VERTIV.

Product brochure

Vertiv™ Liebert® EFC with low-GWP

The next generation indirect evaporative free cooling unit
From 150 to 450 kW

Download the
Vertiv™ XR App

Vertiv™ Liebert® EFC with low-GWP refrigerant is the next generation, indirect evaporative free cooling unit designed to cool data center applications with the future in mind. It combines the capabilities of indirect air-to-air heat exchange and evaporative cooling principles in one single unit.

As climate change continues to impact temperatures worldwide, the demand for efficient and sustainable cooling solutions has never been greater. Liebert® EFC is designed to meet this critical need. In an era where rising energy costs and environmental concerns are at the forefront, this cutting-edge and patented technology leverages the natural power of evaporation to deliver effective cooling while significantly reducing energy and water consumption.

Vertiv™ Liebert® EFC with low-GWP refrigerant at a glance

Game changer, patented, polymer plate heat exchanger, to achieve a pPUE as low as 1.05

Multi-step evaporative system and new DX priority control logic functionality to grant continuous cooling even with limited or absence of water

Inverter driven compressor technology with low-GWP R454B refrigerant to allow reductions in energy consumption and direct CO_2e emissions

DX / WET

Live toggling Wet and DX priority control logics to adapt operations based on the site-specific contingent conditions

Teamwork functionality with the Vertiv™ Liebert® iCOM™ to enable coordinated control, managing all units as part of an optimized system

Innovative design to minimize electrical infrastructure requirements thanks to the free cooling and patented control features at system level

A turnkey solution for **rapid deployment** to facilitate **scalability** over the years and to permit **easy maintenance**

Vertiv™ Liebert® EFC is a forward-thinking choice, especially as industries move toward environmentally friendly technologies and smarter energy usage.

- Medium-Large data centers (>2MW)
- Colocation
- Hyperscale

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

Checkout these environmentally conscious features of the Liebert® EFC with low-GWP refrigerant:

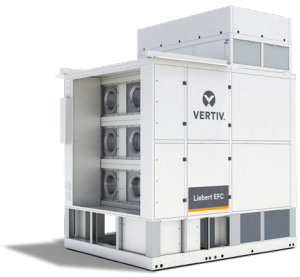
- R454B refrigerant totally compliant with F-Gas regulation (EU) 2024/573 and low Global Warming Potential (GWP) of 466 as per IPCC AR4
- Inverter driven technology
- Annual efficiency improved by 5-19%, through a patented heat exchanger specifically designed for optimal performance during partial load operation
- Higher cycle of concentration for optimized water usage and reduced waste
- Wider range of water quality: reclaimed water can bew utilized to run the unit
- Decreased need for chemicals in water treatment

The state of the art in room cooling

The Vertiv™ Liebert® EFC is equipped with the most advanced industry technology. The unit is capable of reducing air temperatures by leveraging evaporative cooling principles and designed with a polymer heat exchanger, designed for data center applications, it provides higher efficiency together with and increased robustness and reliability.

Liebert® EFC comes in four models and several mechanical cooling systems sizes, offering the perfect solution for any specific need with capacities ranging from 150 to 450 kW.

Vertiv™ Liebert® EFC 251



Vertiv™ Liebert® EFC 321

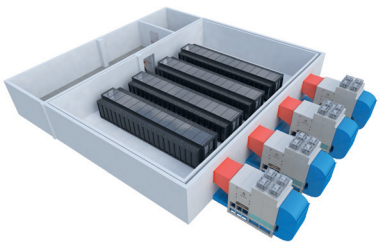
Vertiv™ Liebert® EFC 401

Vertiv™ Liebert® EFC 441

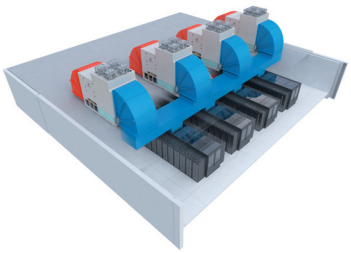
The Liebert EFC is designed to meet a variety of installation needs, offering configurations that allow for optimized performance, space efficiency, and ease of integration in a wide range of environments.

