





APPLIED BUSINESS

1. Company Profile
2. Market Drivers & Local Legislations
3. Products Range & Features
4. Air Side Product Overview

WHO WE ARE



1924 - 2019

95 years dedicated to HVAC

WHO WE ARE



Today's market leader in air conditioning

Daikin Industries Ltd. at a glance



€ million

18,000

16,000

14,000

12,000

10,000

8,000

4,000

2,000

0



Man power

70,000

60,000

50,000

40,000

30,000

20,000

10,000

0

Employees:

70,263

Cons. turnover:

**17,620 million €
FY2017**

Cons. operating profit:

**1,951.5 million €
FY2017**

FY03

FY04

FY05

FY06

FY07

FY08

FY09

FY10

FY11

FY12

FY13

FY14

FY15

FY16

FY17

■ Turnover

— Man power

▨ Operating profit

Daikin Industries Ltd.

Since 1924

Osaka (Japan)

President & CEO: Mr. Togawa



DIVERSIFICATION OF BUSINESS

Air conditioning



Established **1924**

Applied



Established **1933**

Acquisition by
Daikin in **2006**

Heating



Established **1973**

Acquisition by
Daikin in **2008**

Refrigeration



Established **1962**

Acquisition by
Daikin in **2016**

DAIKIN APPLIED BUSINESS

Air conditioning



Established **1924**

Applied



Established **1933**

Acquisition by
Daikin in **2006**

Full brand integration

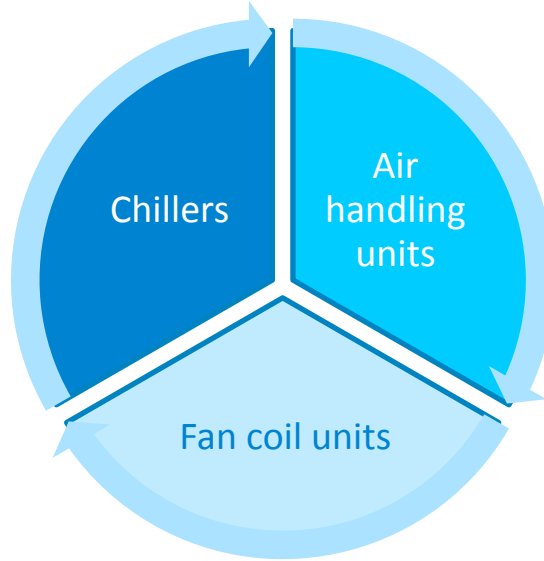
Daikin is now one main player
for **Applied** business in **EMEA**

Applied



DAIKIN APPLIED BUSINESS

Product coverage



DAIKIN APPLIED BUSINESS in EMEA

Production Facilities

Factory number 6
Factory surface (TOTAL) 110,000 m²
Scope of business

Chillers
AHU
Fan coils
Compressors



Daikin Applied Europe

Daikin Applied Europe, formerly known as McQuay Italia, was started in 1968 as the European division of McQuay International, and has an extensive history of developing new, industry leading innovations and technology.

Daikin Applied Europe Factories:

- Chillers + Compressors Factory -> **ITALY Cecchina Factory**
- AHU Factory -> **ITALY Settala Factory**

**50 years of tradition and experience
in Applied Products !!!**

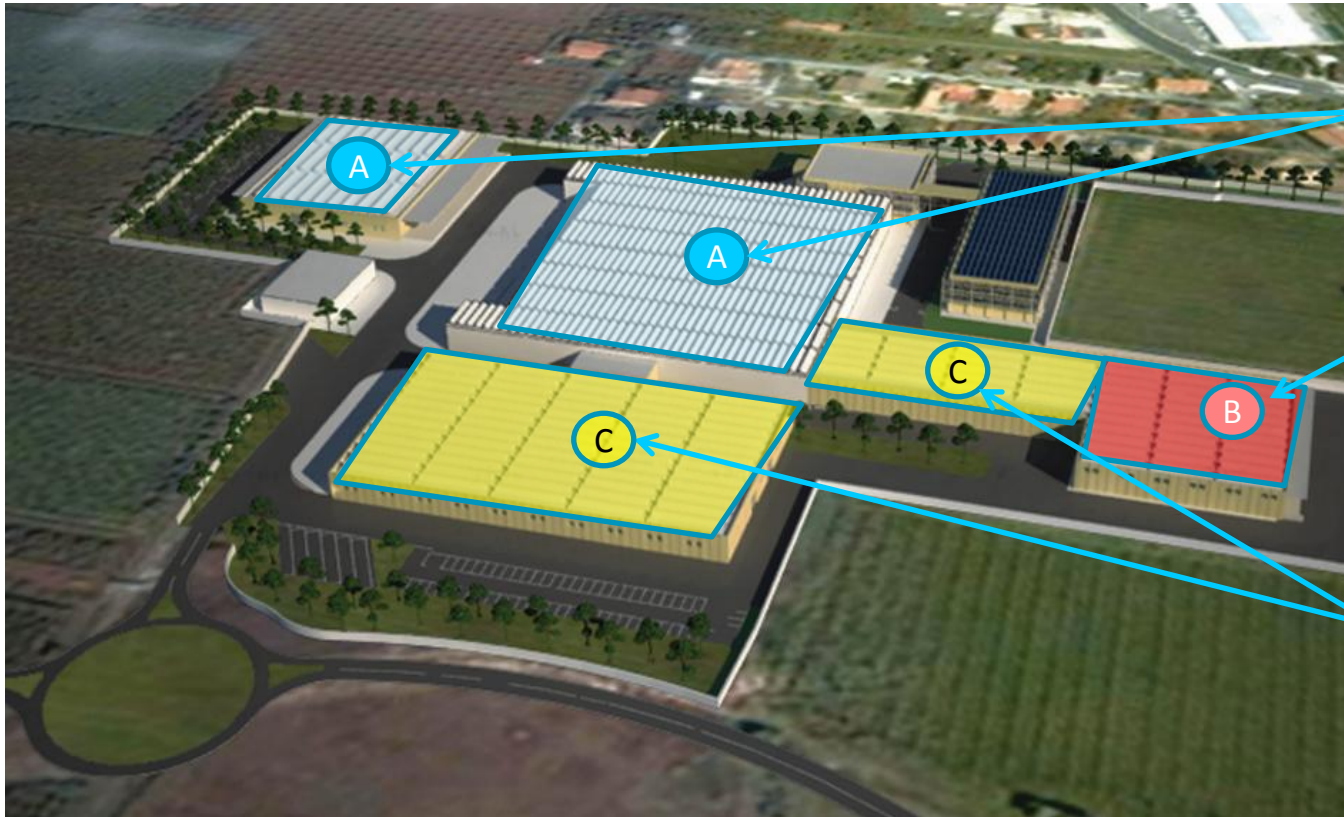


CECCHINA FACTORY



SETTALA FACTORY

Daikin Applied Europe – Cecchina Factory → new factory investments



- A** Existing plant
(chillers and compressors)
- B** First Expansion
Concluded
(W/C chillers and test rooms)
- C** Future Expansion

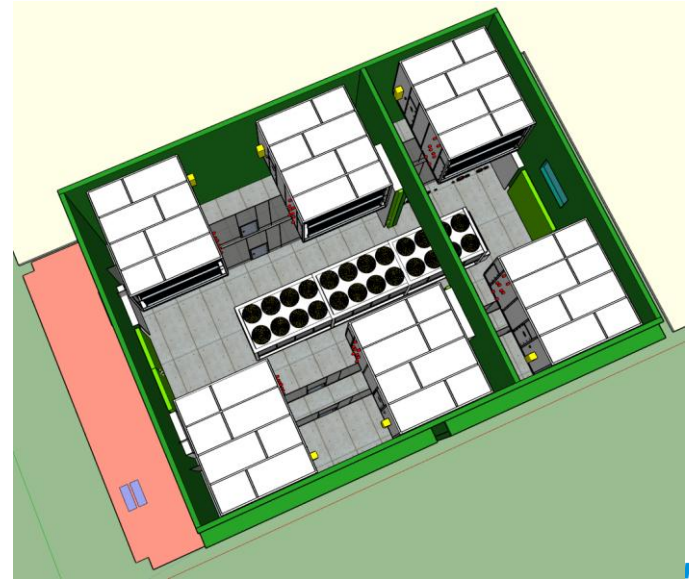
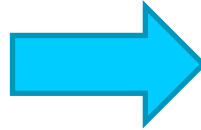
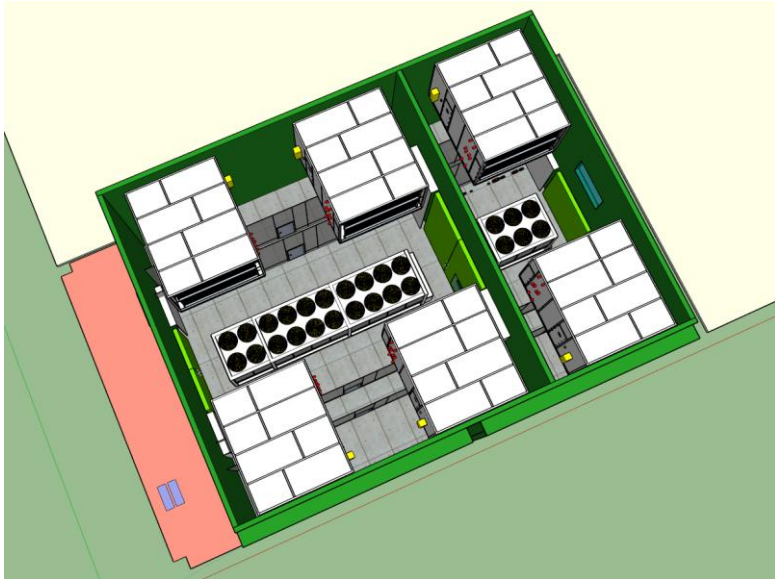
Daikin Applied Europe – Cecchina Factory → new laboratory

Laboratory overview & Schematic Lay-out

Overall test facility lay-out is consisting of two off performances data test laboratories

The two laboratories are completely independent from each-other. The bigger one allows to carry out tests for machines up to **20 fans (about 10 m length)**, while the smaller one allows to carry out tests for machines up to **6 fans (about 3 m length)**

The 2 off test laboratories can be joined together, so that the total facility lay-out capability will allow to carry-out thermal and acoustic performances test for a/c chillers up to **30 fans (about 15 m length)**



Daikin Applied Europe – Cecchina Factory → new laboratory

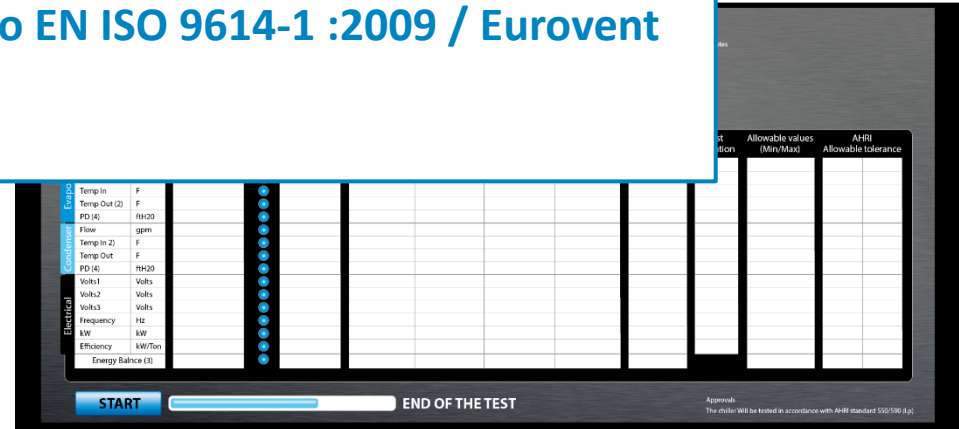
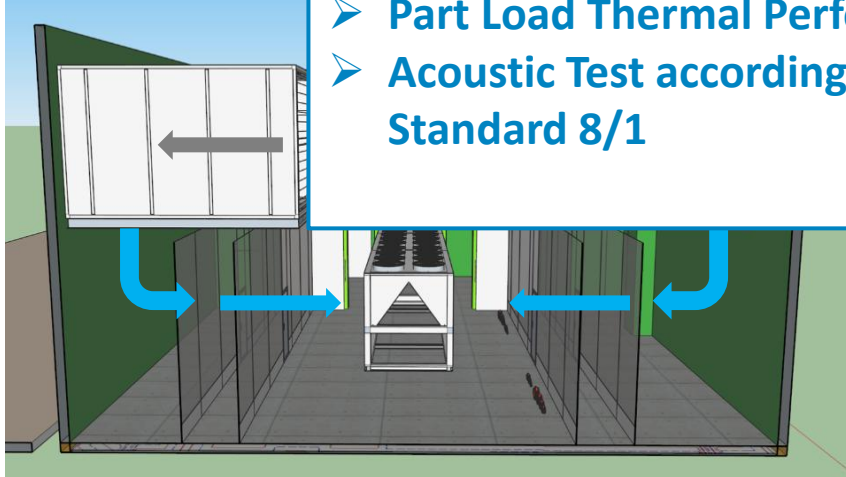
Functioning principle

In case of WT for chillers, the air flow and air temperature inside the test room are managed by the use of 6 off Daikin AHU (100.000 m³/h air flow each one).

Recorded data are acquired by the acquisition data system located in the Engineering Control Room and are also remotized in the customers sepervising lounge r

TESTs AVAILABLE:

- **100% Thermal Performance Test**
- **Part Load Thermal Performance Test**
- **Acoustic Test according to EN ISO 9614-1 :2009 / Eurovent Standard 8/1**



Daikin Applied Europe – Cecchina Factory → new laboratory

Air cooled chiller performances are measured in the Test Laboratory according the international Standards EN 14511:2013

Measurement values meet the requirements of the EN 14511:2013 and Eurovent Standard RS 6/C/003-2016

Ambient, Water Temperatures and Humidity control

Temperature range operating limits that can be simulated at Daikin Applied Europe test laboratory are detailed as follows:

- **Control of Inlet air at condensing section from -15°C to + 52°C**
- Simulation of **Evaporator leaving water temperature from - 8°C up to + 20°C (+ 18°C / TBC)**
- Simulation of **Condenser leaving water temperatures (H/P mode) from + 35°C up to + 70°C**
- Control of **umidity** (only dry bulb measured in cooling mode) **from 5 to 95 % RH**
- Test capacity ranges for **A/C in Cooling Mode up to 2.1 MW**
- Test capacity ranges for **A/C Heat Pump in Heating Mode up to 600 kW**
- Test capacity ranges for **W/C in Cooling Mode up to 2.1 MW**

It is possible to carry out WT with glycol in the water loop (specific running conditions and price impact to be discussed in advance)

Application

Test facilities are suitable to allow test of a/c, w/c, HP, Free Cooling and “4 pipes” chillers, even with HR (“6 pipes”)



MARKET DRIVERS & LOCAL LEGISLATIONS

Market drivers & Local legislations
European Union 2030 objectives

Ambitious target for 2030 towards environmental protection

+27%



Energy Efficiency
Improvement

- 40%



Greenhouse
gas emissions

+27%



Share or
renewable energy

Market drivers & Local legislations
European Union 2030 objectives

Indirect emissions

ECODESIGN

To set the minimum efficiency requirements for HVAC systems.

Direct emissions

F-GAS

To cut the emissions of the F-gases (=fluorinated gases) into the atmosphere.

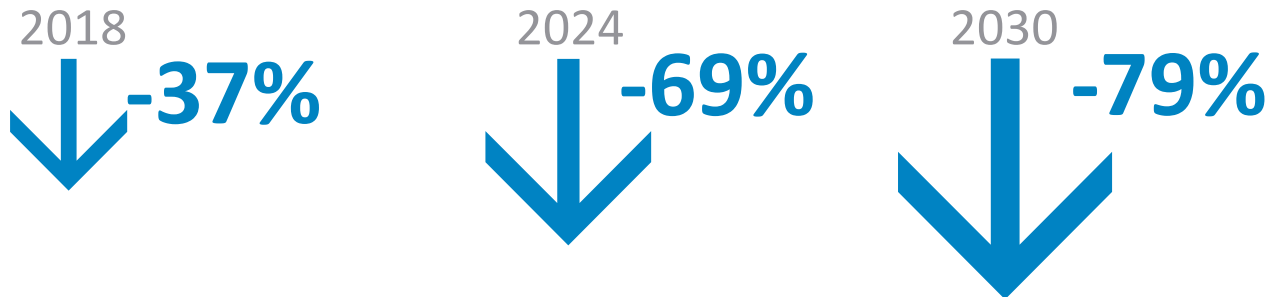
Market drivers & Local legislations
European Union 2030 objectives

Direct emissions

F-GAS

To cut the emissions of the F-gases
(=fluorinated gases) into the atmosphere.

