

# TECS-FC

FREE-COOLING LINE

Air cooled chillers with free-cooling technology, from 302 to 1649 kW

- ✓ Widest use of free-cooling
- ✓ Unbeatable performance
- ✓ Specific solutions for mission critical applications
- ✓ Highest manufacturing quality





“The greater part  
of progress is the  
desire to progress.”

Lucio Anneo Seneca  
(Latin philosopher, 4 a.C. - 65 d.C.)





## Top level efficiency

Strict energy consumption and environmental impact regulations continually push towards ever more efficient units. Achieving the greatest energy savings and ensuring long-term sustainability are challenges that modern cooling systems need to tackle.



## 24/7 reliability

Reliability is key, especially when it comes to IT-cooling and process cooling applications. The uninterrupted operations of data centers, telecommunications infrastructures and manufacturing machineries depend on a steady and precise cooling load coverage.

Some projects don't accept compromises, they simply demand the best technology.

# TECS-FC

FREE-COOLING LINE

The power of the ultimate technological solutions and a massive use of renewable resources have been merged to create TECS-FC: the new forefront of the progress.



### ✓ Widest use of free-cooling

Capitalise the energy of the environment to cut the operating costs.

### ✓ Specific solutions for mission critical applications

- ▶ Fast restart
- ▶ Energy meter
- ▶ Double power supply
- ▶ THDi correction

### ✓ Unbeatable performance

Magnetic levitation compressors, flooded evaporator and EC fans for the highest energy saving.

### ✓ Highest manufacturing quality

Over ten years of experience with magnetic levitation compressors and extensive expertise in the free-cooling technology.

EER

over 4,0 (1)

over 5,0 (2)

TFC\*  
temperature

over 2°C (3)

over 10°C (4)

\*TFC: Total free-cooling

(1) Water (in/out) 15°C/10°C; Air (in) 30°C; Et. glycol 30%.  
(2) Water (in/out) 27°C/20°C; Air (in) 30°C; Et. glycol 30%.

(3) Water (in/out) 15°C/10°C; Et. glycol 30%.  
(4) Water (in/out) 27°C/20°C; Et. glycol 30%.

# Natural efficiency to cool your system

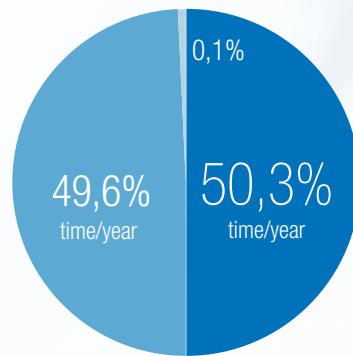
## Free-cooling potential: Temperature occurrence distribution

Wherever cooling demand is constant all year round, free-cooling provides significant energy saving opportunities. In a cooling system located in London, working with favorable levels of water temperature (such as 27-20°C), the outdoor air alone can

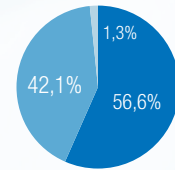
satisfy the cooling demand 50,3% of the time. 49,6% of the time, the outdoor air cooling capacity allows the chiller's compressors to run at part load, with a significant increase in efficiency. For only 0,1% of the time, the unit works as an ordinary chiller.

### London

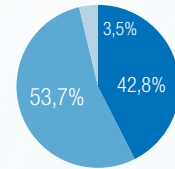
- Total FC
- Hybrid
- Mechanical



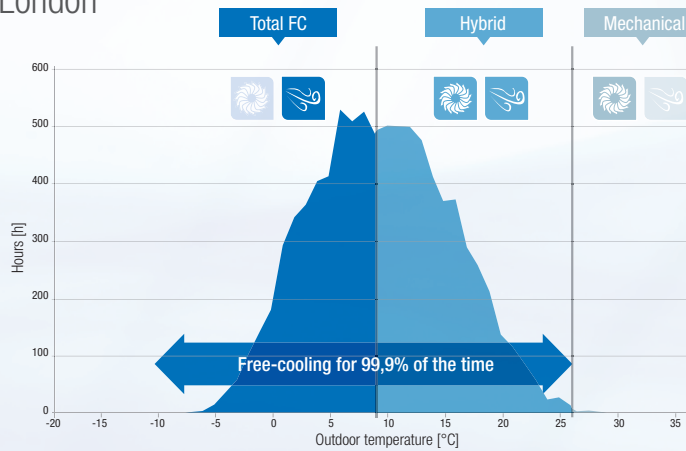
### Munich



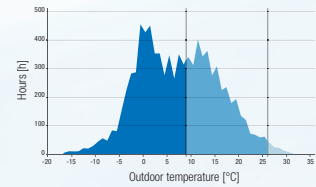
### Milan



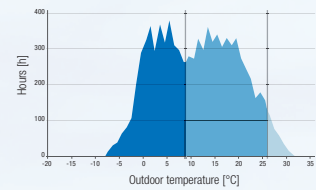
### London



### Munich



### Milan

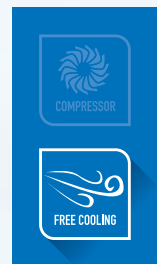


Graphics above show the cumulative hours per year of a unit working 24/7 in either Mechanical, Hybrid or Total free-cooling. Operating water temperature (in/out) 27°C/20°C.

