** Dell restricts its Gaudi3 configuration to eight 2.5-inch NVMe drives (www.dell.com) and excludes certain PCIe slots for the optimized arrangement.
- **Fans and power supplies:** the DGX B300 comes in AC/PDU and DC/busbar versions (docs.nvidia.com). HPE notes that performance may be reduced with a fan fault (shop.vb.net).
- **Cooling medium and interfaces:** air, rear-door heat exchanger or direct liquid cooling, covered below.
- **Firmware and thermal policy:** the version that sets fan curves and warning thresholds. This is rarely in a brochure and must be requested.

The same GPU family can carry different ratings depending on the host. Lenovo's SR675 V3 page caps ambient at 30°C or lower when listed components are installed, including the NVIDIA HGX H100 700 W four-GPU board (pubs.lenovo.com), and at 25°C or lower for specific combinations (pubs.lenovo.com). The H100 board sits in the 30°C list unless it is paired with the AMD EPYC 9174F processor (pubs.lenovo.com), so one board has at least two published ceilings depending on its partner processor.

Source hierarchy

The worksheet ranks sources from most to least authoritative for a specific purchased configuration.

1. **Signed OEM submittal** naming the configuration, altitude, temperature and humidity envelope and the governing manual revision. Only this document resolves conflicts.
2. **Installation or service manual** at a named revision, including thermal restriction matrices. Dell's XE9680 matrix states that ASHRAE A3 and A4 environments are not supported (www.dell.com).
3. **Product data sheet or QuickSpecs** at a dated version. HPE's DL380a Gen12 QuickSpecs says its 3,050 m operating altitude may be limited by the type and number of options installed (shop.vb.net).
4. **Reference architecture or best-practices deck.** NVIDIA's deck marks its specification slides as estimated, with the actual specification possibly differing (docs.nvidia.com).
5. **Marketing page or reseller copy**, useful for discovery only.

Conflict register

A conflict register logs every pair of statements that cannot both be used. The entry below shows how one is recorded.

- **NVIDIA B300 inlet temperature.** The user guide's hardware table lists 10 to 35°C (docs.nvidia.com). Separately, the deck's ASHRAE table marks its A1 row as allowable up to 30 °C for DGX B300 systems (docs.nvidia.com). These figures are published at different scopes, so the buyer needs the vendor to state which governs for the site's altitude.

Altitude and Inlet Temperature: Applying Documented Rules

Unit conversion first

The international foot is exactly 0.3048 m (www.nist.gov), so 900 m is 2,953 ft, 1,524 m is 5,000 ft, 3,048 m is 10,000 ft, and a 1,800 m site is 5,906 ft (5,905.5 ft rounded). Lenovo's GB300 NVL72 page pairs 300 m with "1,000 ft" in its derating rule (pubs.lenovo.com), whereas 300 m is 984 ft, the pairing Dell's XE9680 page uses (www.dell.com). Keep the vendor's original unit in the worksheet, convert once, and ask which unit is binding.

Two kinds of altitude rule

Continuous (linear) rules. The Dell XE9680 documents ASHRAE A2 continuous operation at 10 to 35°C with no direct sunlight (www.dell.com), reduced by 1°C per 300 m above 900 m (www.dell.com), to a maximum operating altitude of 3,048 m (www.dell.com). ASHRAE's table notes derate A1 and A2 allowable dry-bulb temperature at the same rate above 900 m (www.ashrae.org). The general form is:

T_allowed(h) = T_base - k × max(0, h - h_base), valid only within the published altitude range.

For the Dell rule, T_base is 35°C, k is 1°C per 300 m and h_base is 900 m. At 1,800 m that is 35 - (1,800 - 900) / 300 = **32.0°C**. At 2,400 m it is 30.0°C, and at the 3,048 m limit it is 27.8°C. This is a calculation from the environmental rule, conditional on the exact supported configuration and current OEM confirmation. It is not a measured benchmark and not a DGX limit.

