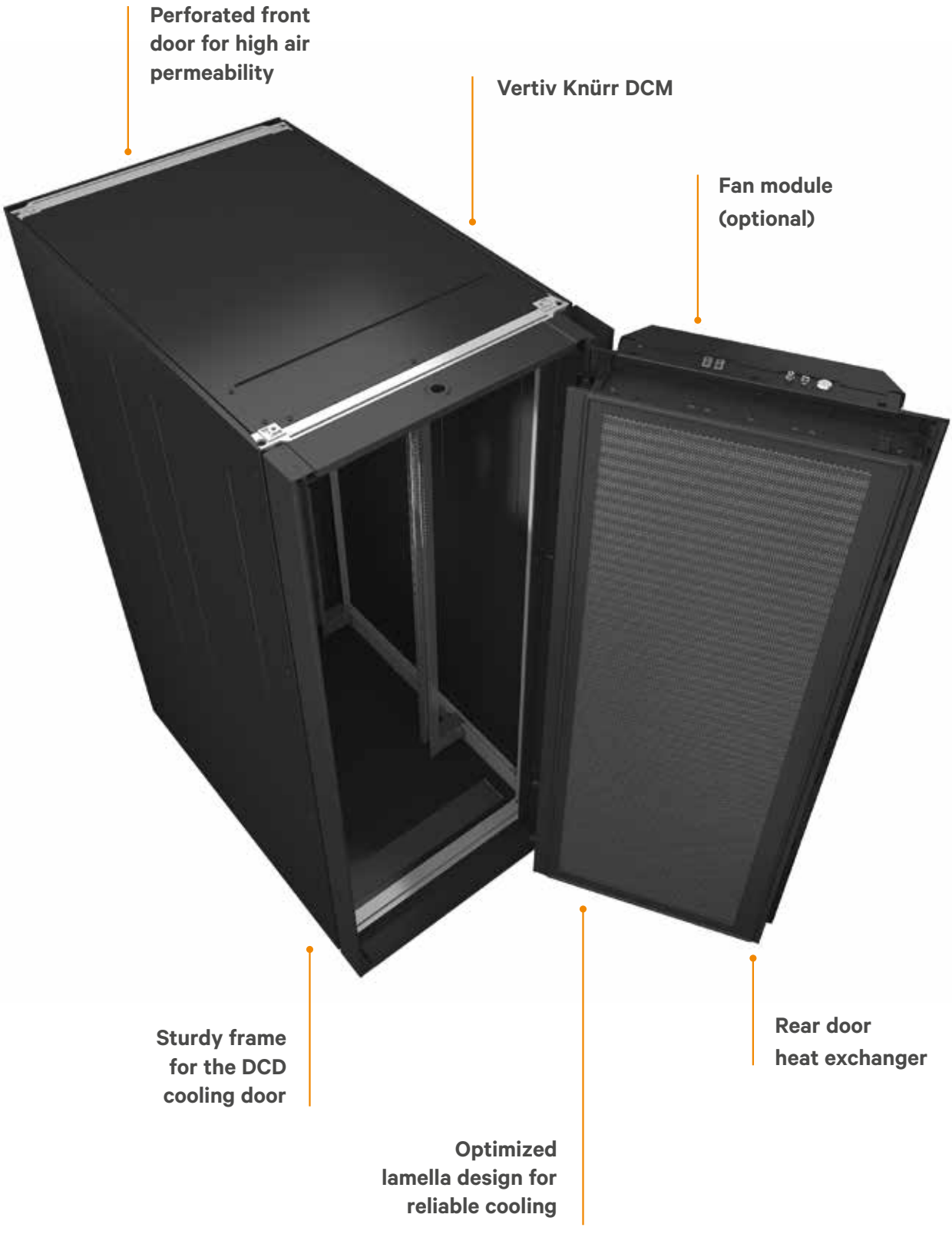
Vertiv™ Knürr® DCD Cooling Door

Cooling door for maximum energy efficiency: up to 50 kW IT cooling


Perforated front door for high air permeability
Vertiv Knürr DCM
Fan module (optional)
Sturdy frame for the DCD cooling door
Optimized lamella design for reliable cooling
Rear door heat exchanger

WHY COOLING DOORS?