## How Climaveneta masters free-cooling

Climaveneta's free-cooling chillers work in three different modes (Total free-cooling, Hybrid cooling, Mechanical cooling), according to outdoor air conditions and operating water temperature.

As the outdoor air temperature drops 1 degree below the returning water temperature, a valve system redirects the water to the special coils and the benefits of the free-cooling begin.



### Total free-cooling

- ▶ The outdoor air temperature is low enough to satisfy the entire cooling demand.
- ▶ Total cooling capacity is provided by the outdoor air in the free-cooling coils while the compressors are off.

### Maximum Energy Saving

# Free-cooling technology:

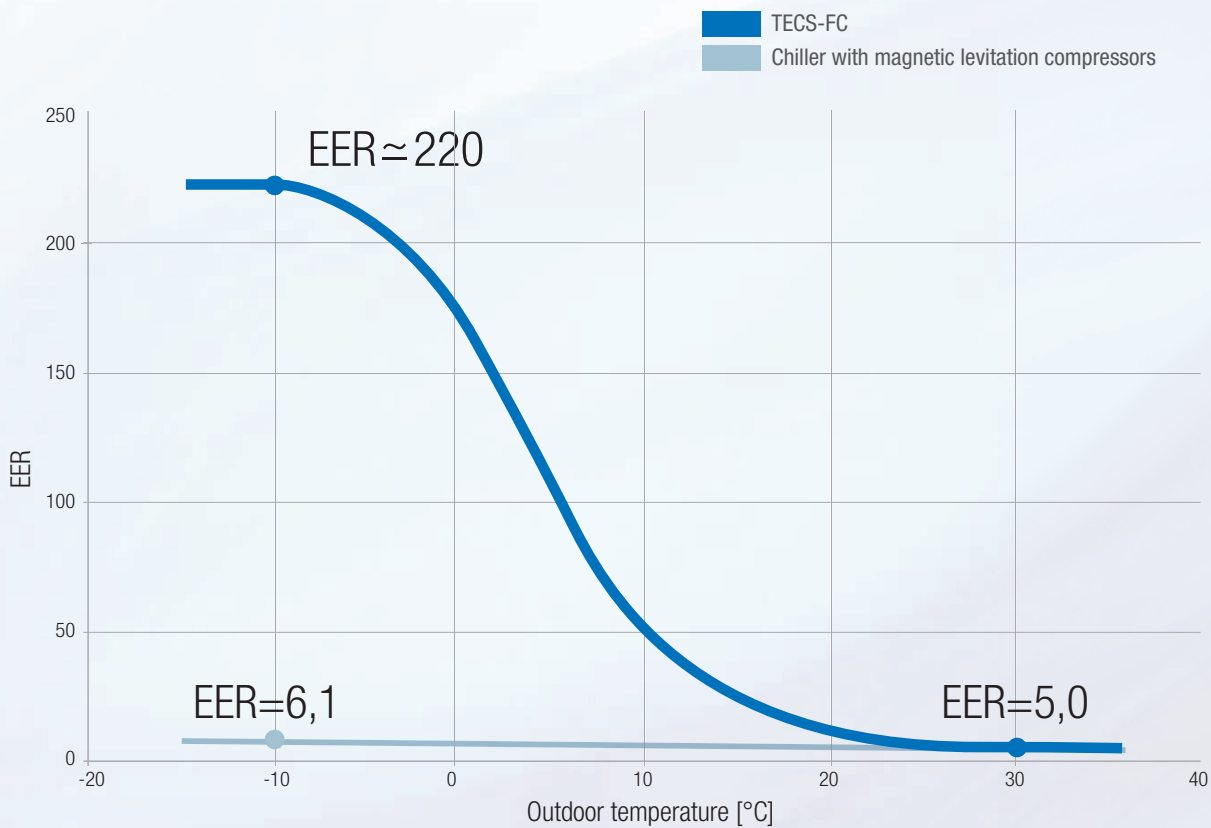
the ultimate solution to harness the full potential of renewable sources

## Efficiency comparison: Traditional Chiller vs Free-cooling Chiller

To understand how free-cooling can cut the energy bill of your cooling system, it is sufficient to compare the efficiency of a TECS-FC unit with the efficiency of a comparable technology chiller without free-cooling. When the outdoor air temperature is too high to provide free-cooling, the EER (Energy Efficiency Ratio) of the two units are aligned.