Discrete (step) rows. NVIDIA's deck lists maximum operating temperatures of 30°C for 0 to 1,000 ft (docs.nvidia.com), 25°C for 0 to 5,000 ft (docs.nvidia.com) and 20°C for 0 to 10,000 ft (docs.nvidia.com), with a maximum altitude of 3,048 m (10,000 ft) (docs.nvidia.com). These are discrete rows, not a slope. They must not be interpolated, and the 35°C general row on the same slide must not be assumed to apply at any altitude. NVIDIA's DGX H100 design guide uses the same style with a 5 to 20°C band for 5,000 to 10,000 ft (docs.nvidia.com).

The base point problem

Whether a derating starts at sea level or at 900 m changes the answer. Cisco's C885A M8 spec sheet (revision A.14, 12 July 2026) says all temperature ratings are for sea level (www.cisco.com) and gives a derating of 1°C per 304.8 m (www.cisco.com), with no 900 m threshold in the retrieved footnote. HPE's DL380a Gen12 QuickSpecs gives 10 to 35°C at sea level with a derating of 1.0°C per 305 m (shop.vb.net). Lenovo's SR680a V3 uses the 900 m reference (pubs.lenovo.com). A derating without a stated threshold is treated as unresolved and put to the OEM. At the 1,800 m example site the two readings differ by about 2.9°C (29.1°C from sea level versus 32.0°C from 900 m), more than the 2.0°C reserve used below.

Why density matters, and what not to infer

The International Standard Atmosphere density ratio is 0.9075 at 1 km (eaglepubs.erau.edu), 0.8216 at 2 km (eaglepubs.erau.edu) and 0.7421 at 3 km (eaglepubs.erau.edu), from a university aerospace text. These figures describe the atmosphere, not a server. They imply no particular percentage of cooling loss, because

fan control, heat-sink design and firmware differ. NVIDIA's deck states about 2145 CFM of supply air per B300 at sea level (docs.nvidia.com), and its SuperPOD guide says actual airflow requirements can vary with environmental conditions and altitude. Neither gives a conversion, so this report invents none.

Headroom arithmetic

Headroom is the confirmed maximum minus the measured worst-case inlet minus explicitly chosen uncertainty and design reserve. In this hypothetical example, the site is at 1,800 m, the worst-case measured top-of-rack inlet is 28.0°C, the sensor uncertainty is 0.5°C and the buyer's reserve is 2.0°C.

- **Dell rule from 900 m:** 32.0 - 28.0 - 0.5 - 2.0 = **1.5°C** headroom, conditional on the configuration appearing in the matrix.
- **Cisco or HPE rule from sea level:** 29.1 - 28.0 - 0.5 - 2.0 = **-1.4°C**, a failure of the reserve.
- **NVIDIA 20°C row:** 20 - 28.0 - 0.5 - 2.0 = **-10.5°C**. At 1,800 m (5,906 ft) this is the altitude row that applies by plain reading of the deck; the 35°C headline range is not applied at altitude. The outcome stays unresolved until NVIDIA confirms the governing row for the configuration.

The warning threshold plays no part in any of these lines. Dell's 38°C threshold is a sensor event level, not a design margin.

Humidity, Dew Point and Temperature Change

Humidity is a dew-point and non-condensing question

The National Weather Service defines dew point as the temperature to which air must be cooled at constant pressure to reach saturation (www.weather.gov). A limit stated as a maximum dew point is a condensation guard, while relative humidity (RH) depends on temperature. The Dell XE9680 allows 8% RH with a -12°C minimum dew point to 80% RH with a 21°C maximum dew point, non-condensing (www.dell.com), and Lenovo's SR680a V3 lists the same 8% to 80% and 21°C (pubs.lenovo.com). Two systems from one vendor can differ: Supermicro's SYS-821GE-TNHR datasheet gives 8% to 80% (www.supermicro.com) while its AS-8125GS-TNHR datasheet gives 8% to 90% (www.supermicro.com).

