

**MITSUBISHI ELECTRIC
HYDRONICS & IT COOLING SYSTEMS S.p.A.**

IT COOLING

CHILLERS

TRCS2-Z

**CHILLERS, AIR AND WATER COOLED,
FEATURING CENTRIFUGAL COMPRESSORS
WITH MAGNETIC LEVITATION,
FROM 233 TO 1325 kW**



STRIVING FOR THE HIGHEST EFFICIENCY

Today's mission-critical projects require leading edge solutions to meet extremely demanding challenges:



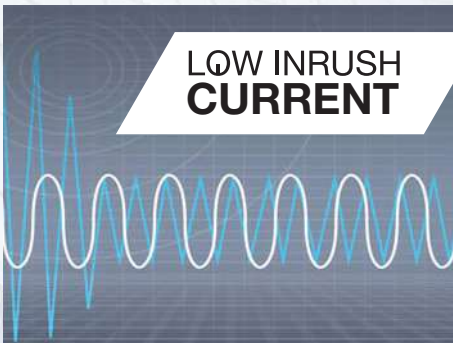
VERY STRICT ENERGY EFFICIENCY AND SUSTAINABILITY REQUIREMENTS

Reduced initial investment and running costs, compliance with increasingly strict energy consumption and environmental impact regulations, are becoming more and more crucial factors not only for real estate valuation, but also for deciding if the project should proceed.



COMPLEX ARCHITECTURE AND LOGISTICS

The search for prestigious central locations together with regulations and incentives for requalification of urban areas increase the building site logistical complexity and the challenge of moving the system's components.



INFRASTRUCTURE AND TECHNICAL SPACE OPTIMIZATION

The real estate value, especially with expensive, prestigious investment in urban environments may also be determined by the quality of the electrical system installed. Hence, choices that do not overload electrical infrastructure are more desirable.

TRCS2-Z

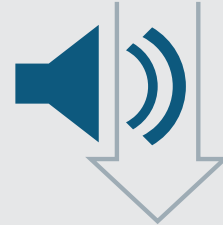
IS THE MOST ADVANCED SOLUTION

Resulting from the recognised prestige of RC brand products utilising magnetic levitation technology, TRCS2-Z air source chillers are the most efficient and reliable solution available in the market today.



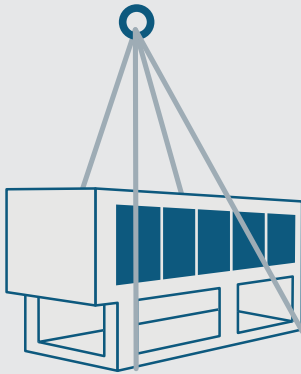
All the advantages in terms of reliability and technical service thanks to the RC's unbeatable know-how for a truly ideal answer to the challenge of the most demanding applications:

E.S.E.E.R.
5,75



UNBEATABLE EFFICIENCY AT PARTIAL LOADS

At partial loads, TRCS2-Z units are far more efficient than traditional scroll/screw units, with ESEER values up to 60% higher. Running cost savings are evident and consistent, especially when all year round operation is required.



SIMPLIFIED LOGISTICS

Turbocor compressors feature an extremely advantageous capacity / weight ratio. The considerable weight reduction allows simplified site operations.

EXTREMELY SILENT OPERATION

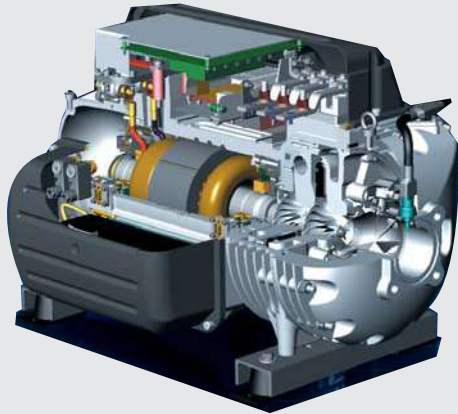
Thanks to the adoption of the centrifugal compressor with magnetic levitation, and fans with reduced noise emission, TRCS2-Z sound power and pressure are the lowest on the market, without peaks in any of the sound frequency spectrum. Vibrations are dramatically reduced as well, with considerable advantages in terms of transmission to the building.



