HiRef

Innovators above
the standards

Liquid Cooling Solutions
for Data Centers

HYBRID ROOMS: the combined solution between air and water cooling for data centers

In recent years, several technologically advanced solutions have emerged to meet the **new cooling needs** of data centers, server rooms, and IT rooms. **Liquid cooling systems**, in particular, have become an increasingly sophisticated choice for air conditioning, both in the **direct-to-chip** versions (where only certain components like chipsets and GPUs are cooled) and **immersion cooling** (where all server components are submerged in a dielectric liquid).

It is true that liquid cooling systems provide **greater thermal efficiency** and **reduce energy consumption**, even as computing needs increase and more powerful microprocessors are used. However, these are not definitive solutions: around 10-20% of the heat is still released into the air. For this reason, **'hybrid' solutions are now being designed and developed**, incorporating perfectly coordinated **liquid and air cooling systems** for the racks.

Recent developments in IT therefore **require advanced heat management solutions**. Liquid cooling offers an effective response to this challenge, providing significant advantages over traditional air cooling systems. Its **superior efficiency in 'capturing' and dispersing heat** from critical production areas within the server (such as the CPU and GPU) not only ensures the **optimal operation of data centers** but also reduces the amount of energy needed to maintain the optimal temperature of the coolant (which is higher than that of the chilled water in air cooling systems).

Liquid cooling is one of the emerging solutions for thermal management in data centers, which could help address the increasing power of modern processors. The use of a coolant to absorb, transfer, and dissipate the heat generated by high-power electronic components offers **several advantages** over traditional air cooling systems:

- **greater thermal efficiency**, with more efficient heat transfer;
- **reduced energy consumption**, as the higher efficiency of liquids in transporting heat requires less energy to maintain the optimal temperature;
- **lower environmental impact**, due to a smaller thermal and energy footprint.

However, liquid cooling cannot be the sole solution. A portion of the heat generated by data centers (about 10-20%) is still released into the air. Therefore, conventional cooling systems will still need to be utilized, prompting a reconsideration of data center room design.

Among the new solutions are **Coolant Distribution Units (CDUs)**, which efficiently distribute the coolant while maintaining it within optimal temperature ranges to ensure the longevity of the cooling system. At the same time, HiRef is developing **Rear Door solutions**, an active or passive air conditioning system to be applied to the rear of the rack.

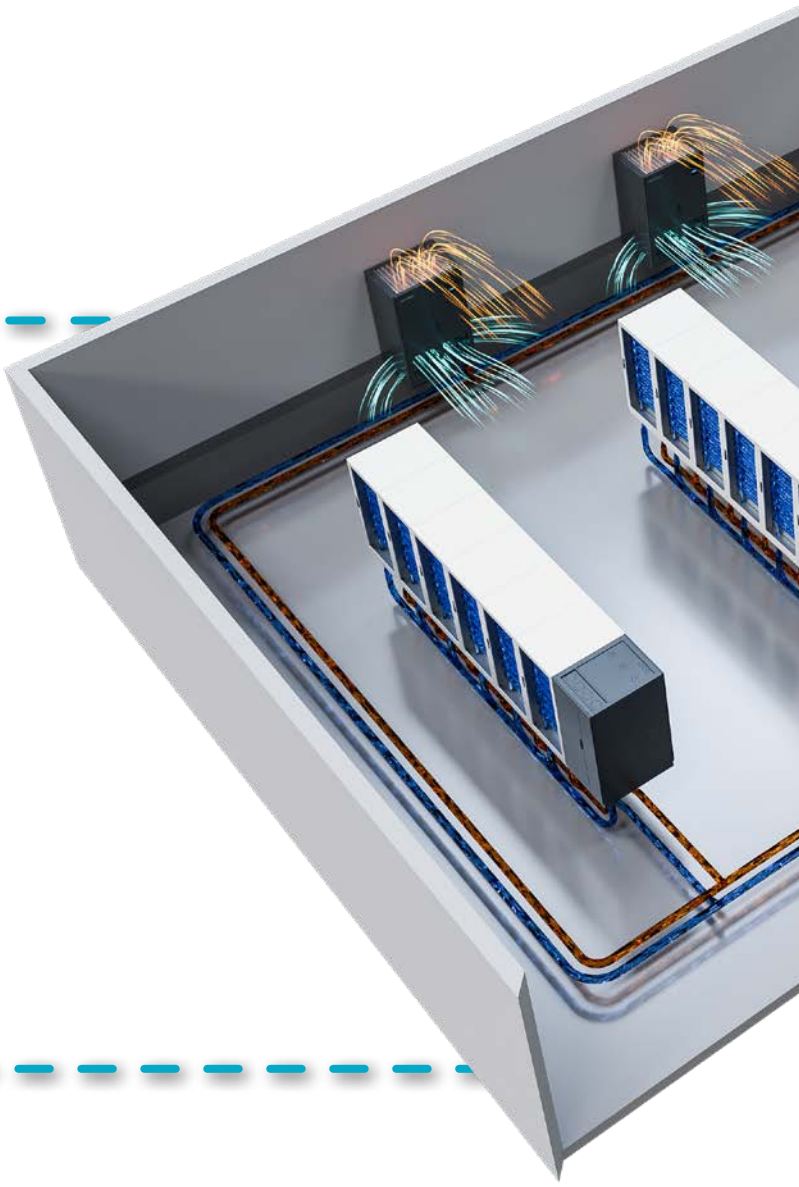
Additionally, in the hybrid room of the future, another key element will be the **HiNode**, a device that enables interfacing with and **monitoring all components and devices** of the cooling system.

A combined solution, therefore, must be able to harness the **synergy between air and water cooling systems** to minimize inefficiencies and ensure maximum operational continuity for data centers.