But as the air temperature decreases, the gap between the units' efficiency becomes clear and even huge.

In total free-cooling mode, the compressors are off and very little energy is needed to provide the whole cooling capacity.



Note: Plant (side) cooling exchanger water (in/out) 27°C/20°C; Ethylene glycol 30%.

### Hybrid cooling

- ▶ The outdoor air temperature is lower than the returning water temperature but not cold enough to achieve total free-cooling.
- ▶ Part of the cooling capacity is provided by the outdoor air while the rest is provided by the compressors.

### Optimised Source Management

### Mechanical cooling

- ▶ The outdoor air temperature is equal to or higher than the returning water temperature.
- ▶ Total cooling capacity is provided by the compressors, in the evaporator.

### Conventional Chiller Operation



# TECS-FC for mission critical applications

Highest standards of reliability and reduced running costs, without any compromise.

In IT cooling applications, telecommunication infrastructures and many manufacturing and chemical industrial processes, downtime costs are a crucial aspect. In all these applications, an interruption in the cooling supply may seriously compromise the technical equipment operation, causing unexpected shutdowns.

## Fast restart

Sometimes few seconds can determine the shutdown of the entire facility. After a power failure, the cooling must be ensured as soon as possible. This is why Climaveneta has developed Fast restart, a special function to provide:



### Immediate cooling start-up

Compressor start-up within 26" after power is restored.

### Accelerated cooling ramp-up

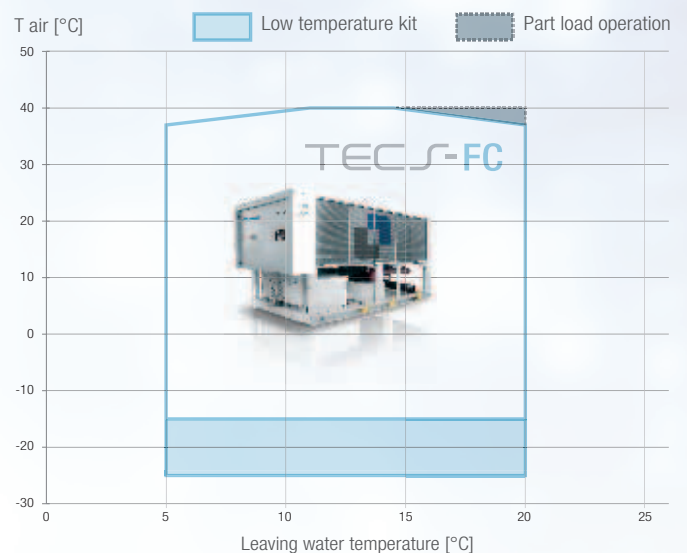
1000 kW are delivered within 6' 30" after a voltage dip.

## Wide operating range

Driven by exponential growth of data exchange and rising power densities, data center design is changing dramatically over time. Cooling equipment needs to evolve together with the IT devices, always striving for reducing the running costs.

Modern infrastructures are designed to work with cooling water temperatures which are higher than traditional levels, significantly enhancing the overall efficiency of the cooling system.

TECS-FC has been developed to operate properly with leaving water temperature up to 20°C, ensuring outstanding energy savings and fully capitalising on free-cooling.

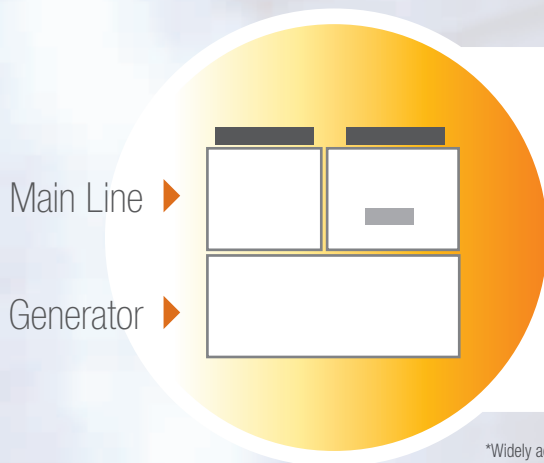


The awareness of the most demanding application requirements and the commitment to improve their energy efficiency has led to the development of devoted solutions.

Climaveneta's approach to cooling dependability goes beyond the unit's accurate and sturdy design. It also involves several devices and functions that maximise unit's uptime in case of emergency circumstances such as power supply outage.

## Double power supply

Redundancy increases uptime. With the aim of enhancing cooling dependability, Climaveneta extends this concept also to the electrical supply.



With the double power supply configuration, the unit is equipped with an ATS (Automatic Transfer Switch) and can be connected to two separate power lines (usually the mains and the auxiliary generator line). In case of a main line power outage, the ATS automatically switches over to the other line, granting uninterrupted power supply to the unit.

