

TRANE 下世代HFO冷媒 超低GWP離心式冰水主機



詮宏空調系統股份有限公司

林世偉 董事長



TOPIC

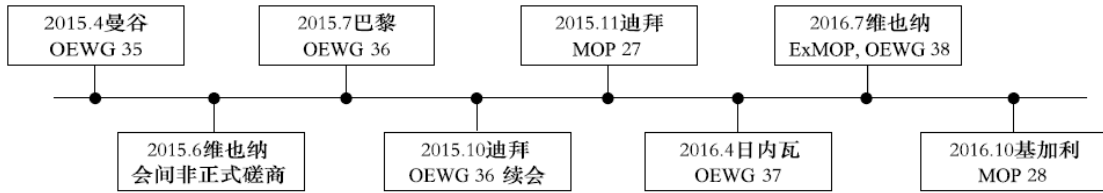


- HFCs減排政策和趨勢
- 下世代HFO冷媒
- TRANE超低GWP離心式冰水主機

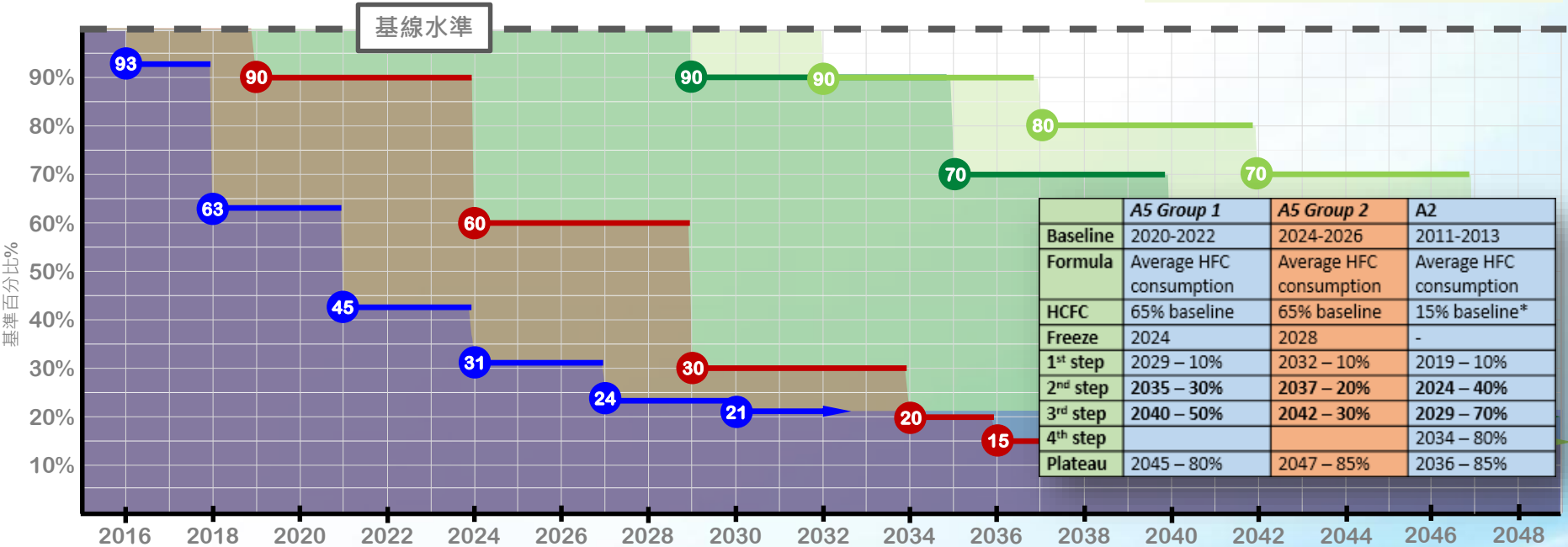
《蒙特利爾議定書》_ 吉佳利修正案



削減HFCs **已於2019年1月1日開始生效**



- 已開發 (非第五條約) 國家
 - 歐盟
 - 已開發國家
- 開發中 (第五條約) 國家
 - 第 1 組
 - 第 2 組



http://ozone.unep.org/sites/ozone/files/pdfs/FAQs_Kigali_Amendment.pdf

全世界一百多個國家均已承諾將逐漸削減HFCs的排放



美國



- 2018年2月，共和黨和民主黨共同提交一份議案(American Innovation & Manufacturing Act of 2018)，將授權環保總署在美國削減HFCs冷媒排放。
- 2018年3月，加州政府通過法案採用環保總署方案削減HFCs冷媒排放。紐約、馬里蘭、華盛頓、康乃狄克等州也在考慮採取類似行動。



September 26th 2016 <https://www.epa.gov/snap/snap-regulations>

“These two rules demonstrate the United States’ continued leadership in protecting public health and the environment,” said EPA Administrator Gina McCarthy. “We are reducing emissions of HFCs that are harmful to the climate system and showing the world that we can do this responsibly and thoughtfully by working with businesses and environmental groups. I’m especially excited that we have taken these actions ahead of next month’s Montreal Protocol negotiations.”