Previously, heat loads of ten kW and more per server rack were found mainly in data centres for scientific computing tasks in research and development facilities for evaluating vast volumes of data from particle accelerators, for example, or simulations. In the meantime, above all co-location, telecommunication and cloud providers are upgrading their data centres with high-performance servers and new IT components. **The reason for this are trends like hyperconverged IT, cloud computing, big data, artificial intelligence, M2M, and IoT, as well as the turbo growth of mobile data volumes.** Whereas traditional cooling solutions were adequate for commercial data centres with heat loads of less than ten to twelve kW per cabinet, today's high-performance data centres require new cooling concepts that address higher heat loads better and more efficiently.

AIR-WATER HEAT EXCHANGERS IN RACK DOORS SAVE SPACE AND ENERGY

The cooling effect kicks in when the warm air flows through the heat exchanger in the rear door of the server cabinet. **The heat from the data centre is dissipated via chilled-water piping and ideally fed into a heat recovery system outside the server zone.** In this way the data centre is kept cool enough without the need for fans or warm/cold aisle containment. Extensive tests have shown that because of the very low counter-pressure of the cooling doors the fans in the servers consume negligibly more power than without cooling doors.

ONLY ONE REQUIREMENT: CHILLED WATER IS NEEDED

Thanks to the large surface area of the Vertiv Knürr DCD Cooling Door the installation can be operated with an overall relatively high chilled-water temperature, which permits a very high level of free cooling. **If chilled water is available from regenerative sources like ground water or lakes, the efficiency of the cooling is enhanced even more.** Lake Geneva, for example, provides the chilled water for the EPFL data centre in Lausanne. The University of Constance takes its water from Lake Constance and in Munich the facilities draw on the massive local aquifers.

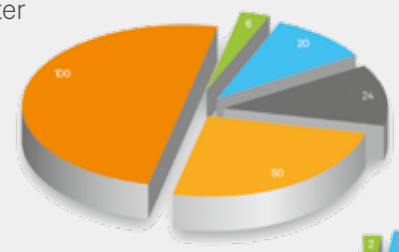
THE COOLING DOOR FOR HIGHEST ENERGY EFFICIENCY

IMPROVING THE PUE (POWER USAGE EFFECTIVENESS) FROM 2.0 TO 1.2

The combination of very low loss of air and water pressure with the largest possible surface area and a highly efficient supply of chilled water results in partial PUE values for the cooling of less than 1.2. The use of infrastructure fans is omitted.

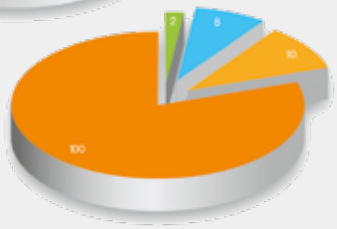
Traditional data center

PUE = 2



Vertiv Knürr DCD Cooling Door

PUE = 1,2



Lighting
Electrical losses
Air circulation
Cooling
IT equipment

PLATFORM DESIGN FOR ALL IT CABINETS

- Standard heights of 2,000 and 2,200 mm (42/47U)
- Standard widths of 600, 700 and 800 mm (DCD50 for width 800mm only)
- Cooling water connection possible via floor or lid.
- Combination of Vertiv™ Knürr® DCD Cooling Door with server racks from other manufacturers. Vertiv Knürr DCD Cooling Door allows you to upgrade existing active server racks of any manufacturer in a climate-friendly way, so you can retrofit modern high performance servers or replace them.

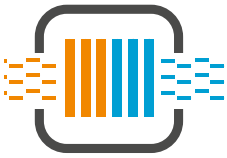
BENEFITS AND FLEXIBILITY OF THE VERTIV KNÜRR DCD COOLING DOOR

Fail-safe and robust

- Vertiv Knürr DCD Cooling Doors are extremely robust because they need neither electrical connection nor network interface. This ensures high fault tolerance and availability, which is of paramount importance to providers in the colocation, cloud and telecommunication sector.