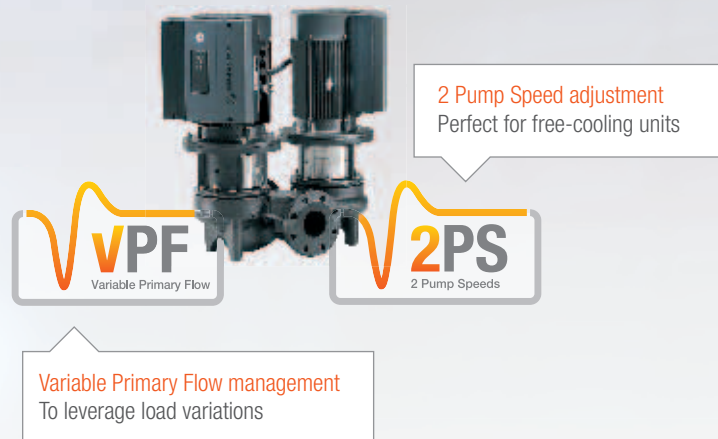
The double power supply makes TECS-FC suitable for TIER III and TIER IV\* design topologies, the highest standards of reliability.

\*Widely accepted within the uninterruptible industry, the Uptime Institute's TIER Performance Standards and Classifications are an objective basis for comparing the capabilities of a particular design topology against others or to compare groups of sites.

## Smart pump management

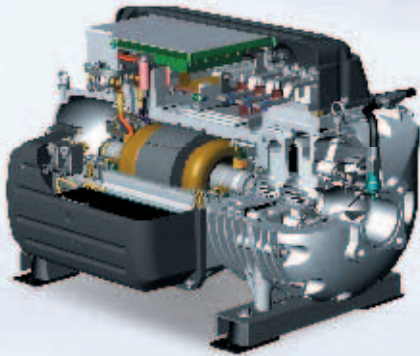
Free-cooling units lead to high energy savings but, because of their very nature, they always involve a water flow management issue: when the free-cooling is activated, the pressure drops suddenly increase due to the additional path throughout the free-cooling coils. This causes a significant change in the pump working conditions.

With the 2PS (2 Pump Speeds) function (opt), Climaveneta adjusts the pump speed according to the free-cooling chiller operating mode, keeping the water flow steady without any energy waste nor hydraulic plant complication.



# Technological choices

## Climaveneta manufacturing

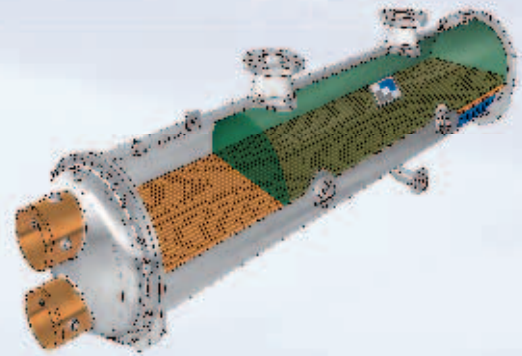


### Centrifugal compressor with magnetic levitation

The expertise makes the difference

These top level technology compressors bring enormous benefits in terms of efficiency, adjustments, vibrations and weight. Magnetic levitation eliminates the need for lubricant, its delicate management and heat exchange penalisation. Partial load efficiency, which is crucial during the hybrid operation, is therefore strongly increased.

A profound knowledge is necessary to harness such a concentration of technology and here is where Climaveneta really makes the difference thanks to its 10-year experience in magnetic levitation compressors units and thousands of projects all over the world.



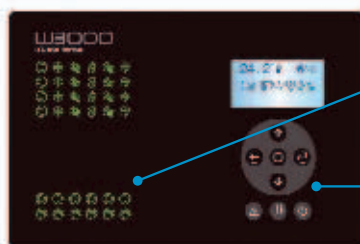
### Flooded evaporator

The excellence in heat exchange

Designed and built by Climaveneta, its geometry grants optimum temperature distribution along the shell, hence highly efficient heat exchange and low refrigerant pressure drops.

Allowing the over-heating surface to be eliminated, the flooded evaporation delivers unbeatable heat exchange efficiency, but it also requires maximum care in keeping the exact liquid refrigerant level. This could become tricky in case of wide variations of the evaporator cooling load, which in these units happens again and again due to free-cooling contribution. Climaveneta ensures a fully reliable way out thanks to specific design solutions and proprietary electronic expansion valve control algorithms.