HiRef

TRF
Displacement

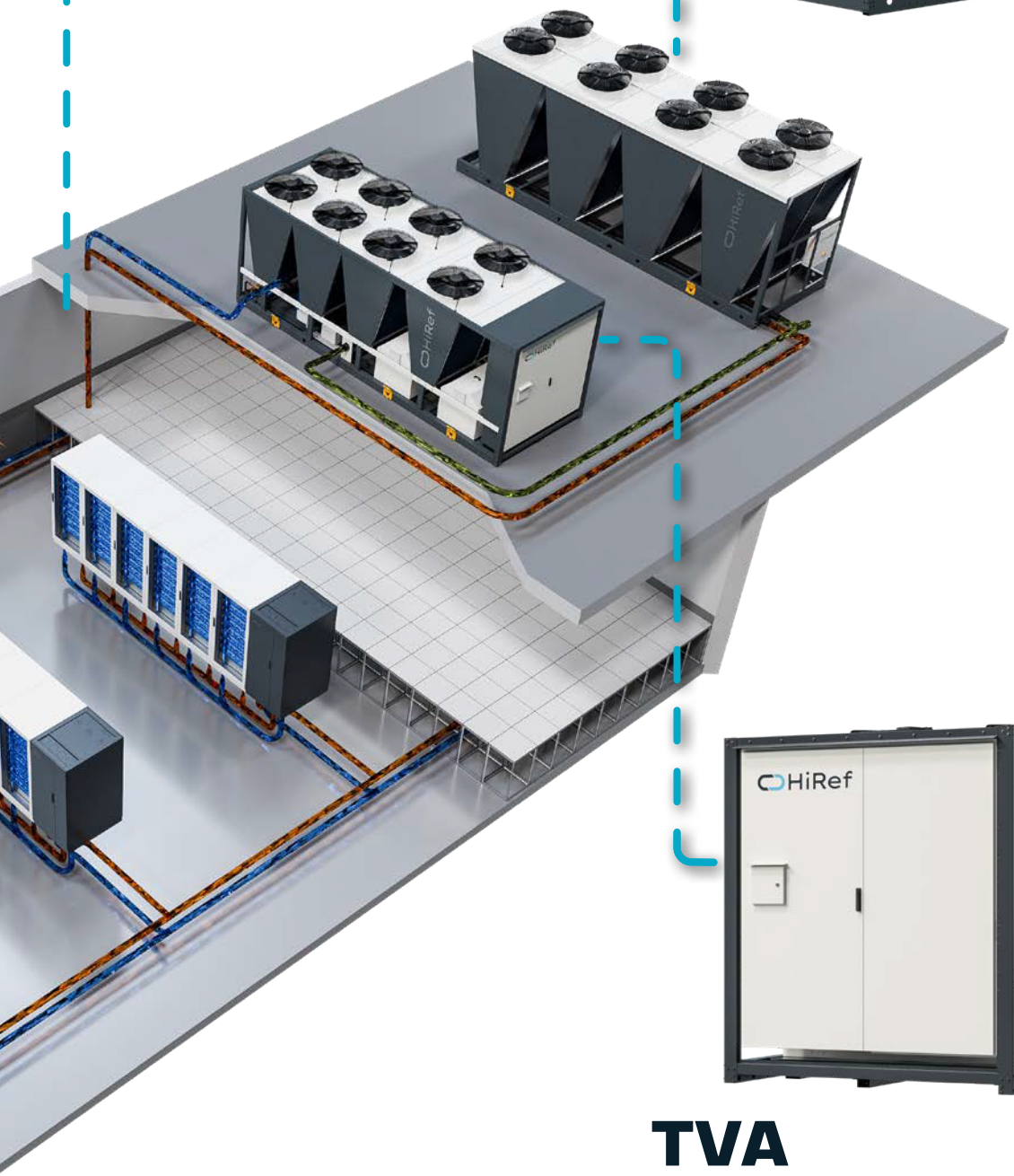
NRG F
Displacement



CDU

HiNode

Dry Cooler

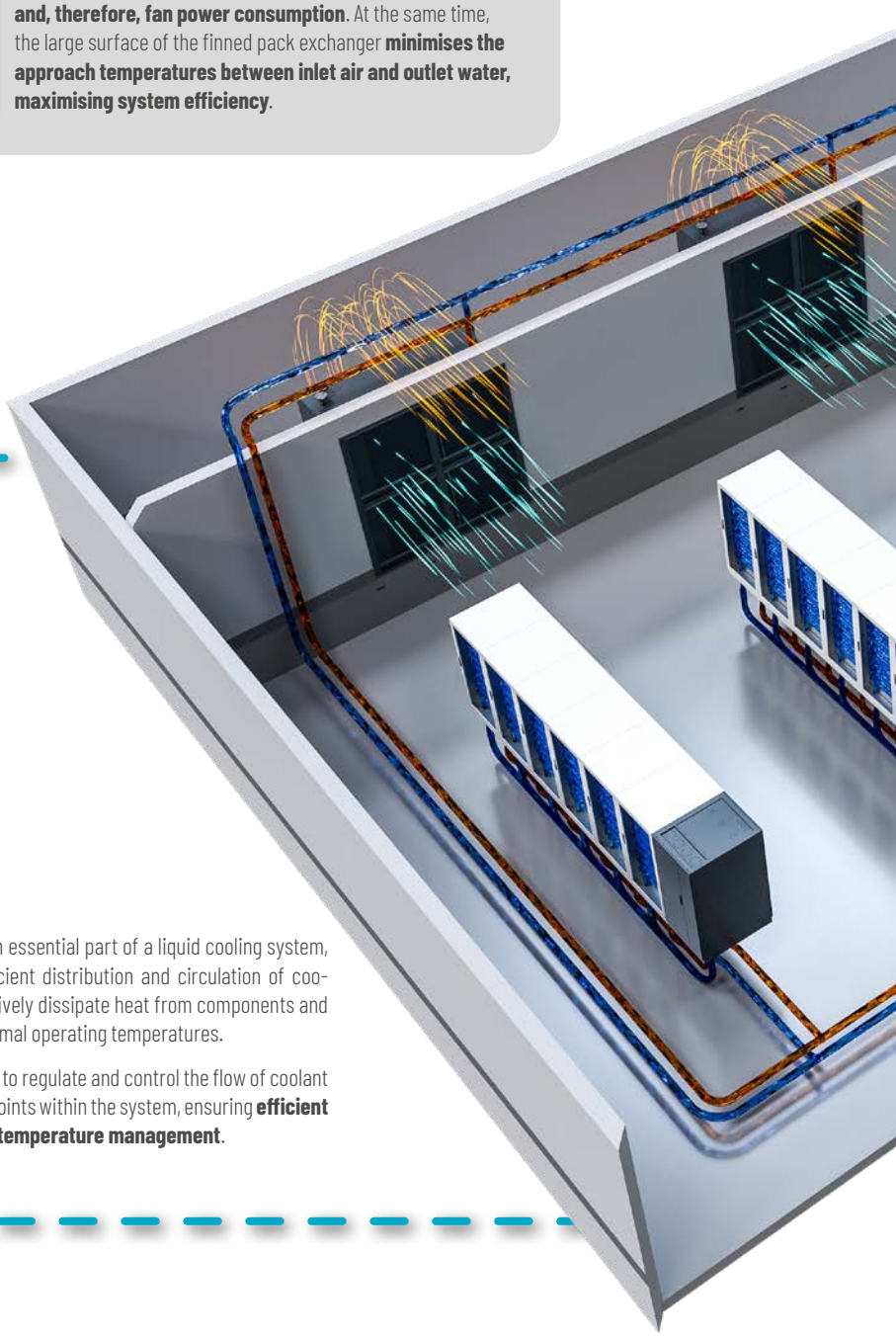


TVA

Hybrid Solution 2

FanWall

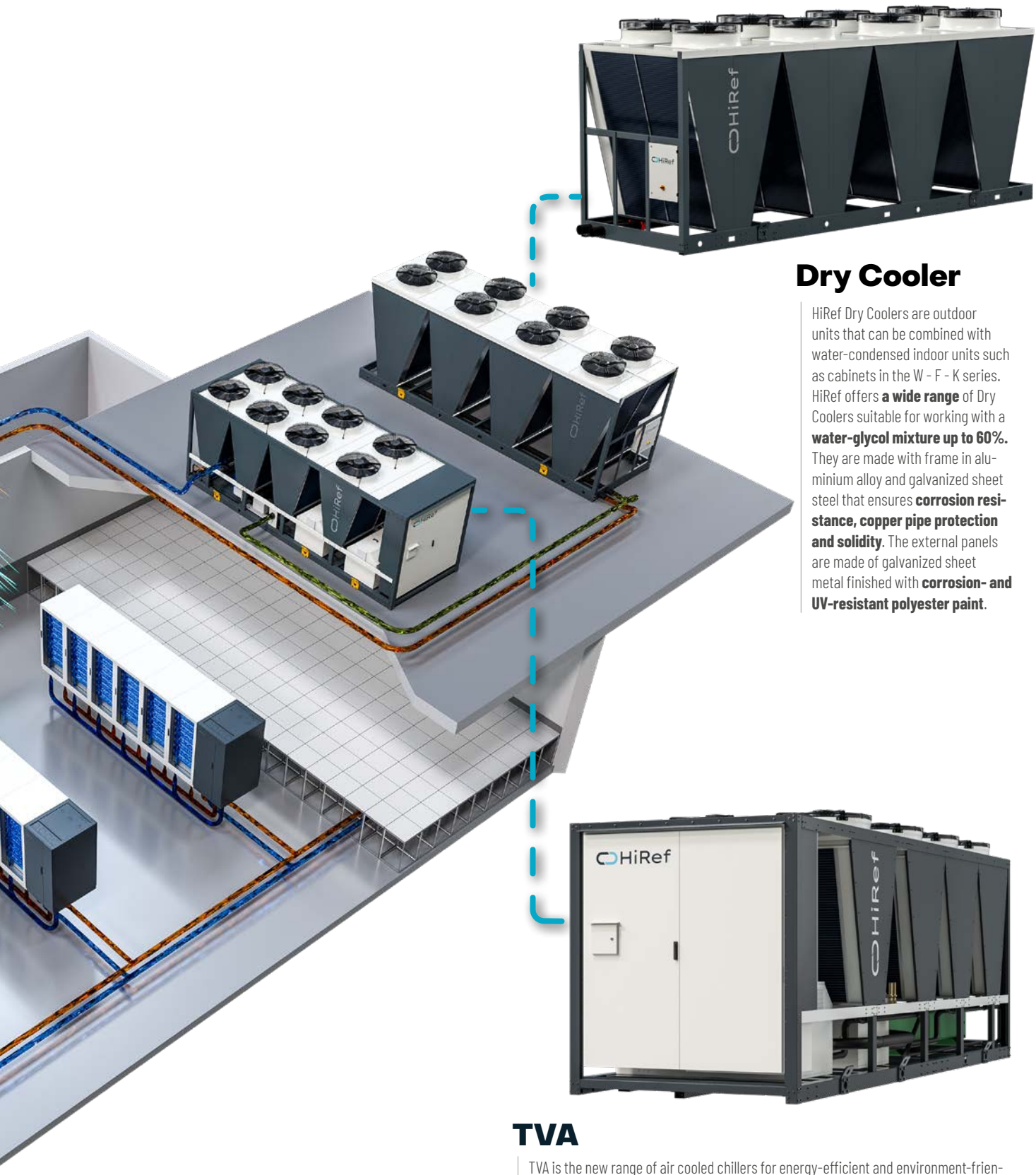
FanWall range is perfectly suited for hybrid applications, offering the possibility of operating with a single external dissipation system. Our chilled water FanWall HBCV series air conditioners are designed for technological environments where a **compact footprint is a requirement - without any impact on these units' cooling output capacity**. An in-depth CFD (computational fluid dynamics) analysis has allowed every last constructive detail to be designed so as **to minimise internal airflow pressure drops and, therefore, fan power consumption**. At the same time, the large surface of the finned pack exchanger **minimises the approach temperatures between inlet air and outlet water, maximising system efficiency**.



CDU

The CDU is an essential part of a liquid cooling system, enabling efficient distribution and circulation of coolant to effectively dissipate heat from components and maintain optimal operating temperatures.

It is designed to regulate and control the flow of coolant to different points within the system, ensuring **efficient cooling and temperature management**.



Dry Cooler

HiRef Dry Coolers are outdoor units that can be combined with water-condensed indoor units such as cabinets in the W - F - K series. HiRef offers **a wide range** of Dry Coolers suitable for working with a **water-glycol mixture up to 60%.** They are made with frame in aluminium alloy and galvanized sheet steel that ensures **corrosion resistance, copper pipe protection and solidity**. The external panels are made of galvanized sheet metal finished with **corrosion- and UV-resistant polyester paint**.

TVA

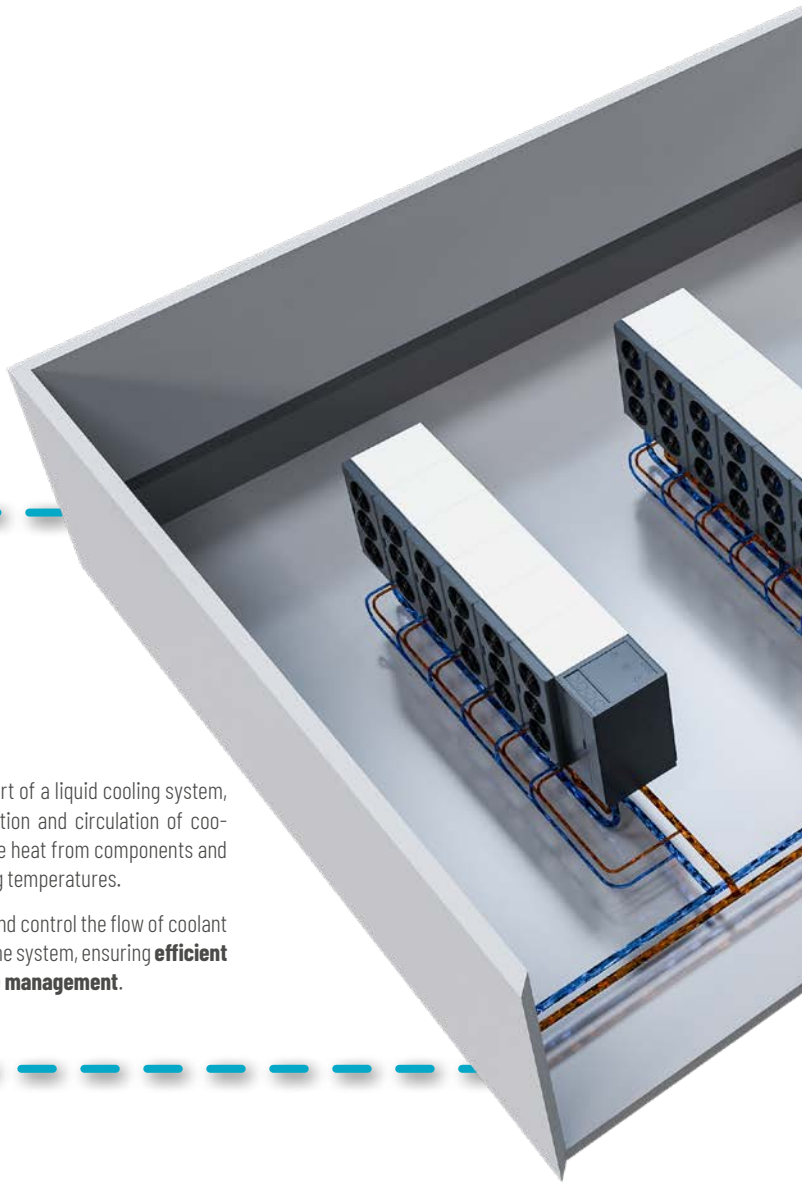
TVA is the new range of air cooled chillers for energy-efficient and environment-friendly processes. Low environmental impact has been achieved by using **new HFO refrigerants** with low Global Warming Potential (GWP), while **higher efficiency/ footprint ratios** are reached thanks to the special V-configuration of the heat exchange coils and their sizing, **the largest among the chillers currently available on the market**. The Free-Cooling version - where heat exchange surface areas are double the market average - **ensure outstanding performance**. The high thermodynamic efficiency with low Total Equivalent Warming Impact (TEWI) is combined with a special focus on maintainability and **easy accessibility of the compressors contained in the removable HiRail** module which reduces noise emissions.

