



超低GWP制冷剂在冷水机组的应用

霍尼韦尔氟产品部

Honeywell

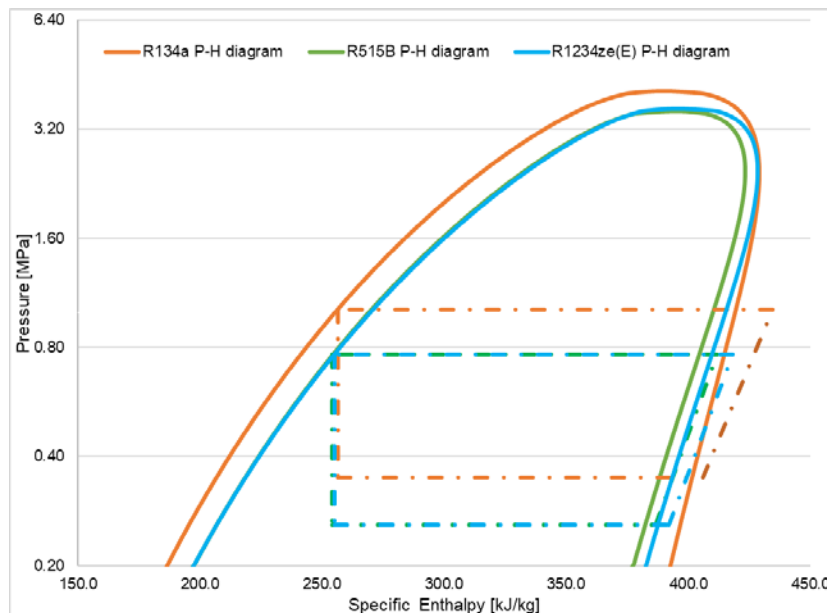
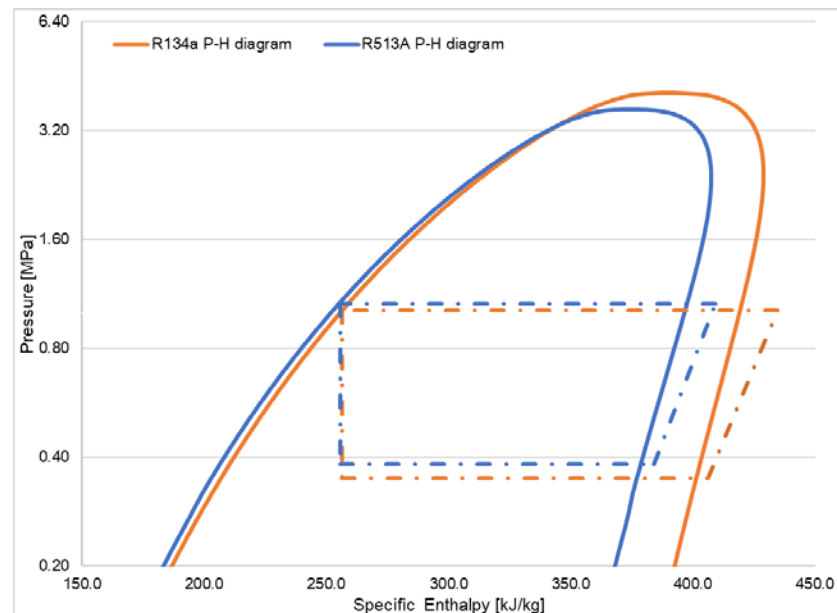
April 7th, 2021

