

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

IT COOLING

CHILLERS

NR²FC-Z

G02

G06

**FREE COOLING CHILLERS
FOR HIGH LEAVING WATER TEMPERATURE
AND HIGH EVAPORATOR DELTA T,
FROM 360 kW TO 895 kW**

FREE COOLING

HIGH TEMPERATURE

R454B



NR²FC-Z

G02
G06



OUTSIDE AIR TO FREELY COOL YOUR DATA CENTER

Free cooling chillers with scroll compressor technology. From 360 kW to 895 kW.

NR2-FC-Z is the ultimate RC brand chiller solution with scroll compressors and a free-cooling system, dedicated to IT infrastructure.

Specifically designed to operate with high water temperatures (set point up to 24°C) and high ΔT (up to 15°C), NR2-FC-Z delivers concrete energy savings

in modern data centers. The free-cooling hydraulic equipment allows the unit to freely employ the outside air to satisfy the cooling capacity. When the air temperature is too high to grant complete free-cooling, high efficiency scroll compressors ensure full load coverage.

THE MOST EFFICIENT AND GREENER FREE-COOLING CHILLER ON THE MARKET

R410A

NR²FC-Z G02

UP TO

R454B

NR²FC-Z G06

UP TO

EER SEPR HT TFCT (°C)

A

4,29

7,16

12,1

K

3,97

6,66

10,0

EER SEPR HT TFCT (°C)

A

4,49

7,42

12,3

K

4,20

6,87

10,3

EER: WWater (in/out) 30/20°C, air (in) 35°C, e.g. 30%, NET VALUE
SEPR HT: Water (in/out) 7°C - Regulation (EU) N.2281/2016. NET VALUES: EN14511, EN14825.

TFC: Total free-cooling temperature. Water (in/out) 30/20°C, Et. glycol 30%.

3 ACOUSTIC VERSIONS

Standard (K, A)

Low sound power levels already in the standard version.

Compressors' acoustical enclosure

Unit with compressor acoustical enclosure **-2 dB(A)**

Super Low Noise (SL-K, SL-A)

Special acoustic insulation, devoted fan speed reduction and increased heat exchange surface. **-9 dB(A)**

FREE-COOLING CONFIGURATIONS

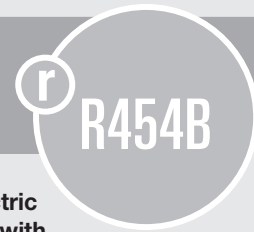
Base

Standard free-cooling unit.

No Glycol

Free-cooling is possible without the use of glycol on the plant side.

NEW GENERATION GREEN REFRIGERANT



Fully committed to supporting the creation of a greener tomorrow, Mitsubishi Electric Hydronics & IT Cooling Systems presents the G06 series, chillers, and heat pumps with reduced environmental impact.

Thanks to the new generation refrigerant R454B, the environmental impact of NR2-FC-G06-Z is greatly reduced. Combining reduced refrigerant charge with a low GWP refrigerant, these units boast the lowest amount of CO₂eq in the scroll unit market, thus resulting as the perfect choice for any new forward looking installation.

R454B REFRIGERANT

High density, low **GWP refrigerant**. Its physical properties are **similar to R410A**, so the same type of equipment / components can be used.

GWP: 467

-76% vs R410A
-31% vs R32

REDUCED ENVIRONMENTAL IMPACT



- ▶ **Low GWP**, only 467
- ▶ **Reduced refrigerant charge** (-10% vs R410A)

RELIABILITY



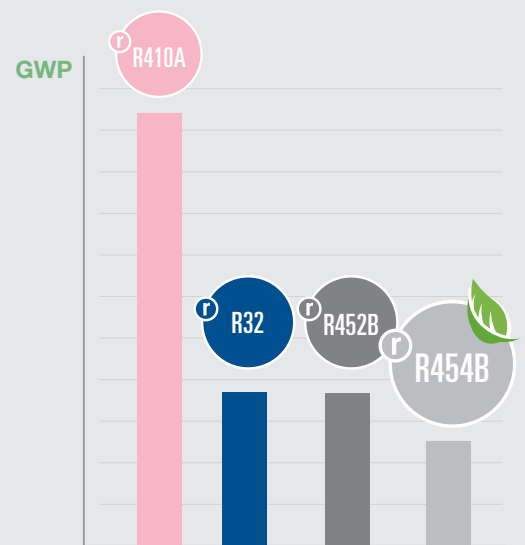
- ▶ Use of **well-known components**
- ▶ Refrigerant circuit **reliability** is maintained

