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

IT COOLING

CHILLERS

formula i-FR(1+i)-Z

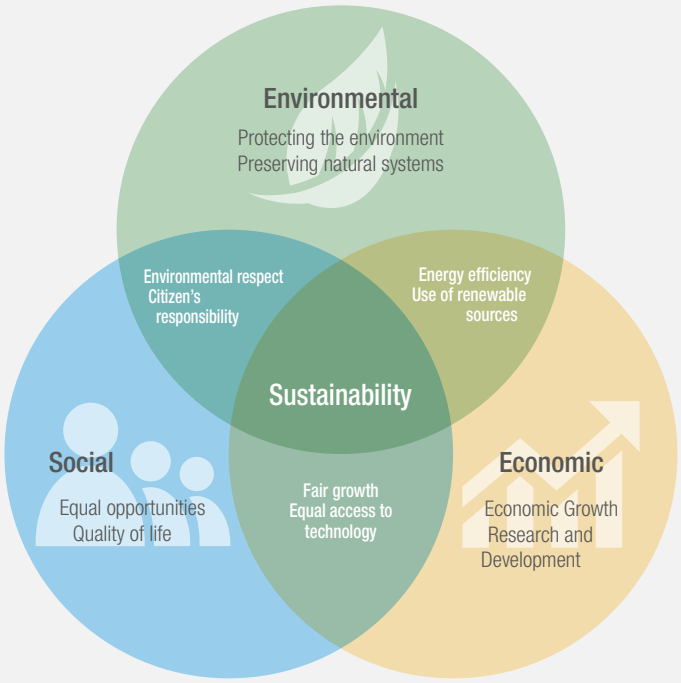
AIR AND WATER SOURCE SCREW CHILLERS WITH FIXED AND VARIABLE SPEED COMPRESSORS, FROM 488 TO 1784 kW

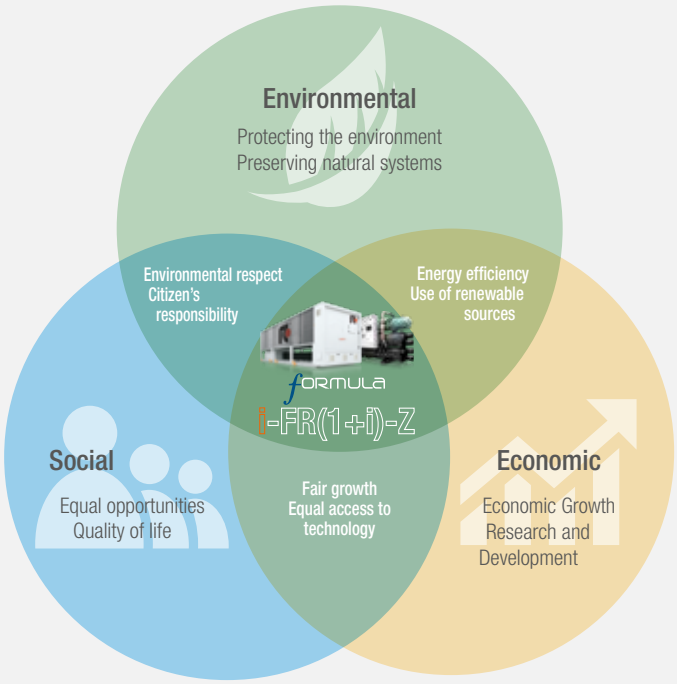
- Premium efficiency
- Low energy consumption
- Quick return on investment
- Environmental compliance

rcitcooling.com

“SUSTAINABLE DEVELOPMENT IS DEVELOPMENT THAT MEETS THE NEEDS OF THE PRESENT WITHOUT COMPROMISING THE ABILITY OF FUTURE GENERATIONS TO MEET THEIR OWN NEEDS”.

World Commission on
Environment and Development





Highest efficiency, precision of control and system’s simplification are distinguishing features of RC brand units.

Now we want to prove that it is possible to combine our innovative technology with a sustainable concept.

Sustainability is conceived as a continuous process of environmental, social and economic development.

ENVIRONMENTAL SUSTAINABILITY

Environmental sustainability involves making decisions and taking actions that are in the interests of protecting the natural world, with particular emphasis on preserving the capability of the environment to support human life.

ECONOMIC SUSTAINABILITY

Economic sustainability involves continuous economic growth, providing long-term benefits and using available resources in a way that is both efficient and responsible.