LOW IN RUSH CURRENT

A further benefit is the very low inrush current, obtained thanks to the characteristics of the compressor and to the soft starter function with inverter technology. This is a crucial factor, as it allows a more favourable selection of the protection devices to be placed on the power supply between transformer and unit.

TECNOLOGICAL CHOICES



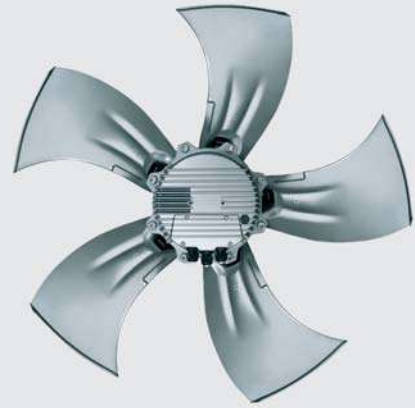
CENTRIFUGAL COMPRESSOR WITH MAGNETIC LEVITATION

This is a miniaturized, highly innovative compressor, with magnetic levitation and digital control of the rotor's speed.

The efficiencies achieved are far superior to those with traditional volumetric compressors.

The extended modulation range of the compressor ensures the precise satisfaction of the building's loads even in partialisation conditions.

A solution that, besides the reduction of weight and dimensions with respect to traditional compressors, permits the compressor to operate completely without oil allowing an improvement of its performance, through the heat exchange process. Vibrations are virtually eliminated together with possible jolts due to inrush current in the start up phase: the unit's wear is minimized.



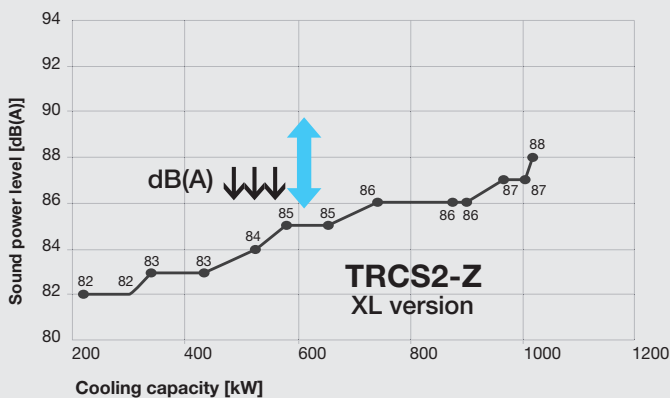
EC FANS

On TRCS2-Z units, the technology of EC electronic switching fans is introduced, as standard on SL-CA-E versions and optional on the other models.

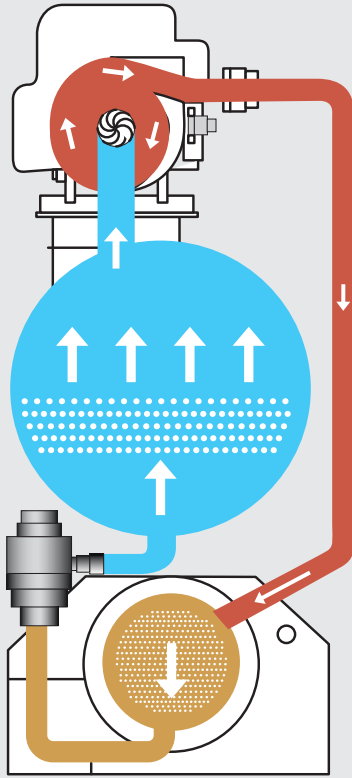
The superior energy efficiency of the DC brushless motor further improves the chiller's performance, that reaches the highest ESEER level in the market.

More advantages are low inrush current and the ability to continuously modulate the rotational speed with an immediate gain in both silence and energy consumption.

Typical Sound Power Level range for screw compressors unit



Efficiency, silent operation and reliability. But also compact dimensions and reduced weight. These are the main features that make TRCS2 units the best result of RC's know-how. Advantages that result from technological choices, involving each aspect of these units.