PERFORMANCE & ENVELOPE



- ▶ **Same operating limits** of R410A both in **cooling** and **heating**
- ▶ Higher efficiency (full load +3,5%, seasonal +2% vs R410A)

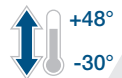
GWP



MASSIVE FREE-COOLING

Thanks to large free-cooling coils, NR2-FC-Z uses the outdoor air as the main source to produce cooling. With a set-point of 20°C, the total free-cooling operation is possible from outdoor air temperature of 12°C.

UNYIELDING IN EXTREME CONDITIONS



NR2-FC-Z can operate in all climates from -20°C (-30°C with options) to +48°C and, equipped with highly resistant coil coatings, it can withstand even the harshest industrial or marine environments.

PACKAGED SOLUTION

NR2-FC-Z is a complete all-in-one solution ready to be installed. The integrated hydronic modules includes the pumps, the buffer tanks and the main hydraulic components, allowing simplified installation and time-saving commissioning.

READY FOR MISSION CRITICAL APPLICATIONS



Designed for continuous operation, NR2-FC-Z meets the needs of the uninterruptible industry. Devoted devices and functions maximize the unit's uptime even in case of emergency circumstances.

FREE-COOLING TECHNOLOGY

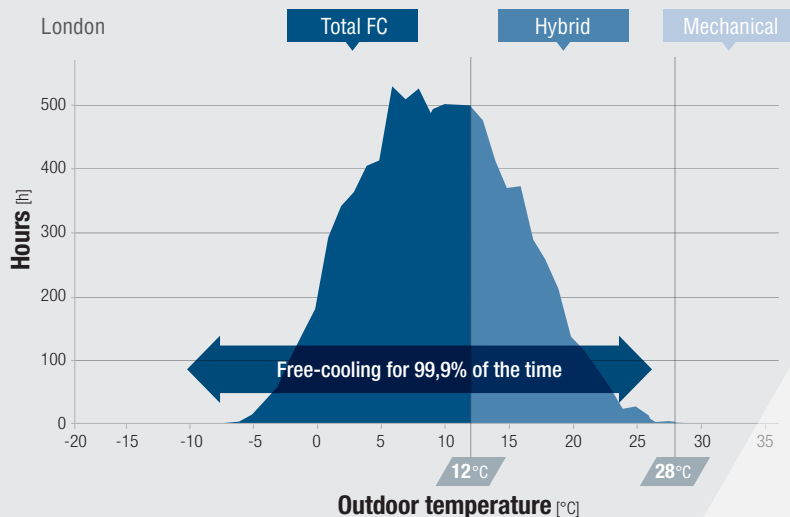
The ultimate solution to harness the full potential of outdoor air.

In many climates, data center managers can reduce the OPEX (Operating Expenditure) of their cooling plant by taking advantage of favorable environmental conditions, that is any time the outdoor air is colder than the operating water.

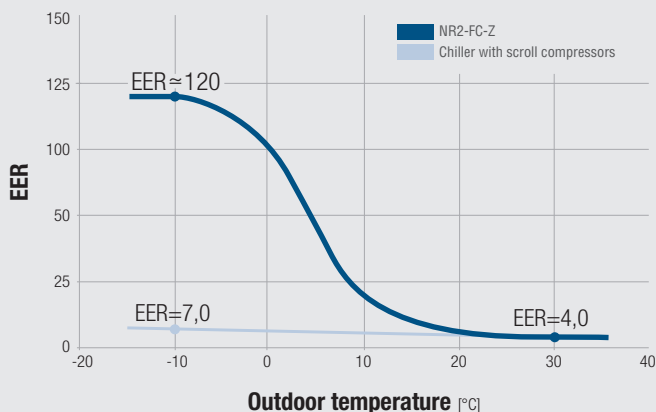
The higher the water operating temperature, the greater the annual free-cooling potential.

In a data center located in London, with operating water temperature 30/20°C, NR2-FC-Z can satisfy the whole cooling demand for 51% of the time by only utilising free-cooling, while for 49% of the time by running the compressors at part loads.

This means that all the time NR2-FC-Z works with the free-cooling activated, and for very little time as an ordinary chiller.