An illustration using standard Magnus-formula psychrometric arithmetic (the author's own calculation, not corrected for altitude pressure, and to be checked by a facilities engineer): a 21°C dew point is about 52% RH at a 32°C inlet and about 66% RH at 28°C. At warm inlet temperatures the dew-point ceiling binds well before the 80% RH ceiling, so a blanket "80% RH" statement is not a safe design input.

NVIDIA's B300 user guide hardware table, as retrieved, has no humidity row, and the only qualitative statement is that the site should be clean and dry. The deck's ASHRAE table gives a recommended humidity range. The DGX H100 user guide lists 20% to 80% non-condensing, but that is a different system and is not carried over to the B300. Lenovo's GB300 NVL72 lists 20% to 80% operating humidity (pubs.lenovo.com) with its own transition-rate limit.

Rate of temperature change

Transient limits matter for cooling faults and economizer swings. ASHRAE's 2015 table note limits non-tape equipment to a 20°C change in an hour and no more than 5°C in any 15-minute period (www.ashrae.org). Dell applies a temperature gradient limit to both operation and non-operation (www.dell.com). Cisco states a maximum rate of change of 20°C per hour and adds that the upper operating limit and rate of change may be limited by installed options (www.cisco.com). Lenovo's GB300 NVL72 states 20°C per hour or less (pubs.lenovo.com), and the rugged Bressner server lists 5°C per hour (shop.bressner.de). The worksheet records the hourly figure and any shorter window, and tests a failure-state ramp against the stricter one.

Acclimation

Equipment moved from a cold dock to a warm room needs a stabilization period. IBM's restatement of ASHRAE guidance gives an acclimation period of 1 hour per 20°C of temperature change (www.ibm.com). Edge-site worksheets should list it beside shipping conditions.

Cooling Medium, Rack Airflow and Facility Interfaces

The cooling medium changes which limits apply

A liquid-cooled server still has an air-side limit. Dell's XE9640 guide states that DIMMs, PCIe cards, power supplies and storage remain air cooled with a maximum inlet air temperature of 35°C (www.delltechnologies.com), and that certain configurations may require operating temperatures below 28°C (www.delltechnologies.com). Lenovo's SR780a V3 is direct water cooled with a W45 rack inlet of up to 45°C (pubs.lenovo.com), yet its air-side envelope is still ASHRAE A2. Lenovo's Neptune design note states that for its Silver tier cold plates take up to 80% of system power (lenovopress.lenovo.com), leaving residual heat of about 25 kW per rack for air handlers in its example (lenovopress.lenovo.com).

Rack-scale systems add facility constraints. Lenovo's GB300 NVL72 states ASHRAE A2 compliance (pubs.lenovo.com), a 10 to 35°C range (pubs.lenovo.com) and a maximum altitude of 1,524 m (pubs.lenovo.com). It lists a 2 to 50°C operating water range for the NVLink switch tray (pubs.lenovo.com) and recommends an industrial data center. For the NVIDIA B300 the deck recommends active rear-door heat exchangers (RDHx) for high-density deployments (docs.nvidia.com) and says passive units are not recommended (docs.nvidia.com).

Rear-door and coolant interfaces

Door capacity figures are tied to rating conditions. Vertiv's Liebert DCD datasheet rates capacity at 21°C ambient air, 12°C entering water and 50% RH (www.vertiv.com). Motivair's brochure calculates capacity at 35% RH and 75°F room temperature with 55 to 65°F supply water (www.motivaircorp.com). HPE's door QuickSpecs accommodates facility water temperatures 2°C above the maximum anticipated dew point (www.hpe.com). Whether a given door can serve a given server at the site's altitude and inlet condition is a question for both vendors, answered in the submittal.