SOCIAL SUSTAINABILITY

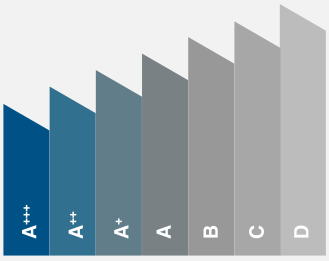
Social sustainability is about creating and maintaining quality of life for people, ensuring that all the people have the same access to social resources.

LAWS AND REGULATIONS

The legislature and international organisations are becoming more and more aware that sustainable development needs to be regulated by laws and programs that aim to integrate social, economic and environmental sustainability.

FORMULA i-FR(1+i)-Z is the innvoative RC chiller range conceived to meet the fast changing efficiency targets of the market.
Because sustainability is the key strategy for long-term success.

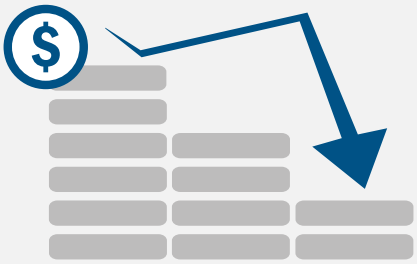
Premium energy efficiency



The FORMULA i-FR(1+i)-Z is the latest range of chillers specifically designed to operate at very high levels of efficiency at both full and partial loads.

With EER in Class A and SEPR values in line with the latest European regulation, the new RC brand range is the best solution available on the market. The unit precisely meets the requested cooling capacity, thus ensuring reduced energy consumption. Top-level efficiency at different loads also results in a large reduction of CO2 emissions: the i-FR(1+i)-Z range features 20% less emissions compared to other Class A chillers.

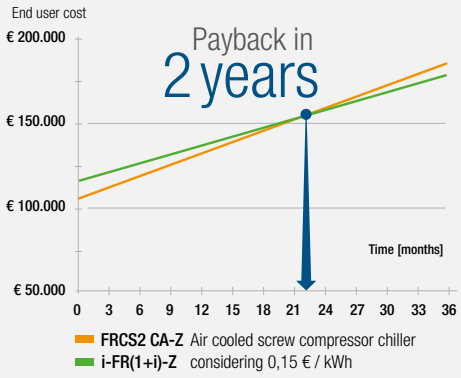
Reduced energy consumption



We always strive to offer high-efficiency and competitive solutions. It is clearly recognised that a low-consumption unit results in a reduction in both CO2 emissions and energy expenses. These cost savings can be reinvested generating new economic value.

Thanks to cutting-edge technologies, the new FORMULA i-FR(1+i)-Z demonstrates that it is possible to combine high efficiency with 21% cost savings (compared to other new generation class A chillers).

Quick return on the investment



Accessibility is a key concept of social development. This means that technology and innovation must be available and affordable.

The high efficiency level of the FORMULA i-FR(1+i)-Z at all operating conditions allows for the small initial investment required to have a payback period of 2 years (compared to other Class A chillers). The new technology of inverter driven screw chillers has never been so accessible.

Compliance with environmental standards

GREEN CERTIFICATION RELEVANT

EUROVENT CERTIFIED PERFORMANCE
www.eurovent-certification.com

E3 Equipment Energy Efficiency

RC brand solutions have been always anticipating the changes established by legislation. FORMULA i-FR(1+i)-Z has been conceived to meet the most challenging standards established by the ASHRAE 90.1-2013 protocol, including the values that are imposed since 2015. All units are Eurovent certified and all the components are accurately selected, taking into consideration the aims established by the EU Ecodesign directive-including the more demanding values established for 2015, and meeting the objectives required by the Australian MEPS system (Minimum Energy Performance Standard).

formula i-FR(1+i)-Z

A new concept of efficiency:
Fixed speed compressor (**1**)
+ Variable speed compressor (**i**)

UNBEATABLE EFFICIENCY, IN EVERY LOAD CONDITION

Maximum reliability, wide operating range, continuous capacity modulation, class A efficiency.
The advantages of the i+i formula represents the no-compromise solution of the new range.