The perimetral setup provides efficient cooling along the building's perimeter, while the roof configuration maximizes space utilization by placing the system on the rooftop. The multi-storey configuration provides scalable cooling across multiple floors, offering flexibility and adaptability to diverse building structures.

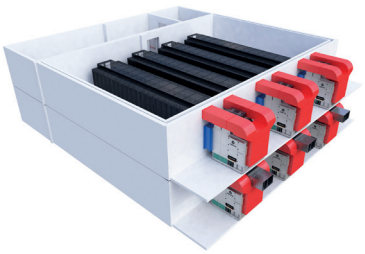
Perimeter configuration



Roof configuration



Multi-storey configuration



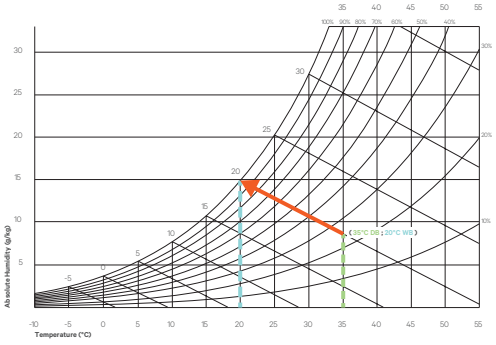
Year-round efficiency with free cooling: nature's way to keep it cool

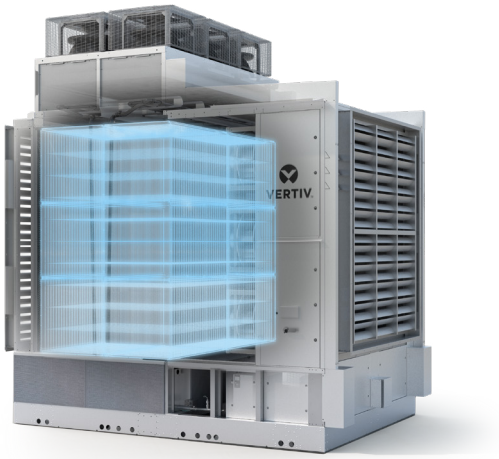
The evaporative system principle uses air to absorb water that is sprayed through special nozzles onto the heat exchanger. Water evaporation thus removes heat from the air and cools the outside air temperature.

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

Therefore, in addition to benefiting from free cooling in dry mode, the machine can continue to operate in free cooling thanks to the evaporative system, which extends the temperature range for free cooling operation. Furthermore, even when the DX priority mode is active alongside the evaporative system, the machine still benefits from free cooling through the heat exchange process in the heat exchanger.

Psychrometric chart for sea-level elevation





The robust and reliable core: the patented, polymer plate heat exchanger

Vertiv™ Liebert® EFC is equipped with a reliable core: 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 patented plate design is crafted to leverage the material properties, optimizing heat transfer performance.

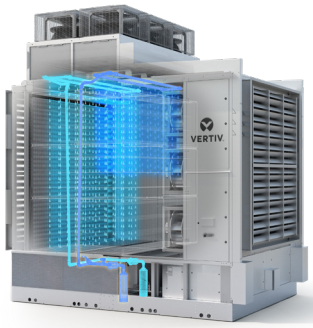
The **plate spacing layout** minimizes the pressure losses on primary air recirculation side thus reducing the energy consumption and consequently the energy costs.

The **asymmetric fluid dynamic plate pattern** optimizes heat transfer while further minimizing pressure drop and enhancing strength, particularly where differential pressure-related loads are most severe.

This **cutting-edge, proprietary design** is capable to recover the heat exchange gap compared to other materials, like aluminum (recognized for its superior heat transfer properties) without compromising on mechanical and chemical resistance which allows for a **seasonal efficiency from 5% to 19% higher** than aluminum versions and for a **wide range of water qualities**, reducing water consumption and streamlining Water Usage Efficiency (WUE).

