Liebert® EFC

Composite Heat Exchanger
from 100 to 450 kW

The Highly Efficient Indirect
Evaporative Freecooling Unit

Download the
Vertiv™ XR App

Vertiv™ brings together hardware, software, analytics and ongoing services to ensure its customers' vital applications run continuously, perform optimally and grow with their business needs.

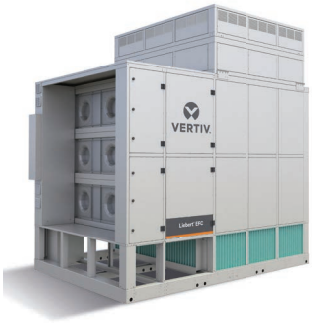
Vertiv solves the most important challenges facing today's data centers, communication networks and commercial and industrial facilities with a portfolio of power, cooling and IT infrastructure solutions and services that extends from the cloud to the edge of the network.

Liebert® EFC, the Highly Efficient Indirect Evaporative Freecooling Solution with composite HE

The **Liebert EFC** is equipped with the most advanced industry technology. The system includes indirect air-to-air heat exchange and evaporative cooling technology all in one footprint. The Liebert EFC is capable of reducing air temperatures by leveraging on the evaporative cooling principle and now, with the new composite heat exchanger designed for data center applications, it provides higher efficiency together with and increased robustness and reliability.

The process involves the evaporation of water which, as a consequence, cools the surrounding air. Through this technology, the Liebert EFC can thus achieve pPUE levels of 1.05 ensuring top energy efficiency, as well as minimized operating costs.

Liebert® EFC 250



Liebert® EFC 300

Liebert® EFC 320

Liebert® EFC 400

Liebert® EFC 440

Vertiv™ Liebert® EFC Composite HE (100 to 450kW)

At Vertiv we believe the sustainable design, development, use , and disposal of our product is critical to the longevity of our industry and to the greater world.

Checkout these environmentally conscious features of the Liebert® EFC Composite HE:

- Increased annual efficiency thanks to reduced internal pressure drop thanks to the new IP property design HE
- Higher cycle of concentration for optimized water usage and reduced waste
- Wider range of water quality: reclaimed water can now be used
- Reduced request for chemicals to be used for water treatment

Supplying indirect freecooling for data center applications via the evaporative technology.

Liebert® EFC - Composite HE | Efficiency, Robustness and Reliability

Evaporative Cooling

The highly efficient evaporative system sprays water onto the heat exchanger to enable cooling even at high ambient air temperatures, without the need for mechanical cooling.

Energy Efficiency

The evaporative cooling technology enables Liebert EFC to reach pPUE levels as low as 1.05.

Highly Efficient Also At Partial Load

The new generation EC fans installed in the Liebert EFC and integrated digital scroll compressors dramatically reduce the noise level and contribute to achieving higher efficiency levels at partial load.

Sustainability

The composite material of the new heat exchanger permits wide water ranges for an optimized and effective water usage (WUE).

Reduced CO_2 Emissions

At pPUE levels of 1.05, Liebert EFC requires minimum power input consequently reducing CO^{Ve} emissions.

Freecooling

Evaporative cooling extends indirect freecooling operation all year round.

Data Center Free from Contaminations

The air-to-air heat exchanger separates external and internal air, protecting the data center air from bacterial contamination, as well as other external events such as fire and pollution.

Integrated Chilled Water Coil and Direct Expansion System

These technologies ensure the unit's operation even in climates characterized by extreme humidity levels or severe temperature peaks.