The advantages of 1+i logic

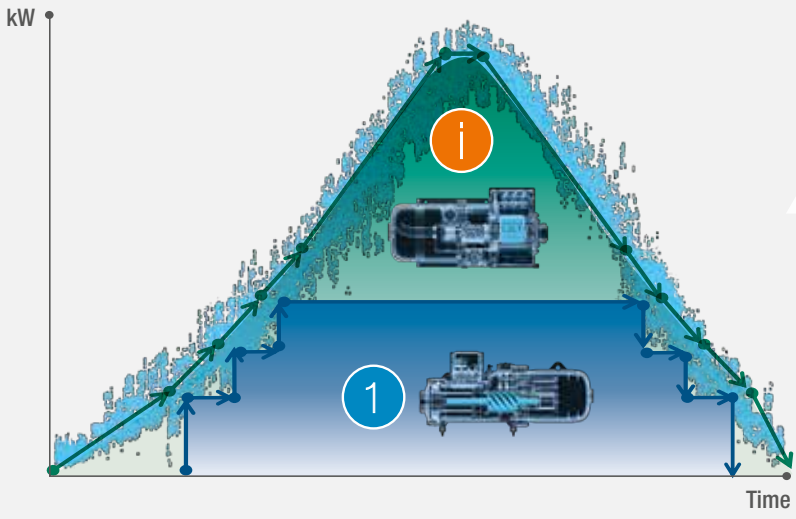
- Always the best combination of compressors
- Continuous modulation from 15% to 100%
- Perfect leaving water temperature stability
- EER in Class A efficiency

Mitsubishi Electric presents a new concept of efficiency: the combination of a fixed speed screw compressor (1) with a variable speed inverter driven screw compressor (+ i). This solution, combined with unique and advanced control logic, improves the best features and benefits of each compressor.

The result is a unit that focuses on efficiency in all load conditions, overcoming the limitations traditionally imposed by the full inverter system on full loads and the fixed speed screw compressors on partial loads.

PREMIUM EFFICIENCY
THANKS TO THE COMBINATION
(1+I) COMPRESSORS

- Cooling load of the variable speed compressor
- Cooling load of the fixed speed compressor
- Total requested cooling load



i-FR(1+i)-Z

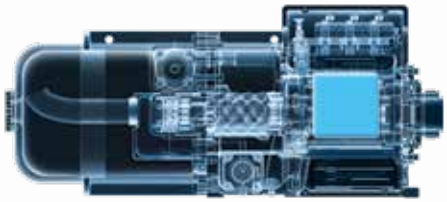
Dedicated Compressors

The new original compressors are the result of a co-development focused on increasing the unit performance. A solution that has been specially designed for the FORMULA i-FR(1+i)-Z products.

1 Fixed Speed Compressor

The new generation of fixed speed compressors is the result of our commitment to avoid the efficiency loss in part-load operation: the new compressor features a better lubrication system and an innovative internal geometry that allows a jump in performance at partial loads.

i Variable Speed Compressor

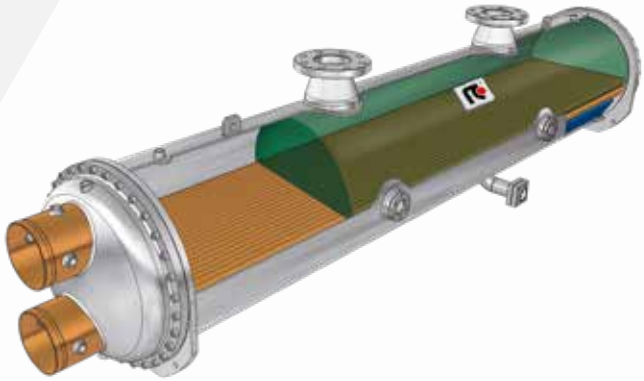


The new inverter driven compressor is compact, with an oil separator, frequency inverter and cooling system integrated all within a single casing. The Vi control allows automatic adaptation to the different operating conditions thus ensuring that different refrigeration load levels are always at the highest values of energy efficiency.

High-performance fans

Both the fans and the ducts meet the performance requirements specified in the European Eco-Design Regulation. As an option, fans are available with special ducts featuring an innovative profile, which increases the efficiency of the ventilation system in line with the most challenging objectives set out in regulations starting in 2015. The new fans, with ducts having a convergent-divergent profile that incorporate straightening vanes for the air flow, lead to the availability of ESP static pressure up to 130 Pa. They are the perfect solution for critical installations where air flow channeling is necessary.

i-FR-W(1+i)-Z



Innovative design of the heat exchangers

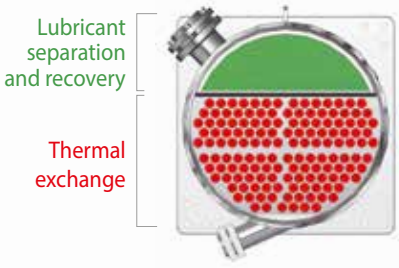
The flooded evaporator and the shell and tube condenser, both fully designed and built internally, present an exclusive layout aimed to maximise the cooling power and optimise the operation of the compressors.

