



Rear-Door Heat Exchangers for GPU Racks in Legacy Halls

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The short answer

A legacy air-cooled hall with a chilled-water plant can host air-cooled GPU racks well above its design density by bolting rear-door heat exchangers (RDHx) onto them. Three numbers set the ceiling, not the brochure: the airflow the servers push through the coil, the water temperature and flow you can deliver, and the room dew point. Vendors rate active chilled-water doors at 70 to 80 kW under stated conditions, passive doors far lower, and some doors at 120 to 200 kW without published conditions. Rack-scale liquid-cooled systems such as GB300 NVL72, which Schneider Electric puts at "over 140 kW per rack" ([Schneider Electric blog, Nov 2025](#)), are out of reach for any door and need direct-to-chip liquid cooling. Below is how to check a door against a real GPU rack before buying one.

What an RDHx is and what it is not

An RDHx is a water (or refrigerant) coil in place of the rack's rear door: server exhaust passes through it, heat moves into the fluid, and air leaves near room temperature. Schneider Electric describes it as a "bolt on solution" that "resembles a large, high-tech radiator," usable for air-cooled servers in a data center that already has an outdoor chilled water system ([Schneider Electric blog, Nov 2025](#)). The servers are unchanged.

Three variants matter:

- **Passive.** No fans in the door; server fans push air through the coil. The USystems ColdLogik CL21 Smart Passive datasheet states plainly that its "performance is entirely dependent on the active equipment inside the cabinet, and the available static pressure" ([USystems CL21 datasheet](#)).
- **Active (fan-assisted).** EC fans in the door overcome the coil's pressure drop. Motivair's ChilledDoor carries "up to 5 hot swappable centrifugal fans" and a PLC that tracks server air, room and entering water temperatures ([Motivair ChilledDoor brochure](#)).

- **Two-phase refrigerant.** OptiCool's door uses a "proprietary two-phase refrigerant design" rather than water in the coil ([OptiCool press release, Sep 8, 2025](#)).

What an RDHx does not do: it does not cool chips better than the server's own heat sinks at a given inlet temperature, it does not take server fan power off your UPS, and it does not help liquid-only servers. Room airflow still matters for everything not behind a door; see [containment strategies](#).

Capacity ratings are conditions, not constants

Every rating below is a vendor claim. The ones worth using state the air and water conditions behind them.

Product (vendor claim)	Type	Rated capacity	Stated conditions
USystems ColdLogik CL21 Smart Passive (datasheet)	Passive	7 to 29 kW	40°C air onto coil, 14°C water in, 20°C water out, 1,000 to 6,000 m³/h (589 to 3,531 cfm)
Same, warmer room	Passive	5 to 22 kW	35°C air onto coil, same water, same airflow range
Lenovo Rear Door Heat eXchanger V2 (Lenovo docs)	Server-fan driven	30 to 40 kW load, % removal varies	27°C inlet air, 18°C ±1°C water (ASHRAE Class 1), 22.7 to 56.8 L/min
Motivair ChilledDoor M4 to M16 (brochure)	Active	12, 30, 45, 55, 65, 70 or 75 kW nominal by model	"Calculated at 35% RH and 75F Room Temp; Supply Temperature Range 55F - 65F water; 100% water"; 0 to 23 GPM
Vertiv Liebert DCD, 80 kW (Vertiv 360AI 1X80)	Passive door plus active fan module	80 kW	44.4°C air in, 25.8°C air out, 50% RH, 20°C water in, 28°C water out
OptiCool 120 kW RDHx (press release)	Two-phase refrigerant	"up to 120kW per rack"	None stated in the release
ColdLogik RDHx (DCD, Jan 31, 2026)	Active	"up to 200kW of heat per rack"	None stated; sponsored article by a Legrand author

Three things stand out. The Motivair line spans 12 to 75 kW by model, and only the largest reach 75 kW, at 55 to 65°F (12.8 to 18.3°C) supply water; Motivair's [product page](#) also says "up to 75kW" (checked 2026-10-28), while Schneider's blog quotes "up to 72 kW per rack." The passive CL21 loses about a quarter of its capacity when air onto the coil drops from 40°C to 35°C (29 to 22 kW at 6,000 m³/h), because a smaller air-to-water temperature difference moves less heat; hot GPU exhaust helps a door. And the 120 kW and 200 kW claims come without water temperature, airflow or fan power: ask for a performance table at your conditions before planning on them.