Sustainable because retrofittable to existing racks

- The Vertiv Knürr DCD Cooling Door can be combined with the server racks of various manufacturers and can also be retrofitted to all standard 19-inch and Open Compute racks.

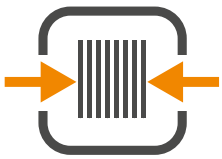


High free cooling rates and adiabatic cooling possible

- Thanks to the large surface area of the register of the Vertiv Knürr DCD Cooling Door the installation can be operated with an overall relatively high chilled-water temperature, which permits a very high level of free cooling. In the case of great heat loss and associated increase in room temperature, the temperature of the chilled water flowing to the door through the chiller can be lowered by one or two degrees.

Cost-effective through low energy requirement

- The total energy requirement for cooling the cabinet is extremely low - in the per mille range per cabinet. For standard applications with 15 kW the cooling portion is about 25 Watt. As an example: Taking the electricity consumption of three baking ovens on at full power, the portion of the cooling for that total energy requirement would be roughly that for the lighting of the ovens.



Space and cost savings

- Since the air circulation is provided only by the server fan, the data centre remains sufficiently cool without the need for fans or warm/cold aisle containment. Other active components that would consume additional energy are not necessary. Extensive tests have shown that because of the very low counter-pressure of the cooling doors the fans in the servers consume negligibly more power than without cooling doors.

GOOD TO KNOW: WATER AND DATA CENTRES

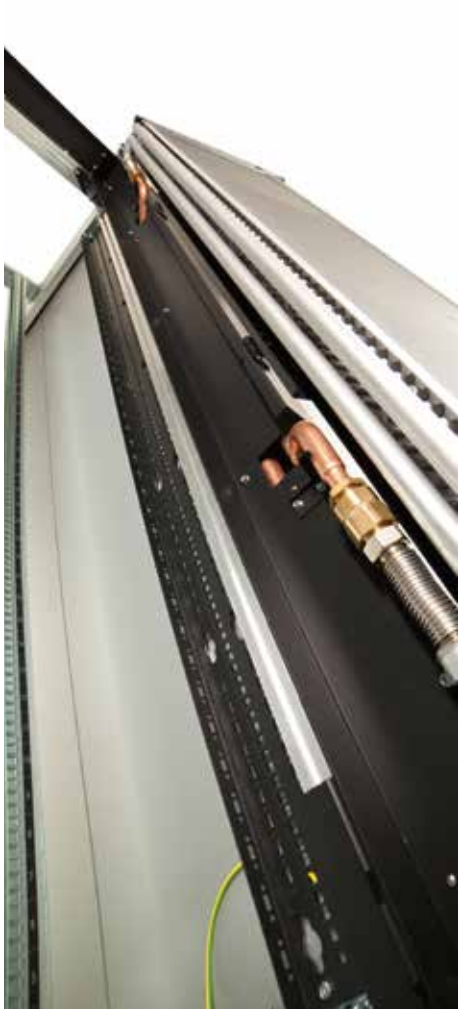


Illustration without cover of the heat exchanger

The probability of Knürr DCD rear door heat exchangers leaking is minimised by their design, construction, industrial manufacture and quality assurance. **Experience with the Knürr DCD and also other cooling solutions with air-water heat exchangers in closed server racks shows that the probability of leakages is in the lower per mille range (2017: 3‰).** If they do occur, it is usually due to how the unit is being operated, for example if the maximum system operating pressure is significantly exceeded. Installation errors and an inadequate building grounding system with ensuing high electrical fault currents can lead to electrochemical corrosion and in turn to leaks. Transport damage caused through incorrect handling of the unit cannot be excluded, which is why it is essential to have a thorough incoming goods inspection on site before installation.

Any leaks that might rarely occur do so at the soldered connections and the curved ends of pipes. These can be considered as predetermined breaking points and, by design, are not located in the air volume flow. **The curved ends of pipes and soldered connections are cladded accordingly.** Drops of water cannot be carried along by the cooling air flow.

Further information about, among other things, the manufacturing process, installation, structural design, and leakage monitoring is available in the document entitled "Questions about Knürr DCD Rear Door Heat Exchangers in the context of DIN EN 50600 Certification".