HFC's phase down objectives*:



Answer from Daikin to F-GAS REGULATION

Reducing direct emissions

Daikin key considerations for refrigerant choice

Safety



A refrigerant must be safe to use through the entire lifecycle of the equipment

Energy efficiency



Carefully consider a refrigerant's potential to improve the energy efficiency

Environmental impact



A core consideration in refrigerant choice is its environmental impact.

Cost effectiveness



Provide to Customers access to affordable solutions

LOW ENVIRONMENTAL IMPACT

Answer from Daikin to F-GAS REGULATION

Reducing direct emissions

Daikin refrigerant choice

SCREW Compressor Unit



R1234ze

SCROLL Compressor Unit

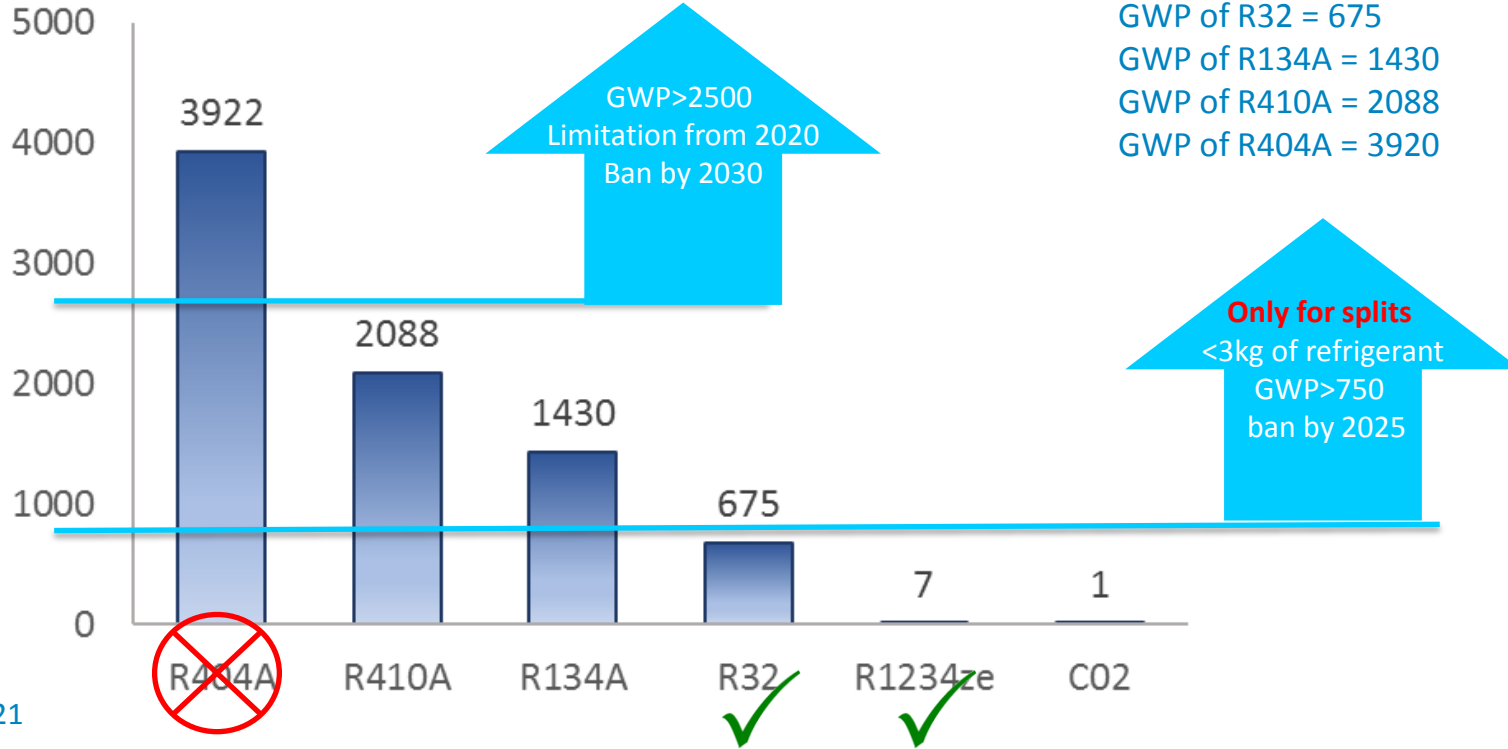


R32

LOW ENVIRONMENTAL IMPACT

GWP of some refrigerants in CO2 equivalents

Global Warming Potential



Measurement unit for GWP is CO₂ equivalent

What is CO₂ equivalent?

Impact on Global Warming compared to CO₂

GWP of CO₂ = 1

GWP of R1234ze = 7

GWP of R32 = 675

GWP of R134A = 1430

GWP of R410A = 2088

GWP of R404A = 3920

LOW ENVIRONMENTAL IMPACT

Under ASHRAE 34 and ISO 817, R32 and R1234ze are classified within the category **A2L**.

A3	B3	Higher Flammability
A2	B2	Flammable
A2L	B2L	Lower Flammability
A1	B1	Non Flammable

No Toxicity High Toxicity

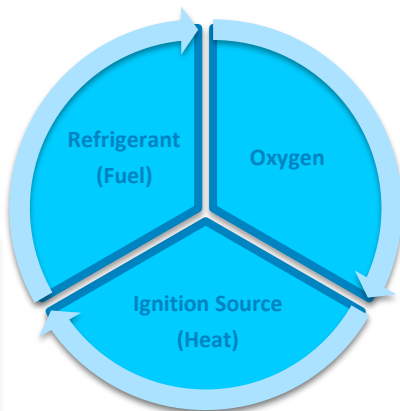
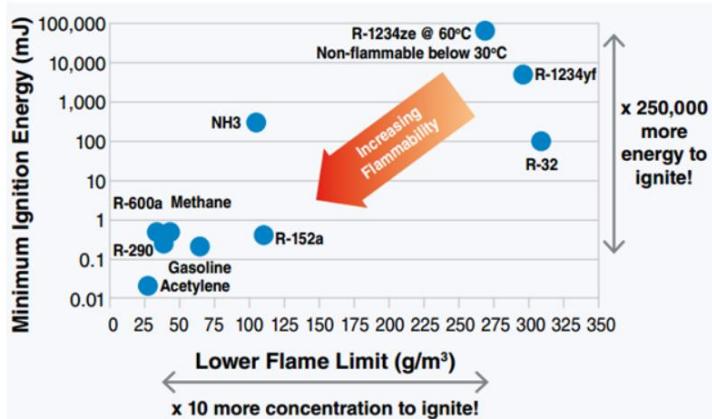
A is referred to toxicity level :
 A → No toxicity (refrigerants that have an occupational exposure limit of 400 ppm or greater)
 B → High toxicity (refrigerants that have an occupational exposure limit of less than 400 ppm)

2L is referred to lower flammability

	1	2L	2	3
Definition	Not Flammable	Slightly Flammable Burning velocity below 10 cm/s	Low Flammability	High Flammability
<i>Examples</i>	R744 (CO2) R410A R134a	R32 R1234 yf R1234 ze	R152a Difluoroethane	R290 Propane R600 Isobutane R1270 Propylene

LOW ENVIRONMENTAL IMPACT

Only a mixture of R32 between 14% and 31% in the air can burn at 23 °C
(Only a mixture of R1234ze(E) between 5,8% and 11,3% in the air can burn, at 60 °C because it is not flammable at ambient temperature).



Even if all the circumstances for ignition occurs together, R1234ze(E) is characterized by very low burning velocity.
less than 1 cm/s !!!
very far from the one of explosive substances like Propane and Gasoline (around 30 cm/s)

Looking at minimum ignition energy it can be seen that selected refrigerants can be ignited only by very high energy-density source, as flames and chemical sources.

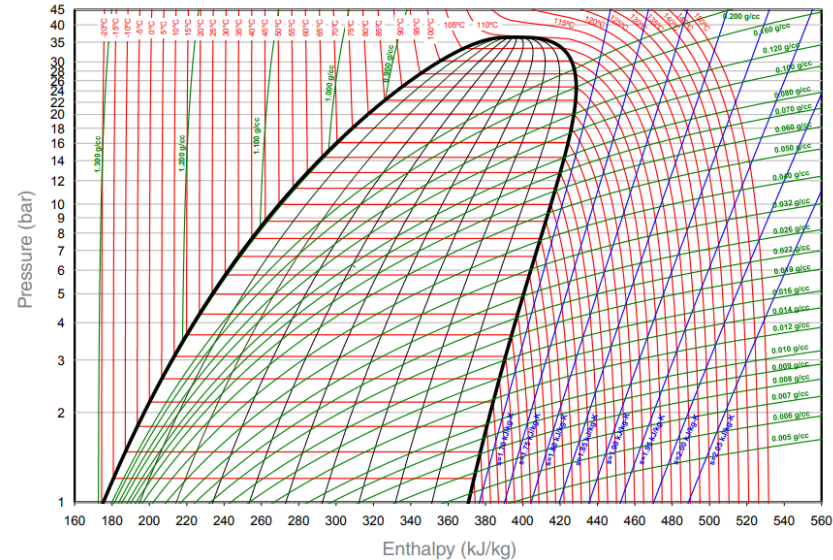
LOW ENVIRONMENTAL IMPACT – FOCUS ON R1234ZE

Similarly to R134a, R1234ze(E) is a medium pressure refrigerant.

In the table below some of the physical property of the two refrigerants are compared

	R1234ze(E)	R134a
Molecular weight [kg/mol]	114	102
Boiling point at 101.3 kPa [°C]	-18,95	-26,06
Critical temperature [°C]	109,4	101,1
Critical pressure [bar]	36,4	40,6
Latent heat of vaporization at 30 °C [kJ/kg]	162,9	173,1
Critical density [kg/m³]	489	515,3

Pressure and enthalpy



LOW ENVIRONMENTAL IMPACT – FOCUS ON R1234ZE

As result of the physical properties R1234ze(e) compared to R134a gives less capacity with same efficiency and GWP = 7.

Also, toxicity levels of R1234ze(E) are favorable and comparable to that of R134a.

	R1234ze(E) vs R134a
Cooling Capacity	Lower (\approx 75%)
Efficiency	same
GWP	much lower (-99% GWP)

LOW ENVIRONMENTAL IMPACT

- No special installation requirements for A2L refrigerant chillers, only minor additional requirements in case of water cooled chillers installed in machinery rooms (indoor)
- Differently from Dx systems, chillers' installation has no refrigerant charge limitation being indirect system (no refrigerant distribution into occupied spaces).

	Air cooled		Water cooled	
Installation	Open air		Machinery room	
Flammability class	A1 (R134a – R410A)	A2L (R1234ze – R32)	A1 (R134a – R410A)	A2L (R1234ze – R32)
Refr. charge	No restriction	No restriction	No restriction	No restriction
Installation requirements	None	None	<ol style="list-style-type: none"> 1. Not occupied space. 2. No naked flames. 3. No storage tanks. 4. Ventilation. 5. Leak detector (most cases) 	<ol style="list-style-type: none"> 1. Not occupied space. 2. No naked flames 3. No storage tanks. 4. Ventilation 5. Leak detector (activating emergency shut down) 6. Not hot surfaces (R1234ze <294°C, R32 <500°C). 7. Exhaust ventilation suitable for hazardous areas.



DAIKIN APPLIED EUROPE PRODUCTS RANGE

DAIKIN APPLIED BUSINESS in EMEA

Product Range

Widest **Chiller portfolio**
covering from 5 kW up to
21,000 kW

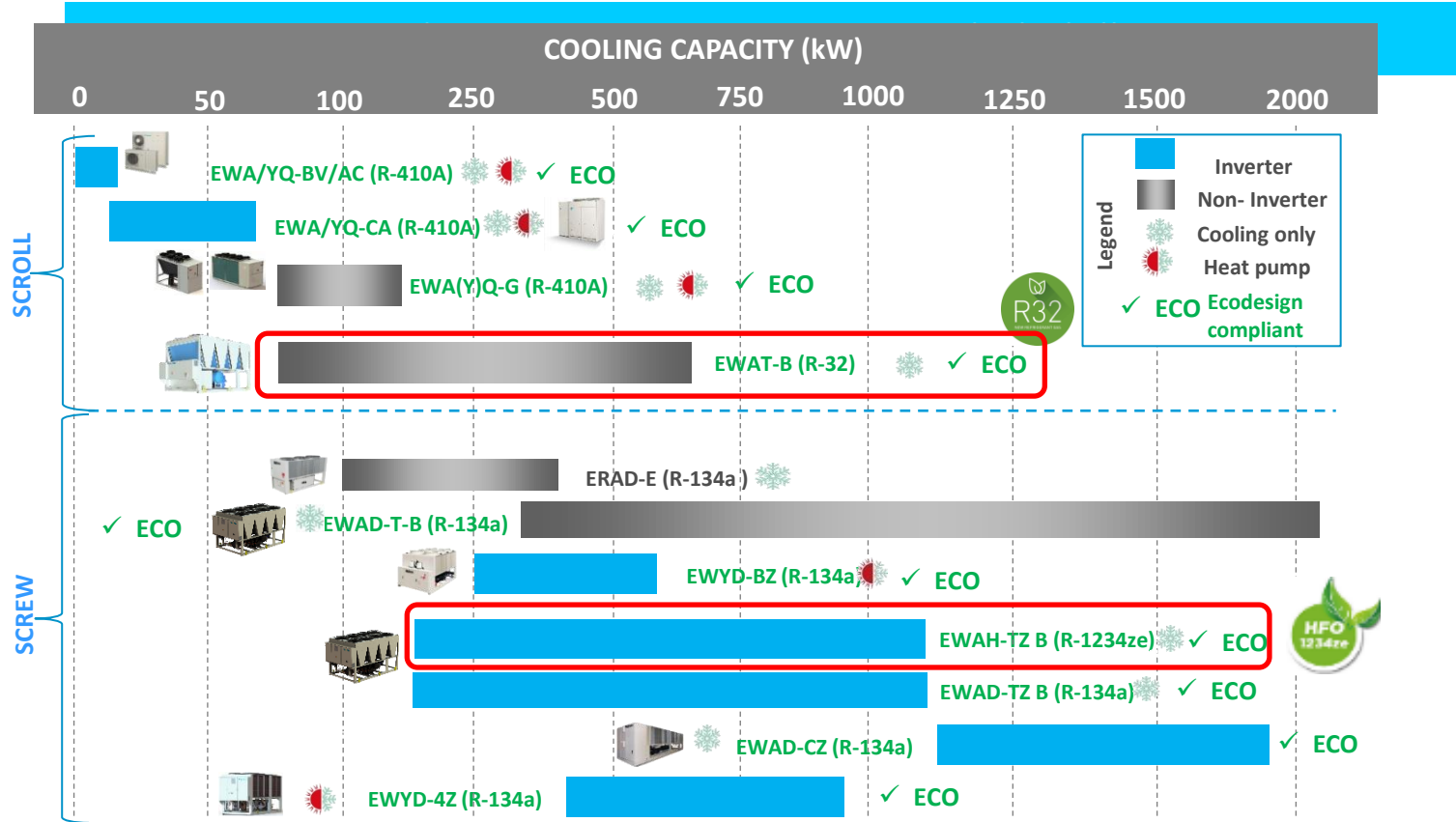


Eurovent certification

Air Cooled Chillers



PRODUCT OVERVIEW 2019 AIR COOLED CHILLERS



EWAH~TZ B – COOLING ONLY CHILLER - R1234ze



Features & Benefits

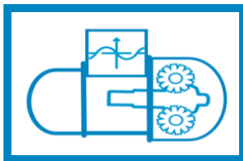
- ✓ designed for commercial and industrial
- ✓ capacity range **from 170 – up to 1060 kW***
- ✓ Single and dual circuit units
- ✓ Extensive list of options and accessories
- ✓ **Low GWP refrigerant**
- ✓ **BEST FULL LOAD AND PART LOAD EFFICIENCY**
- ✓ **3 efficiency levels**
- ✓ **3 sound configurations**