超低GWP 替代方案

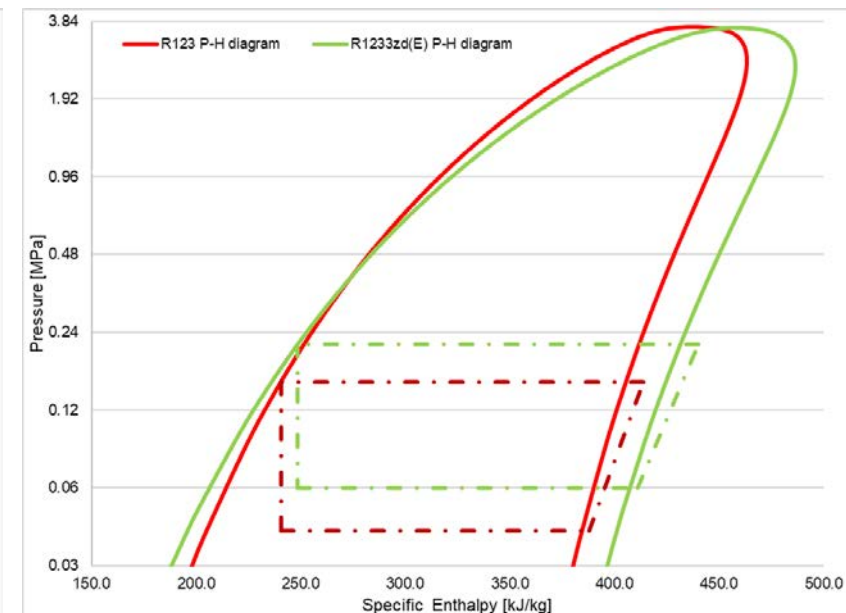
Current Products 现有制冷剂	Non-flammable 不可燃 (ASHRAE A1)	Mildly-flammable 微可燃 (ASHRAE A2L)	Applications 应用
HFC-134a GWP=1300	Solstice® N13(R-513A) GWP=573 Solstice® N15(R-515B) GWP=299	Solstice® yf (R-1234yf) GWP<1 Solstice® ze (R-1234ze) GWP<1	Screw/Centrifugal /Scroll Chillers 螺杆/离心/涡旋冷水机组
HCFC-123 ODP=0.02 GWP = 79 HFC-R245fa ODP=0 GWP = 858	Solstice® zd (R-1233zd) GWP=1	-	Centrifugal Chiller 离心冷水机组

Note: All GWP values from the IPCC, "AR5"

Medium Pressure Refrigerant P-h Diagram with Cycle



Low Pressure Refrigerant P-h Diagram with Cycle



工况：蒸发温度 = 5C; 过热度 = 5C; 冷凝温度 = 40; 压缩机等熵效率 = 0.8

螺杆/离心冷水机组工况下的替代工质性能评估

Solstice® ze (R1234ze)

- 能效与R134a相当
- ASHRAE安全等级A2L
- GWP下降 99.9%

Solstice® N15 (R515B)

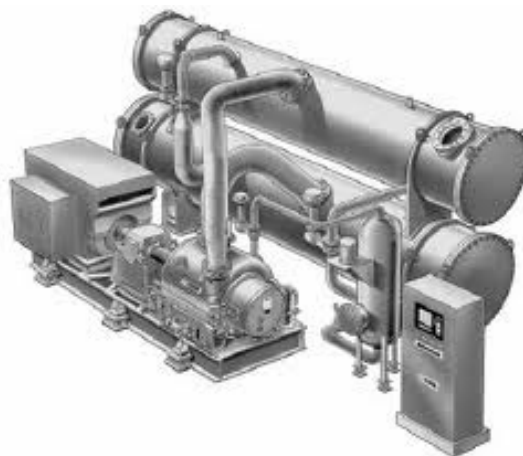
- ASHRAE安全等级A1，不可燃
- 与R134a相当的能效
- GWP下降约 ~77%

Solstice® N13 (R513A)

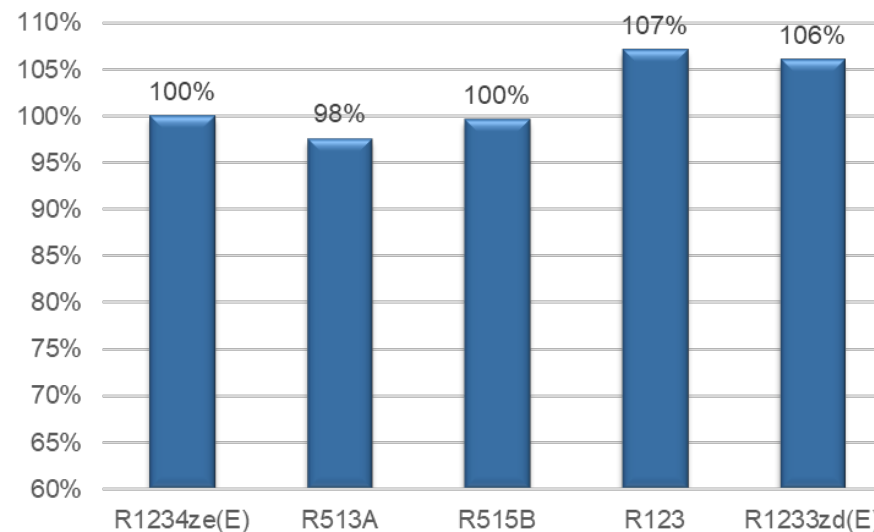
- 能效与R134a相当，更适用于改造
- ASHRAE安全等级A1，不可燃
- GWP下降约 ~56%