- **Centrifugal Chillers** (Jan 1, 2024)
R-134a, R-410A, R-407C, R-245fa...
- **Positive Displacement Chillers** (Jan 1, 2024)
R-134a, R-410A, R-407C, R-245fa...
- **Cold Storage Warehouses** (Jan 1, 2023)
- **Retail Food Refrigeration** (Jan 1, 2021)
- **Household Refrigerators/Freezers** (Jan 1, 2021)

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Current Legislation Examples: hr5, sres9, "health care" MORE OPTIONS

Home > Legislation > 115th Congress > S.2448

S.2448 - American Innovation and Manufacturing Act of 2018
115th Congress (2017-2018) | Get alerts

BILL Hide Overview

Sponsor: Sen. Kennedy, John (R-LA) (Introduced 02/15/2018)

Committees: Senate - Environment and Public Works

Latest Action: Senate - 02/15/2018 Read twice and referred to the Committee on Environment and Public Works. (All Actions)

Tracker:
Introduced → Passed Senate → Passed House → To President → Became Law

More on This Bill
CBO Cost Estimates [0]

Subject — Policy Area:
Environmental Protection
[View subjects >](#)



加拿大



Environment and
Climate Change Canada

加拿大環境部於2017年10月通過
新法令，將於 2025年1月1日 起禁
止在新銷售的冰水主機中使用所
有GWP>700的冷媒。

(R134a GWP=1300)

“...prohibit the manufacture and import of certain refrigeration and air conditioning products that contain HFCs with a global warming potential (GWP) greater than a specified value...”

- *Stand-alone Med Temp Commercial Refrigeration*
(Jan 1, 2020 – GWP > 650)
- *Stand-alone Low Temp Commercial Refrigeration*
(Jan 1, 2020 – GWP >1500)
 - *Centralized Refrigeration*
(Jan 1, 2020 – GWP >1500)
 - ***Chillers – Centrifugal & Positive Displacement***
(Jan 1, 2025 – GWP >700)
 - *Domestic Refrigeration*
(Jan 1, 2025 – GWP > 150)
 - *Mobile Refrigeration*
(Jan 1, 2025 – GWP > 2200)

<https://www.ec.gc.ca/ozone/default.asp?lang=En&n=77A94123-1>



European Commission

歐盟



- 歐盟的含氟氣體法案(F-Gas Regulation)規定，2018年歐盟HFCs冷媒配額將從基線水準的93%縮減到63%。
- 導致歐洲R134a冷媒價格在2017年一年之內飆升了6~7倍。



New F-gas Regulation from 2015

The original F-gas Regulation, adopted in 2006, is being replaced by a new Regulation adopted in 2014 which applies from 1 January 2015. This strengthens the existing measures and introduces a number of far-reaching changes by:

- **Limiting the total amount** of the most important F-gases that can be sold in the EU from 2015 onwards and phasing them down in steps to one-fifth of 2014 sales in 2030. This applies to hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).
- **Banning** alternatives to F-gases that are not meeting the requirements of the Regulation.
- **Preventing** proper selection of F-gases.

F-gas emissions to be cut by two-thirds by 2030 in the EU

The European Union is therefore taking regulatory action to control F-gases as part of its policy to combat climate change.

A first F-gas Regulation was adopted in 2006 and succeeded in stabilising EU F-gas emissions at 2010 levels.

A new Regulation applies from 2015 onwards and phasing them down in steps to one-fifth of 2014 sales in 2030. This applies to hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).

This represents a reduction of 80-95% of F-gas emissions by 2030 compared to 2014 levels.

The expected reduction is 1.5 Gigatonnes of CO₂ equivalents by 2030 compared to 2014 levels.

F-gas facts

- The three groups of F-gases are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆). HFCs are by far the most relevant F-gases from a climate perspective.