Airflow management and recirculation

Air-side limits are met only if the server ingests what the room supplies. NVIDIA's H100 SuperPOD cooling guidance says recirculation artificially increases the supply air temperature at the inlet of the servers (docs.nvidia.com). LBNL's air-management webinar says recirculation air often causes hotspots (datacenters.lbl.gov) and lists a lack of blanking panels as a common cause (datacenters.lbl.gov). The DGX B300 safety text instructs operators to run the system only with chassis covers installed (docs.nvidia.com). A Department of Energy guide gives an example of a 30% increase in server fan speed for an inlet rise from 77°F (www.energy.gov). The worksheet records blanking, containment, door and cover status as observations, not assumptions.

Class H1 and vendor designation

ASHRAE added class H1 for high-density air-cooled equipment, with an allowable range of 15°C to 25°C in its white paper (www.ashrae.org). ASHRAE does not stipulate what makes a system class H1, leaving it to the IT vendor (www.datacenterdynamics.com). Lenovo's SR675 V3 lists H1 as 5°C to 25°C with a derating of 1°C per 500 m above 900 m (pubs.lenovo.com). The white paper and the vendor page state different lower bounds, so the worksheet logs the difference and uses the vendor's value for the vendor's system. ASHRAE also notes that dense servers may be rated to no more than 25°C or 30°C inlet (www.ashrae.org).

Test Plan and Sensor Placement

Principle: test inside the approved envelope

A site test is an acceptance activity, not a stress test. It runs a representative sustained workload at conditions inside the approved envelope, records the result, and stops when any agreed limit is reached. It never deliberately exceeds an approved limit. A pass inside the envelope is evidence of site fit, not permission to operate beyond what the OEM approved.

Sensor-location matrix

- **Rack inlet, top, middle and bottom:** at the geometric center of the air intake of each position (escholarship.org), adding a few sensors per row near the top of racks to capture the maximum (escholarship.org).
- **Distance from the intake:** approximately two inches in front of the server (www.upsite.com).
- **Server inlet telemetry:** the vendor's own sensor, logged in parallel but not used as the sole record.
- **Supply and return:** room or door supply and return, to detect recirculation.
- **Humidity and dew point:** sensors at the same positions wherever the vendor limit is a dew-point figure.
- **Facility water:** only where a liquid interface is in scope, with entering temperature compared against dew point.

Calibration and uncertainty

The Department of Energy guide says monitoring accuracy should be specified, including calibration status (www.energy.gov), and that humidity sensor drift can cause control problems if sensors are not recalibrated (www.energy.gov). A National Institute of Standards and Technology metrology procedure requires a reference thermometer traceable to the SI with an expanded uncertainty under one tenth of the unit under test's smallest division (www.nist.gov). The chosen sensor uncertainty enters the headroom formula as an explicit term.

Procedure

1. Freeze the configuration manifest and record firmware and fan policy.
2. Record rack and room conditions before load: blanking, covers, door and containment status.
3. Run a representative sustained workload to thermal steady state, as agreed with the OEM.
4. Log inlet temperature and dew point at each sensor, plus GPU clocks, power and throttle-reason counters from the vendor's tools.
5. Record the achieved service-level objective (SLO), meaning the throughput or latency the workload must deliver.
6. Stop at any agreed limit and record the condition. Do not extend the test.
7. Repeat at the worst seasonal inlet condition, or at a documented failure state that is inside the approved envelope.

Data Analysis and Evidence

Cross-source operating-envelope worksheet

Table 2 applies the worksheet to published figures for nine configurations. The hypothetical example site is at 1,800 m (5,906 ft) with a worst-case rack inlet of 28.0°C. The outcome column uses three states: confirmed (documented rule inside its range, no open conflict, signed submittal), outside limit (site condition exceeds a documented limit) and unresolved (conflict, missing rule or unconfirmed configuration). No row is confirmed before a submittal exists.