Intrinsic noise mitigation and **easy cleaning** complete and further enhance the suite of innovative capabilities.

Liebert® EFC reveals its exceptional **durability**, its extreme corrosion **resistance** and intrinsic **robustness**, all meticulously designed for a **lifespan of more than 10 years**, validated by numerous laboratory tests and **over 2 years of dedicated field trials**.



Multi step evaporative

System composed by 2 pumps and 2 distribution racks that allows:

- Reduced water consumption
- Reduced emergency water tank size
- Enhanced capabilities on the DX priority control logic

Inverter low-GWP DX system

Inverter-driven scroll compressors with electronic expansion valves (EEV) in R454B configurations, with additional availability of full DX versions and 410A systems:

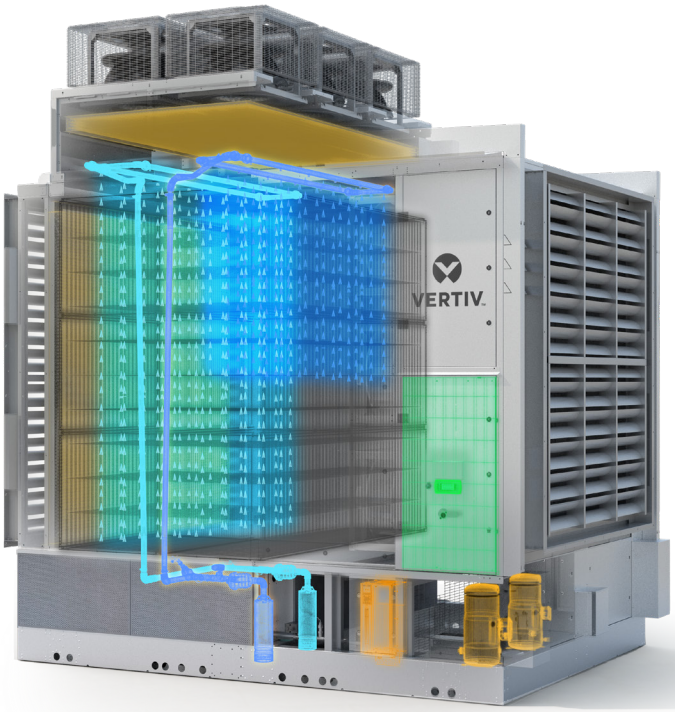
- Higher efficiency especially in partial load (vs digital technology)
- Precise modulation for a stable Supply Air Temperature (SAT)
- Low-GWP configuration

Vertiv™ Liebert® iCOM™ control

- New control logics: smoothly toggle water and DX priorities for extreme flexibility
- Patented embedded functionalities: wintersaver and power demand limit
- Embodied system manager: multiple teamwork strategies are available to optimize the unit capabilities, allowing the group of units to operate as a single, unified system for plug-and-play installation and high-level resilience

Flexibility
Flexibly toggle WATER and DX priority logics in just a click, effortlessly adapting to your site-specific contingency conditions aiming for extreme efficiency or promoting conscious water use, especially in water scarcity periods and regions.

Eco-conscious cooling
Enable reductions in energy consumption and CO_2e emissions with R454B low-GWP refrigerant inverter technology, while enhancing the Water Usage Effectiveness (WUE) with the multi-step evaporative systems to achieve a pPUE as low as 1.05.



Long lasting & highly reliable solution
A complete solution for quick deployment, offering scalability for years to come and simplified maintenance. Built with exceptional durability, outstanding corrosion resistance, and intrinsic strength, designed for a lifespan of over 10 years.

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

Cooling Continuity
Provide essential cooling during water outages without the need for water, using the full DX backup version. Minimize the size of emergency water tanks by leveraging the synergy between the integrated Direct Expansion (DX) system, the multi-step evaporative system, and the DX priority logic.