Efficiency comparison:



Note: Operating water temperature (in/out) 30°C/20°C.

MECHANICAL COOLING vs FREE-COOLING

Comparing the efficiency of a NR2-FC-Z and a traditional scroll compressor chiller, the enormous efficiency gap in the free-cooling temperature range is evident. In any modern IT infrastructure, free-cooling technology is a huge opportunity that must be seized.

In total free-cooling, the compressors are off and minimum energy is needed to satisfy the nominal cooling capacity.

Thanks to maximized free-cooling coils, NR2-FC-Z makes the most of free-cooling, always granting a secure and efficient cooling capacity back-up with highly performing compressors.

How RC masters free-cooling

RC's free-cooling chillers work in three different modes:

- ▶ Total free-cooling
- ▶ Hybrid cooling
- ▶ Mechanical cooling

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.
- ▶ Compressors are off.

MAXIMUM ENERGY SAVINGS

Hybrid cooling

- ▶ The outdoor air temperature is lower than the returning water temperature but not cold enough to achieve total free-cooling.
- ▶ Compressors are partialized.

OPTIMISED RESOURCE MANAGEMENT

Mechanical cooling

- ▶ Outdoor air temperature is equal to or higher than the returning water temperature.
- ▶ Total cooling capacity provided by the compressors.

CONVENTIONAL CHILLER OPERATION

IDEAL FOR HIGH TEMPERATURE IT ENVIRONMENTS

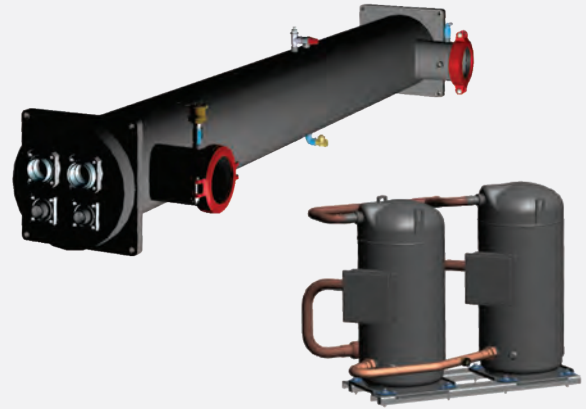
Higher Temperatures for Lower PUE


HIGH TEMPERATURE

Modern IT infrastructures are designed to work with higher indoor temperatures than traditional levels (ASHRAE Thermal Guidelines for Data Processing Environments) to enhance the cooling equipment's efficiency and lower the data center's PUE (Power Usage Effectiveness).

Featuring dedicated compressors and evaporator, NR2-FC-Z is key in matching the challenging standards of next generation data centers.

The compressor has been specifically engineered to give its best during the partial load operation. This means that NR2-FC-Z achieves very high levels of efficiency, and very low energy waste, not only in mechanical mode, but also in hybrid mode (Free cooling + Mechanical).



Evaporator specifically designed to support higher ΔT , up to 15°C.

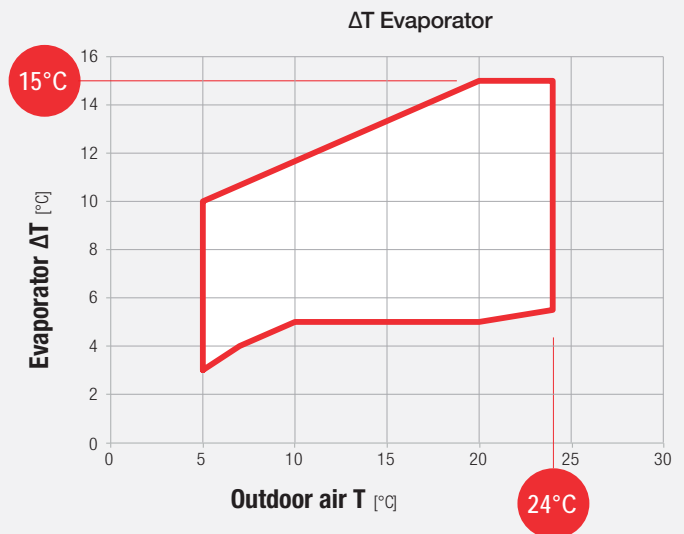
NR2-FC-Z is optimized to efficiently work with high temperature IT environments:

▶ **Leaving water temperature up to 24°C**

To enhance the chiller's EER and fully capitalize on free-cooling.