"This cooling technology is ideal for us because it permits us to drastically reduce our running costs – at comparatively much lower investment costs. Furthermore, the cooling system is compact and integrated in the racks."

Customer opinion: Expert comment of a High Performance Computing customer.

TECHNICAL DETAILS – BENEFITS

Special water-bearing hinge

Top water connection supports

Condensation discharge supports

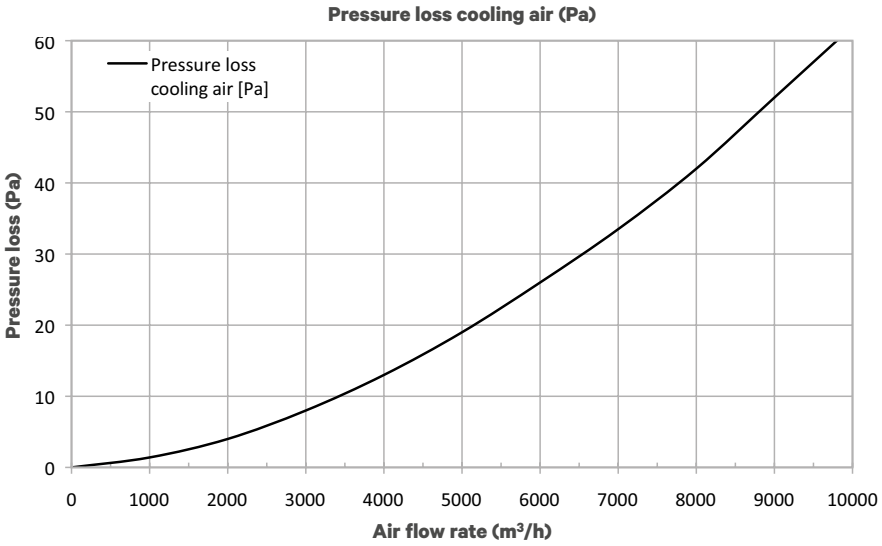
Condensation pan

Availability

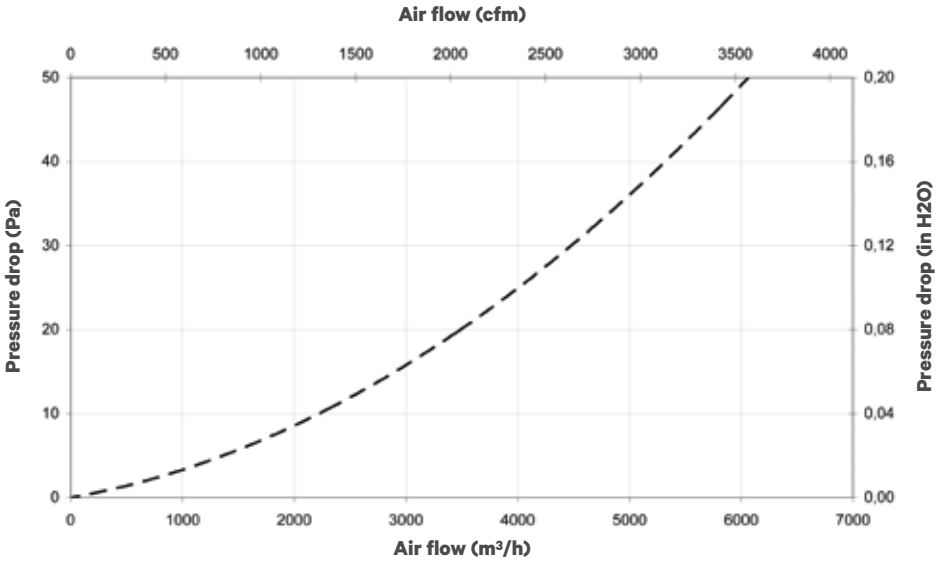
- No additional fans required for cooling so no risk of failure.
  - Greater system reliability.
  - Fewer sources of failure.
  - No additional fans so no waste heat load on the room.
- Guaranteed 50 kW cooling
- Minimal air pressure drop
- Condensation pipe and collector in the event that the temperature falls below the dew point; removed via 5/8“ flexible hose on plug nipple.
- The risk of condensate deposit is reduced by vertical orientation of the heat-exchanger fins.