Hybrid Solution 3

Rear Door Cooling

The rear door is a cooling system used in data centers to dissipate the heat generated by servers **directly at the back of the rack cabinets**.

The operation involves the hot air expelled by the servers passing through the rear door, where it is cooled before being released into the environment. This significantly reduces the air temperature inside the data center, **improving energy efficiency and reducing the need for traditional cooling** at the environmental air conditioning level.



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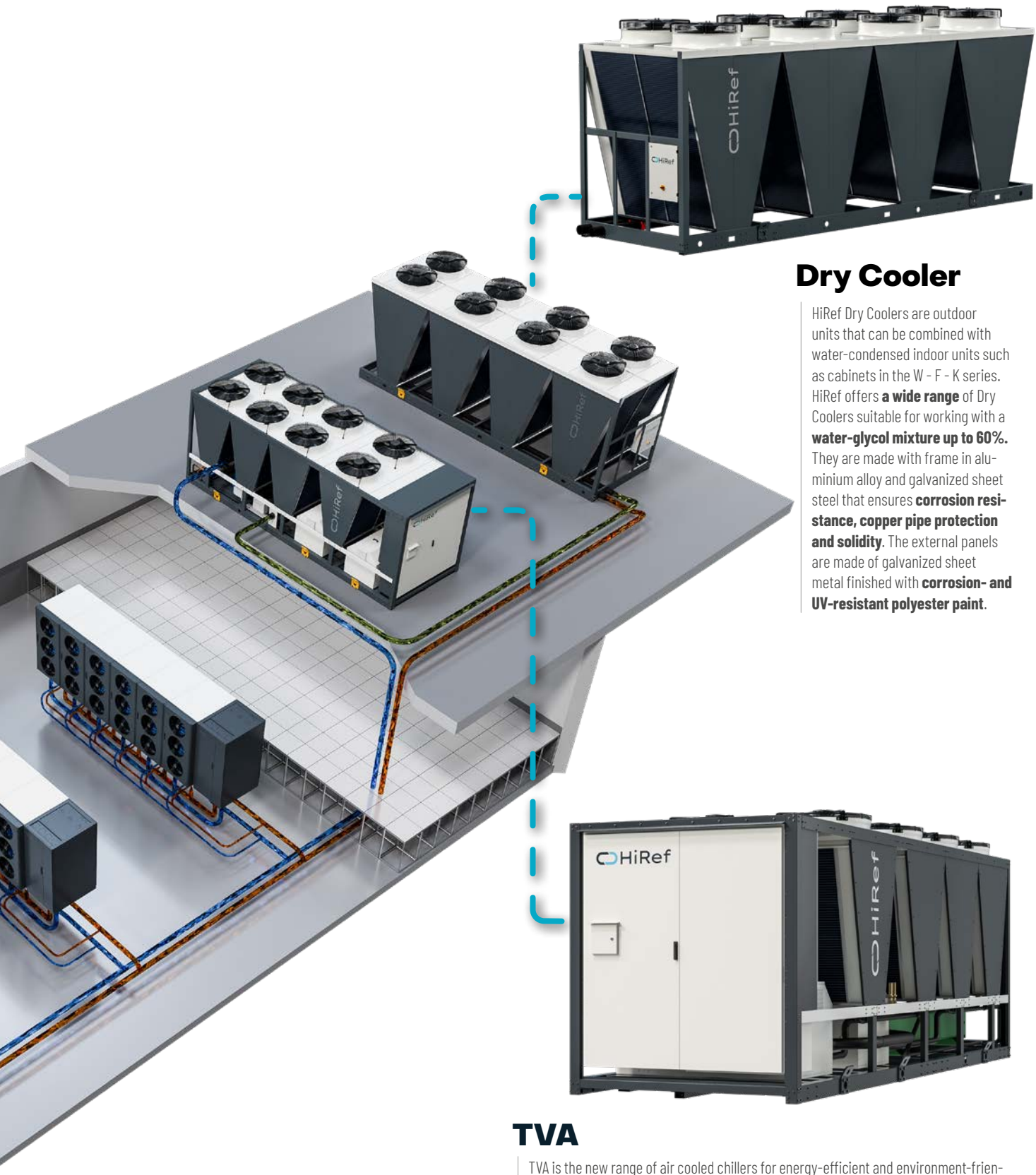

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Platform ***TRF Evolution***

TRF CW

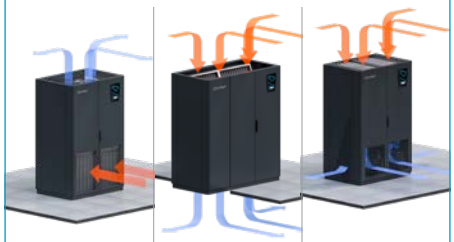
DATA CENTER | INDUSTRIAL

CHILLED WATER PERIMETER MOUNTED UNITS FOR DATA CENTERS

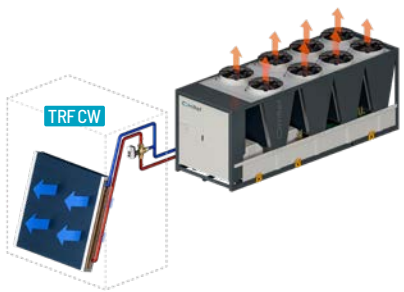
33.4–257.1 kW

The new chilled water air conditioners of the **TRF CW** series are particularly suitable for IT facilities where **temperature and air flow need to be continuously monitored**. The components of the TRF CW unit offer the most efficient solution for **Data Center cooling**, ensuring **reliability**, **precise control of thermo-hygrometric conditions** and the **flexibility** to adapt to different working conditions.

AIRFLOW CONFIGURATIONS

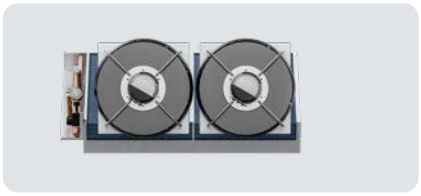


CHILLED WATER



Easier scheduled maintenance

The unit has been painstakingly designed to ensure frontal access to components. This makes **routine maintenance easier in full compliance with safety standards.**



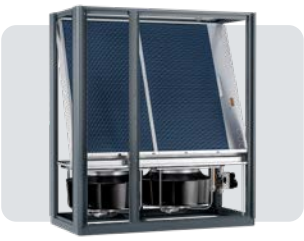
Ventilation adjustment

Depending on the air distribution logic in the server room, it is possible to adjust the machine on-board ventilation system to ensure a **constant air flow rate** (airflow control) **or a constant available overpressure** (ΔP control). The latter is particularly useful if a floating floor is used.

Double circuit

Chilled water units are also available with a double circuit. In this version, the supply is via **two different hydraulic circuits** that can offer the **utmost operational continuity if one of the two circuits malfunctions.** Each circuit is equipped with a regulating valve.

- Temperature control through heating and post-heating systems using electric heating elements, additional hot water coil or both
- Humidity control through dehumidification and humidification (optional)
- Fan speed modulation based on thermal load (constant ΔT)
- Hydraulic connections from the bottom of the unit
- Broad choice of accessories, including base modules and plenums for ducting
- Air filter class G3 as standard. Air Filters G4, M5, F7 (optional)
- Double power supply with automatic switch (optional)
- Double panelling only on the front doors or on the whole machine (optional)
- Instant reading of water flow rate, water inlet and outlet temperatures, or supplied cooling capacity (optional)



Finned pack coil with hydrophilic coating

All models in the TRF CW range feature heat exchange coils with hydrophilic coating. This special coating - together with adequate adjustment of air through-flow speeds - **helps condensate collection and outflow during the dehumidification process, preventing any dripping on the inside and outside of the unit.**

Accurate regulation with multiple types of valves

All units in the TRF CW range have as standard regulating valves fitted with 0-10V servo motor, selectable in 2-way execution, with variable or 3-way flow system or with servo motor with spring return. Pressure-independent valves can also be fitted on request. All these types of valves **ensure the utmost adjustment accuracy while maintaining the system's hydronic balance.**

New design: efficiency, flexibility and optimization of internal layout

Internal spaces have been completely redesigned for **a better distribution of components.** The new internal layout features a larger pack heat exchanger and a state-of-the-art fan **for maximum air flow and efficiency.** Following a **painstaking dynamic fluid study,** the filtering surface has also been expanded, now it is distributed over the entire coil **to further reduce air pressure drops.**

Ventilation EC 2.0

EC PLUG fans, standard throughout the range, are adjustable using different logics: flow rate, overpressure, constant ΔP and ΔT. Their accurate adjustment allows **an efficient use of power for ventilation and a consequent reduction of the system's PUE.** The speed, with extended range, is adjusted via the Modbus protocol. Finally, the "emergency speed" function allows for fan operation **even in the event of microprocessor malfunctions.**

Guaranteed flexibility

With three different types of heat exchangers, each optimised to a specific water ΔT value (difference in water temperature between inlet/outlet), we ensure **high flexibility in adapting to the system or liquid chillers already in operation,** without compromising cooling performance:

- **Geometry A** for ΔT = 5°C
- **Geometry B** or ΔT = 8°C
- **Geometry C** for ΔT = 12°C