### Standard interface



Easy-to read LED icons

Controls for easy and safe access to the unit's setting

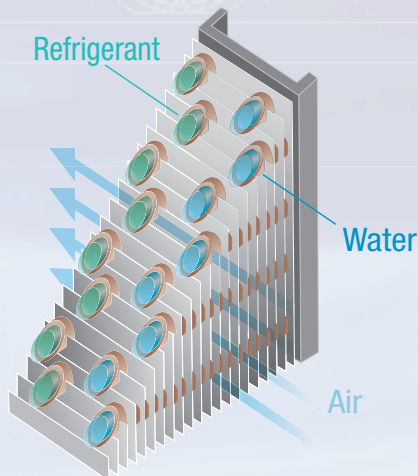
### Advanced control by Climaveneta

The controller features proprietary settings that ensure fast adaptive responses to different dynamics, in all operating modes. The interface is intuitive and user-friendly thanks to the adoption of LED icons for a full and immediate status display of the various circuits.



Extreme efficiency and absolute reliability: the secret formula is cutting-edge technologies and deep know-how.

## quality in every detail



### Special coils

Keep the efficiency up over time

Free-cooling efficacy is strictly related to the effectiveness of the air/water direct heat exchange. Nevertheless, an efficient air/refrigerant coil is necessary for proper condensation.

A special coil, made of both refrigerant and water tubes, achieves both goals. This particular configuration, instead of two separate finned coils, also prevents fin spacing misalignment and dust and dirt accumulation. Hence low pressure drops and high heat exchange efficiency will last.



### EC fans

Hold the reins on air flow rate

Managing both free-cooling and condensation with rough air flow regulation would mean a significant energy loss due to unfavourable condensation pressure or not capitalising on free-cooling.

EC fans are efficient and silent and have the capability to adjust their rotational speed continuously. Their accurate and quick air flow regulation allows Climaveneta's control functions to perform at their best, granting the best possible unit operation in any condition.

## The brain behind the success

As an option, a 7" touch screen color display interface is available with a USB port, for quick and easy application updates and downloading of all registered variables in graphic form.

### Optional touch screen interface



7" colour display

USB port

# TECS-FC 0211 - 1204

High efficiency air cooled chiller with free-cooling (302-1649 kW)



## Versions

- K Compact units
- CA High efficiency units

## Configurations

- Standard
- NG No Glycol



TECS-FC/K			0211	0351	0452	0552	0652	0712	0903	0953	1003	1164	1204
<b>PERFORMANCE - Water (in/out) 15°C/10°C</b>													
Cooling capacity	(1)	kW	302	483	594	689	943	980	1185	1253	1421	1578	1649
Mechanical cooling	Total power input	(1)	87,1	141	179	181	285	275	320	373	425	455	461
	EER	(1)	-	3,47	3,43	3,33	3,81	3,31	3,56	3,7	3,36	3,35	3,47
Total free-cooling	Total power input	(2)	5,1	9,6	12,0	10,2	16,8	19,2	24,0	24,0	26,4	31,2	31,2
	TFC temperature	(2)	°C	-1,9	-2,5	-1,9	-1,4	-2,7	-1,4	-1,2	-2,7	-2,5	-1,6
<b>PERFORMANCE - Water (in/out) 27°C/20°C</b>													
Cooling capacity	(3)	kW	407	616	797	880	1237	1261	1516	1666	1863	2063	2110
Mechanical cooling	Total power input	(3)	93,6	138	191	183	283	273	320	380	427	464	460
	EER	(3)	-	4,35	4,46	4,16	4,81	4,37	4,61	4,74	4,38	4,36	4,45
Total free-cooling	Total power input	(4)	5,1	9,6	12,0	10,2	16,8	19,2	24,0	24,0	26,4	31,2	31,2
	TFC temperature	(4)	°C	3,9	4,3	4,1	4,7	3,4	5,0	5,4	3,4	3,7	4,7
<b>COMPRESSORS</b>													
Compressors No./Circuits No.		N°/N°	1/1	1/1	2/1	2/1	2/1	2/1	3/2	3/3	3/2	4/2	4/2
<b>NOISE LEVEL</b>													
Noise Power	(5)	dB(A)	88	93	94	91	96	96	97	97	98	98	98
<b>SIZE AND WEIGHT</b>													
A	(6)	mm	4000	4000	4900	6400	7000	7900	10600	11200	11200	13000	13600
B	(6)	mm	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260
H	(6)	mm	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500