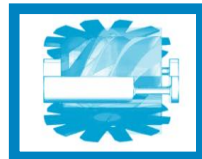
BEST AVAILABLE
TECHNOLOGY
IN ECO-DESIGN



OUTDOOR
INSTALLATION



SINGLE SCREW COMPRESSOR
with
INTEGRATED REFRIGERANT
COOLED VFD



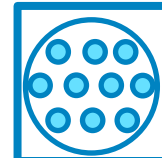
VARIABLE VOLUME
RATIO



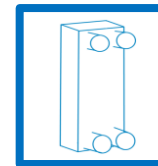
MICROCHANNEL
CONDENSER



AXIAL FANS



DIRECT EXPANSION
SHELL & TUBE
EVAPORATOR



BRAZED PLATE
EVAPORATOR

- * conditions:
- OAT: 35°C
 - EWT in/out= 12/7°C

EWAH~TZ B – COOLING ONLY CHILLER - R1234ze



3 EFFICIENCY LEVELS

Silver

avg. EER = 2,9*
avg. SEER = 4,5**

Gold

avg. EER = 3,4*
avg. SEER = 5,0**

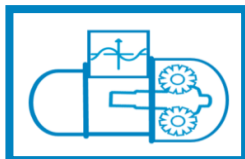
Platinum

avg. EER = 3,7*
avg. SEER = 5,3**

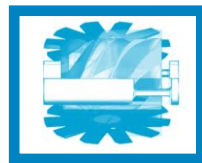
COMPLIANT TO
ECODESIGN TIER 2 of LOT21



OUTDOOR
INSTALLATION



SINGLE SCREW COMPRESSOR
with
INTEGRATED REFRIGERANT
COOLED VFD



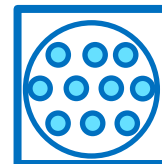
VARIABLE VOLUME
RATIO



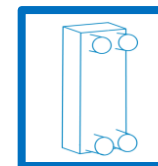
MICROCHANNEL
CONDENSER



AXIAL FANS



DIRECT EXPANSION
SHELL & TUBE
EVAPORATOR



BRAZED PLATE
EVAPORATOR

* According EN14511
** According EN14825
*** Calculated on SEER
profile

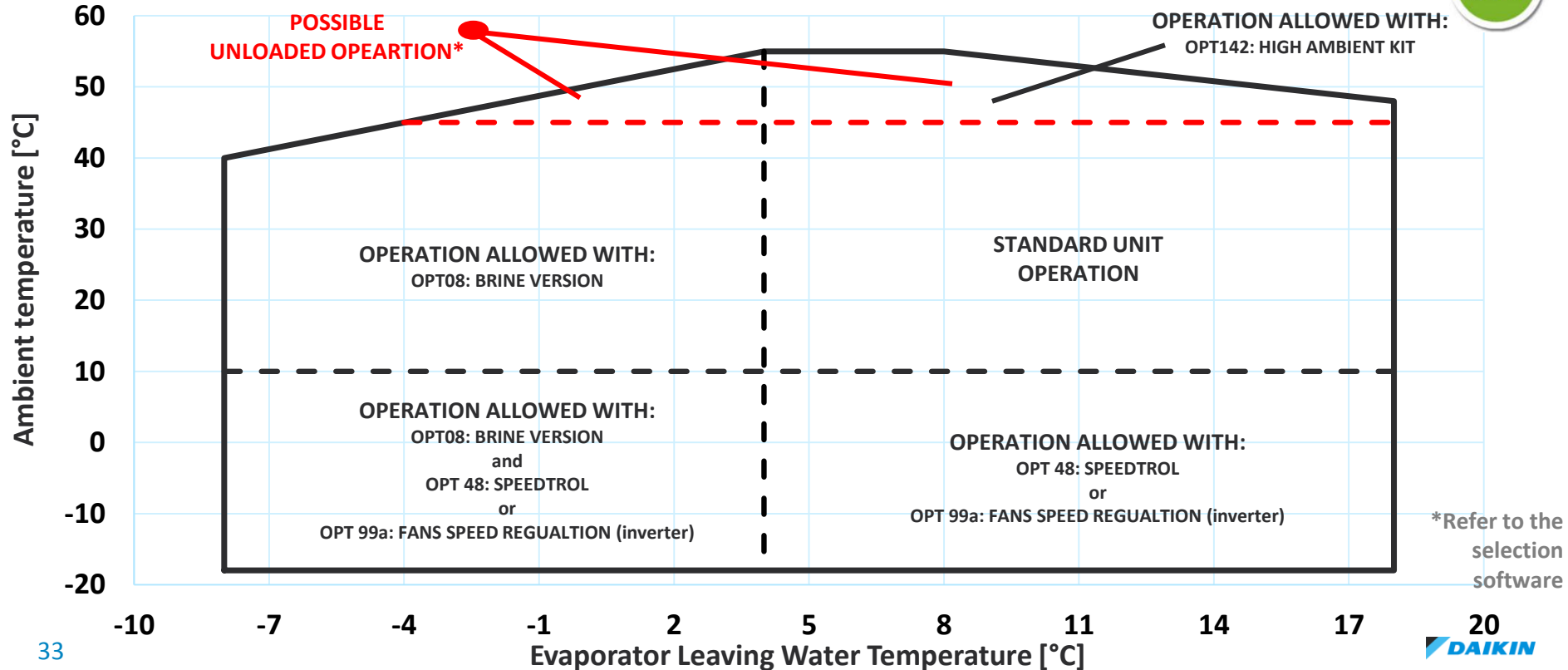


EWAH~TZ B – COOLING ONLY CHILLER - R1234ze



Operating envelope

According to the operating conditions, additional options on the standard unit could be needed



EWAT-B – COOLING ONLY CHILLER – R32



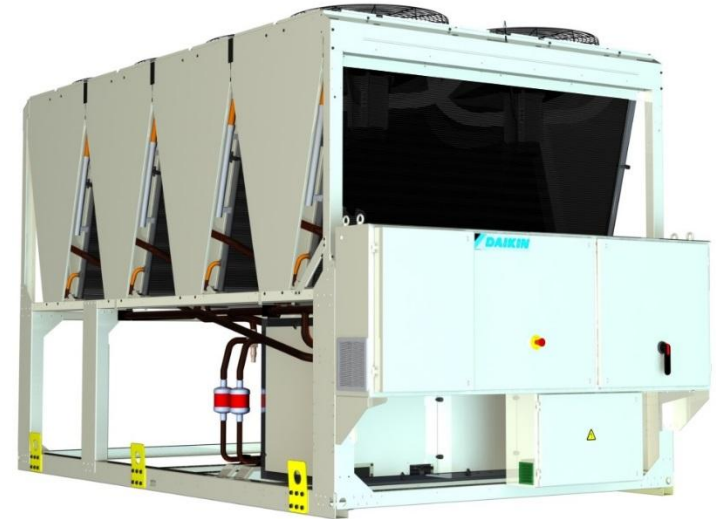
New Daikin “Bluevolution” chiller series

EWAT-B-

- R32 low GWP refrigerant: **first in the market!**
- Wide capacity range: 80 – 700 kW.
- Microchannel coils.
- Silver and Gold efficiency versions.
- Three sound configurations.
- Extensive option lists
- Full compatibility with Daikin on Site.



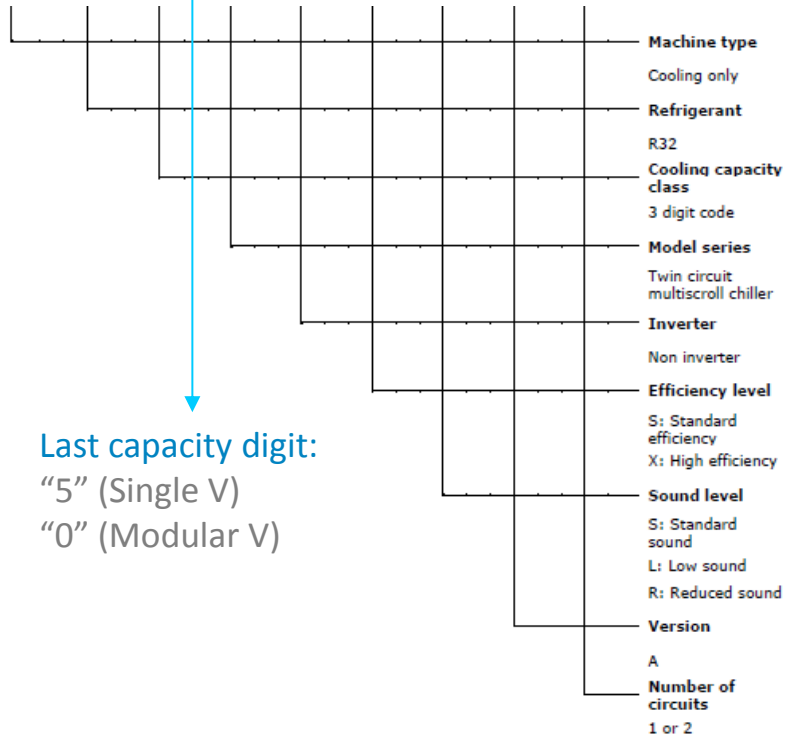
BLUEEVOLUTION



EWAT-B – COOLING ONLY CHILLER – R32



EWA T 215 B - S S A 1



Last capacity digit:
"5" (Single V)
"0" (Modular V)



BLUEEVOLUTION

Single Circuit	Silver Efficiency	81-217 kW	238-341 kW	
	Gold efficiency	81-183 kW	238-350 kW	
Twin Circuit	Silver Efficiency	158-212 kW	240-663 kW	
	Gold Efficiency		178-701 kW	



EWAT-B – COOLING ONLY CHILLER – R32

NEW FREE COOLING OPTIONS

Dx Free Cooling Light, OP.171

Refrigerant migration system allowing to recover up to **25%** of nominal unit capacity.

Dx Free Cooling Full, OP.172

Refrigerant migration system allowing to recover up to **75%** of nominal unit capacity.

Dx Free Cooling Full with Hydro Kit, OP.173

Refrigerant migration system allowing to recover up to **75%** of nominal unit capacity with integrated hydrokit for Plug&Play application.

Free cooling options is available for
Modular V series only:
180-700 kW



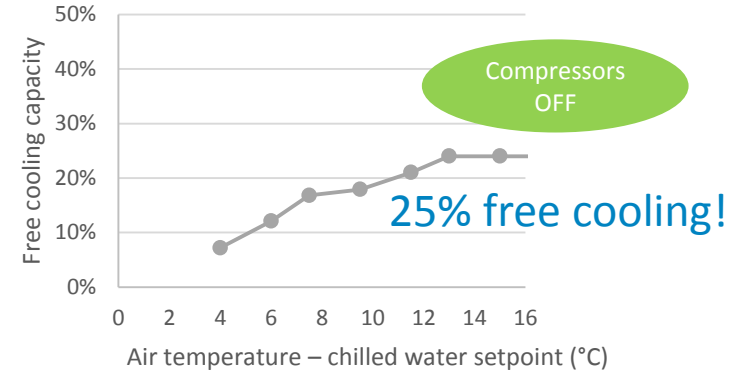
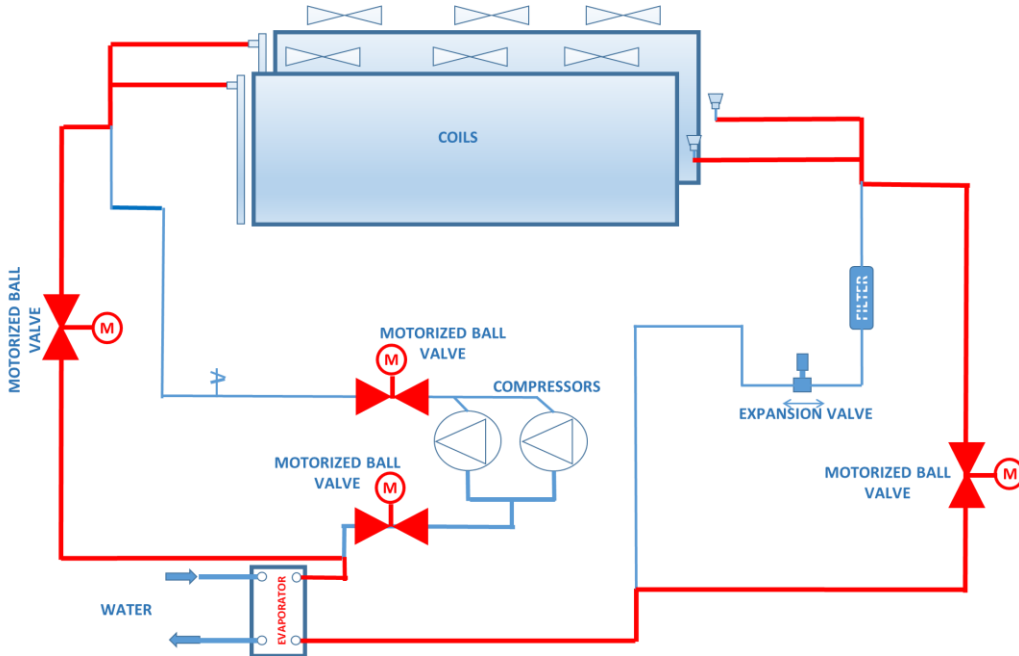
BLUEvolution

DAIKIN NEW FREE COOLING OPTIONS - DX FREE COOLING LIGHT, OP.171



The **LIGHT FREE COOLING** system allows to recover up to **25%** of nominal unit capacity.

Free cooling options is available for Modular V series only:
180-700 kW



Benefits

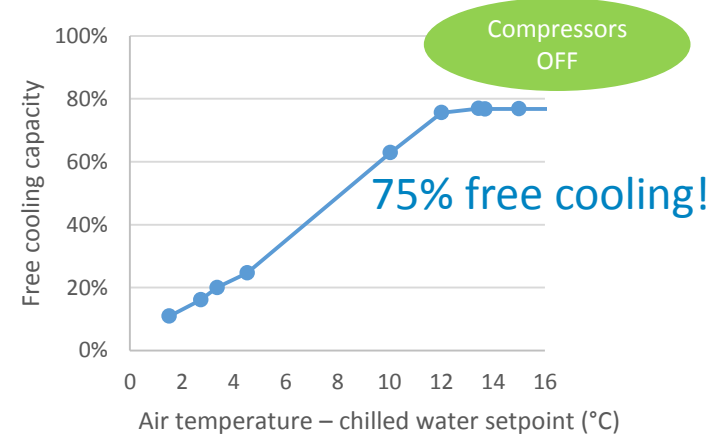
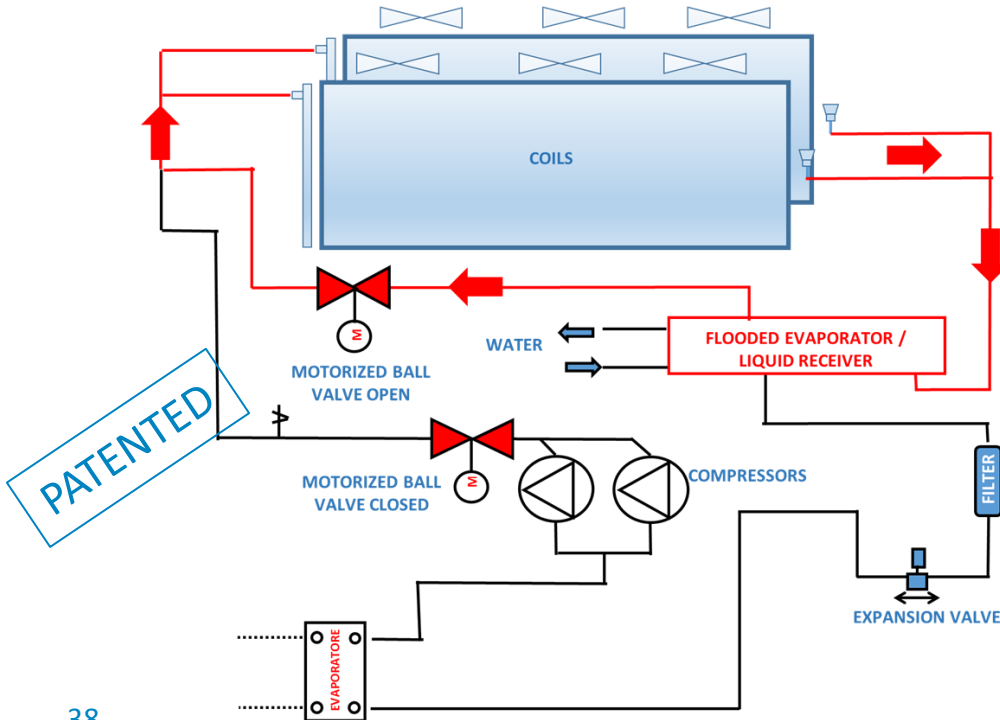
- Glycol free solution.
- No refrigerant pump required.
- No extra footprint Vs standard unit.

DAIKIN NEW FREE COOLING OPTIONS – DX FREE COOLING FULL, OP.172-173



The **FULL FREE COOLING** system allows to recover up to **75%** of nominal unit capacity.