The shell and tube condenser is designed in order to guarantee reduced pressure drops on the water side and to decrease the pumping costs as much as possible.

In the evaporator the complete flooding of the tubes is guaranteed also during partial load conditions by an electronic expansion valve, managed by proprietary control logics.

On the evaporator the presence of refrigerant fluid in the shell side and water in the tube side allows:

- Minimisation of pressure drops
- Perfect unified temperature as well as complete refrigerant evaporation
- No surface for the over-heating
- Easy cleaning operations



Perfect lubricant recovery

Unique design of the heat exchangers that provides the perfect separation and complete recovery of the lubricant in order to guarantee proper lubrication of the compressors and the relevant cleaning of the shell and tube exchanging surfaces.

i-FR(1+i)-Z 2602-5403

High efficiency chiller, air source for outdoor installation.
567 - 1273 kW

EUROVENT CERTIFIED PERFORMANCE
www.eurovent-certification.com
UP TO 1500 kW

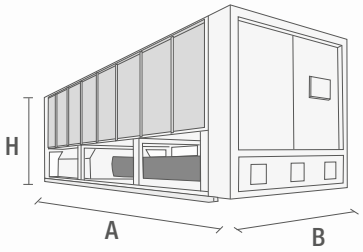
EXCELLENCE IN RESULTS

All i-FR(1+i)-Z units are certified by the EUROVENT program for units with capacities over 600 kW. RC brand products are among the few units which participate in this non-compulsory certification program.

This is consistent with RC brand commitment to transparency as the best guarantee of quality and reliability for our partners and customers.

Accessories:

- Hydronic group
- VPF (Variable Primary Flow) kit: variable flow pumps with on board regulation
- Noise reducer (non-silenced versions only)
- EC fans with electronic DC brushless motor
- Axial fans with External Static Pressure (ESP)up to 130 Pa
- Remote control keyboard (distance up to 200m and up to 500m)
- Set-up for remote connectivity with ModBus/Echelon protocol cards



Notes:
1 Plant (side) cooling exchanger water (in/out) 12°C/7°C; Source (side) heat exchanger air (in) 35°C
2 Values in compliance with EN14511-3:2011
3 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.
4 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.
5 Unit in standard configuration/execution, without optional accessories.
The units highlighted in this publication contain HFC R134a [GWP_{100} 1430] fluorinated greenhouse gases.

EUROVENT CERTIFIED PERFORMANCE | VSPEED | VPF | R HFC R134a | AXIAL | A ENERG.CL. | COOLING | SCREW | T SHELL&T.

i-FR (1+i)-Z /CA			2602	2662	2722	3152	3602	3902	4212	4513	4953	5403
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
PERFORMANCE												
COOLING ONLY (GROSS VALUE)												
Cooling capacity	(1)	kW	567	631	700	785	858	951	1045	1127	1196	1273
Total power input	(1)	kW	181	201	224	249	273	302	333	359	380	405
EER	(1)	kW/kW	3,13	3,14	3,13	3,15	3,14	3,15	3,14	3,14	3,15	3,14
COOLING ONLY (EN14511 VALUE)												
Cooling capacity	(1)(2)	kW	566	629	698	783	855	949	1042	1123	1192	1269
EER	(1)(2)	kW/kW	3,10	3,10	3,10	3,12	3,10	3,11	3,10	3,10	3,11	3,10
Cooling energy class			A	A	A	A	A	A	A	A	A	A
SEPR	(3)(4)		5,74	5,72	5,59	5,63	5,52	5,53	5,66	5,64	5,84	5,73
COOLING ONLY (GROSS VALUE)												
16°C/10°C												
Cooling capacity	(5)	kW	623	691	768	862	942	1045	1147	1234	1311	1395
Total power input	(5)	kW	188	208	232	258	284	313	345	371	394	420
EER	(5)	kW/kW	3,31	3,32	3,31	3,34	3,31	3,33	3,32	3,32	3,33	3,32
23°C/15°C												
Cooling capacity	(6)	kW	717	793	882	993	1083	1205	1303	1414	1505	1602
Total power input	(6)	kW	199	219	244	273	302	332	350	392	416	444
EER	(6)	kW/kW	3,60	3,62	3,61	3,63	3,58	3,63	3,72	3,61	3,62	3,60
EXCHANGERS												
HEAT EXCHANGER USER SIDE IN REFRIGERATION												
Water flow	(1)	l/s	27,14	30,17	33,48	37,55	41,03	45,49	49,96	53,90	57,18	60,88
Pressure drop	(1)(2)	kPa	36,0	35,4	31,1	34,5	41,2	36,7	44,3	51,6	43,6	49,5
REFRIGERANT CIRCUIT												
Compressors nr.		N°	2	2	2	2	2	2	2	3	3	3
No. Circuits		N°	2	2	2	2	2	2	2	3	3	3
Refrigerant charge		kg	115	180	190	200	200	210	220	255	245	255
NOISE LEVEL												
Sound Pressure	(7)	dB(A)	67	68	68	68	69	70	71	72	72	72
Sound power level in cooling	(8)(9)	dB(A)	100	101	101	101	102	103	104	105	105	105
SIZE AND WEIGHT												
A	(10)	mm	7000	7900	7900	7900	9860	10790	11720	12630	12630	12630
B	(10)	mm	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260
H	(10)	mm	2530	2530	2530	2530	2530	2530	2530	2530	2530	2530
Operating weight	(10)	kg	6130	7170	7460	7970	9110	10080	10140	11640	12570	12950