TECS-FC /CA			0211	0251	0351	0452	0552	0712	0803	0903	1003	
<b>PERFORMANCE - Water (in/out) 15°C/10°C</b>												
Cooling capacity	(1)	kW	310	354	496	616	714	990	1068	1209	1446	
Mechanical cooling	Total power input	(1)	85,4	89,8	134	173	177	268	267	308	412	
	EER	(1)	-	3,63	3,94	3,69	3,56	4,03	3,69	4	3,92	3,51
Total free-cooling	Total power input	(2)	5,1	6,8	8,5	10,2	13,6	17,0	20,4	22,1	22,1	
	TFC temperature	(2)	°C	-0,1	-0,2	-1,0	-0,5	0,4	-0,9	0,2	0,0	-1,6
<b>PERFORMANCE - Water (in/out) 27°C/20°C</b>												
Cooling capacity	(3)	kW	417	446	640	832	891	1278	1337	1534	1851	
Mechanical cooling	Total power input	(3)	91,2	88,5	134	185	172	268	260	305	409	
	EER	(3)	-	4,57	5,03	4,79	4,49	5,18	4,77	5,14	5,02	4,52
Total free-cooling	Total power input	(4)	5,1	6,8	8,5	10,2	13,6	17,0	20,4	22,1	22,1	
	TFC temperature	(4)	°C	5,7	6,5	5,2	5,2	7,2	5,4	7,0	6,5	4,5
<b>COMPRESSORS</b>												
Compressors No./Circuits No.		N°/N°	1/1	1/1	1/1	2/1	2/1	2/1	3/2	3/2	3/2	
<b>NOISE LEVEL</b>												
Noise Power	(5)	dB(A)	88	89	90	91	92	93	94	94	94	
<b>SIZE AND WEIGHT</b>												
A	(6)	mm	4000	4000	4900	6400	7900	10000	12100	13000	13000	
B	(6)	mm	2260	2260	2260	2260	2260	2260	2260	2260	2260	
H	(6)	mm	2500	2500	2500	2500	2500	2500	2500	2500	2500	

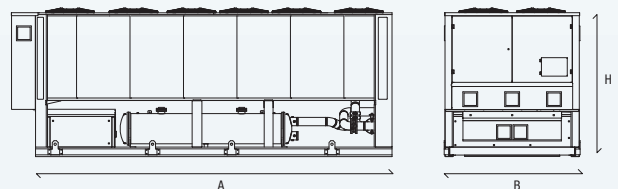
### Notes:

- 1 Plant (side) cooling exchanger water (in/out) 15°C/10°C; Source (side) heat exchanger air (in) 30°C; Ethylene glycol 30%.
- 2 Plant (side) cooling exchanger water (in/out) 15°C/10°C; Ethylene glycol 30%.
- 3 Plant (side) cooling exchanger water (in/out) 27°C/20°C; Source (side) heat exchanger air (in) 30°C; Ethylene glycol 30%.

- 4 Plant (side) cooling exchanger water (in/out) 27°C/20°C; Ethylene glycol 30%.
- 5 Sound power on the basis of measurements made in compliance with ISO 9614.
- 6 Unit in standard configuration/execution, without optional accessories.

### Accessories:

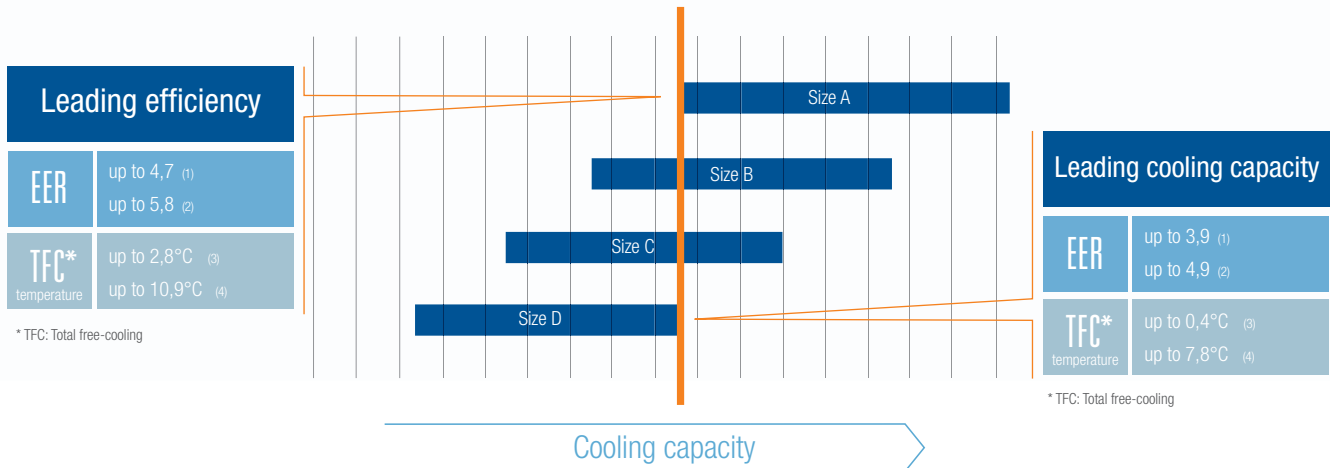
- ▶ Leak detector with automatic refrigerant migration
- ▶ Energy meter with BMS interface
- ▶ Electromagnetic compatibility (EMC) - EN6100-6-3 for residential environments



# Powerful flexibility. A mighty core tailored to a project's needs

Every job has its own specific needs. Because of the skillful use of component technical features, Climaveneta makes the TECS-FC family capable of tailoring the actual specifications and priorities of any project. A definite cooling demand can in fact be provided giving priority to reducing the initial investment cost (leading cooling capacity), or putting a premium on annual energy savings and payback time (leading efficiency).