▶ **ΔT up to 15°C**

For a lower water flow rate and a consequent reduction of the pump consumption.



Combining the free-cooling technology with higher water leaving temperatures, NR2-FC-Z achieves premium efficiency levels and a reduction of operating costs (OPEX) down to 60% if compared with a chiller with inverter compressors and without free-cooling technology.

-60%
OPEX

TECHNOLOGICAL CHOICES

W3000+ CONTROL

Management software developed fully in-house.

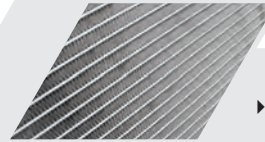
- ▶ Efficient and reliable operation in all conditions
- ▶ Connectivity with the most commonly used BMS protocols (Opt.)



Air side condensing coils

MICROCHANNEL

- ▶ Microchannel coils (standard)
- ▶ E-coating treatment (Optional)



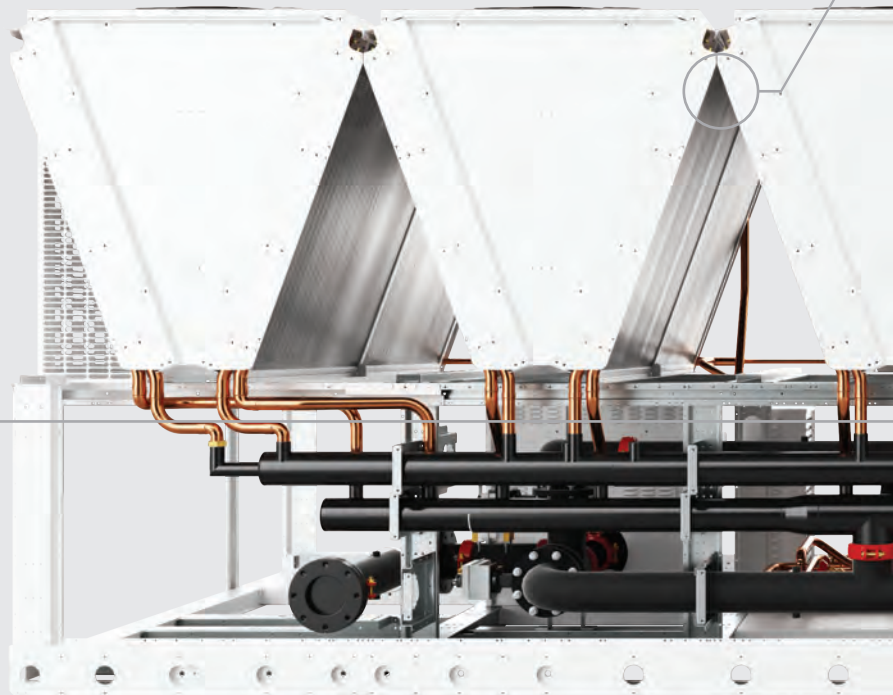
KIPlink USER INTERFACE (Opt.)

Innovative Wi-Fi interface for an easy and enhanced unit management.



Scroll compressors

- ▶ Tandem or trio configuration for multiple step regulation
- ▶ Acoustical enclosure as standard for SL (Super-low noise) versions
- ▶ Optimized for low pressure ratio thanks to IDVs
- ▶ Ideal for high evaporating temperatures



ALL-IN-ONE SOLUTION



The integrated hydronic module (opt.) includes the pumps, the buffer tank, and all the main hydraulic components, for the best optimization of the installation space, time, and costs.

Trusted reliability, simplified installation, maximized performance: NR2-FC-Z is the ideal solution for forward-looking data centers.

Free-cooling coils

TUBE & FINS

- ▶ Copper-aluminium (standard)
- ▶ Pre-painted fins treatment (optional)
- ▶ Fin guard silver treatment (optional)