Efficiency

- Optimum space utilization due to minimal space requirement and therefore very low space costs.
- Lowest pressure loss in the cooling water circuit: Around 54 kPa allow the lowest possible energy consumption of the pumps.
- Lowest pressure loss in the cooling air flow due to optimized heat exchanger structure and linear air paths without deflections: no energy costs due to additional cooling fan cooling unit.



Cooling air flow pressure loss DCD50



Cooling air flow pressure loss DCD35

35 Pa is no problem for the typical fans in servers

FOR SPECIAL CASES: VERTIV KNÜRR DCD ACTIVE

If there is a risk of thermal short-circuiting in the server cabinets of a data centre and the cooling capacity of the passive cooling doors is not enough to cope, Vertiv offers the DCD Active as a solution.

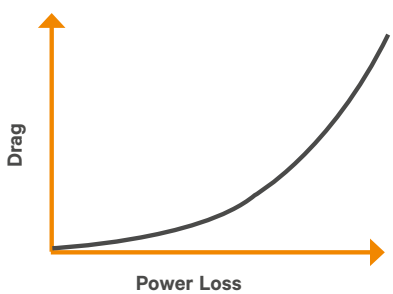
- For server installations with incomplete hot/cold cooling air separation.
- Fan unit that conveys the server's hot cooling air through the Knürr DCD heat exchanger.
- The higher the heat development in the server cabinet, the higher the need for an active module.
- Highest energy efficiency due to very low power consumption.
- Easy installation by attaching to the existing DCD Cooling Door.
- Space-saving cooling solution for up to 50kW.

Product features

- Four fans mounted on the rear of the Vertiv DCD.
- Two designs: for Vertiv DCD35 and for Vertiv DCD50.
- Easy to retrofit existing DCDs.
- Dynamic fan performance adapting cooling air flow.
- Differential pressure dependent fan speed control.

REASONS FOR THE USE OF THE KNÜRR DCD ACTIVE

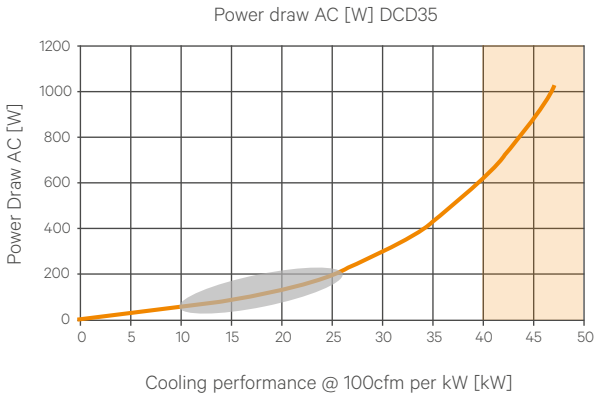
- In rare cases, when cooling with a rear door heat exchanger, backflow of the heated cooling air within the server occurs. Mostly, insufficient hot / cold air separation is the cause. For **servers** that react with increased operating temperatures or even alarm messages to an additional air resistance by the Knürr DCD, the active module provides relief by supporting the server fans.
- Leaks in the hot / cold air separation within the **server cabinet** and also in the air seal to the outside, e.g. at the cable inputs are compensated by the Knürr DCD Activemodul. There is no warm air in the environment or in the intake of the server.
- The higher the power loss in cooling with a rear door heat exchanger, the greater the required cooling air flow. This also increases the air resistance in the heat exchanger. For **high power losses**, the probability increases that the Knürr DCD Active is necessary to compensate for the increased pressure difference.