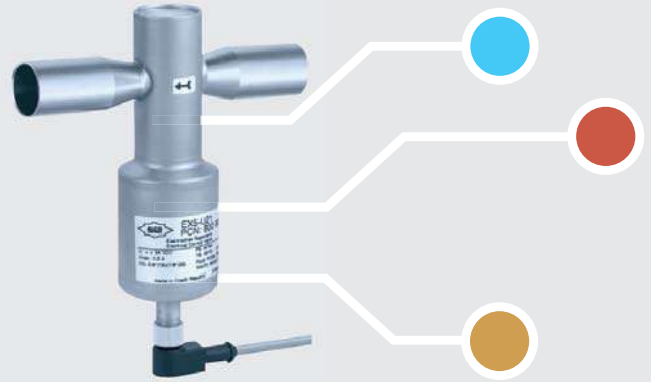


FLOODED EVAPORATOR

The technology of the flooded evaporator, which is further enhanced by the absence of oil in the refrigerant circuits, achieves a substantial increase of cooling capacity and an optimization in the compressor's operational mode. The unit's overall efficiency further increases thanks to:

- ▶ Compression ratio reduction
- ▶ Theoretic absence of refrigerant superheat at the compressor's suction stage
- ▶ Minimization of refrigerant pressure drop on the evaporator's shell side
- ▶ Optimization of the exchange surfaces, also at partial loads, thanks to the complete control of the refrigerant level in all operating conditions.

To comply with the security requirements of the "F-gas Regulation" (CE 842//2006), factory calibrated leak detection systems are available upon request.

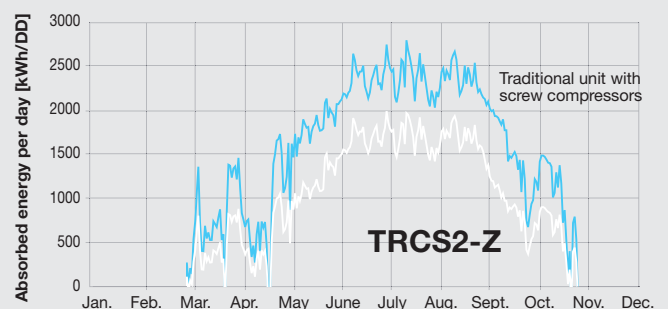


ELECTRONIC VALVE

The electronic valve is adopted to grant the ideal operation of the evaporator in all conditions. In the air cooled unit the control is made with a precise measurement of the subcooling in the condenser coil.

The fast processing of the acquired data allows a quick fluctuation-free regulation, and therefore a highly accurate adjustment to the swings of load and ambient conditions.

Total absorbed energy
TRCS2-Z vs Traditional unit with screw compressors



TRCS2-Z

Air cooled unit with magnetic levitation centrifugal compressors.
From 220 to 1.325 kW