Solstice® zd (R1233zd)

- 能效与R123相当
- 最优的低压替代工质
- ASHRAE安全等级A1，不可燃
- GWP降低 99.9%



以R134a为基准的能效对比



工况：蒸发温度 = 5C; 过热度 = 5C; 冷凝温度 = 40; 压缩机等熵效率 = 0.8

Solstice®低GWP值制冷剂满足各种冷水机组的性能和环保要求

应用案例 – TRANE

Trane first with 1233zd chiller

30 JUN 2014

FRANCE: A new non-flammable, low GWP refrigerant HFO1233zd(E) is being used for the first time in a new Trane chiller.

The Series E CenTraVac water-cooled centrifugal chiller is one of five new chillers launched by Trane and is the first chiller in the world to use the new HFO developed as an alternative to R123.








A single component refrigerant, 1233zd(E) is described as both low toxicity and non-flammable. It was originally developed for use as a blowing agent but has also been found to be a high efficiency alternative to R123. It has been submitted for ASHRAE designation and classification and is expected to be classified as A1. Its GWP is low, listed under the F-gas regulations as 4.5 but variously described as 6, by UNEP, or 1, by Honeywell.

The Series E CenTraVac is available in capacities from 2,600kW to 14,000kW. It is said to be up to 10% more energy efficient than the next best chiller available in this tonnage, delivering industry-leading efficiencies at both part-load and full-load capacity. It allows for heat pump, heat recovery and free-cooling applications resulting in increased sustainability. Additionally, the unit offers an “ice making” feature for ice-enhanced cooling during peak demand.

<https://www.coolingpost.com/world-news>



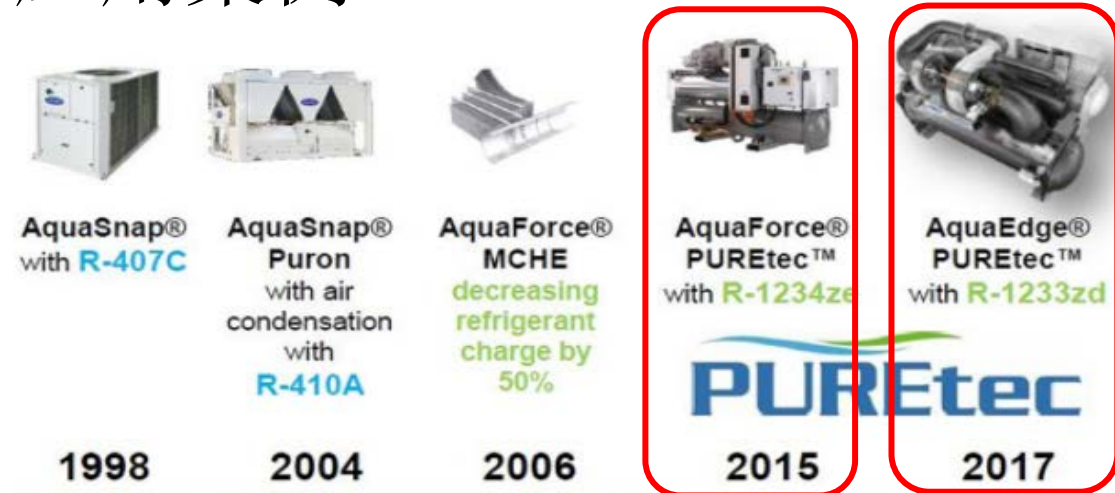
CenTraVac Chiller

Capacity (Tons):		500	1000	1500	2000	2500	3000	3500	4000		
60 Hz	Model CVHS	 180-390 tons (650-1350 kW)									One Refrigerant Circuit
	Model CVHE	 120-500 tons (450-1750 kW)									
	Model CVHF			 325-2000 tons (1150-7000 kW)							
	Model CVHL			 400-1800 tons (1400-6300 kW)							
	R1233zd(E)	Model CVHH			 900-2000+ tons (3150-7000+ kW)						
	1400-3950 tons (5000-13900 kW)				Model CDHF						Two Refrigerant Circuits
1800-4000+ tons (6300-14000+ kW)				R1233zd(E) Model CDHH							

https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/equipment/chillers/water-cooled/CTV-PRC007R-EN_03142020.PDF