Vertiv™ Liebert® iCOM™ Control

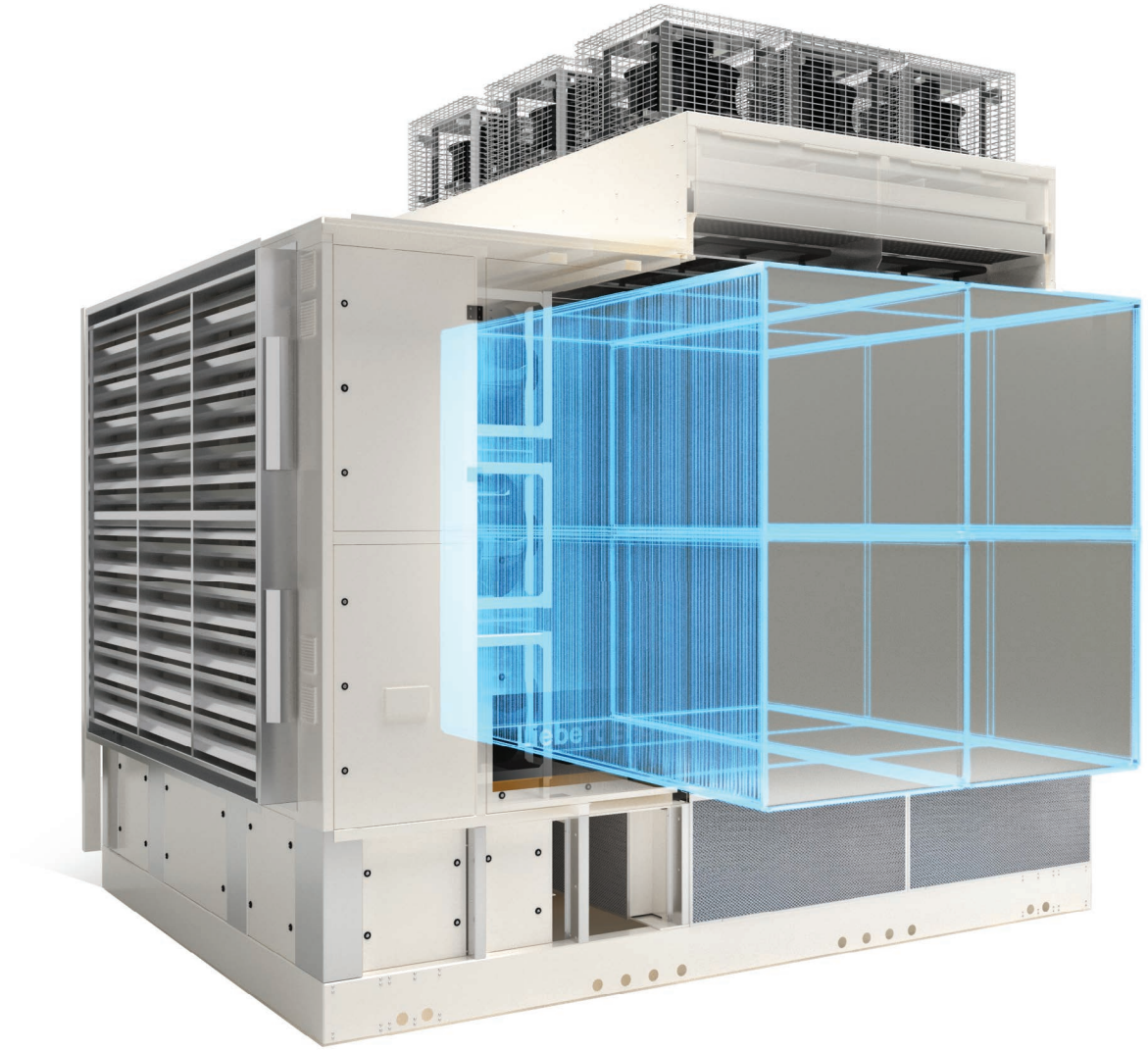
Liebert® iCOM™ Control ensures high level management of the units to work together as a single system, thus optimizing room temperature, airflow and overall system efficiency.

Heat Exchanger

The New Heat exchanger design minimizes the aerodynamic impact of the internal parts ensuring a significant reduction of the pressure drop providing increased annual efficiency and higher maximum air flow versus previous configurations equipped with legacy HE.

A New Heart: The Patented Polymer Plate Heat Exchanger

Vertiv™ Liebert® EFC is now equipped with a new heart: a new generation, high efficiency, patented Polymer Plate Heat Exchanger designed for data center applications for unsurpassed efficiency and optimized water utilization all over the year.



The new plate's pattern design enhances the heat transfer while its asymmetric configuration minimizes the pressure drop and the energy costs related to the primary air recirculation. The design of the new heat exchange enables high mechanical resistance, intrinsic noise mitigation and easy cleaning.