i-FR (1+i)-Z /SL			2602	2662	2722	3152	3903	3953	4013	4063	4953	5403
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
PERFORMANCE												
COOLING ONLY (GROSS VALUE)												
Cooling capacity	(1)	kW	544	611	679	752	805	880	946	1018	1143	1209
Total power input	(1)	kW	181	201	222	249	268	295	311	335	380	411
EER	(1)	kW/kW	3,01	3,04	3,06	3,03	3,01	2,98	3,04	3,04	3,01	2,94
COOLING ONLY (EN14511 VALUE)												
Cooling capacity	(1)(2)	kW	542	610	677	750	802	878	944	1015	1140	1205
EER	(1)(2)	kW/kW	2,98	3,01	3,03	3,00	2,97	2,95	3,01	3,00	2,97	2,90
Cooling energy class			B	B	B	B	B	B	B	B	B	B
SEPR	(3)(4)		5,89	5,86	5,71	5,83	5,81	5,70	5,61	5,79	5,95	5,84
COOLING ONLY (GROSS VALUE)												
16°C/10°C												
Cooling capacity	(5)	kW	595	668	743	823	880	964	1034	1112	1249	1322
Total power input	(5)	kW	189	209	231	259	279	309	324	349	396	429
EER	(5)	kW/kW	3,15	3,19	3,21	3,18	3,15	3,12	3,19	3,19	3,16	3,08
23°C/15°C												
Cooling capacity	(6)	kW	681	763	850	943	1006	1103	1180	1270	1426	1509
Total power input	(6)	kW	202	223	247	276	298	330	344	371	421	458
EER	(6)	kW/kW	3,38	3,43	3,45	3,41	3,38	3,34	3,43	3,42	3,39	3,29
EXCHANGERS												
HEAT EXCHANGER USER SIDE IN REFRIGERATION												
Water flow	(1)	l/s	26,00	29,22	32,46	35,97	38,48	42,09	45,25	48,67	54,66	57,83
Pressure drop	(1)(2)	kPa	33,0	33,2	29,2	31,7	36,3	31,5	36,4	42,1	39,9	44,6
REFRIGERANT CIRCUIT												
Compressors nr.		N°	2	2	2	2	3	3	3	3	3	3
No. Circuits		N°	2	2	2	2	3	3	3	3	3	3
Refrigerant charge		kg	115	180	190	200	200	200	210	220	255	255
NOISE LEVEL												
Sound Pressure	(7)	dB(A)	58	59	60	60	60	60	60	61	61	64
Sound power level in cooling	(8)(9)	dB(A)	91	92	93	93	93	93	93	94	94	97
SIZE AND WEIGHT												
A	(10)	mm	7000	7900	7900	7900	9900	10800	10800	11700	11700	12630
B	(10)	mm	2260	2260	2260	2260	2260	2260	2260	2260	2260	2260
H	(10)	mm	2530	2530	2530	2530	2530	2530	2530	2530	2530	2530
Operating weight	(10)	kg	6410	7400	7690	8370	9570	10080	10650	11090	12600	13530