Vertiv™ Liebert® EFC with low-GWP – Control logic operation modes

Vertiv™ Liebert® EFC features two control logics

- the water priority control logic
- the DX priority control logic

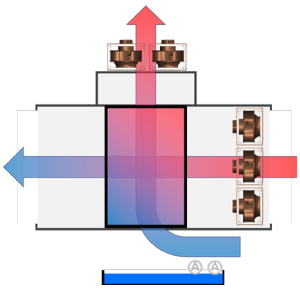
They allow the customer to switch between them at any time, maximizing the free cooling and enabling the choice to either reduce water usage or maximize energy efficiency based on the site-specific conditions: a live toggling feature that puts complete control at the customer's fingertips.

Water priority control logic

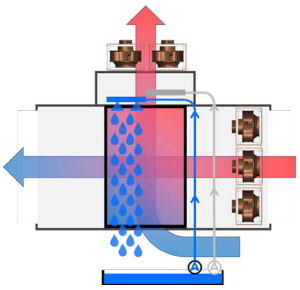
This control logic prioritizes the use of water as primary source for cooling. This mode privileges the unit free cooling operation maximizing the use of the evaporative cooling principle, significantly reducing power consumption leading to lower overall energy usage throughout the year and making it an incredibly efficient solution.

In particular in those regions where abundance of water is an asset to be leveraged for datacenter cooling, this control logic provides the lowest possible carbon footprint and minimizes operating costs.

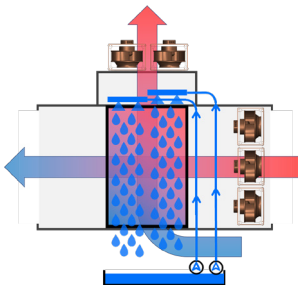
As the temperature increases from lower to higher levels, Vertiv™ Liebert® iCOM™ will activate the transition from Dry operation to Partial Wet operation up to Full Wet operation benefiting the most from the free cooling contribution in both Dry and Evaporative Mode. In case of extreme summer temperatures, in hot and humid conditions, when the evaporative free cooling effect alone is no longer enough to deliver the requested cooling capacity, Liebert® iCOM™ will finally activate the high efficient inverter driven mechanical cooling system.