Free cooling options is available for Modular V series only:
180-700 kW



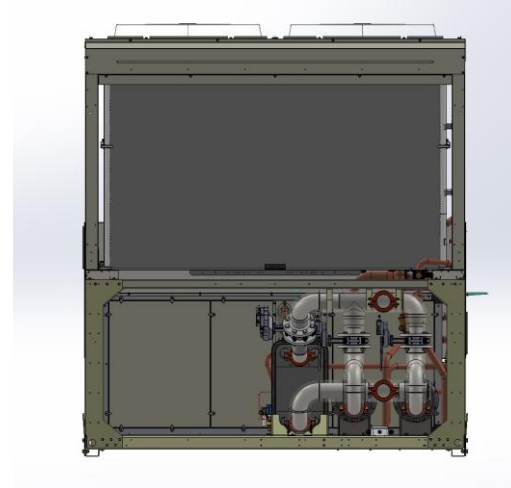
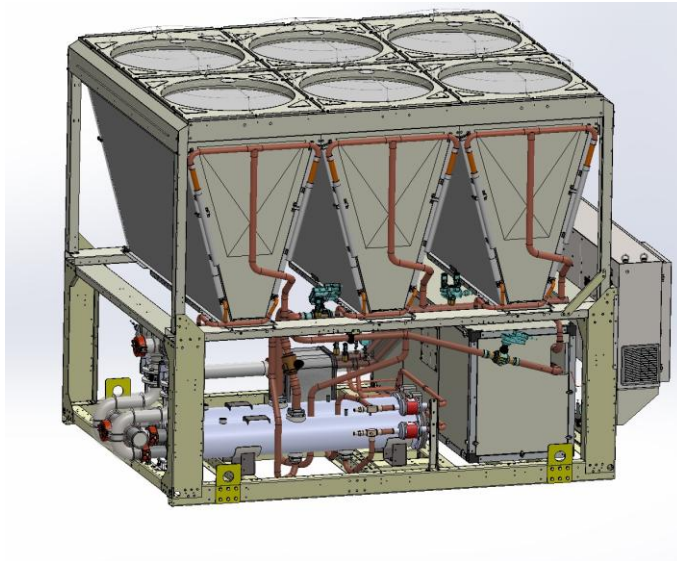
Benefits

- Glycol free solution.
- No refrigerant pump required.
- No extra footprint Vs standard unit*

(*) except 4 fans models

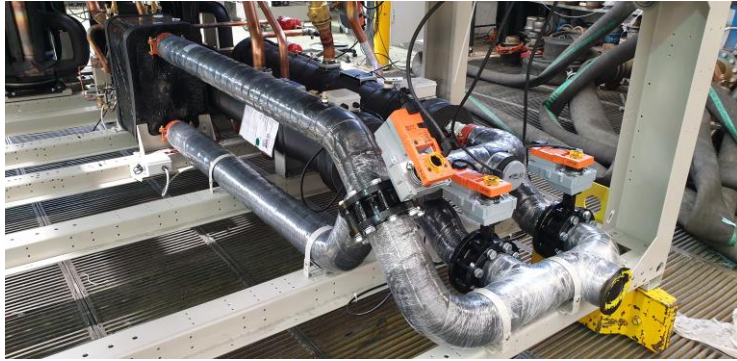
DAIKIN NEW FREE COOLING OPTIONS

Dx Free Cooling Full (glycol free) with Hydro Kit, OP.173



DAIKIN NEW FREE COOLING OPTIONS

Dx Free Cooling Full (glycol free) with Hydro Kit, OP.173



DAIKIN NEW FREE COOLING OPTIONS

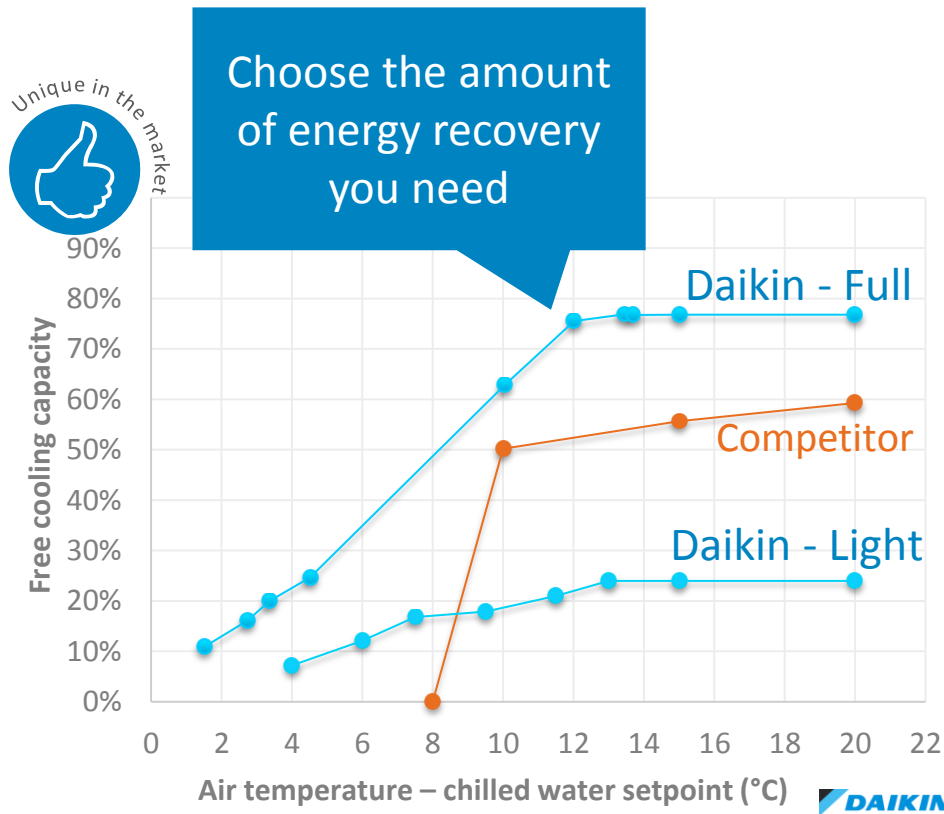


Daikin solution Vs Competitors

- Higher flexibility!
- Better efficiency!

	Daikin Light	Daikin Full	Competitor
Max free cooling capacity	Up to 25%	Up to 75%	Up to 60%
Efficiency	30	30	19

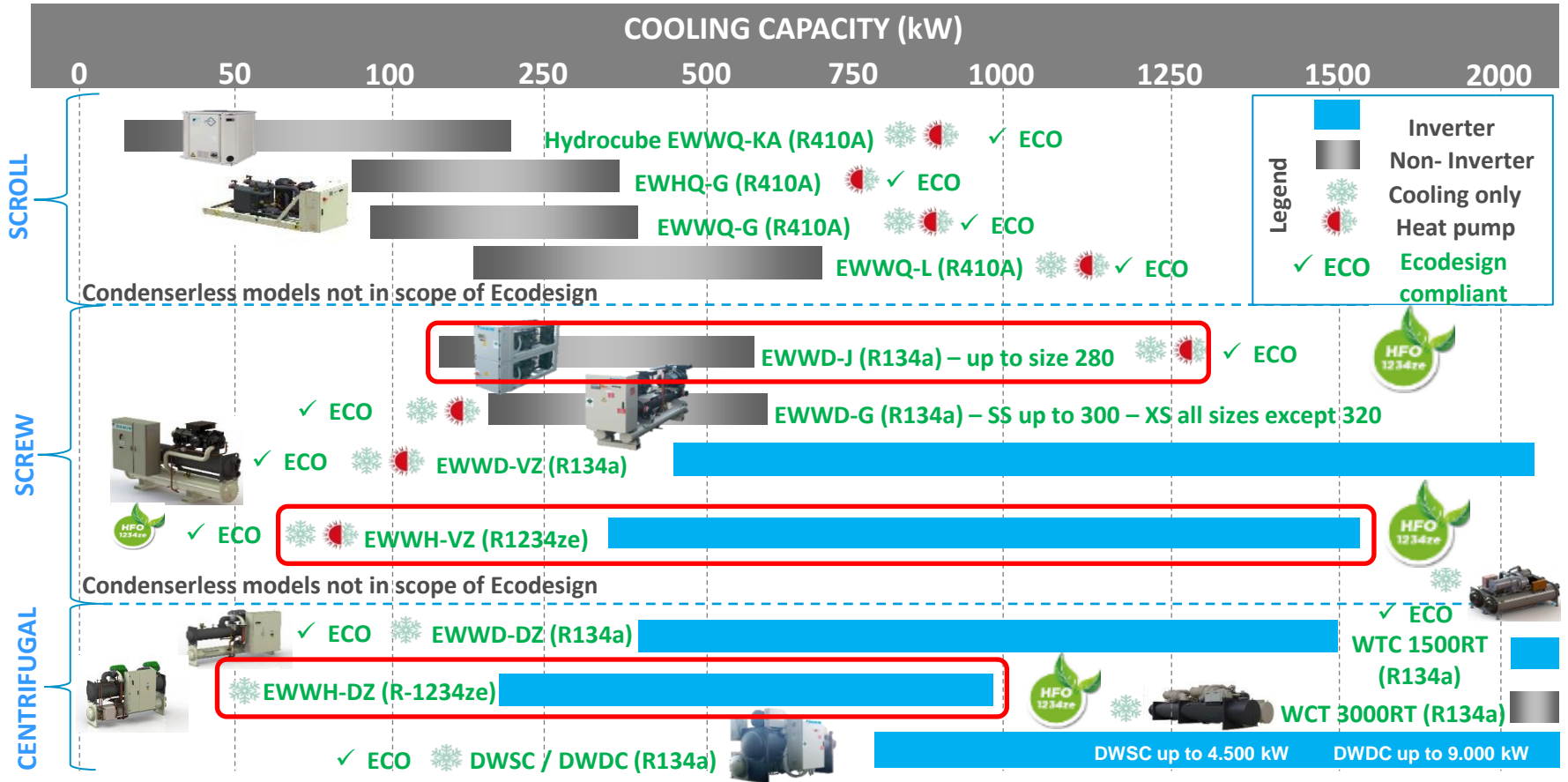
Maximize the efficiency



Water Cooled Chillers



PRODUCT OVERVIEW 2019 WATER COOLED CHILLERS



EWHD~VZ – COOLING ONLY CHILLER – R1234ze

**INVERTER
+ VVR**



Features & Benefits

- ✓ Capacity range **from 330 – to 1540 kW***
- ✓ Single and dual circuit
- ✓ Compact design
- ✓ Condenser leaving water temperature up to 75°C
- ✓ Heat Pump version available
- ✓ Brine version available
- ✓ Sound Proof Systems



.....and many other options and accessories



INDOOR
INSTALLATION



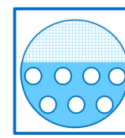
SINGLE SCREW
COMPRESSOR



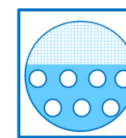
VARIABLE VOLUME
RATIO



AIR-COOLED VFD
COMPRESSOR DRIVE



FLOODED
SHELL & TUBE
CONDENSER



FLOODED
SHELL & TUBE
EVAPORATORE

* conditions:

- CWT in/out = 30/35°C
- EWT in/out= 12/7°C

EWVH~VZ – COOLING ONLY CHILLER - R1234ze

**INVERTER
+ VVR**



3 EFFICIENCY LEVELS

Silver

avg. EER = 5,1*
avg. SEER = 8,5**

Gold

avg. EER = 5,5*
avg. SEER = 8,5**

Platinum

avg. EER = 5,5*
avg. SEER = 8,7**

COMPLIANT TO
ECODESIGN TIER 2 of LOT21



INDOOR
INSTALLATION



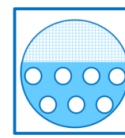
SINGLE SCREW
COMPRESSOR



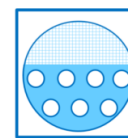
VARIABLE VOLUME
RATIO



AIR-COOLED VFD
COMPRESSOR DRIVE



FLOODED
SHELL & TUBE
CONDENSER

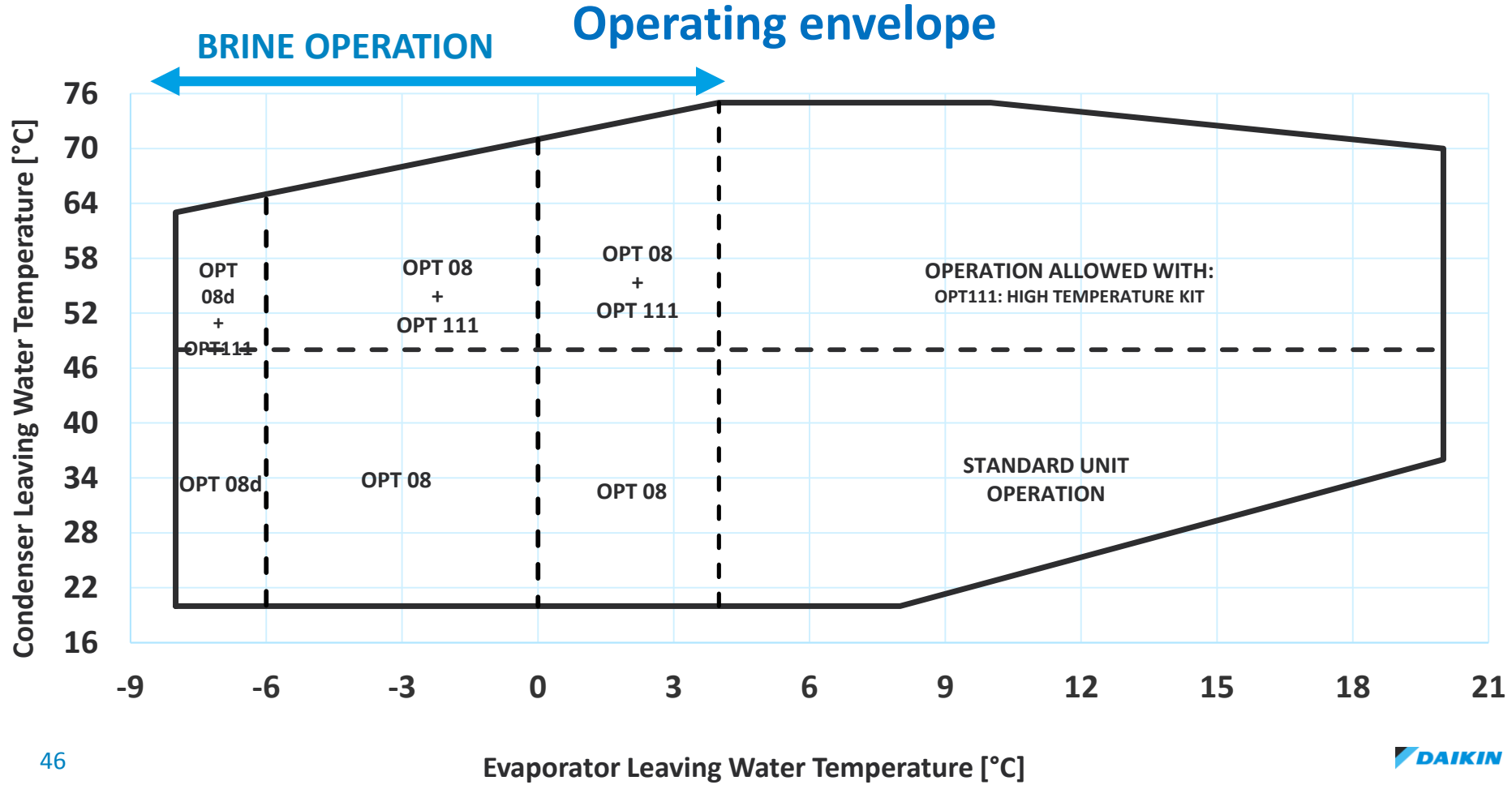


FLOODED
SHELL & TUBE
EVAPORATORE

* According EN14511

** According EN14825

EWWD~VZ – COOLING ONLY CHILLER - R134a



EWWD/H ~VZ – COOLING ONLY CHILLER



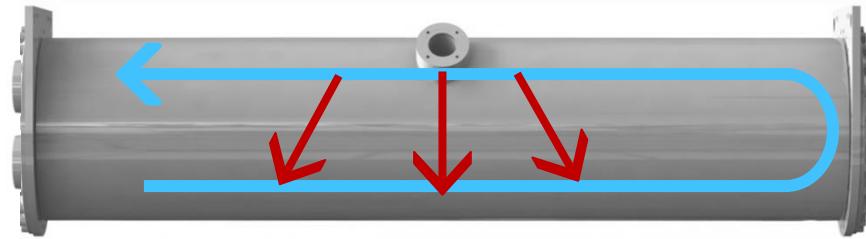
Features & Benefits

Real counter flow single pass condenser

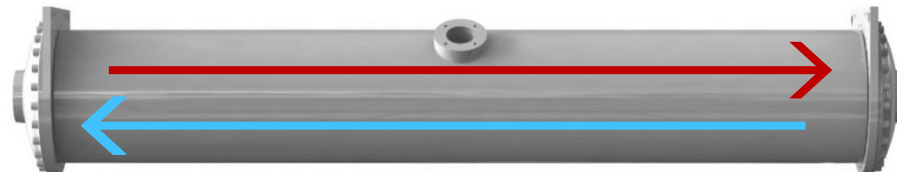
- High heat exchange performances
- Low water pressure drops < 30 kPa