VERY LOW ELECTRICAL POWER CONSUMPTION - EXCELLENT ENERGY EFFICIENCY

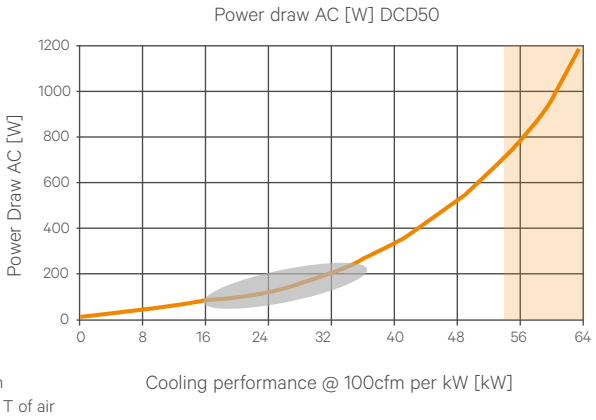
For Knürr DCD35

Up to 30kW performance number (EER) above 100
Up to 15kW electrical power below 100W



For Knürr DCD50

Up to 45kW performance number (EER) above 100
Up to 20kW electrical power below 100W



Error mode -> with 3 fans higher delta T of air

Technical Data

Mechanical Data		**H2000**	**H2100**	**H2200**
Dimensions (L x W x H)	DCD35	1954 x 420 x 125 mm	2088 x 420 x 125 mm	2176 x 420 x 125 mm
	DCD50	1954 x 579 x 125 mm	2088 x 579 x 125 mm	2176 x 579 x 125 mm
Grid feed-in Supply A, B		**Single 110/230V**	**A/B 230V**	**A/B 110V**
Operating voltage		95...264 V, 47...63Hz	190...264 V, 47...63Hz	95...126 V, 47...63Hz
Rated current		5/11 A (110/230 V)	5 A	11 A
Fuses		10/12 A T	10 A T	12 A T
Performance Data				
Air flow rate	DCD35	6300m³/h (N+1 fan redundancy) 7400m³/h (no redundancy)		
	DCD50	9000m³/h (N+1 fan redundancy) 10800m³/h (no redundancy)		
Power consumption in normal operation	DCD35	**130W at 20kW power dissipation (delta T of cooling air 18K)**		
	DCD50	**130W at 25kW power dissipation (delta T of cooling air 18K)**		
Max. Power Consumption (electrical design)	DCD35	980W		
	DCD50	1185W		
Ambient Conditions				
Operating temperature		+10...+40 °C		
Storage temperature		-25...+80 °C		
Relative humidity		0...95 %, non-condensing		
Altitude above sea level		max. 2,000 m		

Knürr DCD Active - optional

- Temperature monitoring and color display
  - **3.5 "color touch display:** Display of operating parameters and faults (temperature at air inlet and outlet at the heat exchanger, fan speed, alarm status)..
  - **Adjustable differential pressure**
    It can enter the warmplenum behind the servers slight underpressure or overpressure.
- **A / B switching for the power supply**
  Switches automatically between primary supply and spare power supply around.

SPECIFICATIONS, UNIT CONFIGURATION NUMBER

Vertiv™ Knürr® DCD Cooling Door/DCM specification

COOLING AIR SIDE	
Housing material	Steel plate (powder coated)
Operating ambient temperature	10 °C – 35°C (50 °F – 95 °F) (other temperatures on request)
Maximum absolute air humidity on site	8 g/kg
Air outlet temperature (in accordance with ASHARE)	18 °C – 27 °C (64.4 °F – 80.6 °F)
Air temperature difference IN – OUT	15 K – 20 K

CHILLED WATER SIDE	
Cooling performance	**DCD35:** 35 kW / **DCD50:** 50 kW
Chilled water temperature inlet	12 °C – 18 °C (53.6 °F – 64.4 °F) (other temperatures on request)
Chilled water temperature outlet	18 °C – 24 °C (64.4 °F – 75.2 °F) (other temperatures on request)
Maximum operating pressure	10 bar (145 psi)
Pipe connection IN / OUT	1" F (on the frame) (DIN ISO 228 - 1)

VERTIV™ KNÜRR® DCD COOLING DOOR CONFIGURATION NUMBER

MODEL NUMBER – PART 1/2										MODEL DETAILS										PART 2/2			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
D	C	D	3	5																				
D	C	D	5	0																				

1.–3. Basic unit
Knürr DCD is an air-water exchanger that is integrated into the rear door of a server cabinet. The heat exchanger serves to absorb heat loads from server cabinets of up to 35 and 50kW. Thereby, it can be configured in such a way that no thermal loads are released to the installation area.