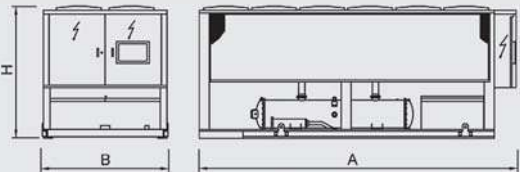


TRCS2-Z / SL-CA		0211	0251	0351	0452	0512	0552	0652	0712	0853	0913	1013	1054	1154	
Power supply	V/ph/Hz	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	
PERFORMANCE															
COOLING ONLY (GROSS VALUE)															
Cooling capacity	(1)	kW	233	258	346	442	509	574	650	742	848	903	977	1065	1183
Total power input	(1)	kW	70,5	81,1	110	138	161	174	208	225	269	286	310	336	374
EER	(1)	kW/kW	3,30	3,18	3,13	3,20	3,16	3,30	3,13	3,30	3,15	3,15	3,15	3,17	3,17
COOLING ONLY (EN14511 VALUE)															
Cooling capacity	(1)(2)	kW	232	257	345	441	507	572	648	740	846	901	975	1062	1180
EER	(1)(2)	kW/kW	3,25	3,14	3,10	3,16	3,13	3,26	3,11	3,26	3,12	3,12	3,12	3,13	3,13
Cooling energy class			A	A	A	A	A	A	A	A	A	A	A	A	A
SEPR HT	(3)(4)		5,87	5,90	6,06	5,95	6,07	5,73	6,20	6,12	6,03	6,07	6,15	5,92	6,14
COOLING ONLY															
16°C/10°C															
Cooling capacity	(5)	kW	258	285	379	488	561	656	746	832	931	992	1074	1176	1297
Total power input	(5)	kW	70,7	81,5	114	139	162	187	213	233	273	292	318	338	380
EER	(5)	kW/kW	3,64	3,49	3,33	3,52	3,47	3,51	3,50	3,57	3,41	3,39	3,37	3,48	3,41
23°C/15°C															
Cooling capacity	(6)	kW	299	333	456	571	658	719	858	940	1134	1197	1289	1375	1574
Total power input	(6)	kW	70,2	81,6	117	138	162	194	218	242	278	298	325	338	387
EER	(6)	kW/kW	4,26	4,08	3,91	4,13	4,05	3,71	3,94	3,88	4,07	4,01	3,96	4,06	4,06
EXCHANGERS															
HEAT EXCHANGER USER SIDE IN REFRIGERATION															
Water flow	(1)	l/s	11,13	12,33	16,53	21,15	24,32	27,43	31,07	35,49	40,56	43,20	46,74	50,93	56,59
Pressure drop	(1)(2)	kPa	36,4	27,4	28,5	27,6	27,7	35,2	21,1	27,6	31,8	36,0	29,7	35,3	37,3
REFRIGERANT CIRCUIT															
Compressors nr.		N°	1	1	1	2	2	2	2	2	3	3	3	4	4
No. Circuits		N°	1	1	1	1	1	1	1	1	2	2	2	2	2
Refrigerant charge		kg	100	100	120	210	180	210	240	280	340	430	490	480	520
NOISE LEVEL															
Sound Pressure	(7)	dB(A)	56	56	58	58	58	59	59	59	60	60	60	61	61
Sound power level in cooling	(8)(9)	dB(A)	88	88	90	90	90	91	92	92	93	93	93	94	94
SIZE AND WEIGHT															
A	(10)	mm	3100	3100	4000	4900	4900	5800	7000	7000	8500	9700	10600	11200	11500
B	(10)	mm	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260
H	(10)	mm	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430
Operating weight	(10)	kg	2320	2370	3050	4000	4240	4530	5800	6150	6940	7370	8150	8700	9020

Note

- Plant (side) cooling exchanger water (in/out) 12°C/7°C; Source (side) heat exchanger air (in) 35°C
- Values in compliance with EN14511-3:2011
- Average sound pressure level, at 10m distance, unit in a free field on a reflective surface; non-binding value obtained from the sound power level.
- Sound power on the basis of measurements made in compliance with ISO 9614 and Eurovent 8/1 for Eurovent certified units; in compliance with ISO 3744 for non-certified units.
- Unit in standard configuration/execution, without optional accessories.

The units highlighted in this publication contain HFC R134a [GWP₁₀₀ 1430] fluorinated greenhouse gases.



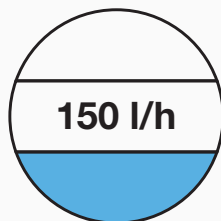
Oasis kit performance

The table on the right shows the effects of Oasis kit in relation to outside air temperature and relative humidity.

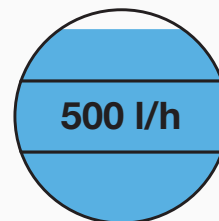
It is clear that, the higher the air temperature and the lower the air humidity, the system is more effective. In these conditions in fact, as higher waterflow is sprayed to the net, and most of it evaporates thanks to the energy given by the airflow through the net, water evaporates and air is cooled.

Water consumption comparison.

Another point to highlight is the water consumption, which is less than 30% of that requested by a water cooled tower coupled to a water cooled unit of the same cooling capacity.



