



VERTIV™ KNÜRR® DCD REAR DOOR HEAT EXCHANGER:

Risk assessment for the operation
of the Knürr DCD rear door heat
exchanger according to DIN EN 50600
certification

1. Risk assessment according to DIN 50600

The operational reliability of the Knürr DCD is included in the classification of the data centres with regard to a risk analysis in accordance with DIN 50600. It is necessary to evaluate the risk of leakage and to describe the effects on data center operation. This whitepaper is an instrument to assist in carrying out the risk assessment when operating the Knürr DCD in data centers.

2. Leakages

The likelihood of leakages at the Knürr DCD rear door heat exchanger is minimized by the design and by industrial production and quality assurance. Experience with the Knürr DCD and other cooling solutions with air-water heat exchangers in closed server racks has shown that the leaks can occur in the low per mille range (2017: 3‰). These usually have their causes in the operation of the plant:

- Significant exceeding of the maximum system pressure due to a missing expansion vessel.
- Exceeding the usual flow velocities due to considerable exceeding of the differential pressure, recommended / usual 50kPa, damage at 800kPa additionally caused by unfiltered chilled water with high contamination of solid particles.
- Mistakes during installation, e.g. drilling into the cold water installation for fixing cable ties.
- Inadequate/faulty building grounding concept and the resulting high electrical leakage currents, which led to extremely increased corrosion.

When installing the Knürr DCD, make sure that these errors are avoided when operating the Knürr DCD.

Transport damage cannot be completely ruled out if the transported goods are handled incorrectly, which is why a thorough incoming goods inspection at the construction site prior to installation is necessary.

The rare leaks then occur at the soldered joints and at the pipe ends. These can be regarded as predetermined breaking points and are not structurally located in the air volume stream. The pipe ends and the soldered joints are covered by cladding parts. It is not possible to entrain the droplets in the cooling airflow.

Basically, the Knürr DCD is designed for non-condensing operation (sensitive cooling). Nevertheless, the Knürr DCD contains many design features that allow condensing operation (latent cooling) for a short time and dissipate water harmlessly:

- Condensate drip tray with condensate drain connection
- Condensate wipers (O-rings) on the flow and return pipes (behind the casing)
- Drainage plate for discharging possible condensate from the pipework into the condensate drip tray
- Vertical fin arrangement for unhindered condensate drainage within the cooling water coil (central section of the air-water heat exchanger)
- Falling below the maximum flow velocity for droplet dragging from the heat exchanger of 2.0 m/s
- Hexagonal grilles on both sides of the heat exchanger, which, in addition to providing access protection and protection against damage to the heat exchanger, also act to a limited extent as droplet separators.

3. Production process, Commissioning

As part of the installation of a DCD in the data center, at least three pressure tests are planned to detect leaks and exclude faulty products from the operation of the data center.

Pressure test at the manufacturer of the heat exchangers:

- All heat exchangers are supplied by the manufacturer with at least 1.3 times (13 bar) the maximum operating pressure of 10 bar. With the DCD, the test pressure is 16 bar and the test duration 5 minutes. Test gas is compressed air or nitrogen. The production is certified according to ISO 9001. When transporting the heat exchangers, they are filled with compressed air at a pressure of 1 bar. This pressure is checked when the real thing arrives.

- Pressure test in the assembly of the DCD: As the final step before packaging, a test is carried out at 1.1 times the maximum operating pressure and takes at least 30 minutes. The test medium is compressed air. The production is ISO 9001 certified.
- The last pressure test before commissioning takes place in the computer centre. After comprehensive flushing, water or a water/glycol mixture is used, usually the cooling medium in the data center. The test pressure should exceed the later operating pressure of the plant, but should not exceed the maximum permissible operating pressure of 10 bar.

In most systems, the operating pressure of the system is between 2 and 4 bar, which means that the actual operating pressure is considerably lower than the maximum possible operating pressure and increases the leak-proofness of the system.



Figure 1: Vertiv Knürr DCD - with cover. The splash guard is integrated in the cover.

4. Design of the DCD

The heat exchanger of the DCD is located behind the IT equipment within the cooling air flow. Possible leaking water droplets are thus transported away from the IT equipment by the air flow. This prevents leaking water from reaching the IT equipment.

5. Leakage monitoring in the data center

In the data center and also within the DCD, there are many possibilities for leakage monitoring. The most effective method has been the pressure monitoring of the chilled water installation and the monitoring of the feeding into the chilled water installation. Pressure drop and periodic water feeding are indications of a leakage. This does not have to occur within the DCD. In any case, a quick elimination of the leakage is indicated.

Monitoring leakages by detecting liquids is another way to protect IT equipment from leaks. Possible leakages are detected at an early stage. However, there is often confusion with condensation. Before an in-depth leak detection, condensation must be ruled out by analysing the chilled water and dew point temperature.

Summary

Leakage water from the DCD is largely excluded. A variety of measures continue to minimize the risk of leaking water leaking onto the IT equipment.

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*Figure 2: Vertiv Knürr DCD – without cover.
The cover - not shown on this picture provides protection against water spray.*

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