Configuration and source	Allowed range	Altitude rule	Restrictions and notes	Outcome at the example site
NVIDIA DGX B300, user guide	Inlet air 10 to 35°C (docs.nvidia.com)	None on the page	AC/PDU and busbar versions	**Unresolved**: no altitude rule on this page; the deck's altitude rows need OEM confirmation
NVIDIA DGX B300, deck v1.0, specification slide	General 10 to 35°C plus altitude maxima of 30, 25 and 20°C (docs.nvidia.com)	Discrete rows to 10,000 ft	Marked estimated; busbar uses active RDHx	**Unresolved**; outside limit under the 20°C row
NVIDIA DGX B300, deck, environment slide	Max supply air 30°C with ASHRAE A2 (docs.nvidia.com)	Not stated	Airflow stated at sea level	**Unresolved**

Configuration and source	Allowed range	Altitude rule	Restrictions and notes	Outcome at the example site
Dell PowerEdge XE9680, installation and service manual	10 to 35°C, ASHRAE A2 (www.dell.com)	1°C per 300 m above 900 m	A3 and A4 not supported; configuration matrix applies	**Unresolved** pending matrix row; derived 32.0°C
Lenovo SR680a V3, specifications page	A2 with certain thermal restrictions (pubs.lenovo.com)	1°C per 300 m above 900 m (pubs.lenovo.com)	Max altitude 3,050 m (pubs.lenovo.com); restriction list not on page	**Unresolved**; derived 32.0°C
Lenovo SR675 V3, specifications page	30°C or 25°C caps by component (pubs.lenovo.com)	H1 at 1°C per 500 m	H100 board depends on CPU pairing	**Outside limit** if the 25°C cap list applies (28.0°C exceeds 25°C); otherwise unresolved
Cisco UCS C885A M8, spec sheet rev A.14	5 to 35°C at sea level (www.cisco.com)	1°C per 304.8 m	Upper limit may depend on options	**Unresolved**: base point not stated; 29.1°C if from sea level
Lenovo GB300 NVL72, specifications page	10 to 35°C	1°C per 300 m to 1,371 m (pubs.lenovo.com)	Max altitude 1,524 m	**Outside limit**: 1,800 m exceeds max altitude
Bressner Gen4 3U-SDS (rugged, AMD)	-10 to 50°C, 0 to 3,000 m (shop.bressner.de)	Not stated beyond range	Throttling may be required; cooling rated for add-in cards up to 300 W (shop.bressner.de)	**Unresolved**: supplier-specific range; confirm for the configuration

Only two rows give a clean arithmetic rule, and both depend on a configuration the buyer must confirm. The NVIDIA rows show a headline range qualified by altitude rows, with the 20°C row applying to the example site by plain reading and placing it outside limit pending OEM confirmation. The rugged supplier row is a separate product class whose published range is a site-fit question for that supplier and is not carried over to enterprise servers. HPE's DL380a Gen12 QuickSpecs adds that extended ambient ranges apply only to approved hardware configurations (shop.vb.net), and HPE sells configuration-tracking SKUs tied to inlet ambient temperature (cdn.blueally.com), with a GPU cooling kit compatible with processors up to 270 W at 30°C or 350 W at 27°C (cdn.blueally.com).

Derating comparison and headroom

Table 3 compares the arithmetic at 1,800 m using the same worst-case inlet (28.0°C), sensor uncertainty (0.5°C) and reserve (2.0°C) as the headroom example above. All values are calculations from published rules and are conditional on confirmation.

Rule and source	Published form	Base point reading	Derived maximum at 1,800 m	Headroom after uncertainty and reserve	Status
Dell XE9680	35°C minus 1°C per 300 m above 900 m	900 m	32.0°C	1.5°C	Unresolved until OEM confirms the exact row