Solstice®zd (R-1233zd)优良的性能广泛应用于特灵低压冷水机组

应用案例 – CARRIER



AQUAFORCE®

30XW-VZE

Cooling Capacity Range (kW):
448~1243

Heating Capacity Range(KW):
524~1485

Type: water-cooled high efficiency variable-speed screw liquid chiller/heat pump

Refrigerant: R1234ze(E)

AQUAFORCE®

30XW-PZE

Cooling Capacity Range (kW):
269~1110

Heating Capacity Range(KW):
319~1296

Type: Water-cooled screw liquid chiller/heat pump

Refrigerant: R1234ze(E)

AQUAFORCE®

30XA-Ze/XAV-Ze

Cooling Capacity Range (kW):
440~1071

Type: Air-cooled screw liquid chiller

Refrigerant: R1234ze(E)

AquaEdge® Water-Cooled Centrifugal Chiller 19DV

Compressor Type: Centrifugal

Refrigerant: R-1233 zd(E)

Capacity Range (Tons): 350 - 800

Capacity Range (kW): 1,231 - 2,814

<https://www.carrier.com/commercial/en/us/products/chillers-components/water-cooled-chillers/>



<https://www.carrier.com/commercial/en/au/products/commercial-products/chillers/>

Solstice®zd (R-1233zd)优良的性能广泛应用于开利离心和螺杆冷水机组

CARRIER FUNAN CASE SGP

FUNAN

New Non-Residential Building



GREEN MARK AWARD FOR BUILDINGS | GOLD^{PLUS}



Client/Developer	CapitaLand Mall Trust
Project Manager	CapitaLand Retail Project Management Private Limited
Architect	RSP Architects Planners & Engineers (Pte) Ltd
M&E Engineer	Alpha Consulting Engineers Pte Ltd
Structural Engineer	RSP Architects Planners & Engineers (Pte) Ltd
Quantity Surveyor	Arcadis Singapore Pte Ltd
Main Contractor	Woh Hup - Obayashi Joint Venture (Funan)
Landscape Consultant	Grant Associates
ESD Consultant	Building System & Diagnostics Pte Ltd

- Estimated energy savings: 6,447,787kWh/yr; Estimated water savings: 12,775m³, RETV: 41.84W/m²
- Use of Next-Gen refrigerant (R1233zd) to achieve state of art plant efficiency of 0.549 kW/RT (First to be used in retail mall).
- Use of EC/DC Fan Coil Units for all the retail shops, office & SR to improve air-side efficiency
- Green Lease will be implemented to ensure tenant's involvement in achieving the energy savings committed during operation stage
- Rainwater harvesting to irrigate extensive greenery at roof top garden & urban farming
- Promote green transport by introducing a underground linkway connecting to City Hall MRT, fast charge EV charging stations and electrical bike charging stations

开利应用霍尼韦尔Solstice®zd在新加坡FUNAN数字商场 – 建筑能效0.549kW/ RT

应用案例 - JCI-YORK

New chiller delivers up to 35 percent annual energy savings, reduced maintenance costs and widest operating envelope in industry

MILWAUKEE – (Jan. 3, 2018) – Johnson Controls introduces the YORK® YZ Magnetic Bearing Centrifugal Chiller, the first chiller fully optimized for ultimate performance with a next generation low-global warming potential (GWP) refrigerant—R-1233zd(E). Chosen for its efficiency, safety, availability, low environmental impact and cost, nonflammable R-1233zd(E) has an ultra-low GWP of 1 and is readily available from refrigerant manufacturers.

"With the new YORK® YZ, we have engineered the world's most efficient low-GWP line of centrifugal chillers."

-- Laura Wand, vice president, Chiller Solutions, Building Technologies & Solutions at Johnson Controls

<https://www.coolingpost.com/world-news>

YZ Magnetic Bearing Centrifugal Chiller

150-2,020 TR (530-7,104 kW)

The YORK® YZ challenges conventional, water-cooled chiller design deliver superior performance, lower cost of ownership and a new definition of sustainability.