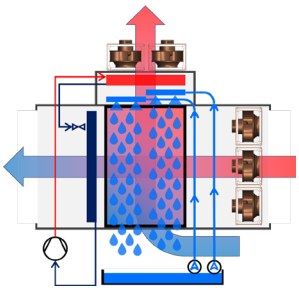
Air to Air Heat exchanger Dry Operation



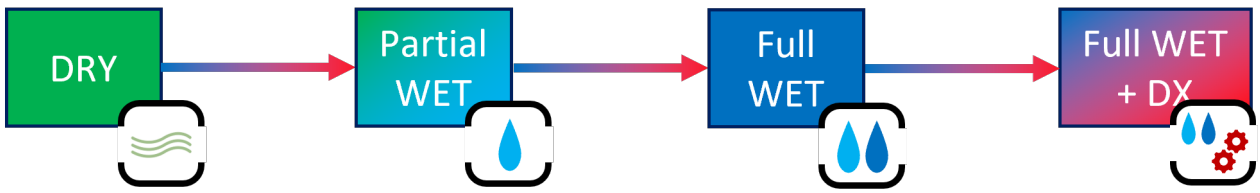
Partial Wet Operation



Full Wet Operation



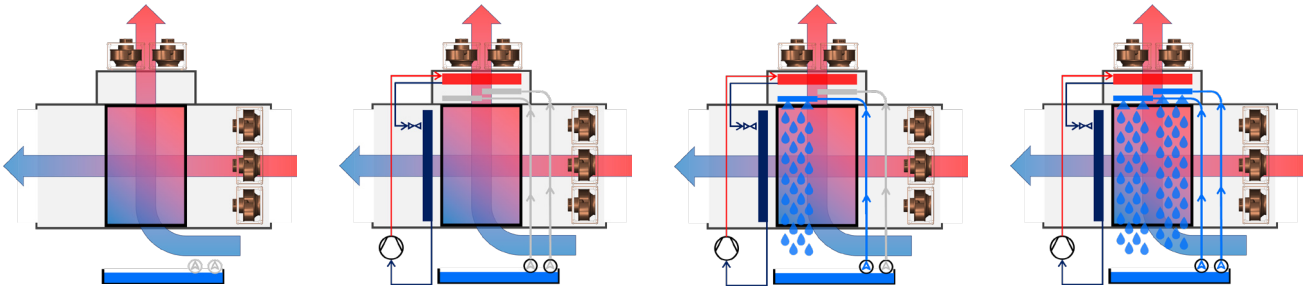
Full Wet + DX Operation



DX priority control logic

In the case of water scarcity periods or regions, or when the use of water for datacenter cooling is no longer a viable option, DX priority logic allows DX Operation to be leveraged as the primary source of cooling, using evaporative technology only when strictly necessary and only when the capacity provided by the mechanical cooling system is not sufficient.

In this way, the sequence of operating modes differs from the previous one. As the temperature increases from lower to higher levels, Vertiv™ Liebert® iCOM™ will activate the transition from Dry operation to DRY + DX operation benefiting the most from the water-free operation of the unit, thus allowing for enhanced Water Usage Effectiveness. In case of extreme summer temperatures when the mechanical cooling effect alone is no longer enough to deliver the request for cooling capacity, Liebert® iCOM™ will activate the transition to Partial Wet + DX and in case to Full Wet + DX. This operation takes advantage of the contribution of the evaporative free cooling effect in the amount strictly necessary to meet the shortfall between DX cooling alone and the datacenter cooling capacity demand. Full DX back up versions are capable of delivering the entire cooling capacity without any need for water.

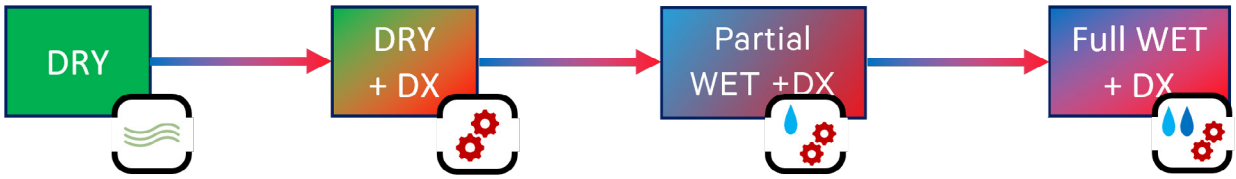


Dry Operation

Dry + DX Operation

Partial Wet + Operation

Full Wet + DX Operation



In either case, the smart Vertiv™ Liebert® iCOM™ control system algorithms facilitates seamless transitions between operating modes, providing always a consistently stable Supply Air temperature (SAT) and resilient, continuous cooling.

High flexibility matching customer needs

Main options	Key benefits
Game changer, patented, polymer plate heat exchanger	To reach your sustainability targets and to achieve a pPUE as low as 1.05 combining high durability and extreme corrosion resistance, optimizing Water Usage Effectiveness water usage effectiveness, which means lower water consumption and lower water waste throughout the year.
Multi-step evaporative system and new live toggling WET and DX priority control logic functionality.	To grant cooling continuity and availability no matter the site-specific contingency conditions, aiming for extreme efficiency and promoting conscious water use.
Inverter driven compressor technology with low-GWP R454B refrigerant	To allow reductions in energy consumption and direct CO_2e emissions.
Teamwork functionality embedded the Vertiv™ Liebert® iCOM™	To enable coordinated control and monitor temperature, humidity, pressure, power utilization, and much more, managing all units as part of an optimized system, Its advanced algorithms seamlessly manage automatic transitions among the working modes.
Indirect deluge evaporative free cooling	Water evaporation lowers temperature reducing electricity use boosting system efficiency lowering the carbon footprint.
Innovative design	To minimize electrical infrastructure requirements thanks to the free cooling and patented control features at system level.
A turnkey solution for **rapid deployment fitting seamlessly**	To allow for scalable deployments in the years thanks to a design which require minimal maintenance and allows no white space occupation.