Adiabatic cooling kit coupled with an air cooled chiller (260 kW @ 12/7°C, 35°C, 50% RH)



Cooling tower coupled with a water cooled chiller (260 kW @ 12/7°C, 30/35°C, 50% RH)

TRCS2-Z / XL-CA		0211	0251	0351	0452	0512	0552	0652	0712	0853	0913	1013	1054	1154	
Power supply	V/ph/Hz	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	
PERFORMANCE															
COOLING ONLY (GROSS VALUE)															
Cooling capacity	(1)	kW	220	254	341	435	525	579	640	739	874	900	972	1049	1174
Total power input	(1)	kW	68,5	79,8	109	137	166	171	206	226	279	290	312	331	377
EER	(1)	kW/kW	3,21	3,19	3,12	3,19	3,17	3,38	3,11	3,27	3,13	3,11	3,12	3,17	3,11
COOLING ONLY (EN14511 VALUE)															
Cooling capacity	(1)/(2)	kW	219	254	340	434	524	578	639	737	872	897	970	1046	1171
EER	(1)/(2)	kW/kW	3,17	3,15	3,08	3,16	3,14	3,34	3,08	3,24	3,10	3,07	3,09	3,13	3,08
Cooling energy class			A	A	B	A	A	A	B	A	A	B	B	A	B
SEPR HT	(3)/(4)		6,01	6,15	6,30	6,18	6,17	5,97	6,43	6,25	6,20	6,27	6,36	6,16	6,33
COOLING ONLY 16°C/10°C															
Cooling capacity	(5)	kW	243	281	390	480	580	655	733	827	959	1033	1112	1158	1350
Total power input	(5)	kW	68,7	80,2	110	137	166	180	207	229	282	291	313	333	378
EER	(5)	kW/kW	,54	3,50	3,53	3,51	3,49	3,65	3,55	3,61	3,40	3,55	3,55	3,48	3,57
23°C/15°C															
Cooling capacity	(6)	kW	284	329	449	563	680	748	844	953	1163	1191	1280	1357	1557
Total power input	(6)	kW	68,5	80,5	114	137	167	188	213	236	283	297	323	334	383
EER	(6)	kW/kW	4,15	4,08	3,94	4,11	4,07	3,99	3,96	4,03	4,11	4,01	3,96	4,06	4,06
EXCHANGERS															
HEAT EXCHANGER USER SIDE IN REFRIGERATION															
Water flow	(1)	l/s	10,53	12,16	16,31	20,82	25,13	27,71	30,62	35,33	41,78	43,03	46,47	50,15	56,14
Pressure drop	(1)/(2)	kPa	32,6	26,7	27,7	26,7	29,5	35,9	20,5	27,3	33,7	35,7	29,4	34,2	36,8
REFRIGERANT CIRCUIT															
Compressors nr.		N°	1	1	1	2	2	2	2	2	3	3	3	4	4
No. Circuits		N°	1	1	1	1	1	1	1	1	2	2	2	2	2
Refrigerant charge		kg	100	100	130	220	220	240	270	310	410	450	520	500	580
NOISE LEVEL															
Sound Pressure	(7)	dB(A)	50	50	51	51	52	52	53	53	53	53	54	54	55
Sound power level in cooling	(8)/(9)	dB(A)	82	82	83	83	84	85	85	86	86	86	87	87	88
SIZE AND WEIGHT															
A	(10)	mm	3100	3100	4000	4900	5800	7000	7000	7900	9400	9700	10600	11200	12400
B	(10)	mm	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260
H	(10)	mm	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430
Operating weight	(10)	kg	2370	2420	3200	4240	4690	5350	6150	6650	7520	7770	8650	9150	9960