TRF CW		040	060	070	080	090	100	110	130	170	240
Version A		Air temperature 24°C - Relative humidity 50% / Water temperature In 7°C Out 12°C									
Cooling capacity	kW	38.1	58	64.4	80.8	85.3	105.5	103.1	137.2	177.2	257.1
SHR		0.86	0.79	0.82	0.78	0.81	0.77	0.83	0.77	0.77	0.74
EER		31.07	39.97	33.28	37.31	34.93	40.41	33.65	40.43	36.02	34.82
Version A		Air temperature 30°C - Relative humidity 35% / Water temperature In 10°C Out 15°C									
Cooling capacity	kW	43.3	59.6	67.9	80.8	89.9	104	112.3	133.7	172.7	236.3
SHR		1	0.99	1	0.99	1	0.97	1	0.99	0.99	0.94
EER		35.36	41.06	35.05	37.33	36.82	39.84	36.66	39.41	35.11	32.01
Version B		Air temperature 30°C - Relative humidity 35% / Water temperature In 10°C Out 18°C									
Cooling capacity	kW	38.9	55.2	63.3	74.8	82.4	98.4	104.8	126.3	163.1	229.5
SHR		1	1	1	1	1	1	1	1	1	0.96
EER		31.69	38	32.69	34.54	33.73	37.69	34.19	37.2	33.15	31.08
Version C		Air temperature 30°C - Relative humidity 35% / Water temperature In 10°C Out 22°C									
Cooling capacity	kW	33.4	49.8	54.4	67.5	73.2	87.6	90.1	111.8	144.4	210.2
SHR		1	1	1	1	1	1	1	1	1	1
EER		27.23	34.32	28.1	31.2	30	33.55	29.39	32.94	29.35	28.47
Version A		Air temperature 35°C - Relative humidity 30% / Water temperature In 15°C Out 20°C									
Cooling capacity	kW	43.7	58.6	68.2	80.2	89.3	102.3	112.9	133.9	172.9	237.5
SHR		1	1	1	1	1	1	1	1	1	1
EER		35.65	40.36	35.22	37.03	36.57	39.16	36.84	39.46	35.16	32.17
Version B		Air temperature 35°C - Relative humidity 30% / Water temperature In 15°C Out 23°C									
Cooling capacity	kW	39.1	55	63.4	75.3	82.4	98.1	104.9	125.9	162.6	228.4
SHR		1	1	1	1	1	1	1	1	1	1
EER		31.89	37.91	32.74	34.8	33.74	37.56	34.24	37.1	33.06	30.94
Version C		Air temperature 35°C - Relative humidity 30% / Water temperature In 15°C Out 27°C									
Cooling capacity	kW	33.9	50.1	56.5	67.9	73.9	87.9	91	112.3	145.1	210.6
SHR		1	1	1	1	1	1	1	1	1	1
EER		27.67	34.49	29.17	31.35	30.24	33.68	29.7	33.1	29.49	28.52
Rated air flow	m^3/h	10700	10700	14500	14500	18000	18000	24000	24000	18000	31000
Total fan absorbed power	kW	1.2	1.5	1.9	2.2	2.4	2.6	3.1	3.4	4.9	7.4
Lp @ Nominal rpm ; dist.= 2 m Q=2	dB(A)	61		67		72		66	67	72	71
Dimensions Mod. "D" (Downflow) [LxHxD]	mm	1010x2000x890		1270x2000x890		1760x2000x890		2020x2000x890		2510 x2000 x890	3160 x2000 x960
Power supply	V/ph/Hz	400/3+N/50									

Performance data relating to Downflow versions. | Also available with 60 Hz power supply. | Units also available in the models Upflow and Displacement, with the exception of size 240. | Height of model Displacement 2250 mm.

Platform ***TRF Evolution***

TRF DX F

DATA CENTER INDUSTRIAL

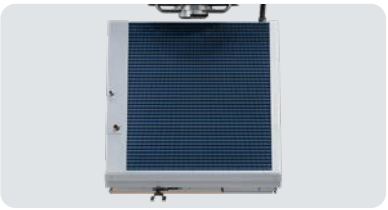
PERIMETER MOUNTED UNITS FOR DATA CENTERS WITH INDIRECT FREE-COOLING

22.9–149.9 kW

TRF DX F units are water-condensed perimeter-mounted cabinets that are able to exploit **the effect of indirect water-based Free-Cooling**. The F Series uses Dry Cooler water as both a cooling source for Free-Cooling and a heat exchange fluid for condensing the cooling circuit. TRF DX F units are monobloc units inside which the **entire cooling circuit is concentrated**. Condensation takes place through a brazed-plate heat exchanger made of AISI 304 stainless steel.

Maximum energy saving

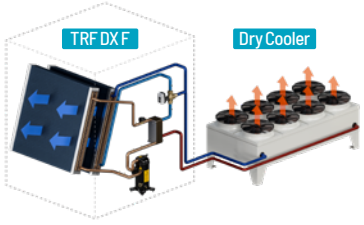
In periods when the air outside is cooler than the warm air inside the Data Center, the cold water produced by the dry cooler directly feeds the heat exchange coil, which is able to provide a part or all of the required cooling capacity. Before returning to the dry cooler, the water is reused inside the plate exchanger, serving the compressor. The entire process is regulated by a 3-way valve **directly controlled by HiRef software, which maximizes the Free-Cooling effect and checks the cooling circuit.** In this way the work of the compressor is significantly reduced, and shuts down when a state of Free-Cooling is fully reached, **with a significant reduction in the system's PUE.**



Safety in the server room

All models in the TRF DX F range feature heat exchange coils with hydrophilic coating as standard. This special coating - together with an adequate selection of air through-flow speeds - **aids condensate collection during the dehumidification process, preventing any dripping on the inside and outside of the unit.**

INDIRECT WATER-SIDE FREECOOLING



- Refrigerant R410A: Also available with R513A and R134a
- EC Fans
- Scroll on/off compressors
- Advanced control comes as standard
- Temperature control through heating and post-heating systems with electric heating elements (optional)
- Humidity control through dehumidification and humidification (optional)
- Broad choice of accessories, including base modules and plenums for ducting
- Air filter class G3 as standard. Air Filters G4, M5, F7 (optional)
- Double power supply with automatic switch (optional)
- Constant-flow (airflow control) or constant available overpressure (ΔP control) ventilation modulation (optional)
- Electronic expansion valves (optional)

Easier scheduled maintenance

The unit has been painstakingly designed to ensure frontal access to components even with the units running. This makes **routine maintenance easier in full compliance with safety standards**.

Efficiency

The performance, reliability and efficiency of HiRef units are guaranteed **by using the best quality components and by cleverly designed internal and external layouts.**

Green

HiRef is constantly committed to the search for refrigerants with ever-lower environmental impact. The use of ASHRAE Class A1 refrigerants, non-toxic and non-flammable, is essential for the close control application. TRF DX F units are available with R134a and R513A refrigerants.

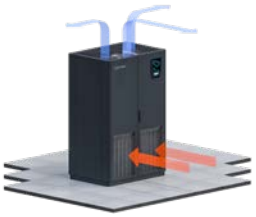
Dual circuit

Double-circuit versions are already available at low power levels. This solution offers **maximum unit redundancy and ensures continuity of service, more precise refrigerating power and less absorption for partial Data Center loads.**

AIRFLOW CONFIGURATIONS

Upflow

Downflow



Displacement

TRF DX F		0241	0261	0291	0331	0361	0391	0441	0481	0521	0382	0432	0492	0532	0602	0632	0682	0762	0802	0872	0962	1204	1304
		Inside air 24°C - 50% / Water 40°C - 45°C / Free-cooling water 7°C / Glycol 30%																					
Cooling capacity	kW	22.9	25.7	28.9	32	34.9	39.1	42.9	46.2	50.8	37.1	41.8	45.8	52.5	57.6	62.3	68.7	75.9	80.1	89.6	96.7	115.4	128.4
SHR		1	0.95	0.89	0.97	1	0.89	0.87	1	0.96	1	1	1	0.94	0.88	0.94	0.91	0.85	0.98	0.88	0.87	0.89	0.85
EER		4.01	4.16	3.95	4.42	4.28	4.24	4.08	4.39	4.29	4.58	4.33	4	4.28	3.96	4.35	4.25	4.12	4.33	4.25	4.07	3.88	3.81
Free-Cooling capacity	kW	24.6	26.9	28	33.3	34.8	37.8	40.8	52.1	52.1	44.9	46.2	52.1	54.2	58.5	62.5	67.6	70.2	85.7	89.1	92.5	124.5	133.3
SHR Free-Cooling		0.9	0.86	0.84	0.9	0.88	0.84	0.81	0.86	0.86	1	0.91	0.86	0.84	0.81	0.86	0.82	0.81	0.84	0.82	0.81	0.79	0.77
Total absorbed power	kW	6.8	7.3	8.4	8.8	9.7	10.7	12	13.2	14.5	10.8	12.2	14.1	15	17.2	17.6	19.4	21.7	23.8	26.4	29.1	35.2	39.2
		Inside air 30°C - 35% / Water 40°C - 47°C / Free-cooling water 12°C / Glycol 30%																					
Cooling capacity	kW	26	28.4	31.4	36	38.7	42.7	46.1	51.5	55.9	42.5	47.9	51.8	57.7	62.1	69.1	74.5	81.2	88.3	97.7	103.3	125.2	136.3
SHR		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EER		4.38	4.45	4.14	4.83	4.61	4.47	4.23	4.75	4.57	5.06	4.76	4.35	4.55	4.12	4.68	4.47	4.24	4.62	4.48	4.19	4.07	3.93
Free-Cooling capacity	kW	24	24.7	25.5	32.4	33.4	34.4	35.3	47.9	49.3	43.8	45.1	49.3	49.3	50.7	57.5	60.8	62.5	77.9	80.1	82.3	109.6	109.6
SHR Free-Cooling		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total absorbed power	kW	7.1	7.5	8.7	9	9.9	11.1	12.4	13.5	14.9	11.1	12.6	14.6	15.4	17.7	18	19.9	22.4	24.4	27.1	29.9	36.3	40.2
		Inside air 35°C - 30% / Water 40°C - 47°C / Free-cooling water 17°C / Glycol 30%																					
Cooling capacity	kW	28.8	31.4	34.5	39.9	42.9	47	50.7	57.2	61.8	47	53.1	57.6	63.9	68.9	76.7	82.6	90.1	98.4	108.1	114.3	137.8	149.9
SHR		1	1	1	0.98	1	0.99	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EER		4.85	4.98	4.59	5.41	5.17	4.94	4.67	5.34	5.07	5.61	5.29	4.83	5.1	4.61	5.23	5.01	4.71	5.18	4.97	4.65	4.49	4.34
Free-Cooling capacity	kW	25.6	26.3	26.4	34.5	34.5	35.7	36.6	50.9	50.9	46.9	47.9	50.9	50.9	53.9	61.1	62.7	63	80.4	82.6	85.2	112.7	113.3
SHR Free-Cooling		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total absorbed power	kW	7.1	7.4	8.7	8.9	9.8	11	12.4	13.4	14.9	11.1	12.6	14.6	15.2	17.6	17.9	19.8	22.4	24.3	27	29.9	36.2	40
Rated air flow	m³/h	8000	8000	8000	10800	10800	15500	10800	15000	10800	15500	15500	15500	15500	15500	18600	18600	18600	24500	24500	24500	31800	31800
Number of circuits		1	1	1	1	1	2	1	2	1	1	2	1	2	2	2	2	2	2	2	2	2	2
Number of compressors		1	1	1	1	1	2	1	2	1	1	2	1	2	2	2	2	2	2	2	2	4	4
Lp @ Nominal rpm ; dist.= 2 m Q=2	dB(A)	61	62		65		71	65	71	65	71					65			69			66	
Dimensions [LxHxD]	mm	1010x2000x890			1270 x2000 x890		1760 x2000 x890	1270 x2000 x890	1760 x2000 x890	1270 x2000 x890	1760x2000x890					2020x2000x890			2510x2000x890			3160 x2000 x960	
Power supply	V/ph/Hz	400/3+N/50																					

Performance data relating to Downflow versions with R410A refrigerant. | Also available with 60 Hz power supply. | Height of model Displacement 2250 mm.