The new polymeric material also combines high durability together with extreme corrosion resistance that leads to a wide water quality for minimum water consumption and optimized WUE (Water Usage Effectiveness).

Ensuring Top Efficiency Levels through the Evaporative Principle

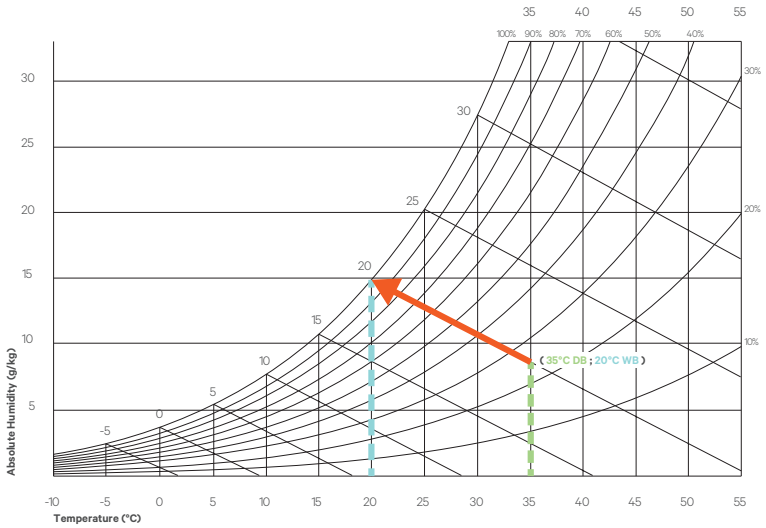
The Liebert® EFC combines the capabilities of freecooling and evaporative cooling principles in one single unit. It has been specifically designed to select the most appropriate operating mode based on the external environment conditions, leveraging both principles in order to deliver significant energy savings.

Water waste is reduced to the minimum thanks to the wider water ranges the new composite heat exchanger can work with. This leads Liebert EFC series to the next step of the water usage optimization (WUE).

The use of the evaporative cooling allows freecooling operation to be maximized and compressor-related cooling to be reduced to a minimum, thus optimizing operating costs.

The evaporative system principle uses air to absorb water that is sprayed through special nozzles onto the heat exchanger. Water evaporation thus removes heat from the air and cools the outside air temperature.

Outside air consequently transits from Dry Bulb Temperature to Wet Bulb Temperature (the graph shows the transition from 35°C to 20°C).



Psychrometric Chart for Sea-Level Elevation

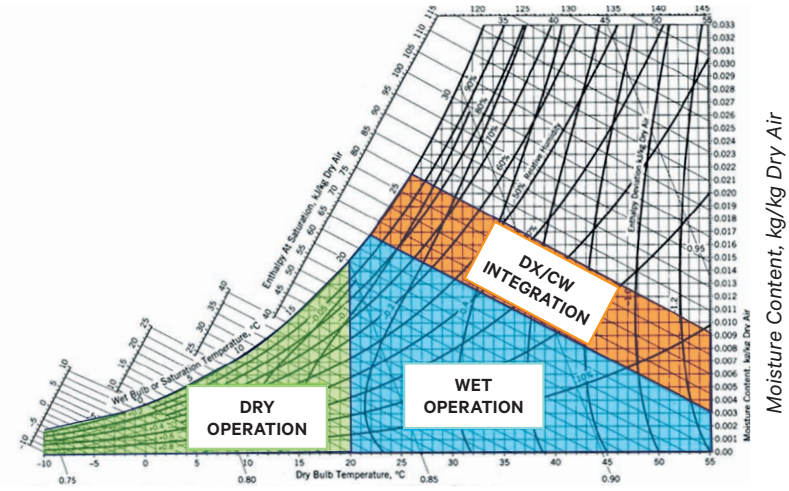
Where Indirect Evaporative Cooling Works

In order to optimize the overall system efficiency, the Liebert® EFC has been designed to change its operation mode according to the external environment.

When the external air is cold enough to allow freecooling, the unit works in dry operation mode (winter operation mode).

When ambient temperatures are higher, also external humidity determines unit capacity and performances as the evaporative effect is directly associated to the external air capacity to absorb water (summer operation mode).