The heat balance: check any door with two equations

The same steady-state energy balance applies on both sides of the coil:

$$Q = \dot{m} \times c_p \times \Delta T$$

- Air side: $\dot{m}_{\text{air}}$ is mass flow in kg/s (volumetric flow $\times$ density), $c_p \approx 1.006 \text{ kJ/(kg}\cdot\text{K)}$, ΔT is air temperature drop across the coil.
- Water side: $\dot{m}_{\text{water}}$ in kg/s (1 L/s $\approx$ 1 kg/s), $c_p \approx 4.186 \text{ kJ/(kg}\cdot\text{K)}$, ΔT is water temperature rise.

Assumed air density: about 1.13 kg/m³ at 40°C and 1.17 to 1.18 kg/m³ near room temperature (textbook values).

Sanity check 1: CL21 at 29 kW. 6,000 m³/h is 1.667 m³/s; $\times 1.13 \text{ kg/m}^3 = 1.88 \text{ kg/s}$ of air. $\Delta T_{\text{air}} = 29 / (1.88 \times 1.006) = 15.3 \text{ K}$, so air leaves at about $40 - 15.3 = 24.7^\circ\text{C}$, close to a typical room. Water: $29 / (4.186 \times 6 \text{ K}) = 1.155 \text{ kg/s} = 4.16 \text{ m}^3/\text{h}$. The datasheet lists 4.2 m³/h. The table is internally consistent.

Sanity check 2: Vertiv DCD at 80 kW. $\Delta T_{\text{air}} = 44.4 - 25.8 = 18.6 \text{ K}$. $\dot{m}_{\text{air}} = 80 / (1.006 \times 18.6) = 4.28 \text{ kg/s}$, about 3.65 m³/s or roughly 7,700 cfm. Water: $80 / (4.186 \times 8 \text{ K}) = 2.39 \text{ kg/s}$, about 143 L/min or 38 US gpm. That airflow is why the 80 kW configuration adds an active fan module.

Worked GPU example (hypothetical rack). NVIDIA rates the air-cooled DGX B200 at " $\sim 14.3 \text{ kW max}$ " in 10 RU ([NVIDIA DGX B200](#)); the DGX B200 user guide lists airflow of 1,550 CFM and a maximum weight of 142.4 kg ([DGX B200 User Guide](#)). Assumption: maximum power and listed airflow coincide, which is a conservative simplification; real airflow varies with fan control and inlet temperature.

Per node, air side:

1. $1,550 \text{ cfm} \div 2,118.9 = 0.732 \text{ m}^3/\text{s}$.
2. $\times 1.18 \text{ kg/m}^3$ (25°C inlet) = 0.863 kg/s.
3. $\Delta T_{\text{air}} = 14.3 / (0.863 \times 1.006) = 16.5 \text{ K}$.
4. With a 25°C inlet, exhaust onto the coil is about 41.5°C.

Rack of four nodes: $4 \times 14.3 = 57.2 \text{ kW}$ and $4 \times 1,550 = 6,200 \text{ cfm}$ (about 10,530 m³/h).

Passive door test (CL21 table, 40°C air on). The table tops out at 6,000 m³/h. One node (about 2,630 m³/h) interpolates to roughly 15.5 kW of door capacity, just above 14.3 kW. Two nodes (about 5,270 m³/h) interpolate to roughly 26 kW against 28.6 kW of load, so a passive door of this class is at or past its limit with two DGX-class nodes, before accounting for the extra 40 to 55 Pa of coil pressure drop the server fans must overcome at those flows. Four nodes is off the table entirely.

Active door test (Motivair M16, 75 kW nominal, 0 to 23 GPM).

1. $23 \text{ GPM} \times 3.785 / 60 = 1.45 \text{ L/s} \approx 1.45 \text{ kg/s}$.
2. Water ΔT at 57.2 kW = $57.2 / (1.45 \times 4.186) = 9.4 \text{ K}$.
3. At 60°F (15.6°C) supply, return is about 25°C.
4. If your loop is designed for an 8 K rise, the rack needs $57.2 / (4.186 \times 8) = 1.71 \text{ kg/s}$, about 102 L/min or 27 gpm, more than the 23 GPM ceiling in the brochure. Either accept a wider ΔT or pick a door and valve sized for it.

Result: four DGX B200-class nodes (57 kW) fit inside an active 70 to 80 kW door's vendor rating if you can deliver about 23 to 27 gpm per rack at 13 to 18°C. A fifth node (71.5 kW) uses almost all the margin. Weight is the other limit: four nodes at 142.4 kg is 570 kg before the rack, PDUs and a door that Vertiv lists at 160 kg

(353 lb) for the DCD80.