TRCS2-Z / SL-CA-E		0211	0251	0351	0452	0512	0552	0652	0712	0853	0913	1013	1054	1154	
Power supply	V/ph/Hz	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	
PERFORMANCE															
COOLING ONLY (GROSS VALUE)															
Cooling capacity	(1)	kW	229	285	385	455	527	590	703	796	902	969	1086	1177	1324
Total power input	(1)	kW	67,1	81,3	113	134	154	168	204	233	263	279	317	336	383
EER	(1)	kW/kW	3,41	3,50	3,40	3,41	3,41	3,50	3,45	3,41	3,43	3,48	3,42	3,50	3,46
COOLING ONLY (EN14511 VALUE)															
Cooling capacity	(1)/(2)	kW	228	284	383	454	526	588	701	794	900	966	1083	1173	1320
EER	(1)/(2)	kW/kW	3,36	3,45	3,35	3,37	3,38	3,46	3,42	3,37	3,39	3,43	3,38	3,45	3,41
Cooling energy class			A	A	A	A	A	A	A	A	A	A	A	A	A
SEPR HT	(3)/(4)		6,41	6,26	6,45	6,60	6,36	6,28	6,74	6,50	6,42	6,61	6,59	6,23	6,48
COOLING ONLY 16°C/10°C															
Cooling capacity	(5)	kW	253	311	418	503	602	643	764	865	1021	1056	1180	1284	1441
Total power input	(5)	kW	67,2	85,8	118	134	168	178	210	243	282	289	328	355	401
EER	(5)	kW/kW	3,76	3,62	3,55	3,76	3,59	3,61	3,63	3,56	3,62	3,65	3,60	3,61	3,60
23°C/15°C															
Cooling capacity	(6)	kW	294	357	485	585	659	737	886	999	1138	1222	1369	1472	1666
Total power input	(6)	kW	66,5	91,5	123	133	173	190	219	256	291	304	344	380	423
EER	(6)	kW/kW	4,42	3,90	3,93	4,41	3,81	3,88	4,04	3,91	3,91	4,02	3,98	3,88	3,94
EXCHANGERS															
HEAT EXCHANGER USER SIDE IN REFRIGERATION															
Water flow	(1)	l/s	10,93	13,62	18,39	21,76	25,19	28,21	33,61	38,05	43,14	46,35	51,91	56,30	63,34
Pressure drop	(1)/(2)	kPa	35,2	33,5	35,2	29,2	29,7	37,2	24,7	31,7	35,9	41,5	36,7	43,1	46,8
REFRIGERANT CIRCUIT															
Compressors nr.		N°	1	1	1	2	2	2	2	2	3	3	3	4	4
No. Circuits		N°	1	1	1	1	1	1	1	1	2	2	2	2	2
Refrigerant charge		kg	100	100	130	220	220	240	270	310	410	450	520	500	580
NOISE LEVEL															
Sound Pressure	(7)	dB(A)	56	56	58	58	58	59	59	59	60	60	60	61	62
Sound power level in cooling	(8)/(9)	dB(A)	88	88	90	90	90	91	92	92	93	93	93	94	95
SIZE AND WEIGHT															
A	(10)	mm	3100	3100	4000	4900	4900	5800	7000	7900	8500	9700	10600	11200	12400
B	(10)	mm	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260
H	(10)	mm	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430	2430
Operating weight	(10)	kg	2270	2350	3130	4070	4230	4570	6040	6450	7020	7610	8510	8660	9720