4.–5. Nominal cooling capacity
35 = 35kW
50 = 50kW (cabinet width 800mm only)

6. Cabinet height
A = For rack height of 2000 mm
B = For rack height of 2100 mm
C = For rack height of 2200 mm

7. Cabinet width
0 = DCD Active Fan Unit (w/o rack)
6 = For rack width of 600 mm (not available for DCD 50)
7 = For rack width of 700 mm (not available for DCD 50)
8 = For rack width of 800 mm

8. Cabinet type
3 = The DCD unit is equipped with adaptor for 3rd party rack
0 = The DCD unit is delivered without cabinet and can be mounted on site on existing DCM cabinet.
A = Unit will be shipped from factory installed on a DCM rack. (no DCDactive)
B = DCD with DCM cabinet and DCDactive
F = DCD Active Fan Unit

9. CW connection - hinge possition
0 = DCD Active Fan Unit only
1 = Unit has chilled water connections from the top left side
2 = Unit has chilled water connections from the top right side
3 = Unit has chilled water connections from the bottom left side
4 = Unit has chilled water connections from the bottom right side

10. Cabinet depth
0 = No cabinet
E = The Rack depth is 1000 mm
F = The Rack depth is 1100 mm
G = The Rack depth is 1200 mm

11. Front door
0 = No cabinet
C = with Single Sheet Steel Front-Door 83% perforation, hinged right hand side
G = with Double Sheet Steel Front-Door 83% perforation,
L = with Single Sheet Steel Front-Door 83% perforation, hinged left hand side
X = Cabinet without front door

12. 19" rails front
0 = No cabinet
L = Asymmetric with air separation and additional vertical U slots (for width 700mm and 800mm)
A = Symmetric with air separation and additional vertical U slots (for Width 800mm only)
B = Symmetric with air separation (for width 600mm only)

13. 19" rails rear
0 = No cabinet
Y = Asymmetric without air separation (for width 700mm and 800mm)
S = Symmetric without air separation (not for width 700mm)
A = Symmetric with air separation and additional vertical U slots (for Width 800mm only)
B = Symmetric with air separation (for width 600mm only)
L = Asymmetric with air separation and additional vertical U slots (for width 700mm and 800mm)

14. Bottom plate
0 = No cabinet
L = Cable entry for cabinets with levelling feet
R = Cable entry for cabinets with casters

15. Plinth
0 = No cabinet
A = with stationary plinth load rating 10 000 N static height 100 mm (rack height + 100 mm),
B = with stationary plinth load rating 10 000 N static height 200 mm (rack height + 200 mm),
R = with caster brackets and high load casters 10 000 N mobile, 15 000 N static on levelling feet,
F = with leveling feet (0-25 mm), no plinth

16. Color
1 = Visible surface of covers RAL 7035 (light gray)
G = Visible surface of covers RAL 7021 (dark gray)

17. Side panels
0 = No cabinet
X = Without side panels
B = with right + left side panel

18. Jumpering depth for front 19" rails
0 = No cabinet
A = jumpering space 80 mm, useful depth 740 mm
D = jumpering space 123 mm, useful depth 740 mm

19. DCDactive upgrades
0 = no DCDactive
N = Standard DCD Active
T = DCD Active with temperature monitoring and display
B = DCD Active with A/B transfer switch 230VAC
A = DCD Active with A/B transfer switch 230VAC + temperature monitoring and display
D = DCD Active with A/B transfer switch 115VAC
C = DCD Active with A/B transfer switch 115VAC + temperature monitoring and display