TRADITIONAL TWO PASSES CONDENSER



NEW SINGLE PASS CONDENSER



EWWD/H ~VZ – COOLING ONLY CHILLER

Features & Benefits

oil separator integrated into the condenser



- Very low oil carry over
- Low refrigerant pressure drops



Traditional layout with separated oil separator



1,420 mm

VZ integrated oil separator



865 mm



40%
footprint
reduction*

EWWD/H ~VZ – COOLING ONLY CHILLER

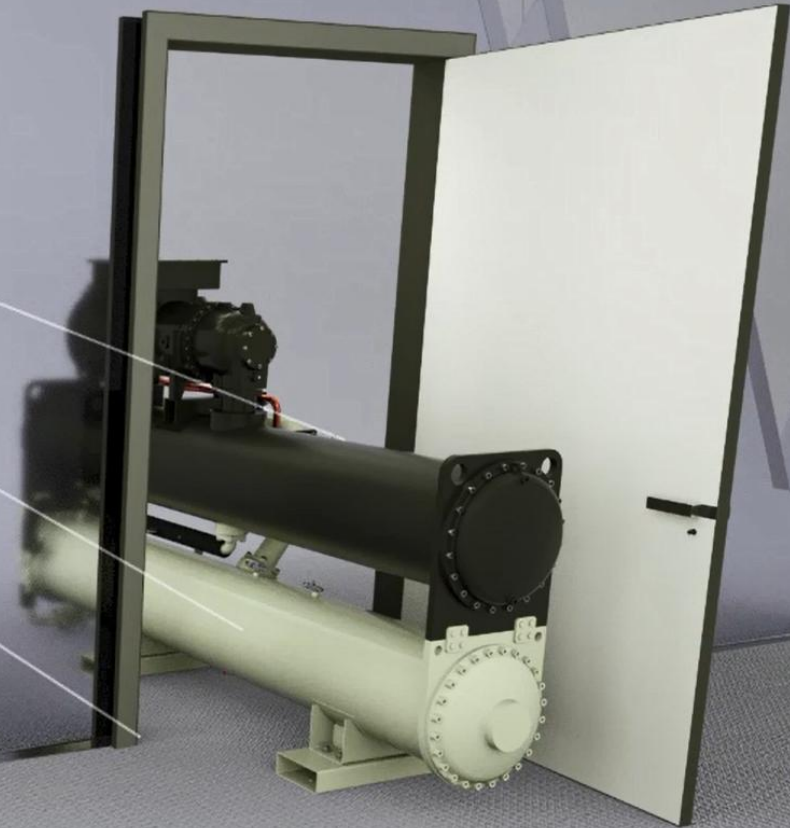


Features & Benefits

Compactness

Increased installation flexibility

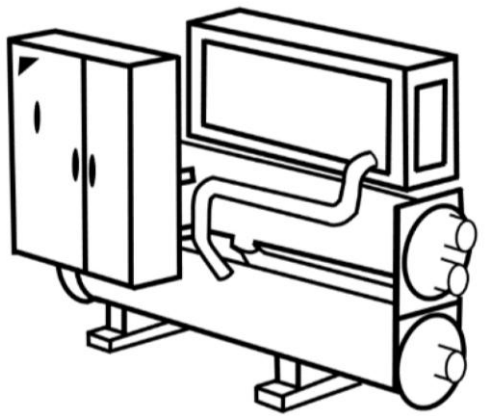
Fits through existing doorways



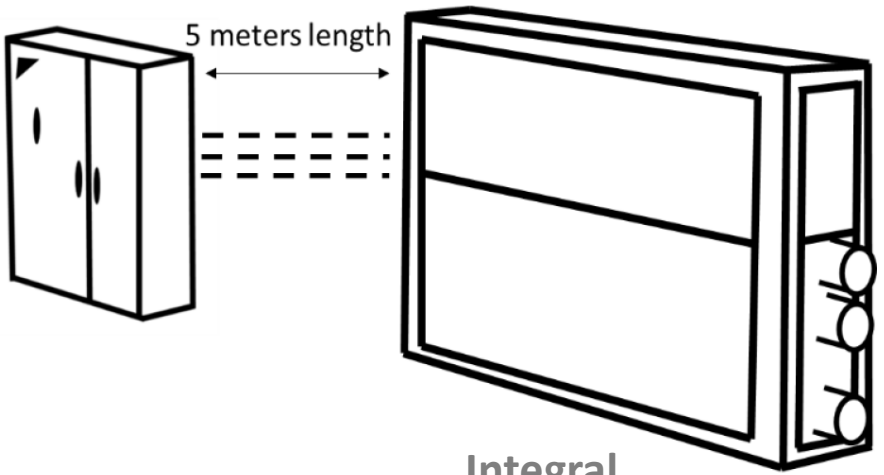
EWWD/H ~VZ – COOLING ONLY CHILLER

Features & Benefits

Sound proof systems



Compressor
soundproof system
avg. – 3 dB(a)

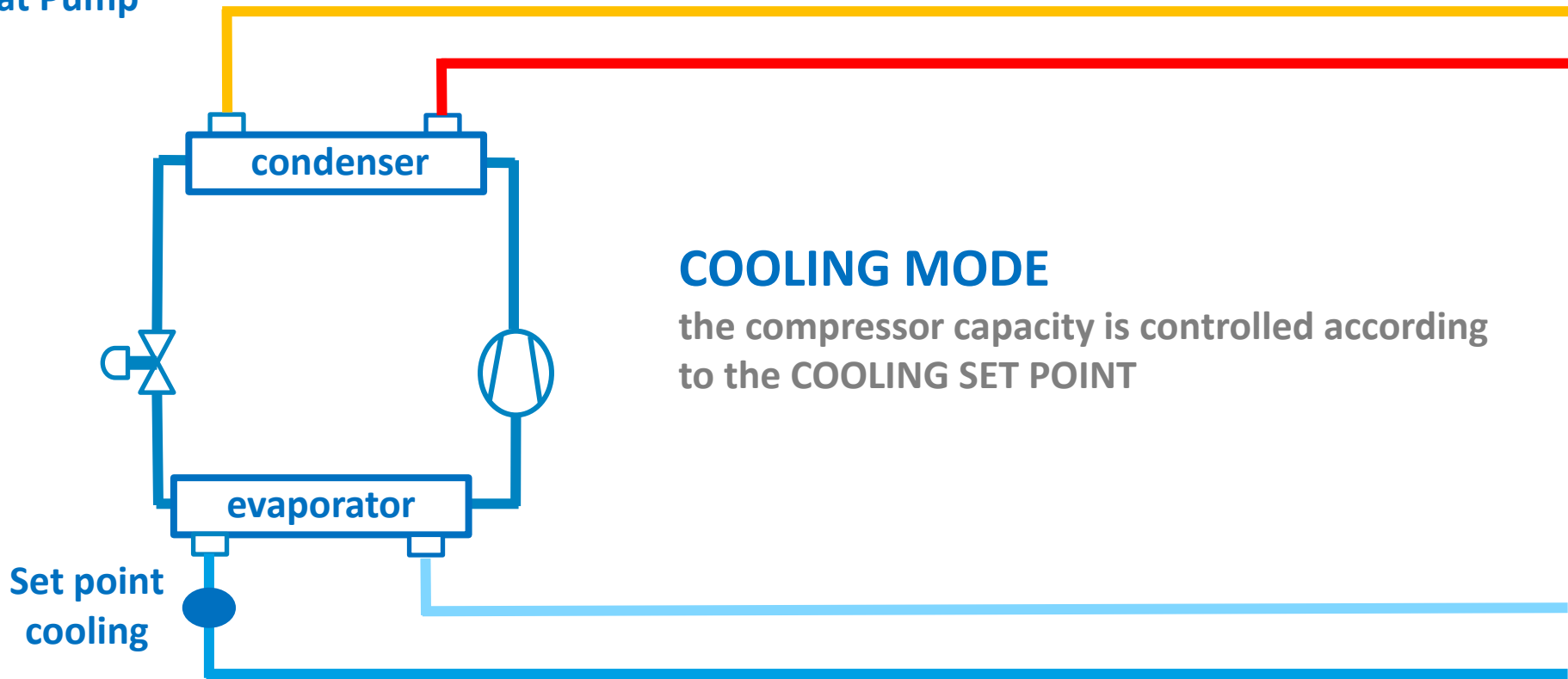


Integral
soundproof system
avg. – 12 dB(a)

EWWD/H ~VZ – COOLING ONLY CHILLER

Features & Benefits

Heat Pump



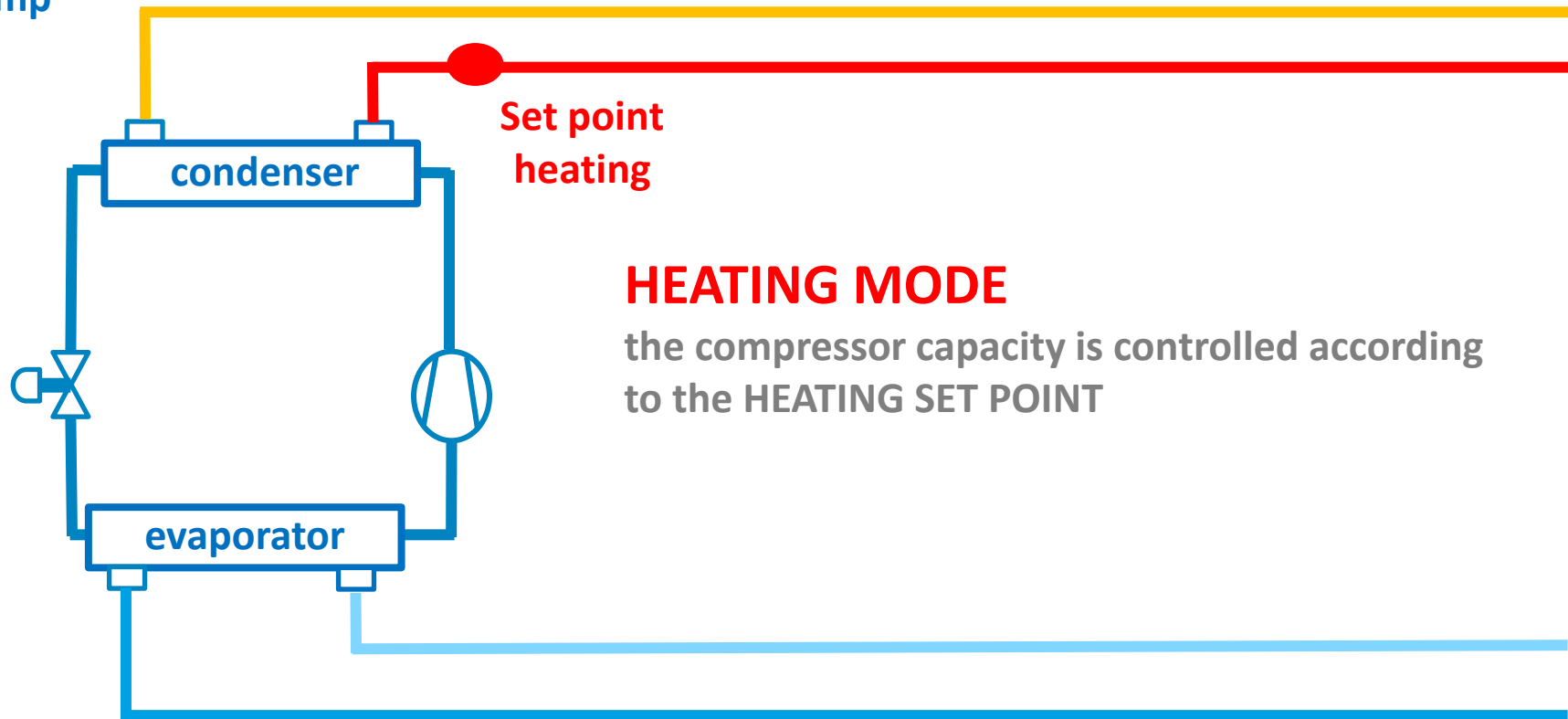
COOLING MODE

the compressor capacity is controlled according to the COOLING SET POINT

EWWD/H ~VZ – COOLING ONLY CHILLER

Features & Benefits

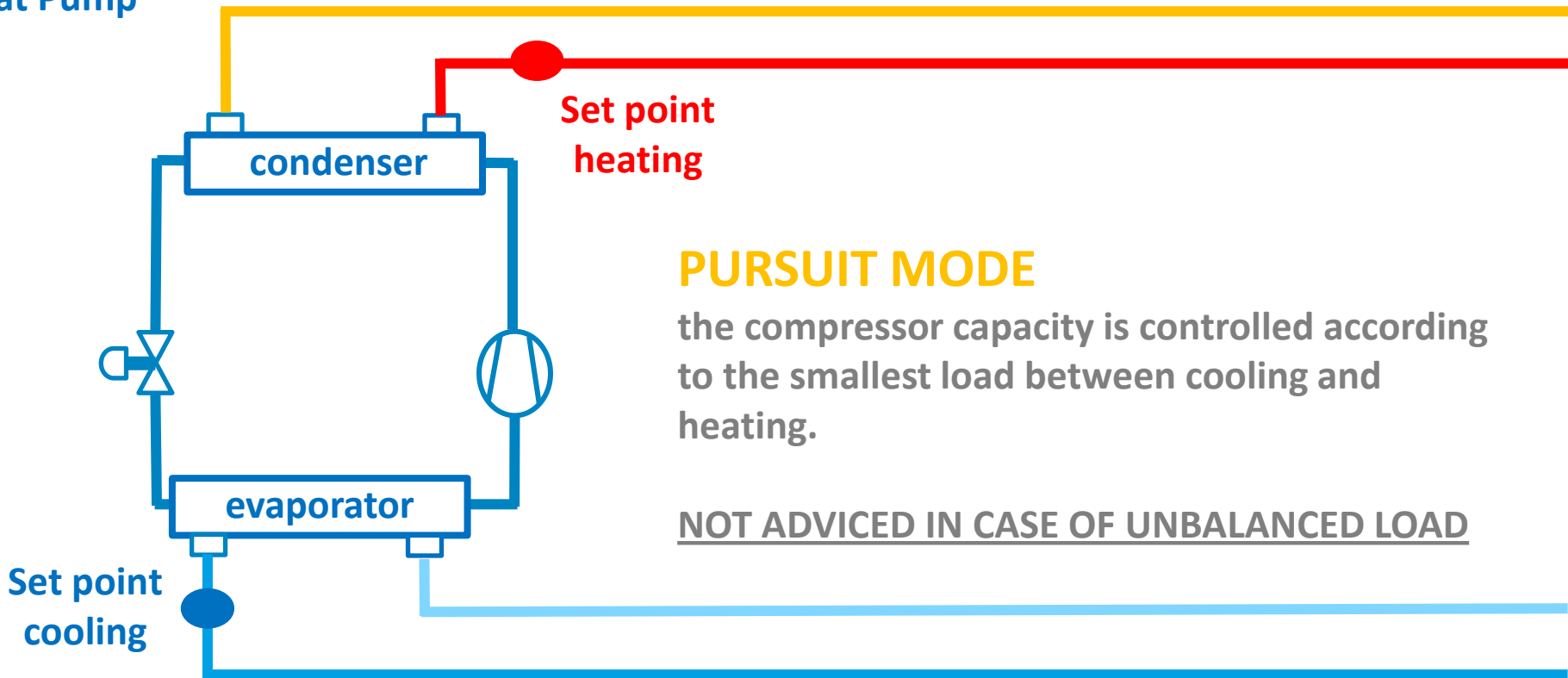
Heat Pump



EWWD/H ~VZ – COOLING ONLY CHILLER

Features & Benefits

Heat Pump



PURSUIT MODE

the compressor capacity is controlled according to the smallest load between cooling and heating.