European Environment Agency



Company reporting for Regulation (EU) No 517/2014 on fluorinated greenhouse gases

Frequently Asked Questions

下世代冷媒的關鍵要求

- 高能效
- 低全球暖化潛值(GWP)
- 非臭氧層消耗物質(ODS)
- 安全
- 洩露量少

下一代冷媒的選擇



高效



低碳



相比R134a及其替代物，R514A和R1233zd(E)效率更高、GWP更低

英格索蘭的環保承諾和行動計畫



50%

到2020年，在產品中減少50%冷媒相關的溫室氣體足跡。到2030年，公司的產品系列均採用低全球暖化潛值(GWP)的替代品。



35%

到2020年，減少35%與公司營運相關的溫室氣體排放。



\$500M

到2020年，投資5億美元展開產品相關的研發，以實現減少溫室氣體排放的長期目標。

EcoWise™

離心式冰水主機是英格索蘭EcoWise™產品組合系列的一部分，該產品組合皆採用新一代、低全球暖化潛勢的冷媒和高效運轉系統設計，以減低對環境的影響。

提高能源效率和減少溫室氣體排放

下世代冷媒離心機系列



EcoWise™

R514A:

單機：約350~1499RT (CVHF)

雙機：約1500~2999RT (CDHF)

注：冷凍噸範圍基於AHRI工況，以TOPSS選型為準。



EcoWise™

R1233zd(E):

單機：約900~2000RT (CVHH)

雙機：約1800~4200RT (CDHH)

注：冷凍噸範圍基於AHRI工況，以TOPSS選型為準。

R514A冷媒特性



- 全球暖化潛值 (GWP ≤ 2), 僅為R134a的約八百分之一
- 不屬於消耗臭氧層的物质
- 屬於低壓冷媒, 洩漏低
- 與R123擁有相近的效率和性能
- 不可燃
- 共沸混合物, 無溫度滑移, 如有洩漏, 僅需補充洩漏量
- 生產商為Chemours (原杜邦)

R514A冷媒



- R514A冷媒的生產商Chemours (原杜邦)從2016年起開始生產R514A冷媒, 供貨給TRANE主機
- TRANE和Chemours簽署全球長期供應協定, 確保產能滿足TRANE需求
- 為了更好地服務於亞太市場, 推動行業儘快實現朝向超低GWP環保冷媒的轉變, Chemours特別在中國投入R514A冷媒的生產線

R1233zd(E)冷媒特性



- 全球暖化潛值 (GWP)約為1, 不到R134a的千分之一
- 不屬於消耗臭氧層的物质
- 屬於低壓冷媒, 洩漏低
- 與R123擁有相近的效率和性能
- 不可燃
- 生產商為Honeywell

R1233zd(E)冷媒特性



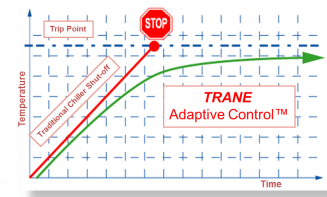
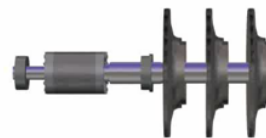
- R1233zd(E)冷媒的生產商Honeywell從2014年起已經開始生產R1233zd(E)冷媒，供貨給TRANE主機
- TRANE和Honeywell簽署了全球長期供應協定，確保產能能夠滿足TRANE需求
- TRANE是業界率先使用R1233zd(E)冷媒的冰水主機製造商