- Innovative design with magnetic-bearing driveline
- Variable-speed drive centrifugal compressor
- Low global warming potential (GWP) refrigerant R-1233zd(E)
- With variable-speed drive, a variable-geometry diffuser and magnetic-bearing technology YORK® YZ deliver up to 35% annual energy savings versus traditional fixed-speed, oil-bearing chillers
- Robust and reliable high-speed, hermetic induction motor reduces maintenance
- This low-pressure chiller has been fully optimized around R-1233zd(E), which has a GWP of 1 and an A1 ASHRAE safety classification

<https://www.york.com/commercial-equipment/chilled-water-systems/water-cooled-chillers>

Titan™ OM Custom Design Centrifugal Chiller

3,000-5,500 TR (10,550-19,350 kW)

The YORK® Titan™ OM Custom Design Centrifugal Chiller features extraordinary capacity, exceptional flexibility and unsurpassed reliability.

- Zero-ODP, R-134a or R-513A refrigerant
- Precise, chilled water temperature to 0.1°F
- Available in electric drive or steam drive for water- or air-cooled condensing



Model YMC² Magnetic Bearing Centrifugal Liquid Chillers

165-1000 Tons, 580-3520 kW, 50 and 60 Hz, R-134a or R-513A

Model YK Style H Centrifugal Liquid Chillers

250 ton to 3,000 ton, 5,274 kW to 10,500 kW, with R-134a or R-513A Refrigerant

York screw chiller designed for R1234ze

8 MAR 2020

EUROPE: Johnson Controls has launched a version of its York YVWH water-cooled, variable speed screw chiller to operate on the low GWP refrigerant R1234ze(E).

The YVWH chiller offers a cooling range of 313kW to 1,228kW, ideal for air conditioning, whether for user comfort or for industrial processes in data centres and other industrial applications.

Johnson Controls first launched the YORK YVWH screw chiller in 2017 to run on R134a. The new version has been redesigned to allow the use of the low GWP HFO refrigerant, while meeting all applicable industrial and safety standards.

<https://www.coolingpost.com/products/york-screw-chiller-designed-for-r1234ze/>

[Turbo Refrigerator Representative Company] Johnson Controls

2019-09-08

No. 1 market share in North America and China

R1233zd-A1 grade YZ refrigerator achieved NPLV 12

Johnson Controls owns the world's leading refrigeration and air conditioning brand YORK® refrigerators with a manufacturing history of 145 years. Turbo chillers, the flagship product of the YORK® brand, are ranked No. 1 in the North American and Chinese markets, which are the largest in the world.

A variety of commercial buildings such as universities, hospitals, and office buildings have adopted and used YORK® turbo coolers, and many industrial sites including semiconductors, pharmaceuticals, and data centers are also adopting YORK® turbo coolers with high reliability.

In recognition of such technology, the Johnson Controls YK turbo chiller is being installed in Korea's largest semiconductor plant under construction this year. A total of 36 units will be delivered by the end of this year, and it is expected to be able to innovatively reduce operating costs by including many YK-EP high-efficiency turbo chillers for the first time in Korea.

<http://www.kharn.kr/mobile/article.html?no=10585>

JCI AU MARYBOROUGH HOSPITAL CASE - 17 APRIL 2019



Maryborough Hospital in Queensland, originally built over 130 years ago, is the first Australian facility to install Johnson Controls state-of-the-art YORK YZ Chillers.

The hospital's existing chillers had reached the end of their working life and needed to be removed and replaced with new equipment that was engineered to meet the very specific needs of the hospital environment, which functions 24/7.

In a first for the Australian market, three YORK® YZ 850kW R-1233zd Magnetic Bearing Centrifugal Chillers..... fully optimized for ultimate performance with a next generation low-global warming potential (GWP) refrigerant, R-1233zd(E), chosen for its efficiency, safety, low environmental impact and cost, the non-flammable R-1233zd(E) has an ultra-low GWP of one.

使用Solstice®zd 的YORK® YZ 与一般定频水机相比可以降低年耗电平均高达35%

应用案例 - JCI-HITACHI

HITACHI

HFC-134a採用 Will be replaced to R1234ze by 2021Q4 or 2022Q1.

日立高効率ターボ冷凍機

インバータ制御ギヤレス ItD-SGシリーズ 1,407~3,516kW (400~1,000USRT)
インバータ制御・固定速 SGシリーズ 527~7,033kW (150~2,000USRT)

**インバータ制御ギヤレスターボ冷凍機
ItD-SGシリーズ**

**固定速ターボ冷凍機
SGシリーズ**

应用案例 - MITSUBISHI HEAVY INDUSTRY

MHI Develops "ETI-Z Series" of Next-generation Centrifugal Chillers -- Adopt New Non-ozone-depleting Refrigerant to Minimize Greenhouse Gas Emissions --



2015-06-10 No.1900






Tokyo, June 10, 2015 - Mitsubishi Heavy Industries, Ltd. (MHI) has developed a new series of centrifugal chillers, dubbed the "ETI-Z Series," adopting a new refrigerant **HFO-1233zd(E)** that offers outstanding environmental compatibility. The various models in the new series will be progressively launched starting this September. The ETI-Z series marks the world's first small-size centrifugal chillers to adopt the new refrigerant.