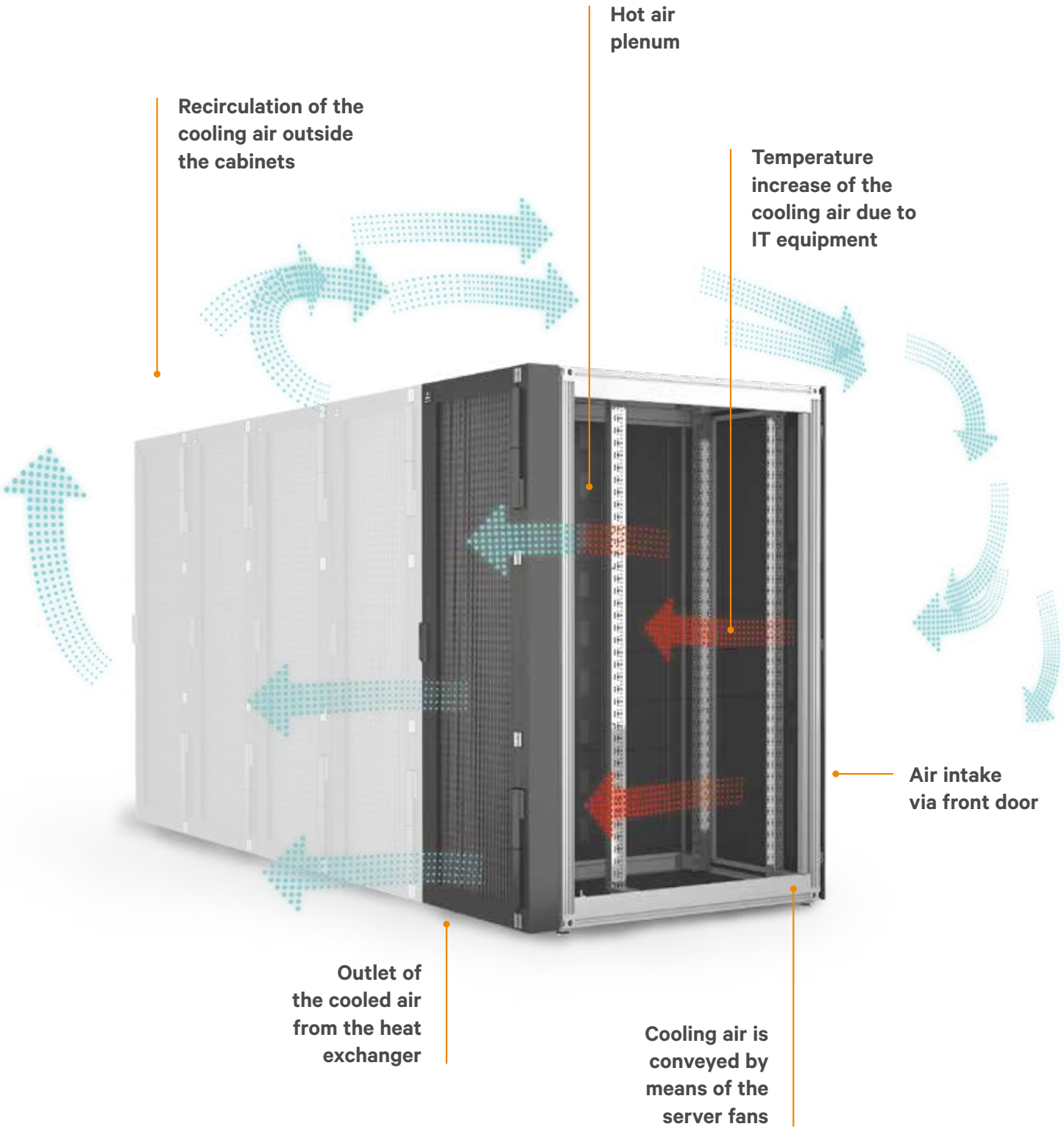
20. Free
0

21. Packaging
P = DCD / DCD Active packed in cardboard box lying on pallet (max. 4 units); DCM Rack/DCD/DCD Active combination upright on pallet, edge protection, dust cover.
S = DCD / DCD Active packed in cardboard box lying on pallet (max. 4 units), wooden crate; DCM Rack/DCD/DCD Active combination upright on pallet, edge protection, dust cover and wooden crate.

22. SFA
A = No SFA
X = SFAs included

23.–25. Internal counter

PRESENTATION OF THE DCD COOLING FUNCTION



Source: Dr. Koch, 29.11.17 „Luft, Wasser und Wärme“ https://www.lanline.de/luft-wasser-und-waerme/

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