Impact of Oasis on the condensation and operational limits

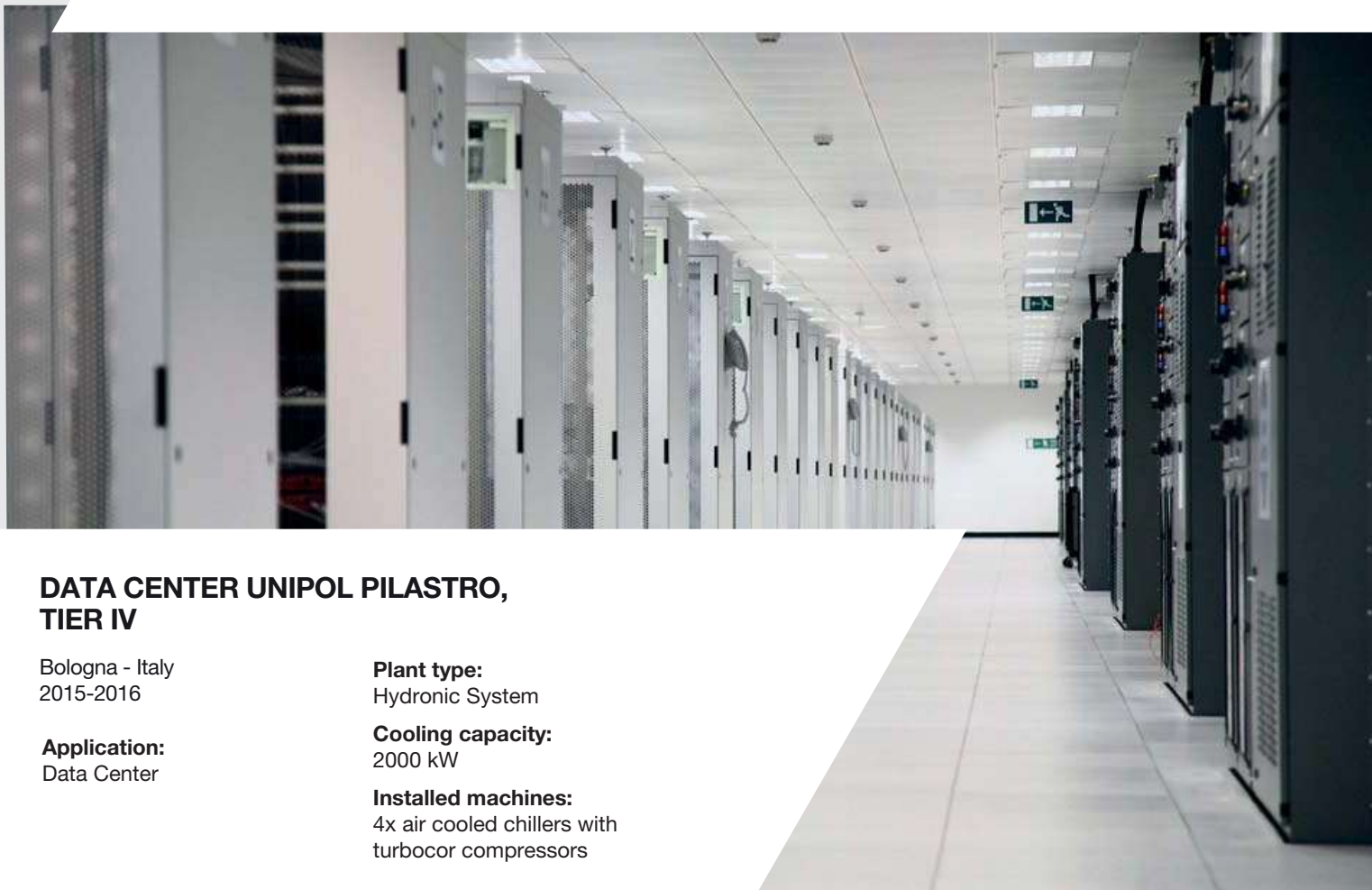
Relative Humidity outdoor air [%]	Ambient air temperature, dry bulb [°C]	Delta T inlet condenser coil temperature [°C]	Water consumption for 1000m ³ /h air flow [l/m]
30	35	6	5,1
	40	6,5	5,6
	45	7,5	6,1
40	35	5	4,0
	40	5,5	4,6
	45	6	5,2
50	35	4,5	3,3
	40	5	3,7
	45	5	4,1
60	35	3,5	2,3
	40	4	2,6
	45	4,5	2,8
70	35	3	1,4
	40	4	1,6
	45	4	1,7

Main accessories

- ▶ Several serial card for protocols ModBus, Bacnet, Echelon IonTalk for supervisory systems both in BMS resources and RC devices (FWS3000, Manager3000)
- ▶ Remote keyboard; it offers access up to 10 units from a singlepoint, with the possibility to set the main plant variables
- ▶ DEMETRA system to have an hourly complete report of the main variables: temperatures, energy given and absorbed
- ▶ Integrated hydronic group, with the possibility to select different pumps. Available also as VPF (Variable Primary Flow)
- ▶ EC fans (already standard in TRCS2-Z/SL-CA-E versions) (only for TRCS2-Z)
- ▶ Acoustical enclosure 'base' and 'plus' for a sound power level reduction of 14 and 18 dB(A) respectively (only for TRCS2-W-Z)
- ▶ Leak detector; devices to detect refrigerant leakage in close ambient

“ BY FAR THE BEST PROOF IS EXPERIENCE ”

Sir Francis Bacon
British philosopher
(1561 - 1626)



DATA CENTER UNIPOL PILASTRO, TIER IV

Bologna - Italy
2015-2016

Application:
Data Center

Plant type:
Hydronic System

Cooling capacity:
2000 kW

Installed machines:
4x air cooled chillers with turbocor compressors

PROJECT

To optimise the Group organization they have planned to gather all the IT services in one data center located in Bologna, on Pilastro Street. The new facility is an example of efficiency, not only in terms of energy consumption but also of reduced space, cooling and CO₂ emissions.