Platform ***TRF Evolution***

NRG F

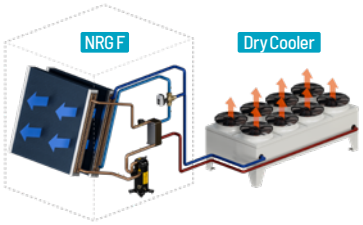
DATA CENTER INDUSTRIAL

PERIMETER MOUNTED UNITS FOR DATA CENTERS WITH MODULATING COMPRESSORS WITH INDIRECT FREE-COOLING

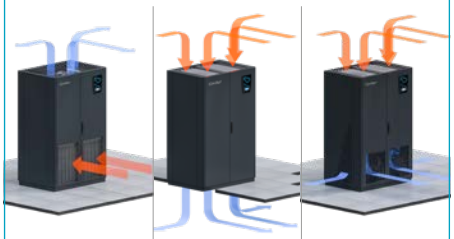
11.4-99.2 kW

NRG F units are water-condensed perimeter-mounted cabinets that are able to exploit the **effect of indirect water-based Free-Cooling**. The F Series uses Dry Cooler water as both a cooling source for free-cooling and a heat exchange fluid for condensing the cooling circuit. NRG F units are "mononobloc" units inside which the **entire cooling circuit** is concentrated. Cooling is via a **brazed plate exchanger made of stainless steel AISI 304.**

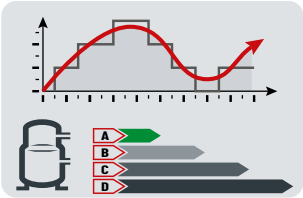
INDIRECT WATER-SIDE FREE-COOLING



AIRFLOW CONFIGURATIONS

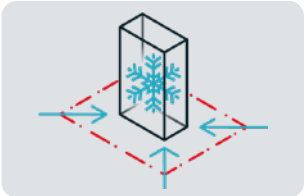


- Refrigerant R410A
- EC Fans
- Scroll inverter compressors
- Electronic expansion valves (optional)
- Advanced programmable microprocessor control with LCD display
- Temperature control through heating and post-heating systems with electric heating elements (optional)
- Humidity control through dehumidification and humidification (optional)
- Broad choice of accessories, including base modules and plenums for ducting
- Air filter class G3 as standard. Air Filters G4, M5, F7 (optional)
- Double power supply with automatic switch (optional)
- Constant-flow (airflow control) or constant available overpressure (ΔP control) ventilation modulation (optional)



Power modulation

NRG F units adapt quickly to Data Center cooling requests. Thanks to the inverter-controlled compressor, performance can be modulated to **up to 25%** of the rated value, thus reducing consumption. This ensures **continuous operation of the unit even at low loads,** without switching cycles on and off.



Maximised power density

The internal design and the special arrangement of the components of the TRF Evolution platform, used in the NRG units, have been designed **to maximise the exchange surface of the evaporating coil.** These characteristics, combined with the use of latest-generation electronic switching EC fans with high air flow rate, have allowed the **power density to be increased.** The space available in the server room is made the most of and this makes the NRG F units suitable for applications with **high thermal load density,** typical of latest generation Data Centers.

Aiming at maximised system efficiency

Design choices include, in addition to the use of electronically controlled expansion valves, the management of variable-speed Scroll compressors and EC (electronically commutated) fans via Modbus. Thanks to these features it is possible **to acquire, manage and adjust operating parameters and therefore thermo-hygrometric values in the server room very accurately, with high levels of energy efficiency.**

Maximum energy saving

In periods when the air outside is cooler than the warm air inside the Data Center, the cold water produced by the dry cooler directly feeds the heat exchange coil, which is able to provide a part or all of the required cooling capacity. Before returning to the dry cooler, the water is reused inside the plate exchanger, serving the compressor. The entire process is regulated by a 3-way valve **directly controlled by HiRef software, which maximizes the Free-Cooling effect and checks the cooling circuit.** In this way the work of the compressor is significantly reduced, and shuts down when a state of Free-Cooling is fully reached, **with a significant reduction in the system's PUE.**

NRG F		0131	0201	0251	0301	0381	0441	0501	0551	0641	0701	0801	0852	0962
		Air temperature 24°C - Relative humidity 50% / Water 40°C - 45°C / Free-Cooling water 7°C / Glycol 30%												
Cooling capacity	kW	11.4	19.3	22.9	29.3	33.7	39.9	43.7	51	51.8	64.2	69.7	76.2	82.7
SHR		0.92	1	0.99	1	0.92	0.85	0.95	0.88	0.94	0.84	0.95	0.93	0.87
EER		3.18	4.14	4.05	4.12	3.57	3.41	3.7	3.4	3.5	3.31	3.56	4.08	3.71
Free-Cooling capacity	kW	8.8	22.5	24.6	33.3	37.8	40.8	48	52	56.4	65.8	80.4	80.4	86.8
SHR Free-Cooling		0.93	1	0.9	0.9	0.84	0.81	0.87	0.83	0.87	0.8	0.85	0.85	0.81
Total absorbed power	kW	4	5.8	6.8	8.7	11	13.3	14.1	17.3	17.5	22.1	24.2	23.3	27
		Air temperature 30°C - Relative humidity 35% / Water 40°C - 47°C / Free-Cooling water 12°C / Glycol 30%												
Cooling capacity	kW	12.5	21.9	25.7	32.9	37.3	43.1	48.7	55.5	57.8	68.9	77.7	84.2	89.5
SHR		1	1	1	1	1	1	1	1	1	1	1	1	1
EER		3.36	4.6	4.44	4.51	3.85	3.56	3.97	3.59	3.79	3.43	3.82	4.36	3.87
Free-Cooling capacity	kW	8.5	22.6	24	31.5	34.4	35.3	45.5	48	53.4	57.9	73.2	75.2	77.3
SHR Free-Cooling		1	1	1	1	1	1	1	1	1	1	1	1	1
Total absorbed power	kW	4.2	5.9	6.9	8.9	11.3	13.7	14.5	17.7	18	22.8	25	24	27.8
		Air temperature 35°C - Relative humidity 30% / Water 40°C - 47°C / Free-Cooling water 17°C / Glycol 30%												
Cooling capacity	kW	13.9	24.3	28.6	36.6	41.6	47.6	54	61.2	63.6	75.9	85.4	93.2	99.2
SHR		1	1	1	1	1	1	1	1	1	1	1	1	1
EER		3.69	5.21	5.01	5.08	4.3	3.9	4.38	3.95	4.17	3.73	4.15	4.86	4.28
Free-Cooling capacity	kW	9	23.5	24.9	33.6	35.5	36.6	48.2	49.7	56.6	58.4	77.5	77.5	80
SHR Free-Cooling		1	1	1	1	1	1	1	1	1	1	1	1	1
Total absorbed power	kW	4.2	5.8	6.8	8.8	11.3	13.8	14.6	17.7	18	23	25.2	23.8	27.8
Rated air flow	m³/h	3700	8000	8000	10800	10800	10800	14300	14300	16800	16800	23000	23000	23000
Number of circuits		1	1	1	1	1	1	1	1	1	1	1	2	2
Number of inverter compressors		1	1	1	1	1	1	1	1	1	1	1	1	1
Number of on/off compressors		-	-	-	-	-	-	-	-	-	-	-	1	1
Lp @ Nominal rpm ; dist.= 2 m Q=2	dB(A)	54	70			74		75	77		75	76	75	
Dimensions [LxHxD]	mm	900 x1875 x600	1010x2000x890		1270x2000x890			1760x2000x890		2020x2000x890		2510x2000x890		
Power supply	V/ph/Hz	400/3+N/50												

Performance data relating to Downflow versions. | Also available with 60 Hz power supply. | Model height Displacement 2125 mm for size 0131.

DATA CENTER

FanWall

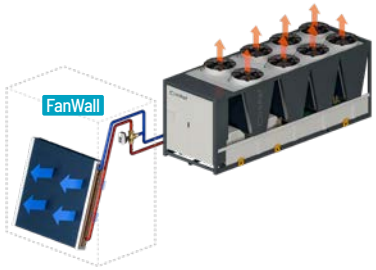
FANWALL AIR CONDITIONERS CHILLED WATER OR DIRECT EXPANSION VERSIONS FOR HIGH DENSITY HYPERSCALE DATA CENTER

44.9-460.6 kW

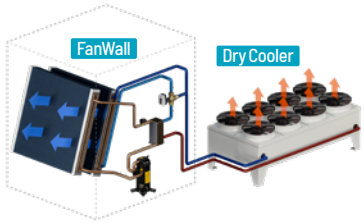
- MULTI-PROTOCOL COMMUNICATION INTERFACE
- EC RADIAL FANS
- MODBUS CONTROLLED FANS
- PRESSURE INDEPENDENT VALVE (PICV)
- INVERTER DRIVEN COMPRESSORS
- FAST RESTART
- VARIABLE GEOMETRY COIL (FLEXY)
- DOUBLE CIRCUIT

Our chilled water or direct expansion **FanWall HBCV** series air conditioners are designed for technological environments where a **compact footprint is a requirement - without any impact on these units' cooling output capacity**. FanWall range is perfectly suited for hybrid applications, offering the possibility of operating with a single external dissipation system. An in-depth CFD (computational fluid dynamics) analysis has allowed every last constructive detail to be designed so as **to minimise internal airflow pressure drops and, therefore, fan power consumption**. At the same time, the large surface of the finned pack exchanger **minimises the approach temperatures between inlet air and outlet water, maximising system efficiency**.