Rule and source	Published form	Base point reading	Derived maximum at 1,800 m	Headroom after uncertainty and reserve	Status
Lenovo SR680a V3	Same form	900 m	32.0°C	1.5°C	Unresolved pending restriction list
Cisco C885A M8	Sea-level ratings, 1°C per 304.8 m	Sea level, if applied from 0 m	29.1°C	-1.4°C	Unresolved; negative under this reading
HPE DL380a Gen12	35°C at sea level, 1.0°C per 305 m	Sea level, if applied from 0 m	29.1°C	-1.4°C	Unresolved; base point to confirm
NVIDIA B300 deck, 20°C row	Discrete row to 10,000 ft	Not applicable	20.0°C	-10.5°C	Outside limit by plain reading; confirm with OEM
NVIDIA B300 headline range	35°C headline, qualified by the altitude rows	Not applied at altitude	Not applied	Not computed	Unresolved
Lenovo GB300 NVL72	Max altitude 1,524 m	Not applicable	Not available	Not available	Outside limit

At 1,800 m the 20°C altitude row gives headroom of -10.5°C. The 35°C headline range is not applied at altitude, so no positive headroom is claimed for it. A buyer who relies on a headline figure without its altitude qualification carries a risk the vendor has not accepted. The resolution is an OEM-approved submittal that names the governing row for the configuration.

Patterns across the sources

Across the sources reviewed, four patterns recur.

- **Single-class envelopes.** Dell's XE9680 and XE9680L state that A3 and A4 are not supported (www.delltechnologies.com), and Lenovo's SR665 page says a server configured with GPUs and other listed components must not be run in the A3 or A4 classes (pubs.lenovo.com).
- **A2 headline at sea level.** Supermicro's datasheet (www.supermicro.com), Gigabyte's product page (www.gigabyte.com) and Dell's XE8640 guide, which states that all configurations support 35°C without performance degradation (www.delltechnologies.com), give 35°C as an upper bound. The Supermicro datasheet and manual and the Gigabyte page, as retrieved, give no altitude rule.
- **Altitude limits differ by product.** Dell's XE9680L gives 3,050 m (10,006 ft) (www.delltechnologies.com) where the XE9680 gives 3,048 m (www.dell.com).
- **Class steepness varies.** Dell's R760xa applies 1°C per 175 m for A3 (www.delltechnologies.com), restricts GPUs in A3 and A4 to named models (www.delltechnologies.com), and allows 30°C for a high-wattage GPU and processor combination in A2 (www.delltechnologies.com).

The headline range tells a buyer where to look, and the configuration-specific table tells the buyer whether the order is covered.

Implications and Future Directions

For procurement

Procurement should treat the environmental submittal as a deliverable on the same footing as price and delivery. The bid should require the OEM to state, for the named configuration, the governing document and revision, the altitude rule and unit, the humidity and dew-point limits, the transient limit and the behavior on a fan or cooling fault. Where vendor documents conflict, as the NVIDIA B300 documents do, the contract should name which governs. Because the deck marks its specifications as estimated, a request for a final written figure is reasonable.

For site owners and colocation operators

Operators should publish the worst-case measured rack inlet at each location, with sensor positions and calibration status, as part of the site datasheet. The Department of Energy guide recommends temperature and humidity sensors at the IT equipment air inlet (www.energy.gov). Edge sites should add failure-state data, since a configuration that fits at nominal airflow may not fit during a fan fault.

Change and retest triggers

Reopen the worksheet when any of the following changes.

- **Hardware:** a different GPU baseboard, processor, drive arrangement, fan module or power-supply version.
- **Firmware:** a version that changes fan curves or warning thresholds.
- **Documents:** a new revision of the governing manual, matrix or best-practices deck.
- **Site:** a new rack position, containment or door, a change in elevation, or a new seasonal peak.
- **Cooling interface:** a change in coolant temperature or door type.

Future directions

Vendors are moving toward liquid interfaces and rack-scale systems, and environmental limits are moving with them. ASHRAE's liquid-cooling guidance requires full performance across a water class (www.ashrae.org), yet air-side limits remain, as the XE9640 and SR780a V3 examples show. Altitude limits may vary further, since Lenovo's rack-scale page lists 1,524 m where its air-cooled HGX servers list 3,050 m (pubs.lenovo.com).