Technical specifications

Models		EFC 251	EFC 321	EFC 401	EFC 441
FANS	n°	6+4	9+6	9+6 (12+6)*	9+6 (12+6)*
Maximum Airflow Data Center Side[1]	m3/h	85000	111000	118500 (130000)	115000 (126000)
Max Cooling Capacity[2]	kW	325	425	453	440
Max Wet Bulb - Evaporative + DX Effect	°C	23.3	20	24.1	26.3
Nominal Cooling Capacity	kW	225	265	400	400
Max Dry Bulb - Only Dry Cooling[3]	°C	15.8	16.0	13.4	16.0
Max Wet Bulb - Only Evaporative Cooling [3] (Water Priority)	°C	19.8	19.8	19.0	20.0
Standard DX Versions					
Max Wet Bulb - Evaporative + DX Cooling[3]	°C	30.9	30.1	29.1	30.4
Max Dry Bulb - DX Cooling only[3] (DX Priority)	°C	29.1	28.0	25.6	28.0
Dry Capabilities		High+	High	Medium	High+
DX Capability Ratio		High+	High+	High	High+
Full Dx Versions					
Remote Condensers		-	2 x MCV210	2 X MCV280	2 X MCV280
Max Cooling Capacity @ 40°C (Dry)	kW	-	302	337	356
Max Cooling Capacity @ 45°C (Dry)	kW	-	265	323	336
Dimensions					
Length[4]	mm	3800	3800	3800	4500
Depth	mm	2500	2900	3400	3400
Height	mm	4675	4675	4675	4585

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. R410A or R454B refrigerant.

(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.
** Special execution*
(4) 320mm to be added in case of Damper option.

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 Large Outdoor Packaged Innovation Lab

Dedicated area to test the state-of-the-art Vertiv™ 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.

Rely on Integrated Project and Lifecycle Thermal Services for Superior Data Centre Protection

Give continuity to your business activities with a service partner who stands by you throughout your critical equipment lifecycle. From the project phase with start-up and testing, to lifecycle maintenance contracts and operational support, Vertiv is key to the optimal performance of your solution.

Global Presence & Local Resources

With the broadest, most comprehensive service presence in the industry and more than 650 engineers dedicated to servicing Europe, Middle East and Africa, Vertiv protects your business and offers/provides 24-hour services a day.

Premium Response

With Vertiv you can count on an extensive supply of critical parts plus crash-kits ready for deployment, and on service engineers that can respond to requests in record time. To do so, they can rely on a solid knowledge-base, and established escalation procedures valid across the entire region. In addition, they can also benefit from advanced incident management, and widespread presence of Service Centres all enabling them to deliver premium restoration capabilities.

Commissioning Phase	Technical Activities	Project Management	
Pre-Project activity		• Project Charter / Project Initiation Docs • Identify Stakeholder	
Level 0 **Program and Design**	• Commissioning Spec & Plan • Engineering • Design Review • Schedule Integration • Submittal Review • Commissioning Procedure • Commissioning Kick-off	• Work Breakdown Structure (WBS) • Supply Chain & Procurement Management Plan • Project Team Creation • Create Risk Management Plan • Create Communication Management Plan • Create Change Management Plan • Create Project Schedule • Health & Safety Assessment • Kick-Off meeting with Customer	
Level 1 **Factory Witness Test**	• Factory Witness Test		
Level 2 **Delivery, QA/QC, Installation Assembly, Field Supervision**	• Site Acceptance Inspection • Delivery & Assembly • Equipment Installation	• Supply Chain & Procurement Management • Execute Project Plan • Schedule On-Site Resource Management • Facilitate Team Meetings & Distributes Minutes • Health & Safety Management	• Manage Issues, Changes & Risks • Report Project Status • Contract, Financial & Quality Review • Health & Safety Review
Level 3 **Start-Up and Site Acceptance Test**	• Installation & Startup • Pre-Functional Equipment Verification • Site Acceptance Test		
Level 4 **Functional Performance Testing**	• Functional Performance Test		
Level 5 **Integrated System Test Support**	• Integrated System Test • Training & O&M Verification		
Level 6 **Close Out & Turn-over**	• System Manual • Seasonal Testing • Warranty Review & Supplemental Report • Commissioning Report	• Customer Acceptance • Handover to Operation & Maintenance • Lessons Learned • Financial Closure • Project Closure	