Notes:
1 Plant (side) cooling exchanger water (in/out) 12°C/7°C; Source (side) heat exchanger air (in) 35°C.
2 Values in compliance with EN14511-3:2013.
3 Seasonal space heating energy index
4 Seasonal energy efficiency of high temperature process cooling [REGULATION (EU) N. 2016/2281]
5 Plant (side) cooling exchanger water (in/out) 16°C/ 10°C; Source (side) heat exchanger air (in) 35°C.
6 User (side) cooling exchanger water (in/out) 23°C/ 15°C; Source (side) heat exchanger air (in) 35°C.
7 Average sound pressure level at 10m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level.
8 Sound power on the basis of measurements made in compliance with ISO 9614.
9 Sound power level in cooling, outdoors.
10 Unit in standard configuration/execution, without optional accessories.
The units highlighted in this publication contain HFC R134a [GWP $_{100}$1430] fluorinated greenhouse gases.
Certified data in EUROVENT

i-FR-W(1+i)-Z 1402 -4252

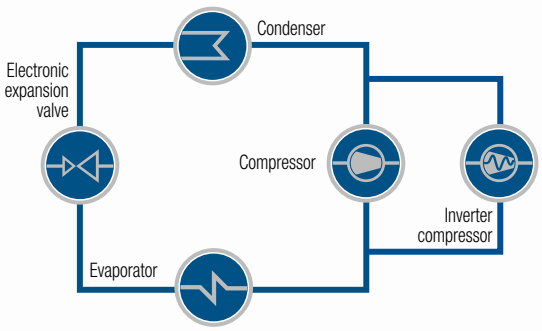
High efficiency water source chillers for indoor installation.
488 - 1607 kW

i-FR-W is the RC brand water cooled chiller with 1+i innovative logics that combines fifixed speed and variable speed screw compressors, thus ensuring continuous modulation of loads and a perfect leaving water stability.
All the units come with an exclusive flooded evaporator and a shell and tube condenser, specifically conceived and developed in-house.

Their exclusive design ensures a perfect heat exchange coefficient and provides EER results not only above class A but also among the highest values available on the market of water chillers with screw compressors.

Developed to answer to the most stringent design conditions, i-FR-W(1+i)-Z is highly confifigurable thanks to a full range of accessories:

- VPF or VPF.D signal
- compressors' soundproofing (noise power reduction of 6dB(A))
- EMC electromagnetic compatibility for residential environments
- fast restart
- /H version (heat pump reversible on hydraulic side)
- refrigerant leak detector, available in 3 versions, one with refrigerant migration in case of leakages



Two compressors in one single refrigerant circuit

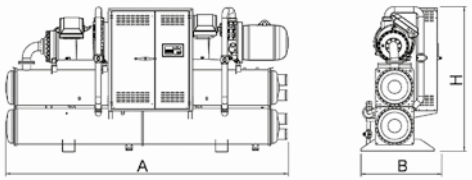
The fixed screw compressor and the inverter one are not only combined in the same unit, but also on the same refrigerant circuit. A revolutionary solution ensuring higher efficiency at partial loads in comparison with a proposal with independent circuits.

The accurate design of electrical and electronic components ensures:

VSPEED VPF COOLING SCREW ENERG.CL. HFC R134a FLOODED

i-FR-W (1+i)-Z			1402	1752	1902	2152	2602	3002	3402	3852	4252
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
PERFORMANCE											
COOLING ONLY (GROSS VALUE)											
Cooling capacity	(1)	kW	488	610	661	752	917	1049	1189	1351	1486
Total power input	(1)	kW	87,6	107	116	132	161	184	206	233	260
EER	(1)	kW/kW	5,57	5,70	5,69	5,68	5,68	5,71	5,76	5,79	5,71
ESEER	(1)	kW/kW	8,52	8,57	8,47	8,62	8,63	8,55	8,56	8,60	8,44
COOLING ONLY (EN14511 VALUE)											
Cooling capacity	(1)(2)	kW	487	608	659	750	914	1046	1186	1348	1482
EER	(1)(2)	kW/kW	5,37	5,49	5,48	5,47	5,47	5,52	5,58	5,62	5,52
Cooling energy class			-	-	-	-	-	-	-	-	-
SEPR	(3)(4)		7,85	7,98	7,79	7,84	7,74	7,88	7,98	8,04	7,74
COOLING ONLY (GROSS VALUE)											
16°C/10°C											
Cooling capacity	(5)	kW	545	680	737	839	1023	1171	1327	1508	1657
Total power input	(5)	kW	88,2	108	117	133	163	186	209	237	264
EER	(5)	kW/kW	6,18	6,32	6,28	6,28	6,27	6,30	6,34	6,38	6,27
23°C/15°C											
Cooling capacity	(6)	kW	645	804	870	990	1209	1384	1569	1782	1957
Total power input	(6)	kW	88,6	108	118	135	165	189	213	240	268
EER	(6)	kW/kW	7,28	7,45	7,35	7,35	7,31	7,34	7,38	7,41	7,29
EXCHANGERS											
HEAT EXCHANGER USER SIDE IN REFRIGERATION											
Water flow	(1)	l/s	23,34	29,16	31,62	35,96	43,84	50,15	56,88	64,63	71,06
Pressure drop	(1)(2)	kPa	30,5	34,7	33,8	33,2	37,1	37,5	31,9	30,9	37,3
HEAT EXCHANGER SOURCE SIDE IN REFRIGERATION											
Water flow	(1)	l/s	27,44	34,18	37,07	42,16	51,41	58,76	66,56	75,57	83,27
Pressure drop	(1)(2)	kPa	37,4	35,4	41,7	41,5	38,7	30,0	33,3	29,6	35,9
REFRIGERANT CIRCUIT											
Compressors nr.		N°	2	2	2	2	2	2	2	2	2
No. Circuits		N°	1	1	1	1	1	1	1	1	1
Refrigerant charge		Kg	136	170	188	212	264	289	328	372	410
NOISE LEVEL											
Sound Pressure	(7)	dB(A)	80	79	79	81	81	81	80	80	82
Sound power level in cooling	(8)(9)	dB(A)	98	98	98	100	100	100	100	100	102
SIZE AND WEIGHT											
A	(10)	mm	2950	3350	3350	3350	4500	4500	4600	4650	4650
B	(10)	mm	1380	1450	1450	1480	1420	1420	1450	1510	1510
H	(10)	mm	2000	2270	2270	2270	2270	2270	2350	2500	2500
Operating weight	(10)	Kg	3340	4190	4280	4680	6420	7260	7960	8490	8580

Notes:
1 Plant (side) cooling exchanger water (in/out) 12°C/7°C; Source (side) heat exchanger water (in/out) 30°C/35°C.
2 Values in compliance with EN14511-3:2013.
3 Seasonal space heating energy index
4 Seasonal energy efficiency of high temperature process cooling [REGULATION (EU) N. 2016/2281]
5 User side heat exchanger water temperature (in/out) 16°C/10°C; source side heat exchanger water temperature (in/out) 30°C/35°C.
6 User side heat exchanger water temperature (in/out) 23°C/15°C; source side heat exchanger water temperature (in/out) 30°C/35°C.
7 Average sound pressure level at 1m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level.
8 Sound power on the basis of measurements made in compliance with ISO 9614.
9 Sound power level in cooling, indoors.
10 Unit in standard configuration/execution, without optional accessories.
The units highlighted in this publication contain HFC R134a [GWP_{100} 1430] fluorinated greenhouse gases.
Certified data in EUROVENT



Power Factor and Displacement Power Factor

DPF (Displacement Power Factor) above 0,97 in every load condition
PF (Power Factor) of 0,9 at full load