<https://www.mhi.com/news/1506101900.html>

Drive	Series	Refrigerant	Capacity (RT) *3										
				100	200	300	400	500	600	700	800	900	1000
Variable (Built-in Inverter)	ETI-Z New	Low GWP Refrigerant HFO-1233zd (E)	150-700RT 527~2,461kW										
	ETI	HFC-134a	150-700RT										

http://www.mhi-mth.co.jp/en/products/detail/centrifugal_chiller_web_catalog.html

MHI Thermal Systems Develops "GART-ZE/ZEI" Series as Next-Generation Large-Capacity Centrifugal Chillers Adopting Low-GWP Refrigerant -- Achieving First Full Range of Refrigeration Capacities in Japan --

2017-02-16 No.2051






Tokyo, February 16, 2017 - Mitsubishi Heavy Industries Thermal Systems, Ltd., a Group company of Mitsubishi Heavy Industries, Ltd. (MHI), has developed new series of next-generation centrifugal chillers adopting the **HFO-1234ze(E)** refrigerant with extremely low environmental impact: zero ozone depletion and a global warming potential (GWP)¹ below 1. The new "GART-ZE" (constant speed) and "GART-ZEI" (inverter) series, which feature **capacities range from 300 to 5,000** refrigeration tons (RT)², will be launched into the market in April. With the current available "ETI-Z" series of low-GWP small-capacity models, MHI Thermal Systems will become the first Japanese manufacturer to offer a full lineup of low-GWP refrigerant models in variations spanning from 150 to 5,000 RT. <https://www.mhi.com/news/1702162051.html>

Low GWP Refrigerant

HFO-1234ze(E)

Next generation centrifugal chiller

GART-

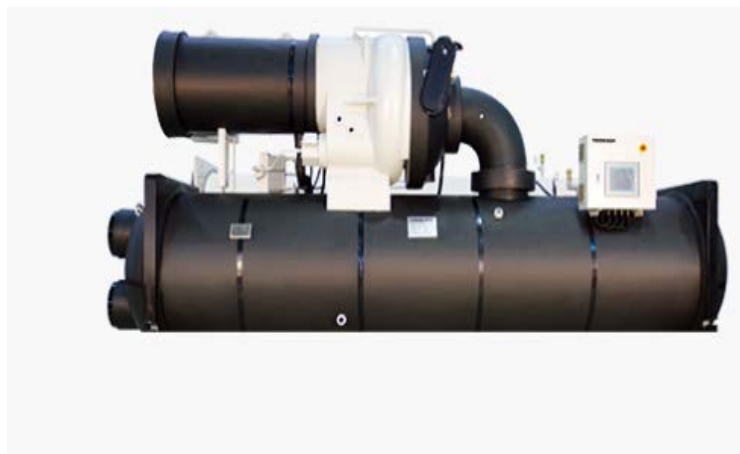
Constant speed

Variable speed

ZE&ZEI series

1371kW (390kW) ~ 17581kW (5000RT)

应用案例 – DUNHAM-BUSH



DCLCDX 双级压缩离心式冷水(热泵)机组

制冷量: 300-3000 RT 1055~10550kW

制热量: 300-2500 RT

产品可广泛适用于能源站、数据中心、综合商超、工业项目等领域

- 采用 R1234ZE、R513a HFC-134a 制冷剂; 通过国内节能认证及国际 AHRI 认证; 可用于国际权威 LEED 认证

<http://www.dunham-bush.cn/product/watl.jsp>



DCLCDT 双级双机头离心式冷水机组

蓄冰量: 200-1700 RT 703~5978kW

产品可广泛适用于各类大型公共建筑、酒店、学校、运动场馆、工厂等场所

01 节能环保

- 采用 R1234ZE、R513a HFC-134a 制冷剂; 通过国内节能认证及国际 AHRI 认证; 可用于国际权威 LEED 认证



DCLC (D) M 磁悬浮变频离心式冷水(热泵)机组

制冷量: 100-1400 RT 351~4923kW

产品可广泛适用于节能改造、能源站、数据中心、综合商超、轨道交通等领域

01 节能环保

- 采用 R1234ZE、R513a HFC-134a 制冷剂; 通过国内节能认证及国际 AHRI 认证; 可用于国际权威 LEED 认证。

应用案例 - DAIKIN

Daikin launches a new generation of inverter driven air-cooled and water-cooled screw chiller series with refrigerant R-1234ze(E).