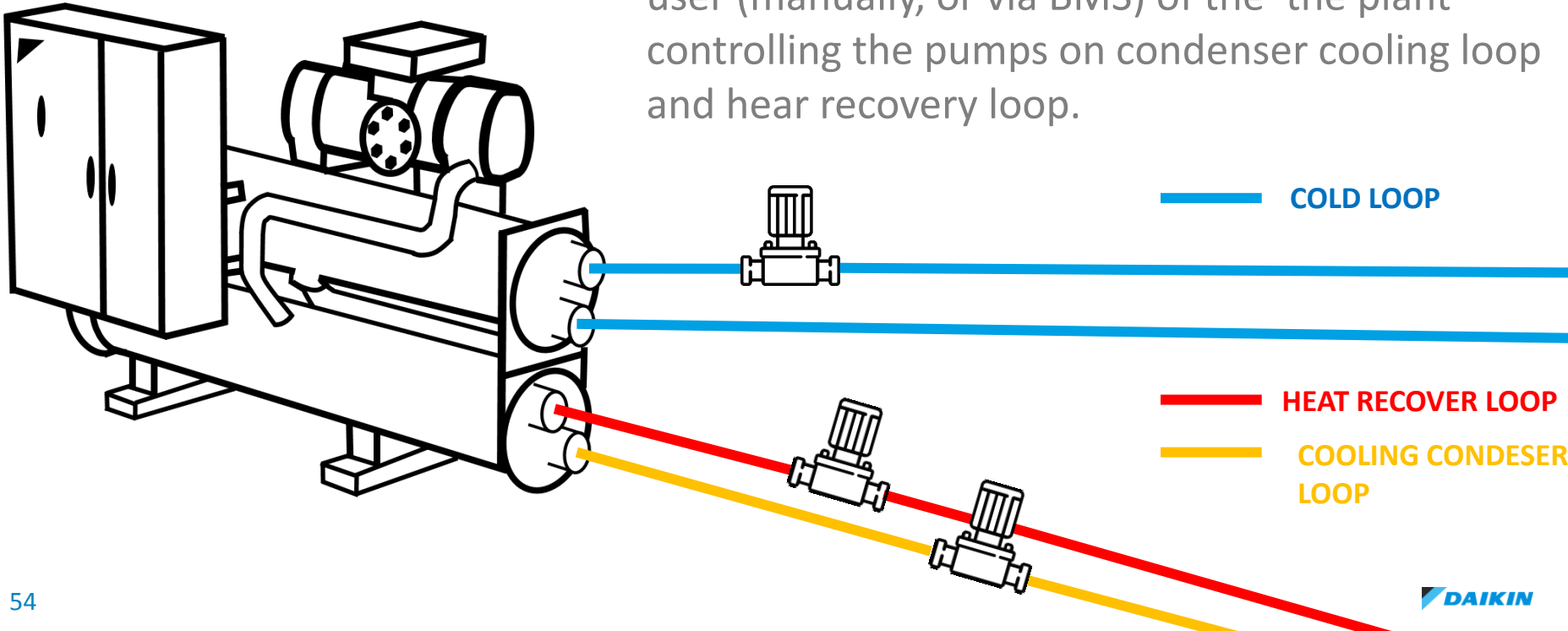
NOT ADVISED IN CASE OF UNBALANCED LOAD

EWWD/H ~VZ – COOLING ONLY CHILLER

Features & Benefits

Total Heat Recovery

The operation of heat recover is managed by the user (manually, or via BMS) of the the plant controlling the pumps on condenser cooling loop and hear recovery loop.

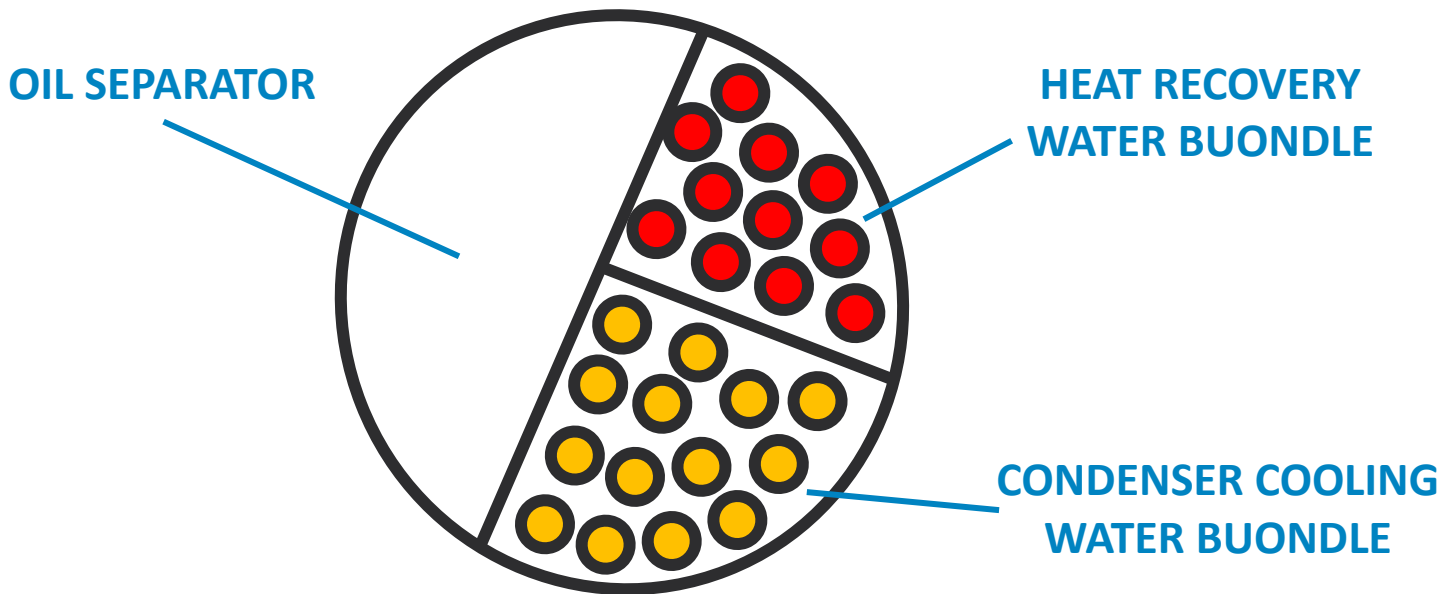


EWWD/H ~VZ – COOLING ONLY CHILLER

Features & Benefits

Total Heat Recovery

The condenser is provided with a two tube bundles, one for the condenser cooling water, one for the hear recovery circuit

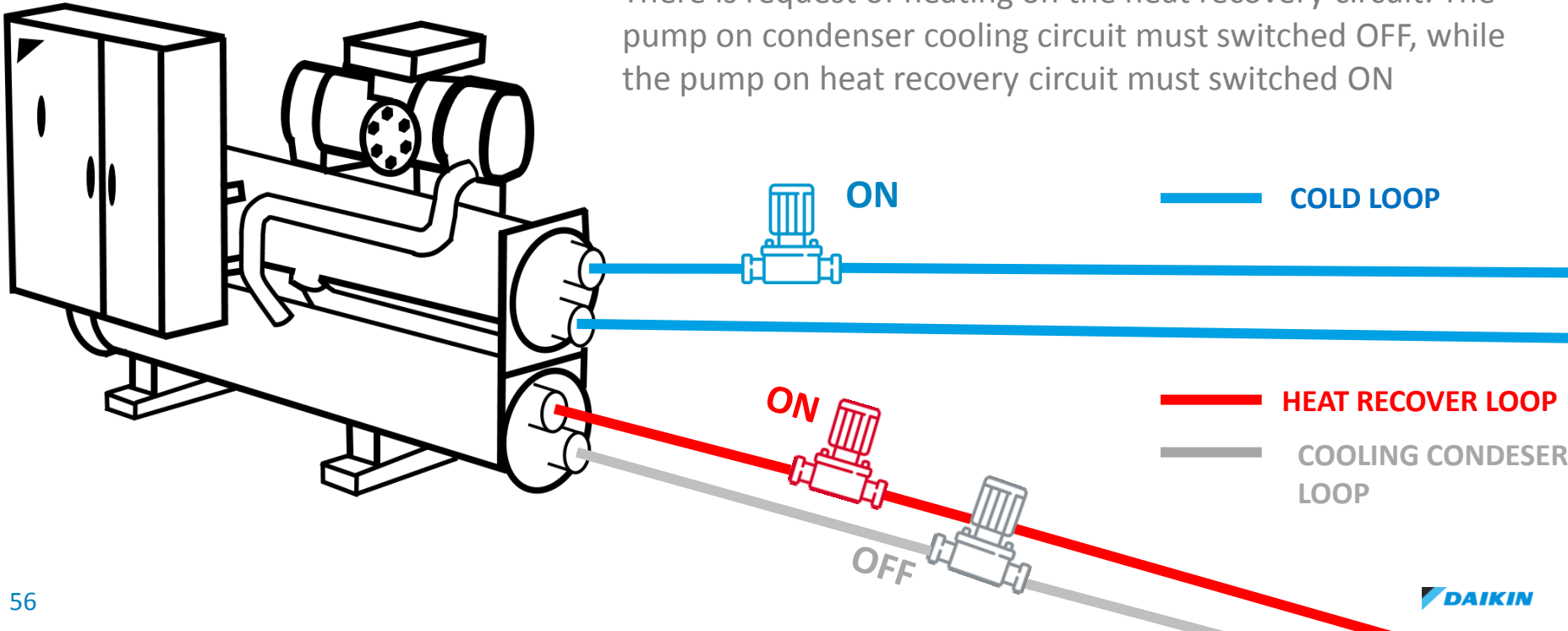


EWWD/H ~VZ – COOLING ONLY CHILLER

Features & Benefits Total Heat Recovery

HEAT RECOVERY ON

There is request of heating on the heat recovery circuit. The pump on condenser cooling circuit must switched OFF, while the pump on heat recovery circuit must switched ON

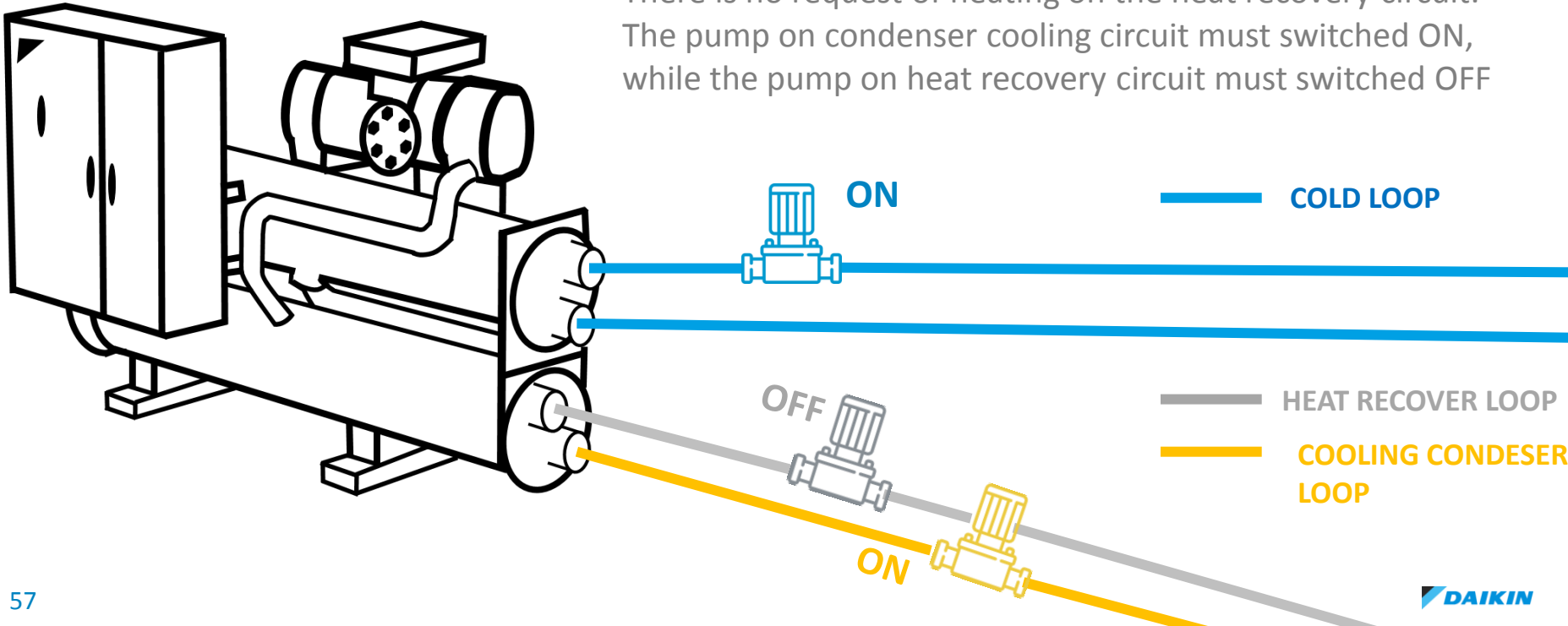


EWWD/H ~VZ – COOLING ONLY CHILLER

Features & Benefits Total Heat Recovery

HEAT RECOVERY OFF

There is no request of heating on the heat recovery circuit. The pump on condenser cooling circuit must be switched ON, while the pump on heat recovery circuit must be switched OFF.



EWHD~DZ – COOLING ONLY CHILLER – R1234ze



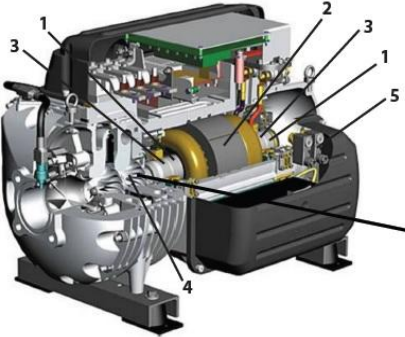
Features & Benefits

- ✓ Capacity range **from 227 to 1415 kW***
- ✓ Single circuit
- ✓ Available up to three compressors sizes
- ✓ Heat Pump version available
- ✓ Hot Gas By Pass (HGBP)

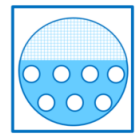


➤ Application

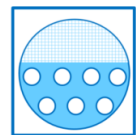
- Dry coolers version -> CLWT 40/45°C (up to 45/50°C)
- Cooling tower version-> CLWT 30/35°C (up to 35/40°C)



1. Magnetic Bearings and Bearing Sensors
2. Permanent Magnet Synchronous Motor
3. Backup Bearings
4. Shaft and Impellers
5. Compressor Cooling



FLOODED SHELL & TUBE CONDENSER



FLOODED SHELL & TUBE EVAPORATORE

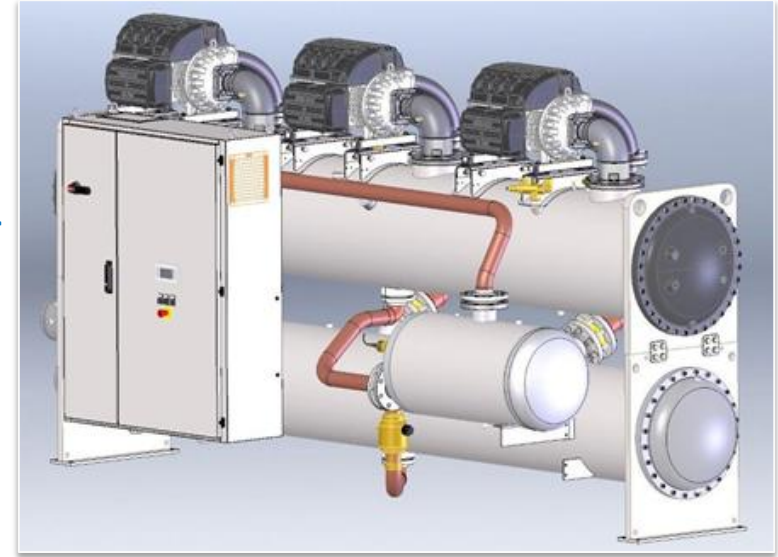


- * conditions:
- CWT in/out = 30/35°C
 - EWT in/out= 12/7°C



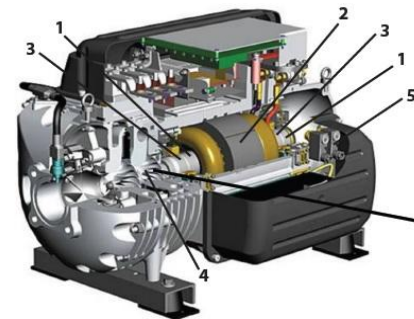
TURBOCOR RANGE – HIGHLIGHTS EWWD/EWWH-DZ - R134A & R1234ZE(E)

- ✓ **Two refrigerant version**
 - EWWD/DZ - R134a
 - EWWH/DZ - R1234ze(E)
- ✓ **Magnetic Bearing Oil Free Centrifugal Double Stage Compressor**

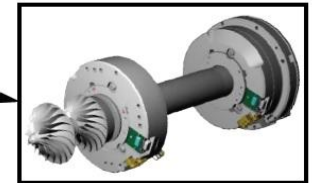


NEW

- ✓ **Extended Cooling Capacity with 3 compressors unit**
- ✓ **Single refrigerant circuit**
- ✓ **Cooling Tower and Dry Cooler applications**
- ✓ **High efficiency Flooded Heat Exchangers**
- ✓ **Compact footprint (width) through stacked heat exchangers**
- ✓ **Price competitiveness**
- ✓ **Eurovent and AHRI Certification**
- ✓ **Extensive option list**
- ✓ **Heat Pump and Hot Gas Bypass options for all the models**



1. Magnetic Bearings and Bearing Sensors
2. Permanent Magnet Synchronous Motor
3. Backup Bearings
4. Shaft and Impellers
5. Compressor Cooling



TURBOCOR RANGE – HIGHLIGHTS EWWD/EWWH-DZ - R134A & R1234ZE(E)



Two refrigerant options available

R134a → GWP = 1430

R1234ze(E) → GWP = 7

Very Low GWP

HFC

HFO

227

320

1415

2173

Cooling capacity kW



TURBOCOR RANGE – HIGHLIGHTS EWWD/EWWH-DZ - R134A & R1234ZE(E)

NEW



- HFC 1038 - 2173 KW
- HFO 741- 1415 KW

TRIPLE



- HFC 610 - 1478 KW
- HFO 426 - 942 KW

DUAL



- HFC 320 – 742 KW
- HFO 227 - 473 KW

MONO

Features & Benefits

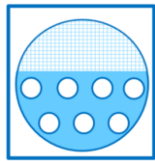
- ✓ TOP FULL LOAD AND PART LOAD EFFICIENCY
- ✓ Compliant to ECODESIGN TIER 2 of LOT 21

High Efficiency

avg. EER = 5.3*
avg. SEER = 8.9**
Max EER = 5.97
Max SEER = 9.37



INDOOR
INSTALLATION



SHELL & TUBES
EVAPORATOR and CONDENSER



CENTRIFUGAL OIL
FREE COMPRESSOR



BEST AVAILABLE
TECHNOLOGY
IN ECO-DESIGN




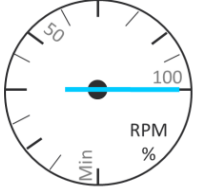
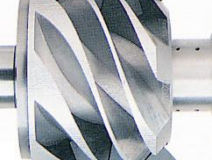
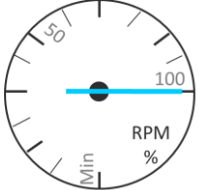
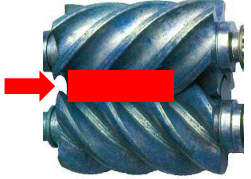
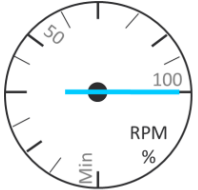

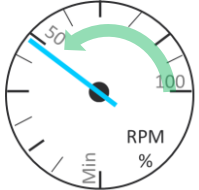
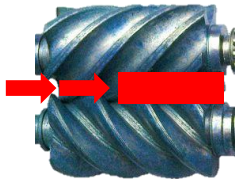
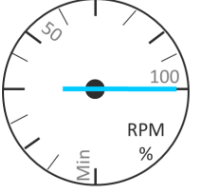

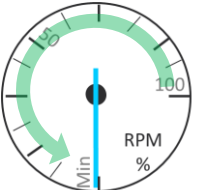
* Nominal condition A35/W12-7
** According to EN 14825



DISTINCTIVE FEATURES

WHY INVERTER TECHNOLOGY?