Which GPU racks fit

- **Fits an active door:** air-cooled 8-GPU HGX/DGX-class servers at three to four per rack, PCIe GPU servers (L40S, H100 PCIe class), and the "mid-density" inference racks for which Schneider says air-cooled solutions "can support densities up to 72 kW per rack" ([Schneider Electric blog](#)).
- **Marginal:** five DGX-class nodes (71.5 kW), or any rack whose server airflow exceeds the door's rated airflow.
- **Does not fit:** GB200 NVL72, which NVIDIA describes as a "rack-scale, liquid-cooled design" with 36 Grace CPUs and 72 Blackwell GPUs at "approximately 120kW" per rack ([NVIDIA GB200 NVL72, DGX GB200 user guide](#)), and GB300 NVL72, described as "a fully liquid-cooled, rack-scale architecture" ([NVIDIA GB300 NVL72](#)). A door can only take their residual air heat.

Water side requirements

Loop isolation. Schneider recommends a liquid-to-liquid coolant distribution unit (CDU), in-rack or serving multiple racks, which "creates isolated liquid loops": a primary loop on facility chilled water and a secondary loop circulating to the doors. Vertiv notes the DCD "can be supplied by either the existing chilled water system or by a coolant distribution unit." A CDU also gives one point to hold supply temperature above dew point.

Temperature class. ASHRAE TC9.9 renamed its liquid cooling classes by upper supply temperature limit: W17 (previously W1), W27 (W2), W32 (W3), W40 (new), W45 (W4) and W+ (W5), all with a 2°C lower limit ([ASHRAE TC9.9 white paper, 2021](#)). The door ratings above sit in W17 to W27 territory: Motivair at 12.8 to 18.3°C, CL21 at 14°C, Lenovo at 18 or 22°C, Vertiv at 20°C. Warmer water widens free-cooling hours but cuts capacity, because it shrinks the air-to-water gap; Schneider's claim that RDHx "can also use warmer inlet water temperatures" needs a derating table behind it.

Flow and pressure. Size piping, valves and pumps for the per-rack flow from the heat balance (27 gpm per 57 kW rack at 8 K rise) plus coil pressure drop (CL21: 18 to 30 kPa at its upper flows).

Condensation and dew point

A coil colder than the room's dew point condenses water behind a rack of power supplies. The fix is keeping supply water above dew point at all times.

- Lenovo's door specification lists the water temperature requirement as "Above dew point." It allows a given supply temperature only "if the system that is supplying the water is able to measure the room dew point and automatically adjust the water temperature accordingly"; otherwise "the water temperature must be above the maximum dew point that is allowed at that data center installation" ([Lenovo docs](#)).
- Motivair says the ChilledDoor "operates above the ambient dew point"; Vertiv describes a "Non-condensing heat exchanger."

- ASHRAE's recommended envelope tops out at a dew point of 15°C (59°F) ([ASHRAE TC9.9 white paper](#)).

Check the vendors' own rating points (dew points computed with the Magnus approximation; derived, not vendor figures):

Rating point	Room condition	Room dew point	Supply water	Margin
Motivair	75°F (23.9°C), 35% RH	about 7.5°C	12.8 to 18.3°C	about 5 to 11 K
Vertiv DCD80	25.8°C, 50% RH	about 14.6°C	20°C	about 5.4 K
CL21	not stated	n/a	14°C	below ASHRAE's 15°C max dew point

The last row is the trap: 14°C water is fine in a dry hall but below dew point if the room drifts to ASHRAE's recommended maximum. Either hold humidity well under that limit or let a CDU raise supply temperature with dew point and accept the capacity loss. Add leak detection at every door.

Stranded capacity: the real reason to retrofit

Legacy halls usually run out of cooling before power or floor. ASHRAE notes that best-of-breed raised floors deliver about 1,900 cfm per tile, while airflow for a 40 to 50 kW rack "could be up to 5000 cfm," and that "many data centers ... gradually depopulate IT equipment as they refresh their racks to fit within legacy power or cooling levels." The four-node example needs 6,200 cfm, over three best-case tiles.