## Cooling demand



(1) Water (in/out) 15°C/10°C; Air (in) 30°C; Et. glycol 30%. (2) Water (in/out) 27°C/20°C; Air (in) 30°C; Et. glycol 30%. (3) Water (in/out) 15°C/10°C; Et. glycol 30%. (4) Water (in/out) 27°C/20°C; Et. glycol 30%.



## THDi and Power Factor

The accurate design of electrical and electronic components and the use of specific solutions, such as compressor line reactors (std) and power factor correction capacitors (opt), reduce the THDi (Total Harmonic Distortion of current) and increase unit's Power Factor. To fit even the most demanding requirements, modular active harmonic filters can be added to cut the THDi down to values below 5%.



## HFO refrigerant

In line with the most severe environmental regulations, TECS-FC is also available with the new green HFO 1234ze refrigerant. A solution that complies with the highest efficiency targets required by modern projects, whilst offering an eco-friendly alternative to HFCs.



## ClimaPRO

According to the units' actual efficiency curves, ClimaPRO continuously optimises plant working conditions by promptly adjusting equipment staging and sequencing, managing operating set-points and controlling water flows throughout the entire system. ClimaPRO can be natively interfaced with any BMS or it can successfully perform all functions on its own.



“ Experience is by far  
the best proof”

Sir Francis Bacon  
(British philosopher, 1561-1626)





# Infocamere Padova

2015 Padua - Italy

**Application:**  
Data Center

**Plant type:**  
Hydronic System

**Cooling capacity:** 1000 kW

**Installer:** Retice  
**HVAC Designer:** per. Ind.  
Roberto Michelotto (TIFS - Padova)

**Machines installed:**  
2x TECS2-FC/NG/SL/S 0512,  
1x MANAGER 3000



## Project

InfoCamere, the IT company for the Italian Chambers of Commerce, is the ideal technological structure for supporting the Chamber system in managing its IT information store and providing high-speed and high-security communication network among an extended network of offices. Located in Padua, Infocamere is a real 'Virtual data center', managing the complex administrative procedures associated with business life.

## Challenge

Built to connect more than 105 Chambers of Commerce and 300 branch offices throughout Italy on a daily basis, Infocamere operates as real cloud, offering customers a number of services and providing easy to access information all the year round, 24/7. Reliable and safe operation, together with high energy efficiency standards, were therefore the main drivers when it came to evaluating cooling solutions for the data center.

## Solution

The units selected for the cooling plant are 2 TECS-FC chillers featuring magnetic levitation compressors and an advanced free-cooling system aimed at achieving the best efficiency in any load condition.

When outdoor temperatures are low enough, TECS-FC switches the compressors off and utilises outdoor air to directly chill the water (free-cooling). When temperatures, on the other hand, rise above the minimum threshold, the unit switches on the magnetic levitation compressors, ensuring premium efficiency levels in all other conditions. Additionally, VPF (Variable Primary Flow) function smartly adjusts plant's water flow, capitalising on load variations.

Total system's reliability is ensured by the FAST RESTART function for a quick reboot in case of power outage or voltage dips.





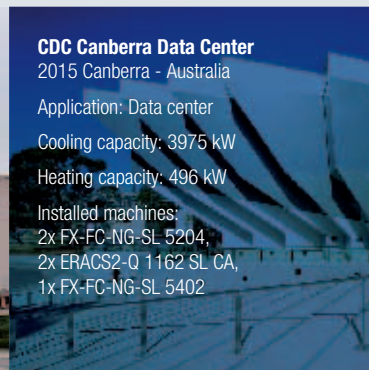
# More than 1000 projects all over the world



**Baptist University  
Shaw Campus**  
2015 - Hong Kong

Application: Universities / Schools  
Cooling capacity: 2015 kW

Installed machines:  
3x TECS2/SL-CA 1013,  
2x TECS2/SL-CA 0251



**CDC Canberra Data Center**  
2015 Canberra - Australia

Application: Data center  
Cooling capacity: 3975 kW  
Heating capacity: 496 kW

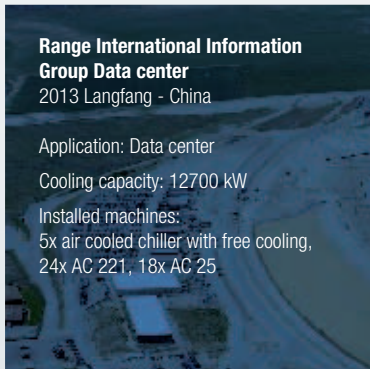
Installed machines:  
2x FX-FC-NG-SL 5204,  
2x ERACS2-Q 1162 SL CA,  
1x FX-FC-NG-SL 5402