EC axial fans

SEASONAL EFFICIENCY: up to **+5%**

NR2-FC-Z / A versions

High performing EC fans for the highest efficiency

NR2-FC-Z / K versions

Variable speed AC fans equipped with phase-cut device

Shell and tube evaporator

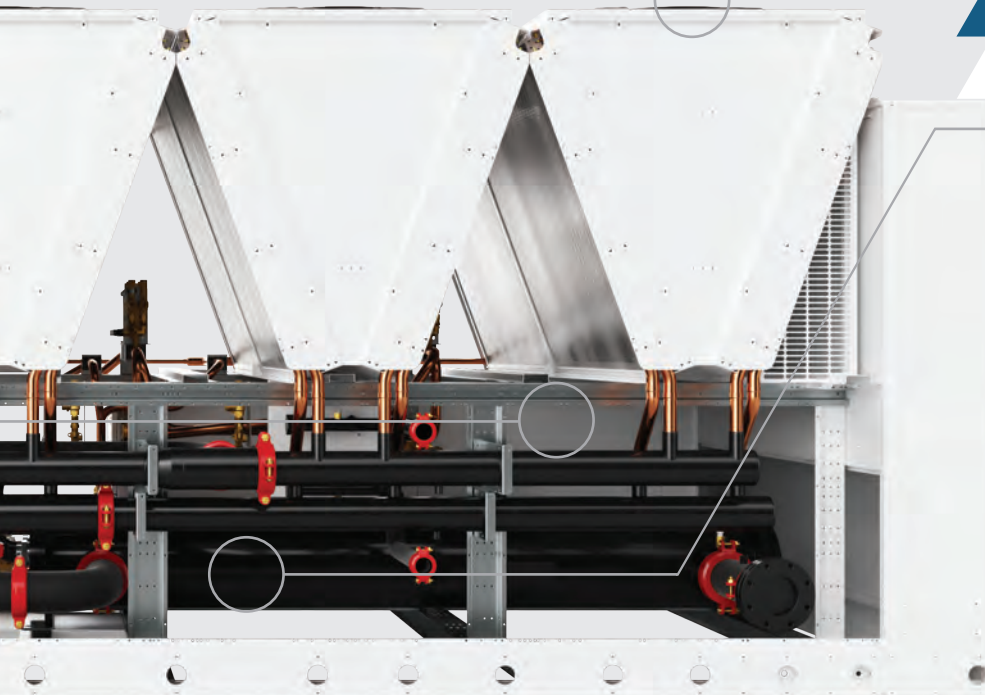
ΔT : up to 15K

Direct expansion shell & tube evaporator, with internal grooved copper tubes.

Water-side: single pass

Refrigerant side (multi-circuit): double pass

- ▶ Robust, reliable, inspectionable
- ▶ Fully protected against ice formation
- ▶ Low pressure drops and optimal heat transfer efficiency



INTEGRATED HYDRONIC MODULES

PUMPS

- ▶ Single or twin pumps
- ▶ Low or high head (approx. 100 or 200 kPa).
- ▶ Fixed or variable speed

PUMPS + BUFFER TANK

- ▶ 1000 litre buffer tank
- ▶ 20 mm insulation lining
- ▶ Including: expansion vessel, safety valve, manometer.

ONLY TERMINALS

- ▶ Control 1 or 2 external pumps
- ▶ On/off or modulating signal

CHILLERS LAN FUNCTIONS

The control of NR2-FC-Z features embedded functions that leverages the LAN connection between the chillers and the indoor units, in order to enhance the system's efficiency and dependability.

If you're looking for an integrated solution to manage your data center chillers.

LAN Multi Manager allows one to create single group of chillers (up to 8 units) where one chiller works as the master unit coordinating the others.

CHILLERS LAN FUNCTIONS

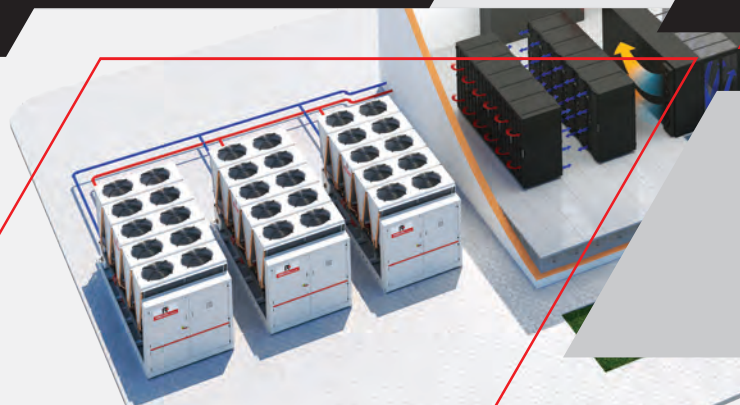
- ✓ Dynamic Master
- ✓ Load distribution or saturation
- ✓ Stand-by management with automatic or forced rotation
- ✓ Resource priority management
- ✓ Group fast restart
- ✓ Pump management
- ✓ Auxiliary inputs

DYNAMIC MASTER

The Dynamic Master logics automatically elect a new Master from all other units connected in the same LAN when the master unit fails.