CHILLED WATER



INDIRECT WATER-SIDE FREE-COOLING



- Refrigerant R513A
- Stainless steel condensate drain pan
- Fan speed modulation based on thermal load (constant ΔT)
- Constant-flow ventilation modulation (Airflow Control), optional
- Double power supply with automatic switch (on request)
- Instantaneous reading of the supplied cooling capacity (optional)

Ventilation EC 2.0

The use of standard-equipment EC plug fans across the whole range - designed to adjust the air flow according to the thermal load - results in efficient use of the electricity for ventilation purposes, **with a positive impact on the system PUE.** Extended range speed adjustment is carried out via MODBUS protocol. The emergency speed function allows for fan operation consistency **even in the event of microprocessor malfunctions.**

Finned pack coil with hydrophilic coating

All models in the FanWall HBCV range feature heat exchange coils with hydrophilic coating. This special coating - together with adequate adjustment of air through-flow speeds - **helps condensate collection and outflow during the dehumidification process, preventing any dripping on the inside and outside of the unit.**

Blown finned coil

According to a specific design choice, this finned coil is installed downstream of the fans. This ensures a more even distribution of the delivery air to the racks, **minimising turbulence in the air flow.**

Maximum possible redundancy

To ensure system operation continuity, the FanWall HBCV range makes it possible to have a **fully redundant refrigeration circuit:** a double coil and double water adjustment valve allow the server room to be cooled **even when either circuit fails.**

Accurate regulation with multiple types of valves

The adjustment valve with 0-10V servomotor (standard on the whole range) can be obtained in a 2-way (requires variable flow system) or 3-way version. The other versions available with configurator are those with spring return servomotor or independent pressure valves. The flow control performance of this type of valve guarantees **adjustment accuracy, while at the same time maintaining the hydronic balance in the system.**

Ventilation adjustment

Depending on the air distribution logic in the server room, it is possible to adjust the machine on-board ventilation system to ensure **a constant air flow rate** (airflow control) **or a constant available overpressure** (ΔP control). The latter is particularly useful if a floating floor is used.

Easier scheduled maintenance

The unit has been designed with the utmost care to grant front (air inlet side) access to internal components even with the units running. This makes **routine maintenance easier in full compliance with safety standards.**

FanWall		051	102	121	171	242	342
Geometry B		Air temperature 30°C - Relative humidity 35% / Water temperature In 10°C Out 18°C					
Cooling capacity	kW	48.5	97	118.2	173.4	236.4	346.8
SHR		1	1	1	1	1	1
EER		69.3	69.29	62.21	59.79	62.21	59.79
Geometry C		Air temperature 30°C - Relative humidity 35% / Water temperature In 10°C Out 22°C					
Cooling capacity	kW	44.9	89.8	110.2	164.4	220.4	328.8
SHR		1	1	1	1	1	1
EER		64.1	64.1	58	56.7	58	56.7
Geometry B		Air temperature 35°C - Relative humidity 25% / Water temperature In 10°C Out 18°C					
Cooling capacity	kW	63.7	127.4	157.1	230.3	314.2	460.6
SHR		1	1	1	1	1	1
EER		91	91	82.68	79.41	82.68	79.41
Geometry C		Air temperature 35°C - Relative humidity 25% / Water temperature In 10°C Out 22°C					
Cooling capacity	kW	60.6	121.2	148.9	219.8	297.8	439.6
SHR		1	1	1	1	1	1
EER		86.6	86.6	78.4	75.8	78.4	75.8
Rated air flow	m^3/h	8700	17400	21200	31100	42400	62200
Total fan absorbed power	kW	0.7	1.4	1.9	2.9	3.8	5.8
Dimensions [LxHxD]	mm	1500 x1475 x1300	1500 x2950 x1300	2950 x1475 x1300	4000 x1475 x1300	2950 x2950 x1300	4000 x2950 x1300
Power supply	V/ph/Hz	400/3+N/50					
Module number		1	2	1	1	2	2

Data declared for chilled water version. | Also available with 60 Hz power supply. | The dimensions shown refer to standard models but can be customised according to application requirements.

DATA CENTER

CDU

COOLANT DISTRIBUTION UNIT FOR HIGH DENSITY HYPERSCALE DATA CENTER

750–1250 kW

MULTI-PROTOCOL COMMUNICATION INTERFACE

ΔT PRECISION CONTROL

PRESSURE INDEPENDENT VALVE (PICV)

CORROSION RESISTANT MATERIAL

MODULATING PUMPS

PLATE HEAT EXCHANGER

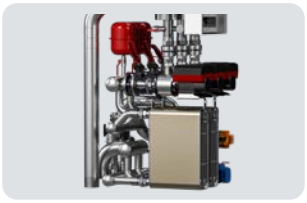
A **CDU** is an essential part of a liquid cooling system, enabling efficient distribution and circulation of coolant to effectively dissipate heat from components and maintain optimal operating temperatures.

It is designed to regulate and control the flow of coolant to different points within the system, ensuring **efficient cooling and temperature management**.

Filtered Data Center Side

The CDU is equipped with filters that have a filtration rating of 25 microns, which remove impurities from the coolant, preventing clogging and damage to other components in the system. These filters can be cleaned while the CDU is operating, **eliminating the need to shut down the system**. By keeping the coolant clean, the CDU helps to extend the life of the entire cooling system.

- 3 Grundfos CME15 pumps with integrated inverter
- High efficiency plates heat exchangers for low ATD
- Effective separation of primary/secondary water circuits
- All stainless-steel secondary circuit with self-filling and venting capability
- Large dual redundant secondary filters with configurable filtration degree (25µ, 50µ)
- Integrated expansion vessels on secondary side
- 15" Colour touchscreen controller
- Communication via Modbus RTU (RS485) and TCP/IP protocols
- Temperature and humidity sensors for room control



Stainless steel brazed plate heat exchangers

Stainless steel heat exchangers ensure the better solution considering efficiency, durability and compactness. This type of heat exchanger allows the **use of different type of fluids, from glycol mixtures to non conductive fluids without reducing the reliability**.

Redundant inverter driven pumps

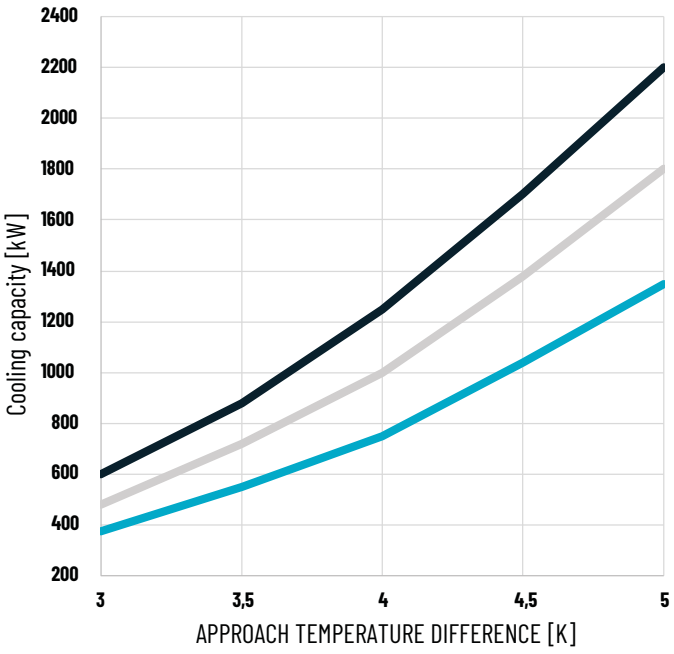
The CDU unit is equipped with 3 modulating pumps with integrated inverter and IE5 motor. The pump design allowes to reach **high level of flexibility and redundancy**: normal mode, all 3 pumps work together in parallel with a large modulation range; in emergency mode, when one pump is on fault, two pumps can deliver 85% of the total water flow allowing the system to continue working.
The IE5 motor meets **the highest efficiency requiremnts while reducing the pumping costs**.

3-way valve for HYBRID APPLICATIONS

The CDU unit is provided with an integrated 3-way valve on the primary circuit, that allowes to **modulate the capacity provided by the cooling generator and delivered to the datacenter side**.
The water by-pass, generated by the valve opening, provides different advantages:reduction of pumping power consumption on primary side, precise modulation of the cooling capacity, and safe operation of the chiller as cooling generator, which can work allways with the minimum necessary flow.

Variable connections

The connections position both on primary and secondary side can be configurated on top or on bottom sides of the unit, in order to **meet the installation site requiremens, also in case of retrofit installations**.
The unit is provided in addition with a stainless steel basin that protects from fluid drops in case of losses.



ΔT = 10K primary side
ΔT = 10K secondary side
RANGE T PRIMARY SIDE FROM 45°C TO 17°C
PRIMARY SIDE FLUID 30% ETHYLENE GLYCOL
SECONDARY SIDE FLUID PG25

CDU		0750	1000	1250
Cooling capacity	kW	750	1000	1250
Primary - Heat exchanger losses	kPa	33	31	33
Primary - Rated flow	l/h	72270	96360	120460
Secondary - Heat exchanger losses	kPa	29	27	29
Secondary - Rated flow	l/h	67690	90260	112820
Pump redundancy		N	N+1	N+1
Total absorbed power	kW	6	8	12
Power supply	V/ph/Hz		400 / 3 / 50	
Dimensions [LxHxD]	mm	600x2000x1200	900x2000x1200	1200x2000x1200

ATD=4K, Primary 20°C/30°C, Secondary 24°C/34°C. Primary side fluid 30% ethylene glycol, secondary side fluid PG25.

DATA CENTER

RDC

REAR DOOR COOLING FOR HIGH DENSITY HYPERSCALE DATA CENTER

26.3–67.1 kW

MULTI-PROTOCOL COMMUNICATION INTERFACE

ΔT PRECISION CONTROL

PRESSURE INDEPENDENT VALVE (PICV)

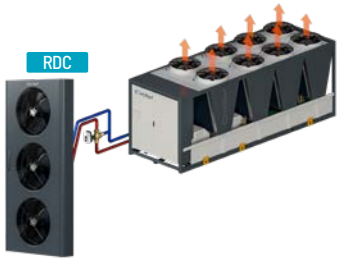
CORROSION RESISTANT MATERIAL

Rear Door solutions are cooling systems designed to reduce the temperatures generated directly at the rear of the racks, where the heat produced by the servers is most intense. **Rear Door solutions can be active**, featuring fans to increase air flow, **or passive**, relying solely on natural air flow. In this way, they not only significantly lower the temperature but also **improve the overall energy efficiency of the data center**.