Frequently Asked Questions (FAQs)

What is the GPU server inlet temperature limit?

It depends on the exact configuration and altitude. Air-cooled eight-GPU servers commonly list 10 to 35°C at sea level, for example Supermicro (www.supermicro.com) and Dell. NVIDIA's DGX B300 documents carry 35°C in one place (docs.nvidia.com) and altitude maxima as low as 20°C in another. Without a signed submittal the answer for a given purchase is unresolved.

What is the GPU server maximum operating altitude?

Many air-cooled servers list 3,048 m or 3,050 m, including Dell and Lenovo (pubs.lenovo.com). Rack-scale systems can differ: Lenovo's GB300 NVL72 lists 1,524 m (pubs.lenovo.com). HPE notes that its 3,050 m may be limited by installed options.

How does server altitude derating of inlet temperature work?

Many vendors reduce the maximum inlet temperature by 1°C per 300 m above 900 m, as Dell does (www.dell.com). Others publish a sea-level rating with a per-305 m derating. NVIDIA's deck uses discrete rows instead. Use only the rule the vendor publishes, within its altitude range. The same logic holds at facility scale: the limit applies to the air the server ingests, so derating is judged at the rack inlet rather than at the room level.

Does ASHRAE A2 apply to GPU servers?

Many GPU servers state A2 compliance, often with configuration restrictions (pubs.lenovo.com). ASHRAE A2 allows 10 to 35°C (www.energy.gov) and a 21°C maximum dew point on the vendor pages reviewed (pubs.lenovo.com). Dell's XE9680 states that A3 and A4 are not supported. A class is a vendor claim for a configuration, not a site property.

What belongs on a GPU server site requirements checklist?

- **Configuration manifest** and governing document revision.
- **Altitude and unit**, with the derating rule and base point.
- **Worst-case rack inlet** at top, middle and bottom positions (escholarship.org).
- **Humidity and dew point** limits at the operating temperature.
- **Rate of temperature change** for normal and failure states (www.ashrae.org).
- **Airflow management:** blanking, covers and containment.
- **Cooling interface** requirements, including dew-point margins for doors (www.hpe.com).
- **Sensor calibration** and uncertainty (www.energy.gov).
- **Site compliance** against the equipment's operating requirements, as NVIDIA's deck site assessment asks.

Can you run GPU servers in a hot room?

Only inside the documented envelope for the exact configuration. A room can be hot while the inlet is within limits, and the reverse is possible because the rack environment may be greater than room ambient. Warning thresholds above the continuous maximum, such as Dell's 38°C threshold, are not permission to run hotter.

What are the GPU server environmental specifications beyond temperature?

Humidity and dew point, rate of change (www.dell.com), maximum altitude, air cleanliness and cooling-medium interfaces. NVIDIA's deck also asks for MERV 13 or better filtration (docs.nvidia.com), which should be confirmed in the submittal.

Conclusion

Whether a GPU server fits a site is answered per configuration, with the altitude-adjusted inlet condition, the humidity and dew-point limits and the transient limits all documented by the OEM for that configuration. The sources reviewed show many air-cooled GPU servers sharing a headline 10 to 35°C range, with rules that differ by base point, unit, class and component. NVIDIA's B300 documents give a 35°C headline range qualified by altitude rows down to 20°C, and the Dell XE9680 yields 32.0°C at 1,800 m only if the configuration is supported.

Allowable limits, warning thresholds and measured no-throttle capacity are different evidence. The worksheet records each separately, converts units once, applies only documented rules within their stated range, and returns unresolved when a conflict remains. The acceptable resolution is a written, OEM-approved submittal for the named configuration, a test inside the approved envelope and a defined set of retest triggers. A buyer who accepts the installation envelope on those terms holds evidence of fit. A buyer who selects the most permissive brochure number holds a hypothesis.

Source links

Links cited in this article, in order of first appearance. Full addresses are provided for readers using extracted text.

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