Thus, the group will continue to operate.

MANAGEMENT OF
UP TO 8 UNITS PER GROUP



RESOURCE PRIORITY MANAGEMENT

The outdoor group is set to exploit the most advantageous cooling technology. Free cooling chillers will have the highest working priority, if free cooling operation is available. Furthermore, when units with different compressor technologies are in the same system, it is possible to set different working priorities exploiting the most advantageous and efficient one.

DATACENTER MANAGER+

Choose DCM+, if you're looking for a centralized solution with a devoted keyboard to monitor and control the plant room, and also with report and mailing service.



TO LEARN MORE ABOUT DCM+



IT COOLING MANAGEMENT SOLUTIONS

HPC and ClimaPro+ centralised control and optimization solutions are available for managing complex IT cooling systems.

These solutions optimize the entire IT cooling system by managing each component directly involved in production and distribution of heating and cooling energies, therefore involving chillers and indoor units, pumping groups as well as the source-side devices such as cooling towers.

Control solutions for IT cooling systems:

HPC

Hydronic Plant Connect



clima PRO+



Exploits **proprietary LAN technology** to connect chillers or chilled water indoor units.

1 ARCHITECTURE

Completely **custom designed** to be connected to every chiller or other chilled water indoor units.

Completely Integrated in the units.

2 PHYSICAL DEVICE

Devoted cabinet with 19" touch display.

Optimization of the entire cooling system: Fanwalls (or other chilled water indoor units), Chillers, FC availability, fans, pumps, valves.

3 FUNCTION

Full control and monitoring, **advanced and real time optimization** based on **unit performance curve**.

Straightforward solution for **Medium data centers** with **simple** cooling plant scheme.

4 APPLICATION

State of the art solution for **medium-large and Hyperscale data centers** also with complex cooling plant scheme. Ideal for **TIER III – TIER IV** data centers.



TO LEARN MORE ABOUT HPC



TO LEARN MORE ABOUT ClimaPRO+

EQUIPMENT FOR MISSION CRITICAL APPLICATIONS

FAST RESTART

Ensures a **faster return to the necessary cooling** levels in the shortest time possible, while maintaining the **reliability** of the chiller.



Ensure fast cooling start-up



Have the unit running at full load in a shorter time

A 6-cpr unit in standard working conditions delivers 100% of cooling capacity (850 kW) within 72" after power is restored.

Fast restart - UPS excluded

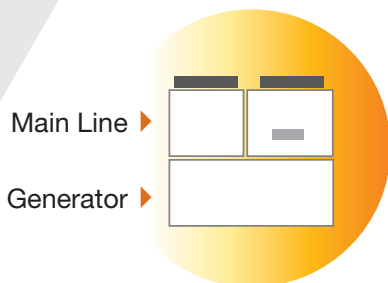
This option requires an external 230V AC UPS, not supplied with the unit, to keep the on-board controller functional and ensure fast restart after a power outage.

Fast restart - UPS included

This option includes an electric device capable of keeping the controller power supply uninterrupted during a power failure. The capacity of this device is selected on the basis of the needs of a specific project.

DOUBLE POWER SUPPLY

NR2-FC-Z can be connected to two separate power lines to enhance the system's dependability.



In case of a main line power outage, the ATS* automatically switches over to the backup line, granting uninterrupted power supply to the unit. The double power supply makes NR2-FC-Z suitable for Uptime Institute's TIER III and TIER IV** design topologies, the highest standards of reliability.

* ATS: Automatic Transfer Switch

** The Tier Classification System provides the data center industry with a consistent method to compare typically unique facilities based on expected site infrastructure performance, or uptime.

Double power supply (ATS)

The ATS, installed within the electrical board, automatically senses if one of the sources has lost or gained power. The switching is completely automatic (line priority and frequency of checking are selectable).

Double power supply (Motorized changeover)

The motorized changeover, installed within the electrical board, is with remote control (i.e. signal of generator start-up).

ADVANCED METERING

You can't manage what you don't measure.

PUE (Power usage effectiveness) is the ratio that determines how energy efficient data centers.