CHALLENGE

The new building has been TierIV. certified. That is to say these facilities have multiple, independent, physically isolated systems that provide redundant capacity components and multiple, independent, diverse, active distribution paths simultaneously serving the critical environment, being fully Fault Tolerant Site Infrastructures.

SOLUTION

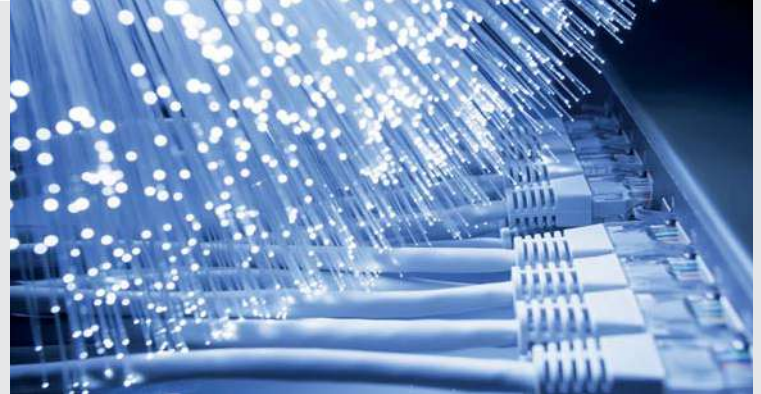
At Unipol Data Center Pilastro Climaveneta supplied 4 x air cooled chillers with turbocor compressors, high efficiency version selected, that easily adapt themselves to different thermal load conditions thanks to their precise thermoregulation together with the use of inverter technology. The compressor is radically innovative: magnetic bearings and digital rotor speed control allow it to guarantee energy efficiency at partial loads, which represents more than 75% of a datacenter's working time.

Every project is characterised by different needs and system specifications for various climates. All these projects share high energy efficiency, maximum integration, and total reliability resulting from the RC brand experience.



**GALILEO CONNECT
LONDON CENTRAL**
2012 London (Great Britain)
Application: Data Center
Plant type: HPAC System

Cooling capacity: 4852 kW
Installed machines:
3x air cooled chillers with turbocor compressors,
29x chilled water Close Control units



ECMWF
European Centre for Medium range
Weather Forecasts
2008-2013 Reading - Great Britain
Application: Data Center - Offices
Plant type: Hydronic System

Cooling capacity: 4596 kW
Installed machines:
6x air cooled chillers with turbocor compressors,
2x high efficiency air cooled chillers with turbocor compressors



NOS DATA CENTRE
2016-2018 Carnaxide (Portugal)
Application: Data Center

Plant type: Hydronic System
Cooling capacity: 510 kW
Installed machines:
1x high efficiency air cooled chiller with turbocor compressors



**TELECOM DATA CENTER
ACILIA, TIER IV**
2016 Rome (Italy)
Application: Data Center
Plant type: Hydronic System

Cooling capacity: 7804 kW
Installed machines:
3x high efficiency air cooled chillers with turbocor compressors,
5x high efficiency air cooled chiller with inverter technology



VODAFONE BUCCINASCIO
2015 Buccinasco (Italy)
Application: Data Center
Plant type: Hydronic System

Installed machines:
4x high efficiency air cooled chillers with turbocor compressors,
1 high efficiency air cooled chiller with inverter technology and free cooling,
29x chilled water Close C. Units



**FASTWEB DATACENTER,
TIER IV**
2014 Milan (Italy)
Application: Data Center

Plant type: Hydronic System
Cooling capacity: 2800 kW
Installed machines:
4x high efficiency air cooled chillers with turbocor compressors



for a greener tomorrow

Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.



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