- Microchannel coil for light execution
- Up to 50kW of cooling capacity
- Adaptable for every rack dimension/ brand*
- Passive solution without fans: no noise, no additional power consumption, low maintenance
- Active solution with fans for higher dissipation capacity
- Water connection from top/bottom
- Integrated microprocessor and remote monitoring
- Small footprint

REAR DOOR		60	80
		Server air outlet 35°C 30%, inlet water temperature 15°C	
Cooling capacity	kW	26,3	45,2
SHR		1	1
EER		26,3	28,3
Room temperature	°C	24,9	22,5
		Server air outlet 40°C 25%, inlet water temperature 15°C	
Cooling capacity	kW	32,8	56,1
SHR		1	1
EER		46,9	35,1
Room temperature	°C	27,2	24,1
		Server air outlet 45°C 20%, inlet water temperature 15°C	
Cooling capacity	kW	39,2	67,1
SHR		1	1
EER		56	41,9
Room temperature	°C	29,3	25,6
Nominal air flow	m^3/h	8000	11000
Water flow	l/h	2000	4000
Fans power consumption	kW	0,7	1,6
Dimensions [LxHxD]	mm	600x2000x350	800x2000x400
Power supply	V/ph/Hz	230/1/50-60	

CHILLED WATER



DATA CENTER

HiNode

ADVANCED AND FLEXIBLE SYSTEM FOR THE CONTROL AND MANAGEMENT OF AIR CONDITIONING SYSTEMS

MULTI-PROTOCOL COMMUNICATION INTERFACE

MONITORING AND CONTROL

HiNode 2.0 is the exclusive system designed and developed by HiRef for air conditioning **management and supervision**. It interfaces with every unit and device in the system, optimising their operation, **meeting user requirements efficiently and effectively**, and delivering performance in line with the analysis brief. **Failure prediction logic** and calculation of performance degradation over time allow taking timely action to ensure service continuity to the user.

Controlled devices and functions: on/off and modulating valve management

Inactive circuit shut-off. **Direct and mixed zone management**. Groundwater temperature control before return to aquifer (temperature and flow limit).

The heart of the device

HiNode 2.0 consists of a programmable microprocessor controller that ensures compatibility with the main serial and Ethernet communication protocols. It has digital and analog (0-10 V, 4-20 mA) inputs and outputs to control system auxiliaries (pumps, valves, etc.) and acquire temperature and pressure signals. Operation data can be accessed locally via LCD or touchscreen display, or **remotely via web interface**. HiNet service can be added for data synchronization to cloud.

User flexibility

HiNode 2.0 software was **designed and developed by the HiRef** Controls team. It allows several basic operations to be performed and can be integrated with many customised functions according to the type of system to be managed.

Operation logic

HiNode 2.0 efficiently and effectively manages the distribution of thermal loads among the units installed, even from different ranges. The **implemented control algorithms** determine which and how many resources will be activated, ensuring contemporaneity - i.e. partial load operation - and energy recovery. This makes it possible to achieve **very high energy efficiency levels** and greater operating cost savings.

Controlled devices and functions: on/off and modulating distribution pump management

Timed rotation, **constant and variable flow control**, constant ΔT, constant head pressure Flow balancing between primary and secondary circuits.

Controlled devices and functions: HiRef air conditioning unit

Management of load distribution between available units with **selection of the most suitable resource**, in addition to basic functions managed by LAN connected machines. Heating/cooling generation calculation based on working temperatures between primary and secondary circuits. **Running time balancing** and advanced Dynamic Setpoint function.

- Electrical or thermal energy metres upon request, also MID certified (Measuring Instruments Directive 2014/32/UE)
- Supported serial communication protocols: Modbus RTU on RS485; Bacnet on RS485; Konnex; LonWorks
- Supported Ethernet communication protocols: Modbus TCP/IP; Bacnet/IP; SNMP v1-v2c

Controlled devices and functions: energy metering

Thermal energy and electric energy. **MID-certified devices**.

Information management

The system lets you verify the main operating variables for the managed units**, displaying trends** over time in graph form and recording them together with the event history. **The data can also be exported** in different formats and sent automatically by e-mail.

DATA CENTER

HDC

MODULAR DRY COOLER FOR HIGH DENSITY HYPERSCALE DATA CENTER

372.4 – 1551.2 kW

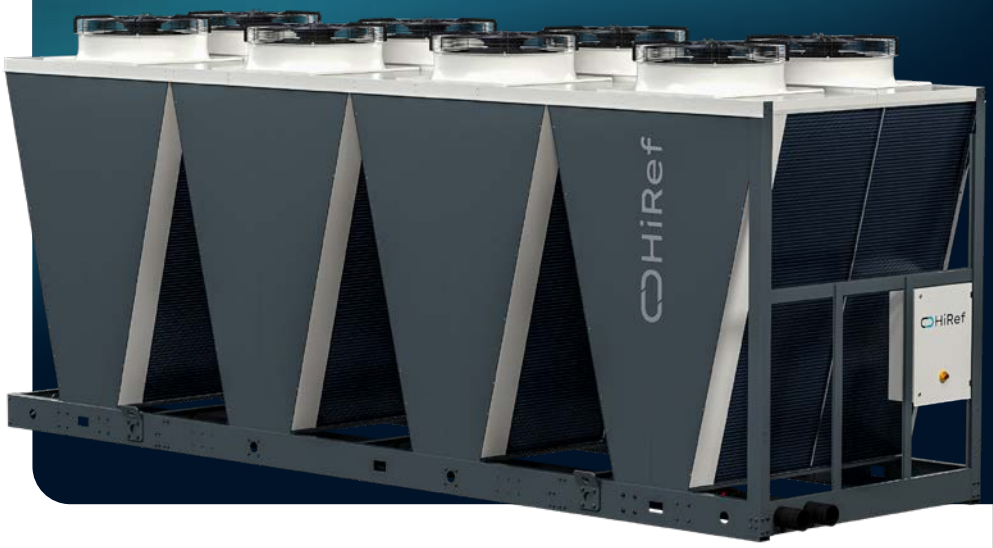
MULTI-PROTOCOL COMMUNICATION INTERFACE

ΔT PRECISION CONTROL

PRESSURE INDEPENDENT VALVE (PICV)

PATENTED SOLUTION

CORROSION RESISTANT MATERIAL



The Dry Cooler range from HiRef has been **specifically designed for data center applications**. It is ideally suited for use with liquid cooling systems or in any situation where free cooling can be utilized.

HiRef Dry Coolers are outdoor units that can be combined with water-condensed indoor units such as cabinets in the W - F - K series. HiRef offers **a wide range** of Dry Coolers suitable for working with a **water-glycol mixture up to 60%.** They are made with frame in aluminium alloy and galvanized sheet steel that ensures **corrosion resistance, copper pipe protection and solidity**. The external panels are made of galvanized sheet metal finished with **corrosion- and UV-resistant polyester paint**.

- Power supply 230V single phase or 400V three phase
- Power supply from HiRef indoor unit (standard) or stand alone (on request)
- Modular solution "grows with the business"
- Larger heat exchangers
- Reduced foot print
- EC fans
- Water circuit optimized for variable flow rates
- Regulation on board the unit with integrated ATS
- Modbus interface for connection to CMS

Finned coil

The finned-coil heat exchangers are made with copper tubes and, depending on the model, wavy or corrugated aluminium fins. The standard spacing between the fins is 2 mm, **offering high heat exchange efficiency without affecting the ease of routine cleaning.**

Silent operation

The Dry Coolers are also available in **low noise emission versions,** ideal in areas where a **high level of acoustic comfort must be maintained.**

Customization

The units can be customized on request to meet the customer's design needs. Among the various options:

- **special treatment for the finned-coil exchanger,** including epoxy treatment, offering good resistance to corrosive environments, or copper fins for installation in marine environments;
- **increased fin spacing** to reduce soiling and facilitate cleaning in sandy environments.

Microchannel coil

As an alternative to the finned pack coil, it is possible to select the version with microchannel coils, which allows for a **lighter construction of the unit itself**. In this configuration, the heat exchangers come standard with a protective treatment against corrosion.

Modular solution

HiRef's dry coolers have been designed with the concept of connecting an increasing number of heat exchangers to the master dry cooler to accommodate the growing power demand. This expansion is possible **without the need to modify the customer-side piping**, simply by planning for the additional space required for future expansions during the design phase.

HDC		04H057E	06H057E	08H057E
		Air temperature 35°C / Ethylene glycol 30% / Fluid temperatures 45/40°C		
Cooling capacity	kW	372,4	558,6	744,8
Fluid flow	l/h	69200	103800	138400
		Air temperature 10°C / Ethylene glycol 30% / Fluid temperatures 30/20°C		
Cooling capacity	kW	775,6	1163,4	1551,2
Fluid flow	l/h	72000	108000	144000
Power input	kW	8,88	13,32	17,76
Sound power	dB(A)	89,6	91,3	92,6
Dimensions [LxHxD]	mm	3750x3135x2250	5625x3135x2250	7500x3135x2250
Power supply	V/ph/Hz	400 / 3 / 50		

DATA CENTER | INDUSTRIAL | SERVICES

TVA-F

AIR CONDENSED CHILLERS WITH INVERTER DRIVEN SCREW COMPRESSORS FREE-COOLIG VERSION

285.9–1367.1 kW

MULTI-PROTOCOL COMMUNICATION INTERFACE
SCREW COMPRESSORS
SHELL AND TUBE HEAT EXCHANGER
FAST RESTART
AXIAL FANS
CORROSION RESISTANT MATERIAL
CLASS A
INVERTER DRIVEN COMPRESSORS
FREE-COOLING
LOW GWP REFRIGERANT

TVA is the new range of air cooled chillers for energy-efficient and environment-friendly processes. Low environmental impact has been achieved by using **new HFO refrigerants** with low Global Warming Potential (GWP), while **higher efficiency/footprint ratios** are reached thanks to the special V-configuration of the heat exchange coils and their sizing, **the largest among the chillers currently available on the market**. The Free-Cooling version - where heat exchange surface areas are double the market average - **ensure outstanding performance**. The high thermodynamic efficiency with low Total Equivalent Warming Impact (TEWI) is combined with a special focus on maintainability and **easy accessibility of the compressors contained in the removable HiRail** module which reduces noise emissions.

- Refrigerant R1234ze and R515B
- Also available with R134a refrigerant and on request with R513A
- Capacity modulation: with slide valve or with inverters on both compressors or on one compressor only
- EC Fans
- Electronically controlled expansion valve
- HiNode Supervision
- Monitoring and limitation of the maximum absorbed power

Inverter screw compressors

Inverter equipped with screw compressors combine the possibility of moving large volumes of refrigerant with **the guarantee of constant power modulation and high energy efficiency even at partial loads.**

New refrigerant R1234ze

TVA air condensed chillers use **the new HFO refrigerant with low GWP** (GWPR1234ze=6) as part of a wider Green Technology approach. (Also available in version with R134a refrigerant and on request with R513A.)