Thermal energy meter

Acquires water temperature and flow ratio delivered by the unit and compute the cooling capacity produced. Together with energy meter you can instantaneously evaluate the EER.

Energy meter

Acquires the electrical data and the power absorbed by the unit and sends them to the supervisor for energy metering.



ENERGY ANALYSIS

Project: Large size data center

The data center, located in London, has a nominal cooling load of 3000 kW.

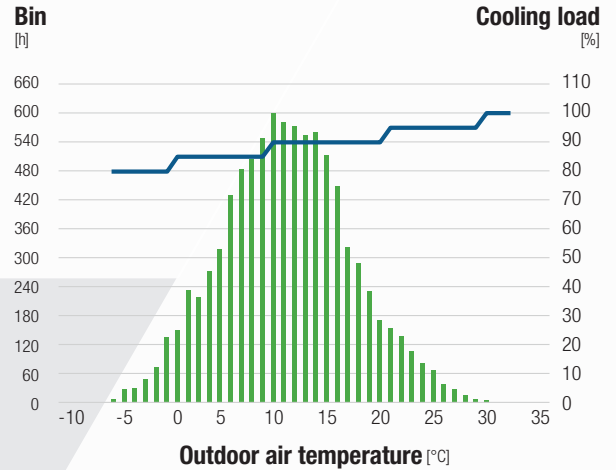
The infrastructure is characterized by a high temperature IT environment and the cooling equipment is based on a chilled water system operating with water temperature 30/20°C.

The data center is active 24/7, with a cooling load ranging from 80% to 100%, according to the outdoor conditions.

Energy analysis parameters:

Operating schedule: 24/7, all-year-round	Electricity cost: 0,16 €/kWh
Fluid temperature: 30/20°C	Inflation rate: 3%
Fluid type: Water + et. glycol 30%	Interest rate: 6%

Temperature profile



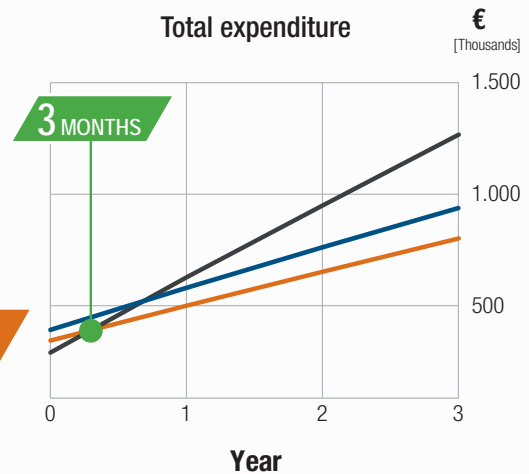
Comparison between technologies

According to the N+1 redundancy, 6 chillers of approximately 650 kW have been selected, for a total cooling capacity of 3900 kW.

The load is shared equally among all the 6 chillers, following the active redundancy principle.

The analysis compares three models of high efficiency chillers, with different technology.

Payback Time



Free-cooling chillers with screw compressors

CC: (30/20°C) 630 kW
EER: (30/20°C) 4,01
SEPR HT: 6,28

Chillers with full inverter screw compressors

CC: (30/20°C) 680 kW
EER: (30/20°C) 3,95
SEPR HT: 6,43

NR2-FC-G06-Z /A 0685

CC: (30/20°C) 660 kW
EER: (30/20°C) 4,45
SEPR HT: 7,33

Results

The results obtained are astounding: the chillers with free-cooling achieve -53% of annual energy consumption compared to the best-in-class full inverter screw chillers.

From the two free-cooling chillers, NR2-FC-Z is evidently the winning solution. In fact multi-scroll units achieve a good part load performance, with limited investment costs compared to screw or MagLev compressors.

Significant annual energy savings of NR2-FC-Z reflects the higher free-cooling potential of the new unit compared to regular free-cooling units.

AT A GLANCE

NR2-FC-Z vs full inverter screw compressor chillers

Power input savings

1,612 MWh per year

CO₂ saved per year

910 tons, equivalent to CO₂ emissions produced by a petrol car driving 5.400.000 km

Payback period

3 months

Annual energy savings

-58 %



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

Head Office: Via Caduti di Cefalonia 1 - 36061 Bassano del Grappa (VI) - Italy
Tel (+39) 0424 509 500 - Fax (+39) 0424 509 509
www.melcohit.com