Vienna, February 21st 2018

Daikin launches a new generation of inverter driven air-cooled and water-cooled screw chiller series with refrigerant R-1234ze(E).

The Air-cooled chiller range (TZ series) will be available from 130 kW up to 830 kW cooling capacity.

The Water-cooled chiller range (VZ series) will be available from 340 kW up to 1600 kW cooling capacity.

The selection of R-1234ze(E) allows to minimize the global warming impact of screw compressor chillers thanks to low Global Warming Potential in combination with high energy efficiency.

R-1234ze(E) is a HFO refrigerant (Hydro Fluoro Olefins). Its Ozone Depletion Potential (ODP) is equal to zero (0) and the Global Warming Potential (GWP) is 7 (according to the EU F-gas Regulation based on IPCC Fourth Assessment Report). The GWP value is less than 1 according to the IPCC Fifth Assessment Report.

The new range of screw compressor chillers will be equipped with Daikin design inverter driven single screw compressor with Variable Volume Ratio (VVR) technology.

https://www.daikin-ce.com/en_us/press-releases/2018/new_chiller_ranges_r-1234ze.html



EWWH-DZ

Water cooled chiller for indoor installation equipped with premium efficiency oil free centrifugal compressor

Heating capacity: 238 - 1200 kW
Cooling capacity: 230 - 1415 kW
Refrigerant: R-1234ze
Compressor: Centrifugal oil free



EWAH-TZ

Air cooled Inverter Screw chiller - the best choice for your plant & the environment

Cooling capacity: 170 - 1603 kW
Refrigerant: R-1234ze
Compressor: Screw inverter



EWWH-J-

Water to water heat pump reversible on water side standing out for its compactness and reliability

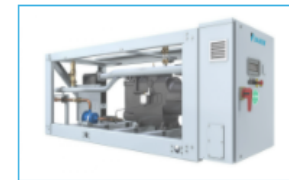
Heating capacity: 106 - 243 kW
Cooling capacity: 89 - 201 kW
Refrigerant: R-1234ze
Compressor: Screw



EWWH-VZ

Water cooled Inverter Screw chiller & heat pump - top-class efficiency with low environmental footprint

Heating capacity: 409 - 1924 kW
Cooling capacity: 329 - 1540 kW
Refrigerant: R-1234ze
Compressor: Screw inverter



EWLH-J-

Water-cooled screw condenserless chiller solution ensuring compactness and efficiency.