Dual power supply

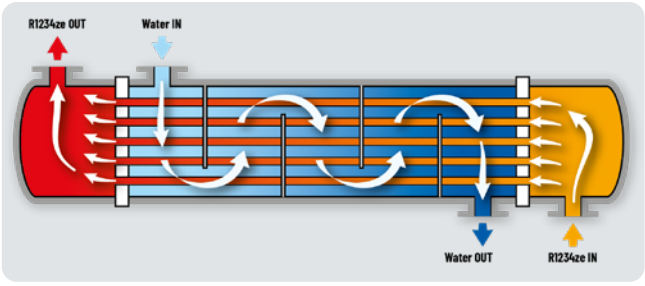
Active filter against harmonic distortion in voltage and current, glycol-free kit.

Low noise and accessibility: HI-RAIL

The compressor hoods **dramatically reduce noise** thanks to the use of special soundabsorbing materials. On request, sliding rails allow them **to be removed effortlessly, making all maintenance tasks much easier**. The compressors can also be removed by hooking from above and lifting with a crane.

Modular and efficient

The configuration with very deep 'V' modular coils provides **an extensive heat exchange surface area and therefore excellent thermal efficiency in relation to the unit footprint.** The Free-Cooling version features heat exchangers sized in such a way as to allow a Total Free-Cooling Temperature (TFT) of 10°C.



New concept of heat exchange

Single pass shell and tube evaporators provide **excellent levels of thermodynamic efficiency** thanks to full heat exchange counter-flow.

TVA		0311F	0331F	0361F	0381F	0421F	0451F	0481F	0531F	0581F	0621F	0661F	0721F	0801F	0831F	0901F	0971F	1041F	1101F	1161F
Cooling: User water values 12/7°C, 35°C outside air, 40% U.R.																				
Cooling capacity	kW	285.9	296.7	329.9	362.4	394.2	420.3	438.8	478.4	513	579	596.9	660.7	719.1	749.1	790.8	847.2	929.2	979.7	1059.1
Total absorbed power	kW	90.2	92.9	98.2	105.9	113.1	121.5	126.7	131.3	146.3	165.4	171.6	193.4	200.7	216.8	233.9	248.7	273.6	298.7	315.5
EER		3.17	3.19	3.36	3.42	3.49	3.46	3.46	3.64	3.51	3.5	3.48	3.42	3.58	3.46	3.38	3.41	3.4	3.28	3.36
Sound power	dB(A)	92	92	93	93	94	94	94	95	96	97	97	98	99	99	99	99	99	100	100
Dimensions [LxHxD]	mm	5404 x2650 x2255		6655 x2650 x2255		7906x2650x2255			9722 x2650 x2255		11100x2650x2255			12854x2650x2255			13355x2650x2255			

		0311F	0331F	0361F	0381F	0421F	0451F	0481F	0531F	0581F	0621F	0661F	0721F	0801F	0831F	0901F	0971F	1041F	1101F	1161F
TVA		**User water temperature 12/7°C 20% ethylene glycol, outside air 35°C, 40% R.H.**																		
Full Free-Cooling temp.	°C	1.1	1	1.8	1.4	2	1.8	1.5	1.9	1.7	1.8	1.7	1.2	1.4	1.2	0.9	1.2	0.7	0.3	-1.3
Sound power	dB(A)	92	92	93	93	94	94	94	95	96	97	97	98	99	99	99	99	99	100	100
Dimensions [LxHxD]	mm	5404 x2650 x2255		6655 x2650 x2255		7906x2650x2255			9722 x2650 x2255		11100x2650x2255			12854x2650x2255			13355x2650x2255			

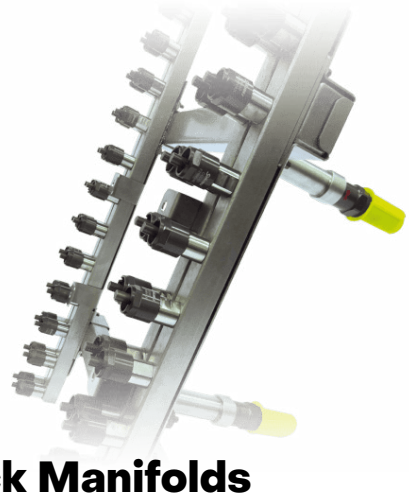
		0381C	0401C	0451C	0481C	0531C	0581C	0621C	0661C	0721C	0801C	0831C	0901C	0971C	1041C	1101C	1161C	1231C	1291C	1351C	1421C
TVA		**Utility water temperature 12/7°C, ethylene glycol 20%**																			
Cooling capacity	kW	354.5	386	423.1	464.1	500.3	520	568.3	609.4	699.7	751.7	802.4	865.5	877	958.3	1007	1065.1	1121.2	1178.4	1247.6	1367.1
Total absorbed power	kW	112.3	123.4	132.9	146.9	156.1	165.7	180.4	190.8	224.1	238.1	251.1	277.9	280.7	306.3	319.5	333.9	351	375.4	388.2	417.5
EER		3.16	3.13	3.18	3.16	3.21	3.14	3.15	3.19	3.12	3.16	3.2	3.11	3.12	3.13	3.15	3.19	3.19	3.14	3.21	3.27
SEER		4.43	4.43	4.53	4.57	4.53	4.52	4.5	4.62	4.51	4.5	4.65	4.57	4.44	4.52	4.59	4.64	4.66	4.65	4.54	4.92
SEPR		5.4	5.45	5.52	5.91	5.9	5.83	5.52	5.99	5.54	5.59	6.05	6.04	5.67	5.64	5.81	6.02	5.75	5.75	5.96	6.46
ESEER		4.11	4.14	4.22	4.28	4.26	4.24	4.19	4.35	4.18	4.18	4.36	4.27	4.14	4.23	4.31	4.34	4.33	4.31	4.26	4.5
Sound power	dB(A)	92	92	95	96	97	96	96	100	99	99	102	101	99	99	102	104	100	100	103	105
Dimensions [LxHxD]	mm	5404x2650x2255				6655x2650x2255				7906x2650x2255				9722x2650x2255				11100 x2650 x2255		12854 x2650 x2255	

Dati dichiarati con utilizzo di refrigerante R134a | Disponibile anche in alimentazione 60 Hz

Liquid cooling components

Quick Coupling

Quick connectors make it easy to add or remove cooling from servers. Customizable connector types and port positions on manifolds are available for unique systems.



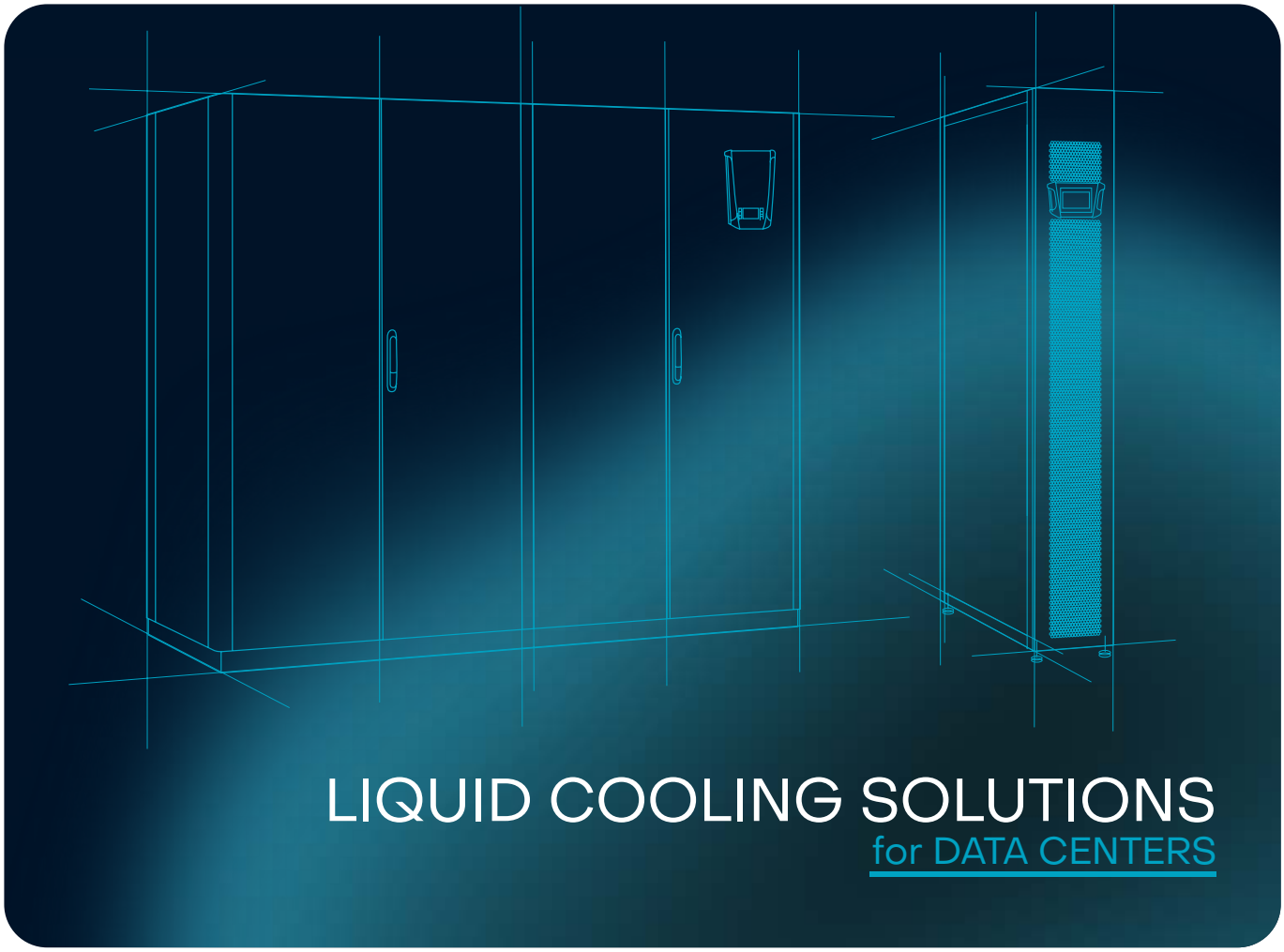
Rack Manifolds

Quick connectors make it easy to add or remove cooling from servers. Customizable connector types and port positions on manifolds are available for unique systems.

Leackage Detection

Direct-to-chip liquid cooling handles higher densities than air cooling and uses almost half the power of server fans and computer-room air conditioners. Coolant flows through cold plates directly mounted on server processors, removing heat at its source and improving data center cooling efficiency.

HiRef



LIQUID COOLING SOLUTIONS
for DATA CENTERS

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