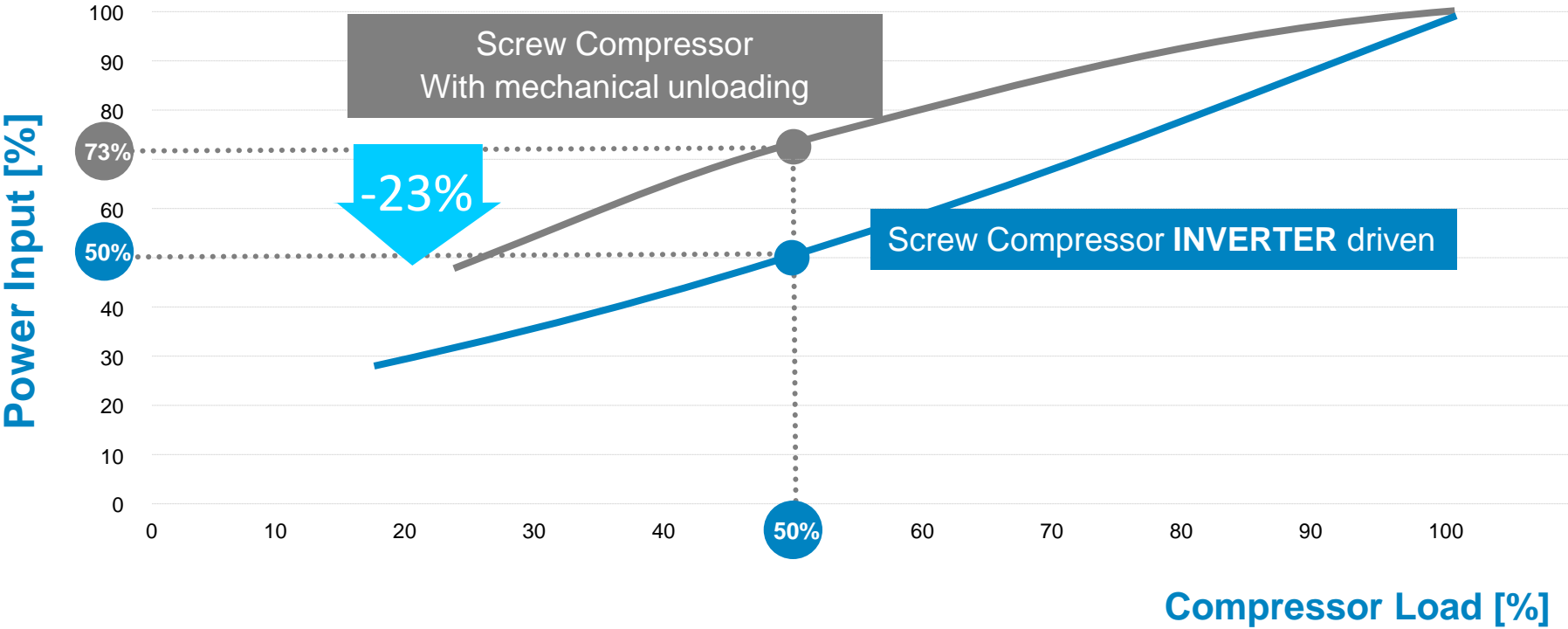
DAIKIN – WHY INVERTER TECHNOLOGY ?

Compressor load	Traditional mechanical Unloading with sliding valves		Daikin unloading with inverter technology	
100% load			100% speed	 
50% load			100% speed + <u>mechanical unloading</u>	 
25% load			100% speed + <u>mechanical unloading</u>	 

During chiller's part load operation the flow rate of refrigerant in the circuit needs to be reduced. To do that, the slide valve creates a bypass of refrigerant. Meaning that compressor starts to compress refrigerant that won't give useful effect

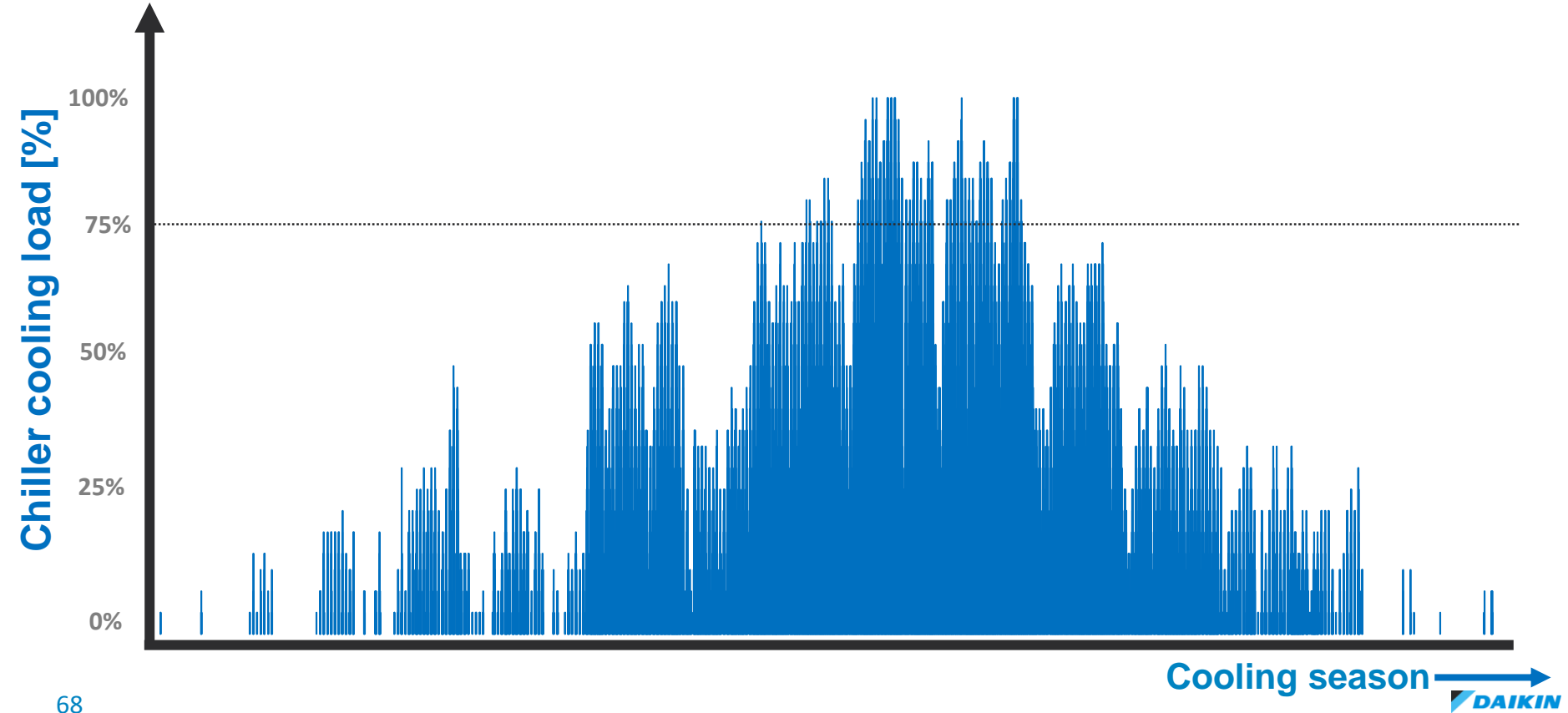
In case of compressor driven by inverter the compressor reduce the rotational speed and so the flow rate of refrigerant. There is no bypass and so no compression of refrigerant that won't give useful effect.

DAIKIN – WHY INVERTER TECHNOLOGY ?



DAIKIN – WHY INVERTER TECHNOLOGY ?

Most of the time the chiller operates in part load. So, to reduce the plant running costs high part load efficiency is key. Daikin inverter technology is the right solution to achieve best part load performances



DAIKIN – WHY INVERTER TECHNOLOGY ?

entered in to force on January 2018 (ECODESIGN Regulation 2281/2016) awards part load efficiency setting minimum efficiency requirements not on full load efficiency but on part load efficiency introducing the: **SEER** (Seasonal Efficiency Energy Ratio)

20.12.2016 EN Official Journal of the European Union L 346/1

II
(Non-legislative acts)

REGULATIONS

COMMISSION REGULATION (EU) 2016/2281
of 30 November 2016
implementing Directive 2009/125/EC of the European Parliament and of the Council establishing a framework for the setting of ecodesign requirements for energy-related products, with regard to ecodesign requirements for air heating products, cooling products, high temperature process chillers and fan coil units

(Text with EEA relevance)

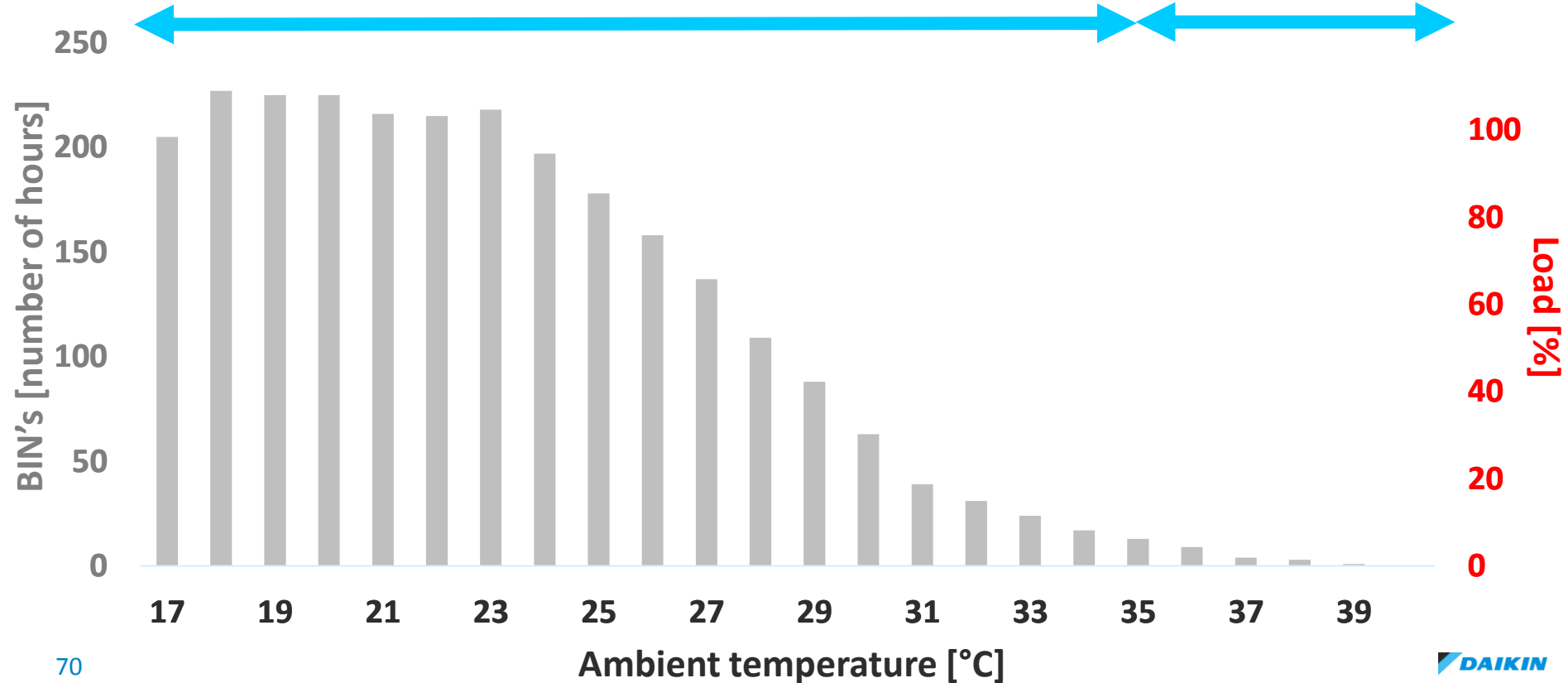
DAIKIN – WHY INVERTER TECHNOLOGY ?

SEER is calculated over 2600 hours of chiller operation over the year.

Only 30 hours are considered as full load operation

Full load 99% of the time

Full load 1% of the time



DAIKIN – WHY INVERTER TECHNOLOGY ?

Starting from January 2018 only chillers compliant with minimum SEER requirements can be on the market

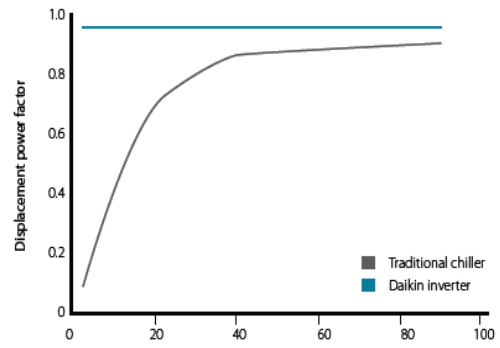
		TIER 1 (1st Jan 2018)		TIER 2 (1st Jan 2021)	
Chiller type	Capacity (kW)	η_s (%)	SEER	η_s (%)	SEER
Air Cooled	<400	149	3,80	161	4,10
Air Cooled	\geq 400	161	4,10	179	4,55
Water Cooled	<400	196	5,10	200	5,20
Water Cooled	\geq 400 and < 1500	227	5,88	252	6,50
Water Cooled	\geq 1500 and <2000	245	6,33	272	7,00

DAIKIN – WHY INVERTER TECHNOLOGY ?

Other benefits deriving from inverter technology....