In climates featuring high levels of humidity the unit may thus require the integration of a Direct Expansion (DX) system or the installation of a Chilled Water (CW) coil (extreme operation mode).

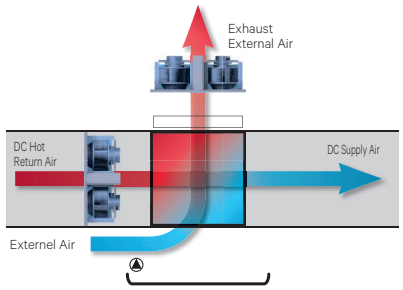


Dry Bulb Temperature, °C

Liebert® EFC Operation Modes in Detail

Winter

Air-to-air heat exchanger provides the required cooling which is modulated by external air flow.

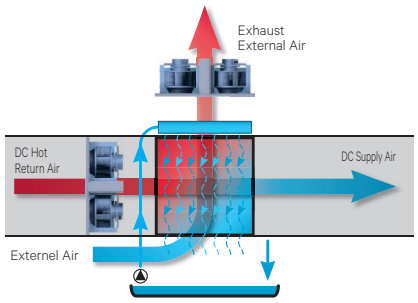


DRY OPERATION
(Dry Bulb Temperature <17°C -20°C)*

Air-to-Air Heat Exchange Without Spraying Water

Summer

During the warm season, the evaporative system must run to saturate the air. This enables the unit to cool the data center air even with high external air temperatures. By saturating the air, the dry bulb temperature can be reduced.

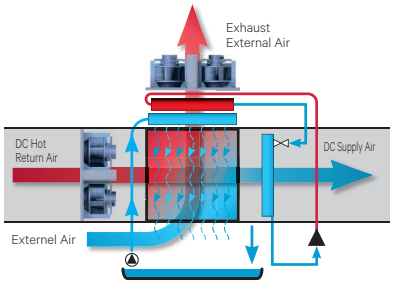


WET OPERATION
(Wet Bulb Temperature <20°C - 22°C)*

Air-to-Air Heat Exchange Via the Spraying of Water to the External Air Side

Optional

In case of extreme external conditions, a Direct Expansion (DX) system is available to provide additional cooling. As an alternative, the Chilled Water (CW) coil can be installed. DX and CW systems are sized to provide partial back up for the overall cooling load and are designed to provide maximum efficiency with minimum energy consumption.



DX/CW INTEGRATION

External Air Is too Hot to Achieve 100% Cooling with Adiabatic, the DX Module Is thus Integrated to Cover the Missing Capacity

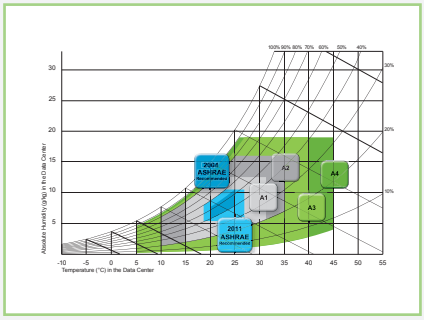
**Assumptions: data center 37°C ➞ 25°C*

The State-of-the-Art Vertiv™ Liebert® iCOM™ Control

Precise, User-friendly Information at Unit Level

To guarantee ASHRAE recommended guidelines even at extreme conditions

- Extreme Winter Operation (i.e. below-20°C) can cause the unit's unrequired internal dehumidification causing it to exceed ASHRAE recommended minimum humidity. Liebert® EFC offers a constant control of data center air via its integrated Liebert® iCOM™ control logic, ensuring dew point temperature is lower than heat exchanger surface temperature, thus avoiding unrequired dehumidification.



To provide precise temperature and airflow control in front of servers

- The Vertiv™ SmartAisle™, like other control logics embedded in the Liebert® iCOM™, optimizes internal air volumes and temperatures according to specific server needs allowing Liebert® EFC to exactly match the servers' airflow needs, avoiding possible hot spots and ensuring that not even a single Watt is wasted in moving or cooling unrequired air.

To optimize water and electricity costs with the Cost Function software feature

- The user friendly Liebert® iCOM™ Control exploits the management of energy and water also at teamwork level. The system collects information from the different units' key parameters and operating modes (dry, wet and DX/CW) while taking into account water and electricity costs. The control predictively calculates and then implements the combination which optimizes operating costs.