Expertise & Training

All service engineers are regularly certified according to country-specific regulations as well as wider European and international regulations and standards. Vertiv F-gas certifies all thermal service engineers. This enables them to operate with all refrigerants including the ones with low GWP (Global Warming Potential) and A2L* category such as R454B, used in Vertiv™ Liebert® EFC.

Vertiv service engineers are trained, experienced professionals who undergo an average of one week of intensive training each quarter, totalling one month of full-time training per year. Training includes both technology and safety, to enable competent and safe field operations, reinforced by established procedures to follow and central technical support in case of need.

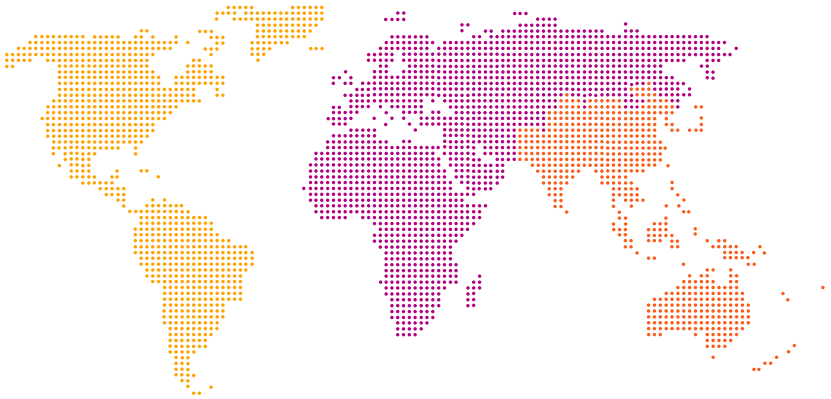
Project Services

From project planning and design, through to equipment procurement, installation, and commissioning, our project team offers comprehensive capabilities, providing speed of deployment and execution according to pre-defined and repeatable procedures. Low-GWP gases require the use of specific tooling. Vertiv engineers are endowed with the right tools and trained on how to use them, thus delivering proper installation, start up, and maintenance of low-GWP units.

Supporting Your Business Around the Globe

Regular service of critical equipment supports maximum uptime and often reduces total cost of ownership. A service programme provides timely and proactive maintenance for avoiding unexpected, costly equipment downtime and enables optimal equipment operation. Vertiv™ service programmes cover all technologies and can be tailored to suit individual business needs.

Preventing or minimising refrigerant losses is key to every direct expansion circuit. Even more so with low-GWP refrigerants, where the aim is to use as least refrigerant as possible both in case of maintenance or repair. Advanced incident management procedures leveraging site data allow Vertiv to be extremely effective in fault management and root cause analysis should it occur. Vertiv extensive service offering includes installation, startup, commissioning, maintenance, replacements, 24x7 remote monitoring and diagnostics, and much more.



Worldwide

Manuf. and Assembly Locations: **22**
Service Centers: **240+**
Service Field Engineers: **3,500+**
Technical Support/Response: **190+**
Customer Experience Centers/Labs: **19**

Americas

Manuf. and Assembly Locations: **8**
Service Centers: **100+**
Service Field Engineers: **1,600+**
Technical Support/Response: **70+**
Customer Experience Centers/Labs: **5**

Europe, Middle East, and Africa

Manuf. and Assembly Locations: **9**
Service Centers: **60+**
Service Field Engineers: **600+**
Technical Support/Response: **100+**
Customer Experience Centers/Labs: **5**

Asia Pacific

Manuf. and Assembly Locations: **5**
Service Centers: **80+**
Service Field Engineers: **1,300+**
Technical Support/Response: **20+**
Customer Experience Centers/Labs: **9**

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