**SFR**  
2013-2014  
Several applications in France

Application: Data Center  
Cooling capacity: 1454 kW

Installed machines:  
2x NECS-FC/SL 0704,  
3x NECS-FC/SL 0452,  
2x FOCS/LN 0961,  
3x NECS-FC/SL 0352



**Range International Information  
Group Data center**  
2013 Langfang - China

Application: Data center  
Cooling capacity: 12700 kW

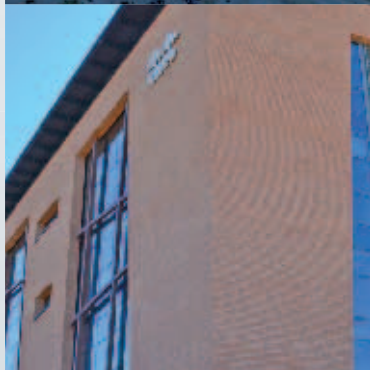
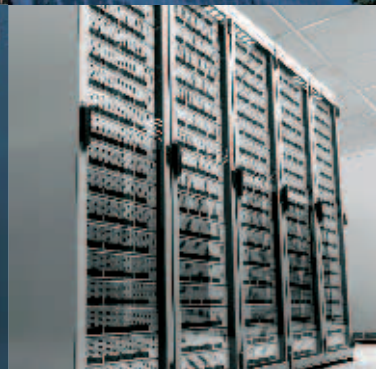
Installed machines:  
5x air cooled chiller with free cooling,  
24x AC 221, 18x AC 25




**Wuxi National Super Computing  
Data Center**  
2015 - Jiangsu Province  
(China)

Application: Data center  
Cooling capacity: 28000 kW

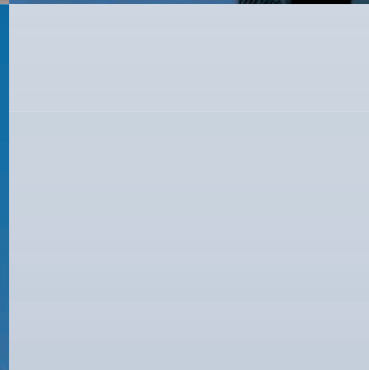
Installed machines:  
18x TECS-W /H water cooled chillers



**Cisco Systems Vimercate**  
2014 - Milan  
(Italy)

Plant type: Hydronic system  
Cooling capacity: 4505 kW  
Heating capacity: 459 kW

Installed machines:  
1x TECS2/SL-CA-E 0712, 2x TECS-W HC 812,  
1x ERACS2-WQ 1702, 2x FOCS/SL-CA-E 1922,  
1x FX-FC NG 3402, 1x ClimaPRO,  
AC Close Control Units





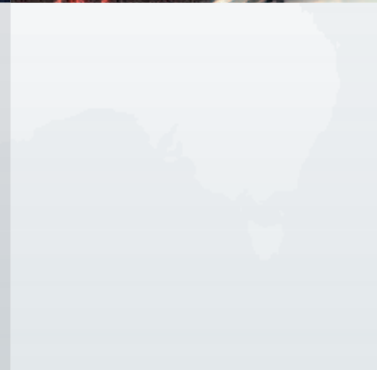
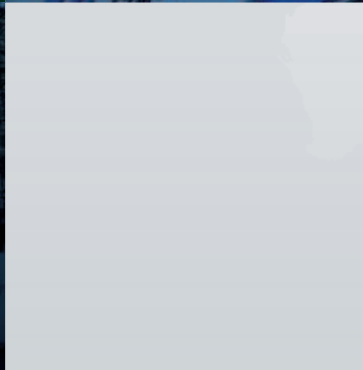
Each one featured by different usage, location and system requirements. All of them sharing the highest efficiency, lowest noise emissions and complete reliability of Climaveneta's unique experience and know-how.



**2 Triton Square  
Abbey Headquarters**  
2013 London - Great Britain  
Investor: Abbey Santander Bank  
Application: Mixed-use buildings  
Cooling capacity: 3318 kW  
Installed machines:  
3x TECS-F/SL 1004,  
4x FX-FC/T+/S 4502,  
2x MANAGER 3000



**Bush House London**  
2013 London - Great Britain  
Application: Office buildings  
Cooling capacity: 3124 kW  
Installed machines:  
1x TECS2/XL-CA 0652,  
2x TECS2/SL-CA 0452,  
2x TECS2/XL-CA 0552,  
1x TECS2/XL-CA 0452,  
2x MANAGER 3000



**Principal Place  
THE UN SQUARE MILE**  
2015 London - Great Britain  
Application: Mixed-Use Development  
Cooling capacity: 9243 kW  
Heating capacity: 478 kW  
Installed machines:  
6x TECS2-W/LC 1453,  
1x FOCS2-WR/CA-E 1801



A Group Company of **MITSUBISHI ELECTRIC**

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