With doors, exhaust leaves near room temperature, so CRAH units no longer absorb it and stranded UPS and floor capacity becomes usable. The one published retrofit figure we found is vendor-authored: at the University of Cambridge's West Cambridge Data Centre, ColdLogik doors were part of a hybrid strategy that raised cabinet density "from approximately 30kW to 44kW per rack" and hall capacity "from 900kW to 1.2MW" ([DCD, sponsored by Legrand](#)). That is a 33% hall uplift, possible only with electrical headroom.

Hybrid: RDHx plus direct-to-chip

Cold plates take most of the heat; memory, power supplies, NICs and drives still reject heat to air. A rear door can take that residual, and this is not new: ASHRAE cites TACC's Frontera, whose nodes have "CPUs, direct liquid cooled, and rest of the system air cooled with a rear door heat exchanger (RDHX) in the rack." Motivair markets an "Air-Assisted Liquid Cooling" mode that integrates a water loop for DLC servers with the door ([Motivair ChilledDoor brochure](#)).

How big is the residual at the top end? Schneider's Helios reference design with AMD targets racks "up to 246 kW per rack" with a liquid-first architecture where "84% of heat removed via liquid, 16% via air" ([Schneider Electric blog, Aug 5, 2026](#)). $246 \times 0.16 = 39$ kW of air-side heat per rack, a load inside the active door ratings above. But 246 kW is the rack, not a door rating, and the Helios material we reviewed does not specify a rear door for that air fraction.

The cold-plate side of a hybrid rack has its own acceptance tests; see [cold-plate commissioning](#).

Efficiency claims, read carefully

- Schneider: "Traditional air cooling is 30-60% less efficient than cooling with an RDHx." Vendor claim, no baseline given.
- Motivair: data center efficiencies "can be increased by up to 90%." Vendor claim, no method given.
- ASHRAE (vendor-neutral): server fan power of "10% to 20% is not uncommon for some of the denser servers"; "In a 50 kW rack, the fan power translates to be at least 5 kW," and raising fan share from 2% to 10% "equates to reducing the data center UPS capacity by 8%."

The ASHRAE point cuts against RDHx long term: server fans still run on your UPS. On the four-node example, 10 to 20% fan share is 5.7 to 11.4 kW of UPS capacity spent on air movement inside the servers, which direct-to-chip cooling would largely recover.

Retrofit checklist

1. **Heat balance per rack:** kW, server airflow and exhaust temperature against the door's table at your water temperature.
2. **Water:** plant capacity, supply temperature, CDU or direct feed, per-rack flow and pressure drop, water quality.
3. **Dew point:** room humidity control, dew-point-tracking supply temperature, alarm thresholds.
4. **Structure:** rack plus servers plus wet door weight (CL21 wet weight 87.8 to 125.4 kg; Vertiv DCD80 160 kg); see [rack floor loading](#).
5. **Clearance:** door depth (CL21 198 mm) and swing (Motivair 95°, Vertiv 135°) against aisle width; ASHRAE notes aisle pitches "may need to accommodate additional spacing for RDHXs."
6. **Hoses:** top or bottom feed, quick connects, routing, leak detection under each rack.
7. **Power and controls:** door fan power (up to 3,000 W max on Motivair's M14-6), A/B supplies, fan-failure behaviour.
8. **Commissioning:** load test at design water temperature, logging air-off temperature and dew point.

When RDHx is the wrong answer

- **Racks designed for liquid:** NVL72-class systems and anything else that ships only with cold plates.
- **Air-cooled racks above about 70 to 80 kW:** beyond the conditioned ratings we could verify; 120 to 200 kW claims lack published conditions.
- **No chilled water:** Schneider points to a heat dissipation unit (HDU, "up to 150 KW per rack") for liquid-cooled servers, which rejects heat into the room and "does put an extra burden on the data center's air-cooling system."
- **Humid halls without dew point control.**

Decision table

Per-rack load (air-cooled IT)	Chilled water available	Practical choice
Up to about 20 kW	Either	Containment and existing CRAH; passive door if hot spots
About 20 to 30 kW	Yes	Passive or active RDHx; check server fan static pressure
About 30 to 75 kW	Yes	Active RDHx with CDU and dew-point control
About 30 to 75 kW	No	Bring water to the row first; a door needs a water source
Above about 75 to 80 kW, or liquid-only servers	Yes	Direct-to-chip; RDHx only for the residual air fraction

Thresholds are heuristics derived from the ratings above, not standards. For the wider architecture choice see [GPU data center cooling design](#). GPU Smith helps teams run this kind of per-rack heat and water balance before committing to a door or a CDU.

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Source links

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