Utmost Efficiency Even at the Data Center System Level

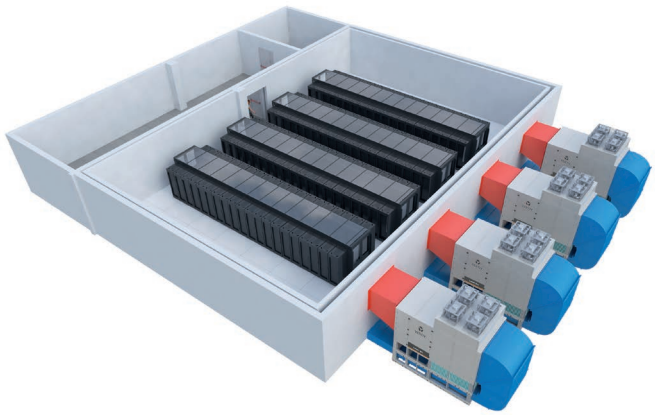
The Liebert iCOM Control manages the operation of the Liebert EFC units, in order to ensure top reliability in all conditions. Access to the units installed in the data center, is granted through the Ethernet connection, that is capable of coordinating the multiple on-site installations. The high-level supervision of multiple units allows these to work together as a single system, thus optimizing overall system performance.

High Flexibility Matching Customer Needs

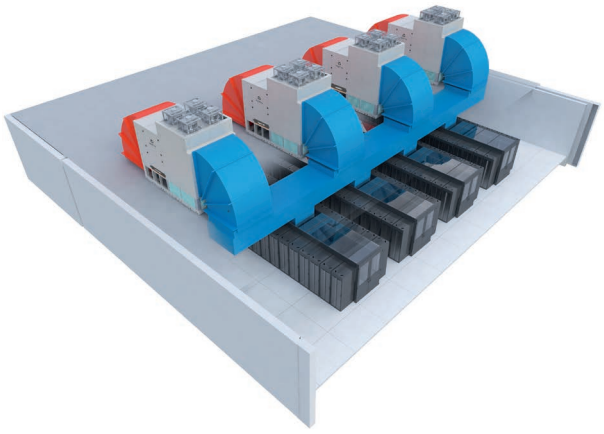
The Vertiv™ Liebert® EFC delivers substantial reductions and savings in terms of electrical infrastructure and equipment. With the unit being installed externally, the available internal white space is maximized ensuring ease of system installation.
All of these features significantly reduce data center TCO.

Main Options Available	Benefits
DX or CW coil for mechanical cooling integration (with advanced dehumidification option)	Water storage reduction Premium efficiency Delivery temperature guaranteed also under the worst ambient conditions Dehumidification availability (with advanced dehumidification option)
Coarse 60% (G4) ePM10 50% (M5)	State-of-the-art filtration class
Low ambient kit	To avoid unrequired dehumidification at very low ambient temperatures
Automatic transfer switch with intelligent controller	Due to the communication with the unit control, all the electrical power data is monitored through the BMS
UltraCapacitor	Control always active even during a power failure
Monitoring	Integrated BMS interface (i.e. ModBus, Bacnet and SNMP)
Energy meter/water meter	To manage energy and water consumption, thus optimizing operating costs
Right and left versions available in both perimeter and roof configurations	To adapt to any data center layout