Cooling capacity: 84 - 193 kW
Refrigerant: R-1234ze
Compressor: Screw

应用案例 - GREE & MCQUAY



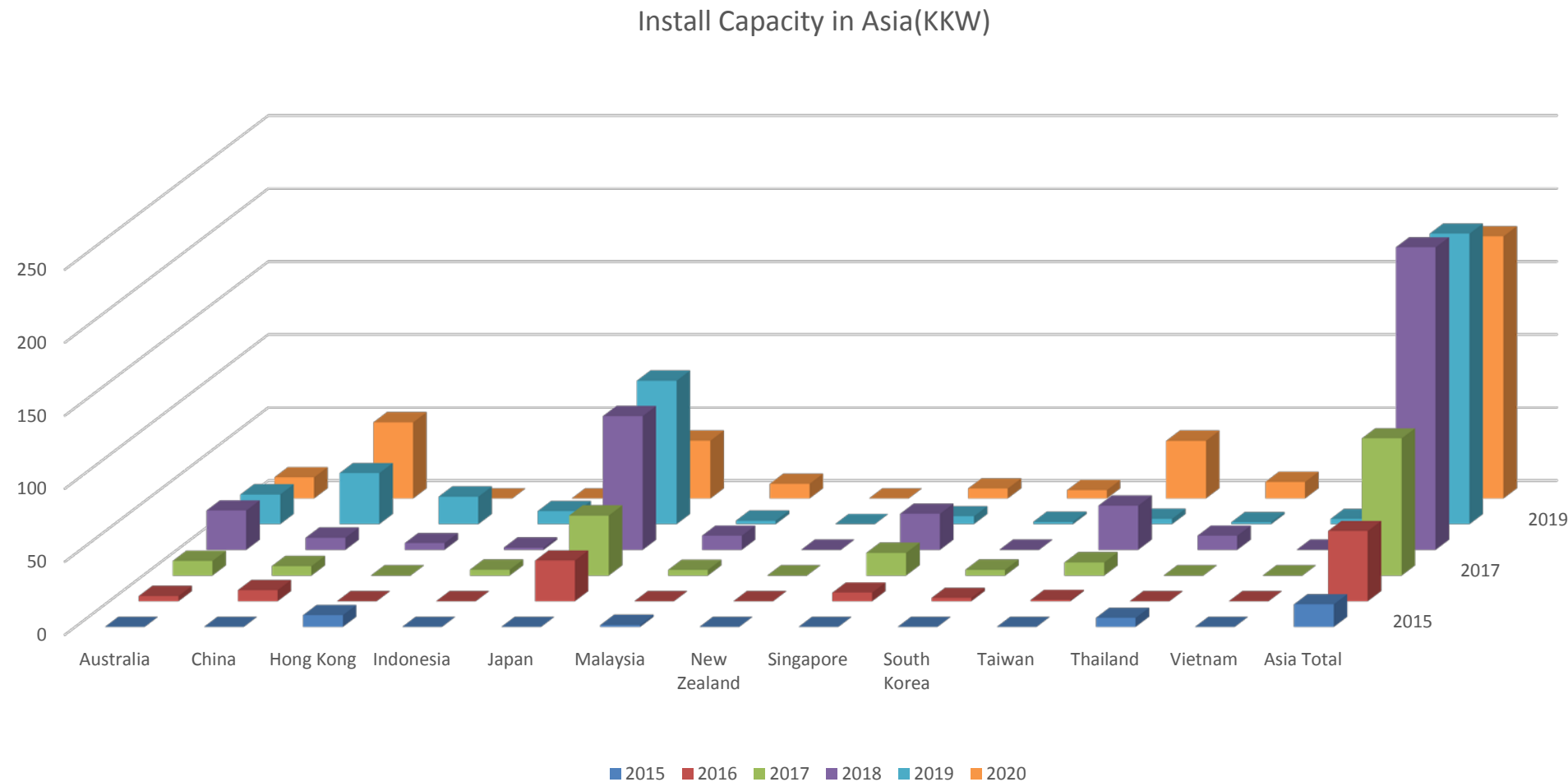
2018年制冷展，格力R1233zd（E）无油变频离心式冷水机组

https://www.sohu.com/a/227747538_259724



2018年制冷展，麦克维尔新冷媒双级压缩磁悬浮离心机组，
机组采用新冷媒R1233zd，GWP值低至1

亚太区各国超低GWP冷水机应用略图



低GWP冷水机装机在亚太区成稳定增长趋势、各国发展略有不同

超低GWP 冷水机客户应用

Solstice zd 离心机组

- Trane 高效离心机组
- JCI-YORK Centrifugal Chiller 离心机组
- Mitsubishi Heavy Industries 离心机组
- Carrier AquaEdge 19DV 离心机组
- GREE 离心机组

Solstice ze 冷水机组及热泵

- Carrier Aqua Force 螺杆/离心机组及热泵
- JCI-YORK Screw Chiller 螺杆机组
- DAIKIN 螺杆/离心机组
- Dunham-Bush 离心机组
- Mitsubishi Heavy Industries 离心机组
- Geoclima 螺杆/离心冷水机组
- Star Refrigeration high efficiency Turbocor
- Airedale chillers with free cooling 水冷机组
- Cofely Turbocor 离心冷水机组
- Multistack 螺杆冷水机组
- Cooltherm 冷水机组
- Smardt 冷水机组
- Blue Box 螺杆机组
- RC high efficiency screw chiller, water- and air-cooled chillers
- Climaveneta 螺杆/离心机组
- Rhoss 离心机组
- Aermec 风冷/水冷机组/热泵
- Friothers 区域供热热泵/冷水机组
- Viessmann 余热高温热泵



Compressors and components

- Frascold
- Danfoss Turbocor
- Bitzer
- Highly



Industry converting, regular announcements of new launches

THANK YOU FOR YOUR ATTENTION

[HTTPS://WWW.FLUORINEPRODUCTS-
HONEYWELL.COM/REFRIGERANTS/](https://www.fluorineproducts-honeywell.com/refrigerants/)

Honeywell