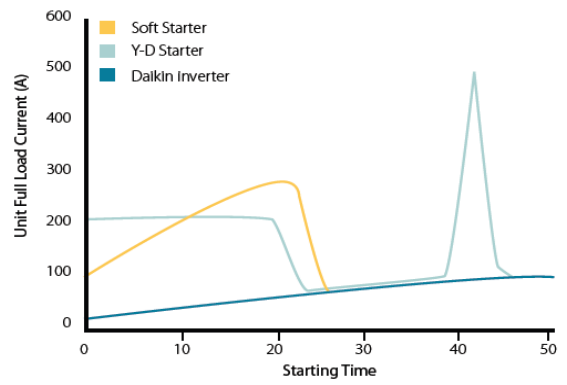


Reduced mechanical stress

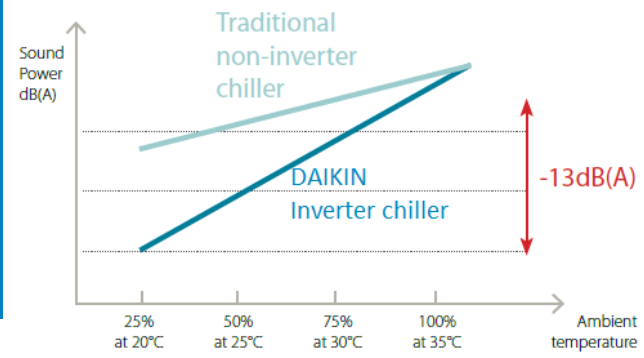


High power factor

No inrush current



Lower noise level at part loads



Daikin solutions for high efficiency

Latest generation Daikin design inverter screw compressors with Variable Volume Ratio technology

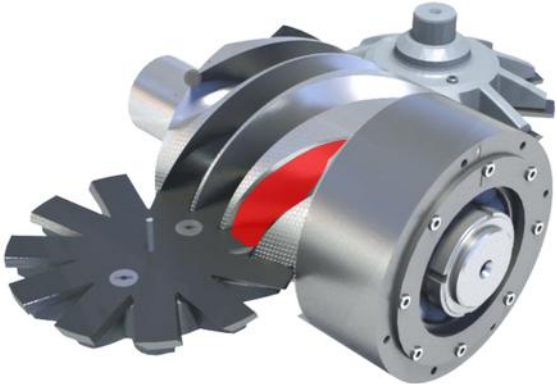


+ **INVERTER** + VVR

Daikin's unique single screw design
for perfectly balanced loads combined
with inverter technology
And VVR (Variable Volume Ratio)



V_{Suction}



$V_{\text{Discharge}}$

Volume Ratio =



$$\text{Volume Ratio}^k = \frac{P_{\text{Discharge}} \cong P_{\text{Condensing}}}{P_{\text{Suction}}}$$

With $k = c_p/c_v$ specific heat ratio

DAIKIN – Variable Volume Ratio Technology

IDEAL CASE

$$P_{\text{Discharge}} \cong P_{\text{Condensing}}$$

REAL CASE

fixed VR \leftarrow $P_{\text{Discharge}} \neq P_{\text{Condensing}}$ \rightarrow variable

DAIKIN – Variable Volume Ratio Technology



$$P_{Discharge} < P_{Condensing}$$

Refrigerant flows back from condenser to compressor

Under compression

$$P_{Discharge} > P_{Condensing}$$

Refrigerant is compressed more than needed to move it to condenser

Over compression



Efficiency loss

DAIKIN – Technical arguments: the VVR

fixed VR REAL CASE variable

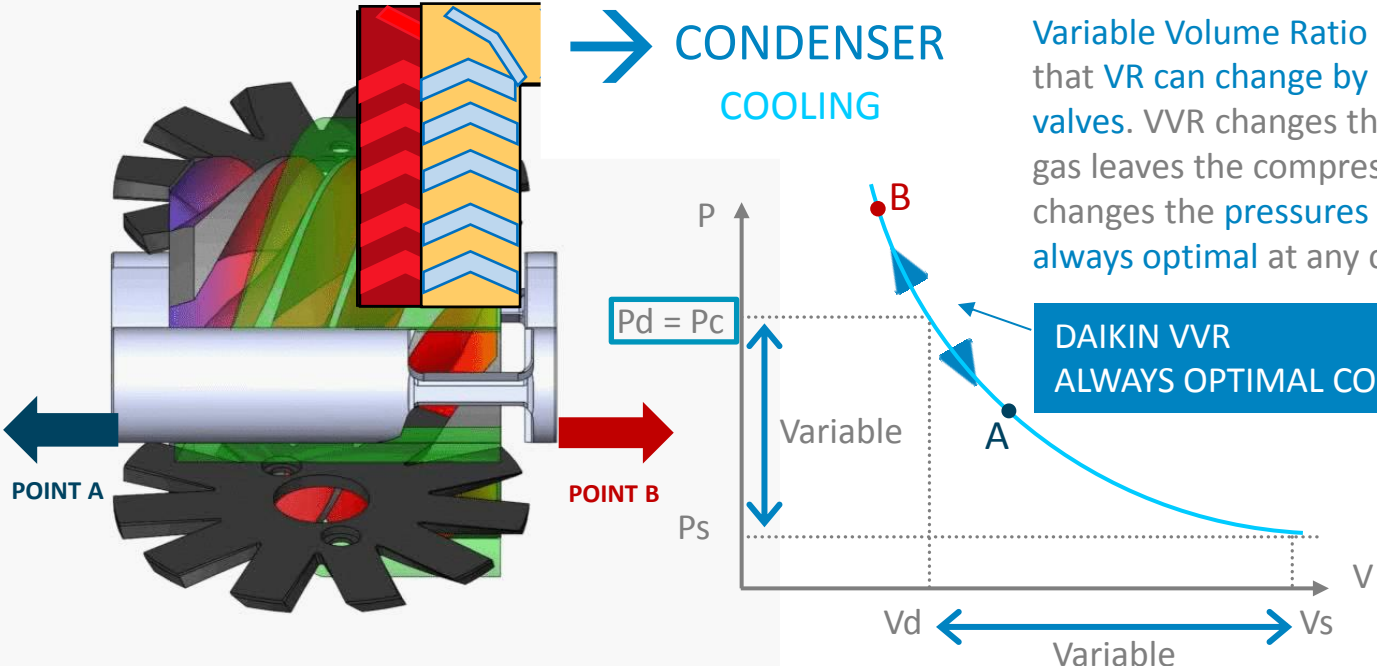
$$P_{\text{Discharge}} \neq P_{\text{Condensing}}$$

What is Daikin solution to overcome this issue?

variable VR DAIKIN Solution variable

$$P_{\text{Discharge}} \cong P_{\text{Condensing}}$$

DAIKIN – Technical arguments: the VVR



Variable Volume Ratio (VVR) means that VR can change by moving of sliding valves. VVR changes the point at which the gas leaves the compressor, and therefore changes the pressures at discharge which is always optimal at any condition.

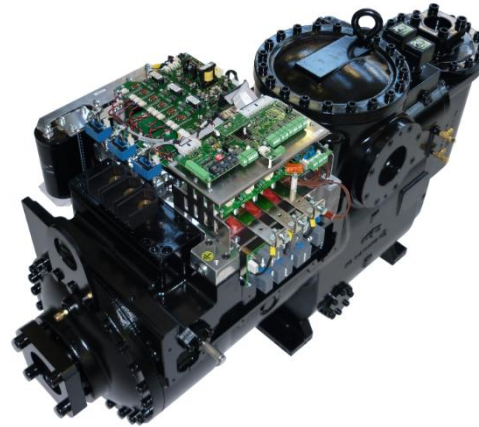
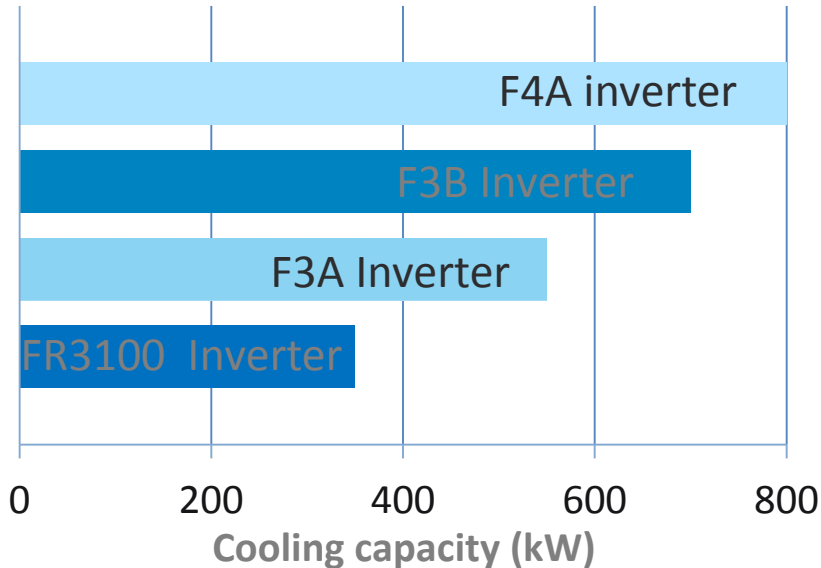
DAIKIN VVR ALWAYS OPTIMAL CONDITIONS

DAIKIN APPLIED BUSINESS in EMEA

Leadership in Product Development

Ownership of base technology components

Design and manufacturing of **SCREW** compressors:



First in the Market
with
Integrated inverter
refrigerant cooled.
and
Variable Volume
Ratio technology



DAIKIN APPLIED BUSINESS in EMEA

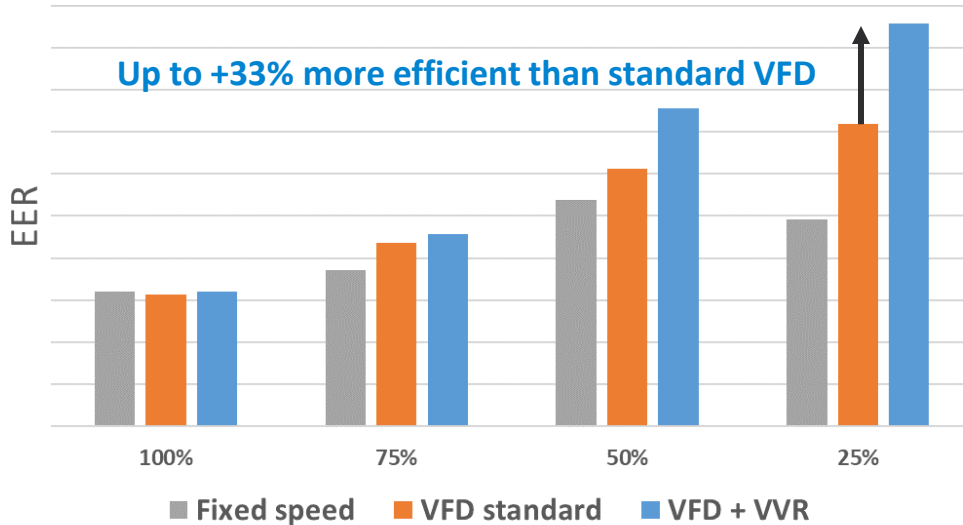
Leadership in Product Development

Ownership of base technology components

Design and manufacturing of **SCREW** compressors:



Efficiency comparison on part load profile (ESEER)



FR3100 Inverter

Daikin Applied Europe – Cecchina Factory → First Expansion Concluded

WCT series - The largest package chiller in the world (fully factory assembled and tested)



District Cooling application: **KHALIFA INTERNATIONAL STADIUM** (Doha, Qatar)

DAIKIN APPLIED BUSINESS in EMEA Leadership in Product Development 2013 – WCT series



AHRI CERTIFIED®



Largest package chiller in the world

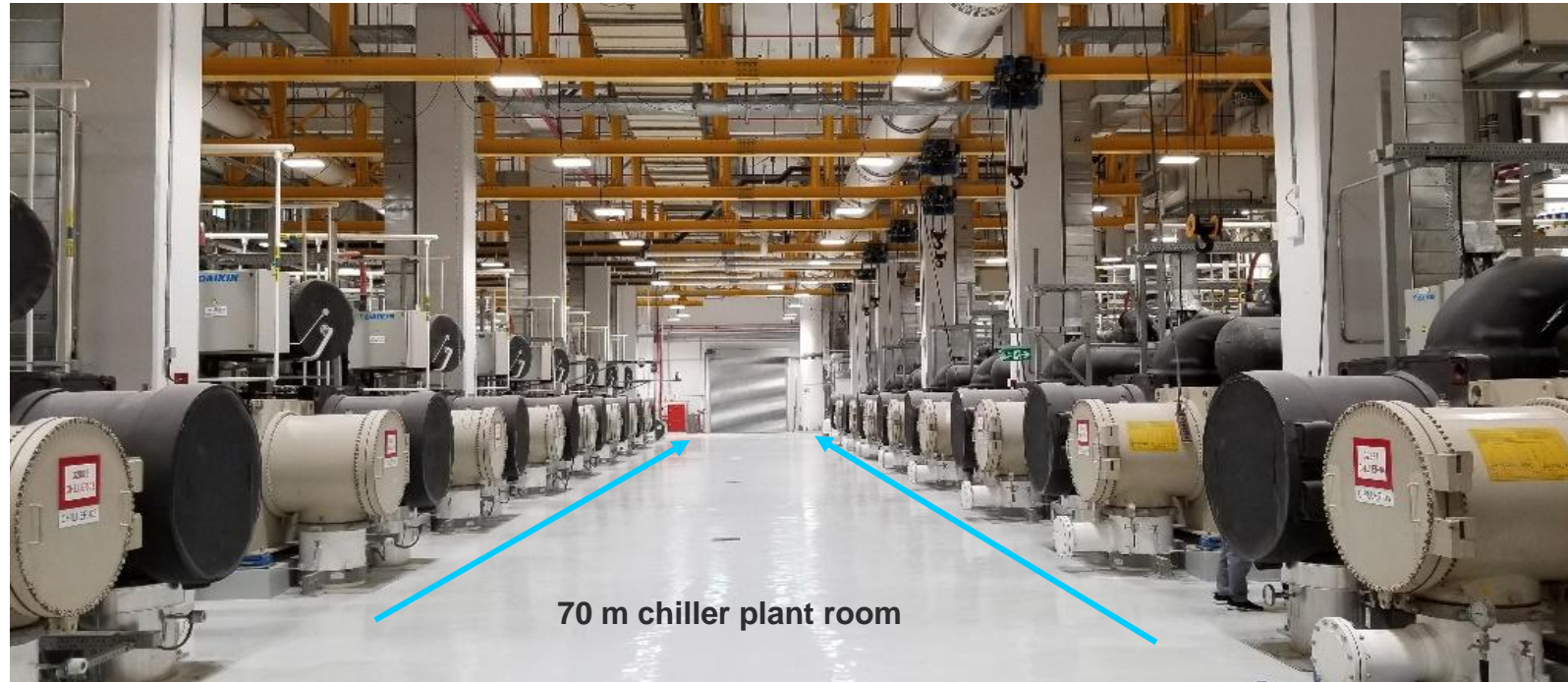
21.800 kW (6.200TR) cooling capacity (in series counter-flow)

COP up to **7,1 kW/kW** or **0,49kW/TR** (AHRI conditions)

High lift capabilities (for middle east operation)

WCT CHILLER PLANT – KHALIFA STADIUM

Khalifa Stadium for 2019 IAAF World Athletics Championships and 2022 FIFA World Cup™



Daikin has supplied the chillers for providing **comfort cooling** to the stadium and site's facilities

9 pairs of WCT **premium efficiency** centrifugal chillers, arranged in series-counterflow, resulting in total 18 **chillers** and

183,5 megawatt of cooling capacity.



AIR SIDE PRODUCT OVERVIEW

DAIKIN APPLIED BUSINESS in EMEA

Product Range



Standard sizes or customizable configurations

Complete line up of **Air Handling Units** with standard sizes or customizable configurations covering from **500 to 144,000 m³/h**



EC Fans



Eurovent certification



Rounded Profiles

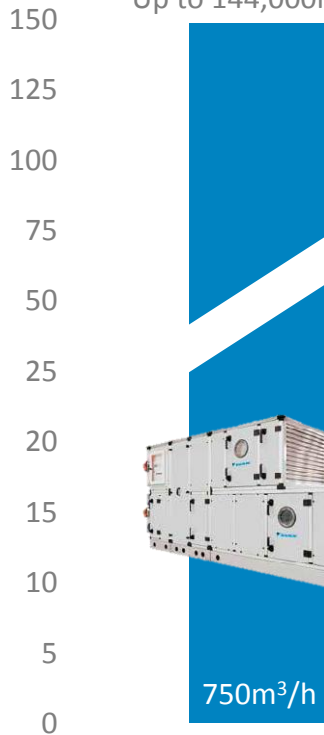


Plug & Play VRV

DAIKIN AHU - VENTILATION PORTFOLIO

Professional

Up to 144,000m³/h



750m³/h



Modular R

Up to 25,000m³/h



500m³/h



Modular P

Up to 15,000m³/h



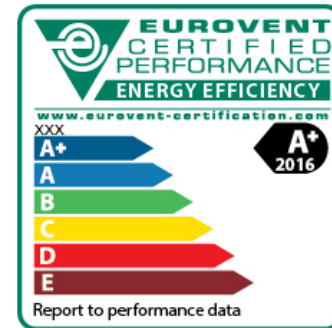
500m³/h



Modular L

Up to 3,450m³/h

150m³/h



VENTILATION SYSTEM

Centralized ventilation

Modular R



Modular P



Professional



Decentralized ventilation

Modular L



NEW

DAIKIN APPLIED BUSINESS in EMEA

Product Range

Inverter
Technology
BLDC Inverter Option

Complete line up of
Fan Coil Units for any kind
of applications



Eurovent Certification



Floor Standing



Ducted



Wall Mounted



Cassettes