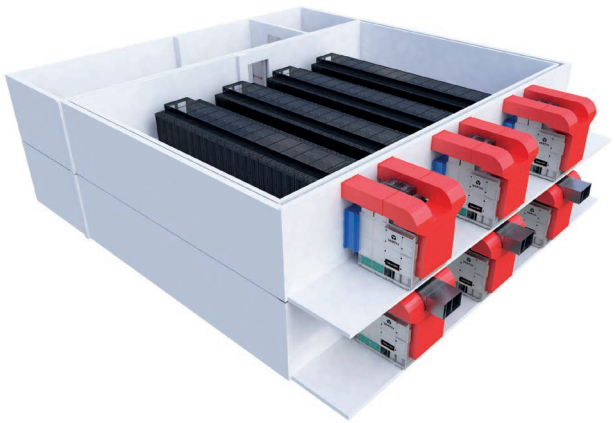
Perimeter Configuration



Roof Configuration



Multi-Storey Configuration



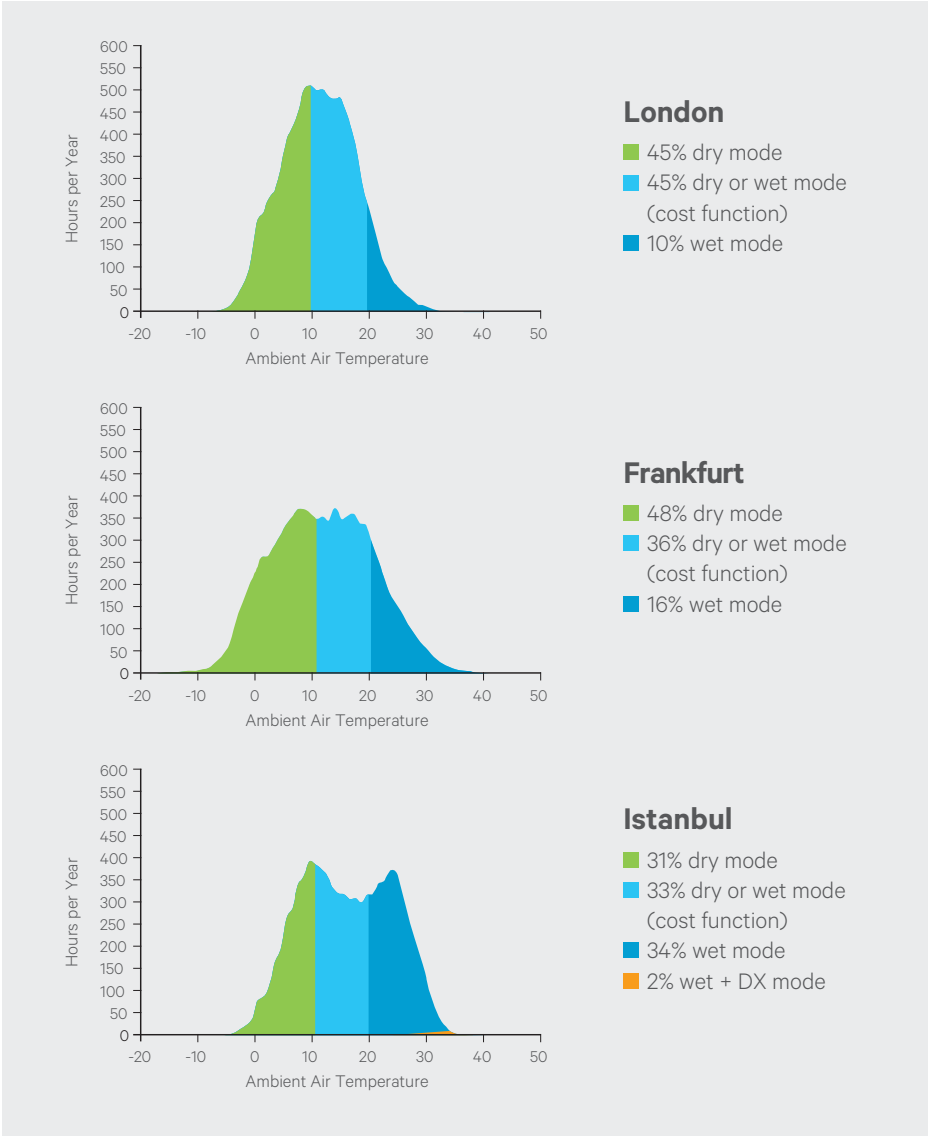
Annual Distribution of Operating Modes with Indirect Evaporative Freecooling

While respecting ASHRAE guidelines, the Vertiv™ Liebert® EFC unit can be installed not only in cold climates, where the unit can leverage on the dry operating mode, but also in hotter ones (as shown in the example below for Istanbul) where DX operation is reduced to a minimum and used only during extreme temperature peaks that may be experienced throughout the year. This results in a significant reduction in electrical consumption possible even at full load (reaching the highest possible savings at partial loads).