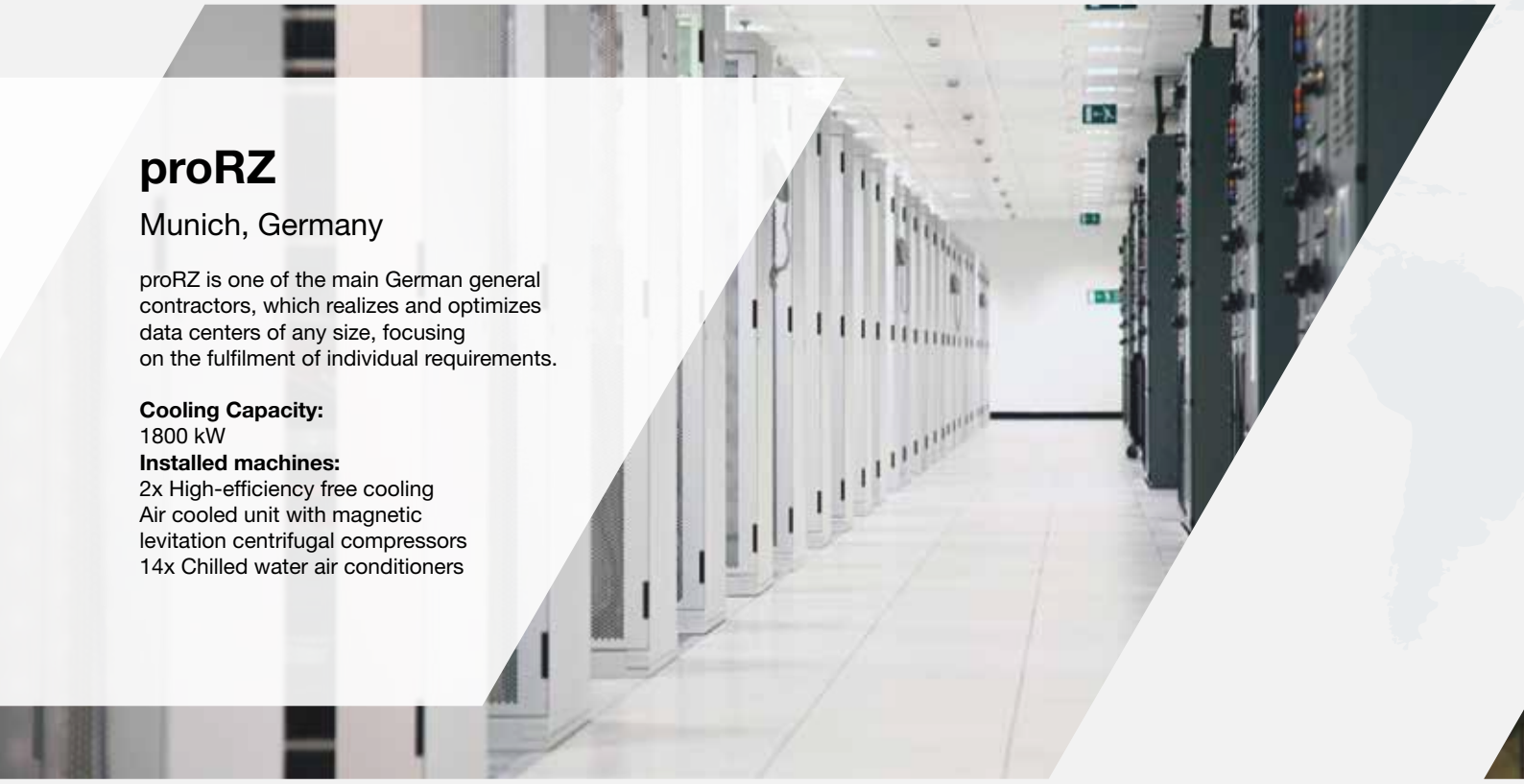
Optimised compressors

Screw compressors optimised for applications with low condensing temperature.

This enhances their efficiency and makes the ESEER/IPLV values achieved exceed by far the common standard of compact screw compressors.

“EXPERIENCE IS BY FAR THE BEST PROOF”

Sir Francis Bacon
British Philosopher (1561-1626)



proRZ

Munich, Germany

proRZ is one of the main German general contractors, which realizes and optimizes data centers of any size, focusing on the fulfilment of individual requirements.

Cooling Capacity:
1800 kW
Installed machines:
2x High-efficiency free cooling Air cooled unit with magnetic levitation centrifugal compressors
14x Chilled water air conditioners

WIIT Tier IV

2014 Milan, Italy

WIIT is an italian company focused on Private and Hybrid continuative services, it is one of the main players in Europe and Worldwide among the most specialized players in application management and critical application as disaster recovery and business continuity.

Cooling Capacity:
700kW
Installed machines:
12X Close Control Air Conditioners with downflow air delivery equipped with BLDC scroll compressors
18x Remote condensers

FastWeb Tier IV

2014 Milan, Italy

Fastweb, a telecommunications operator, decided to build a new data center offering the highest level of security possible to its clients.

Cooling Capacity:
2800 kW
Installed machines:
4x High-efficiency Air cooled unit with magnetic levitation centrifugal compressors.

Unipol Tier IV

2015-2016 Bologna, Italy

Unipol is the second largest insurance group on the italian market and the first in Non-Life business, classified among the top ten in Europe.

Cooling Capacity:
2300 kW
Installed machines:
4x High-efficiency Air cooled unit with magnetic levitation centrifugal compressors

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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.

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

Head Office: Via Roma 5 - 27010 Valle Salimbene (PV) - Italy
Tel +39 (0) 382 433 811 - Fax +39 (0) 382 587 148
www.rcitcooling.com
www.melcohit.com