The Liebert® EFC **Cost Function** optimizes running costs (water and electricity), and according to the external dry bulb and heat load, selects the most convenient working mode (i.e. dry vs. wet). With the same logic, the Cost Function will also optimize the use of the optional Direct Expansion (DX) mode.

Other functionalities are included in Vertiv™ Liebert® iCOM™ control logic for an unsurpassed customer's experience:

- **Winter saver**: Leveraging cold outdoor temperature, the supply set point temperature is reduced providing the same cooling capacity with lower air flow and lower energy costs for air circulation.
- **Power demand limit:** in case of power emergency situations, the unit electrical consumption can be limited to a specific value. UPS, generators and electrical infrastructure can thus be downsized.



Technical Specifications

Model		EFC 250	EFC 320	EFC 300	EFC 400	EFC 440
FANS	n°	6+4	9+6	9+9	9+6	9+8
Maximum Airflow Data Center Side(1)	m^3/h	85500	112500	102000	119500	116000
Max Cooling Capacity(2)	kW	326	428	391	459	446
Max Wet Bulb - Evaporative + DX Effect	°C	22.0	19.4	23.6	24.6	26.6
Nominal Cooling Capacity	kW	225	265	300	400	400
Max Dry Bulb - Only dry mode(3)	°C	15.4	15.6	18.7	13.9	17
Max Wet Bulb - Only Evaporative Effect(3)	°C	19.8	19.5	21.0	19.9	19.9
Max Wet Bulb - Evaporative + DX Effect(3)	°C	29.3	28.6	28.6	29.1	31.0
Dry Capabilities		High	High	High+	Medium	High+
DX Capability Ratio		High	High	Medium	High	High+
Dimensions						
Length	mm	3650	3650	4500	3650	4620
Depth	mm	2500	2900	2900	3400	3400
Height	mm	4700	4700	4700	4700	4600

Referred to STANDARD CONDITIONS: Return air condition: 36°C DB; 25% R.H., Supply air condition: 24°C DB; 50% R.H. Air flows refer to the standard configuration with clean filters (Coarse 60% class primary side, Coarse 40% process side). DX system included. ESP=100Pa in Data center side.

(1) Fan speed: 100%
(2) Delta T=12K and Maximum Air Flow Data Center.
(3) Maximum Ambient temperatures to provide 75% of the nominal cooling capacities.

Vertiv's Customer Experience Center located in Tognana (Padova - Italy)

The site includes 7 different laboratories and is specifically designed for customers to interact with Thermal Management data center technologies. Lab 4 is dedicated to test and validate Packaged Outdoor units including Vertiv™ Liebert® EFC.

1 R&D Validation Lab 1

The Research & Development Validation Lab 1 is specifically designed to test floor-mount units and can balance a thermal load of up to 150 kW with a chamber air temperature between 0°C and 60°C.

2 R&D Validation Lab 2

Designed for conditioners belonging to the Telecom sector, the Research & Development Validation Lab 2 includes two different testing chambers: one simulating internal ambient conditions from 0°C to 60°C and the other simulating external ambient conditions from -32°C to 60°C. This validation area can balance a thermal load of up to 100 kW (50 kW in each room).

3 Floor-Mount Validation Lab

The lab is equipped with a highly automated testing chamber, this validation area can balance a thermal load of up to 200 kW and can simulate a test environment within a temperature range of 0°C to 60°C.

4 Evaporative Cooling Innovation Lab

Dedicated area to test the state-of-the-art Liebert EFC - Vertiv's highly efficient indirect evaporative freecooling unit. Testing parameters include IT loads of up to 450 kW and an airflow of up to 120,000 m^3 per hour at any external ambient temperature required to simulate typical peak conditions across the EMEA region.

5 Freecooling Chiller Validation Area

The Freecooling Chiller Validation Area is able to balance a thermal load of up to 1600 kW with a chamber air temperature between 20°C and 50°C and chiller water set point between 5°C and 20°C.

6 Adiabatic Freecooling Chiller Innovation Lab

This latest designed lab can test units with cooling capacities up to 1.5 MW with state-of-the-art accuracy in a broad range of working conditions, from -10°C to +55°C, also for adiabatic units.

7 Large Indoor Innovation Lab

This latest designed lab can test up to 400 kW and 100,000 m3/h, with operating conditions between +10°C and 50°C.

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