TRANE離心式冰水主機

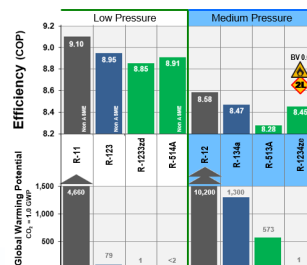


採用下世代HFO冷媒

✓ 低碳



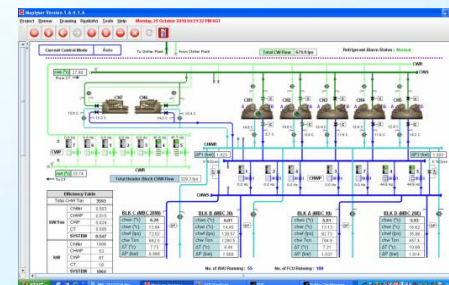
✓ 高效



✓ 可靠

✓ 冷凍噸範圍廣

✓ 全方位的系統節能方案



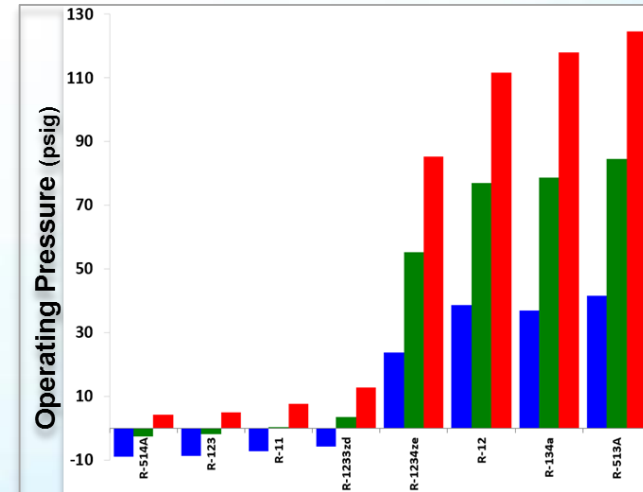
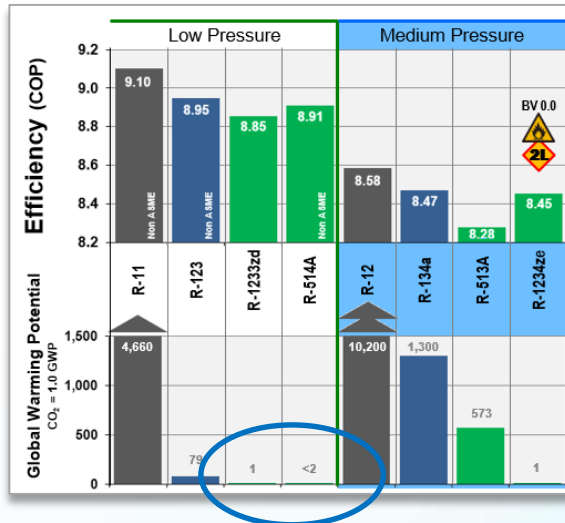
TRANE離心式冰水主機



採用下世代HFO冷媒

✓ 低碳

- 超低全球暖化潛值(GWP ≤ 2), 遠遠低於R134a(GWP=1300)和R513A(GWP=573), 滿足全球最為苛刻的GWP標準, 一步到位
- 採用不可燃冷媒, 安全性高
- 低壓運轉(僅為R134a的十分之一), 洩漏率低
- 冷媒充填量少, 更容易滿足LEED綠色認證要求



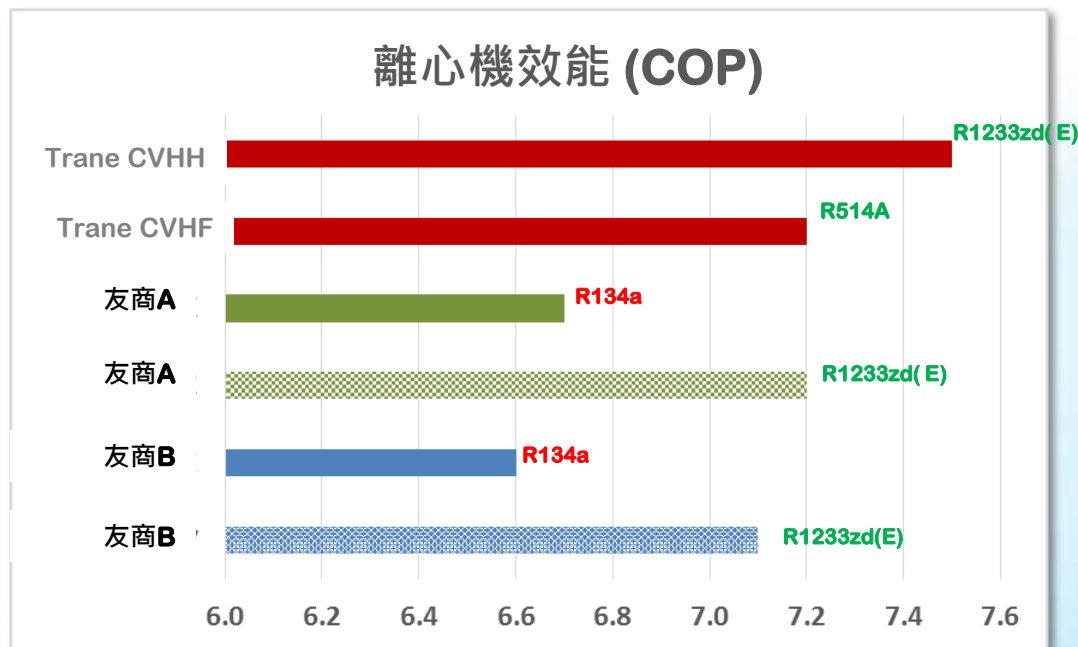
TRANE離心式冰水主機



採用下世代HFO冷媒

✓ 高效

- 領先業界的滿載(7.5 COP)和部分負載效率(12.0 IPLV)
- 其他廠商的下一代離心主機也開始採用低壓冷媒



※ 基於AHRI工況的最高效能主機。



York YZ
165~1000RT, R1233zd(E)



Carrier 19DV
600~800RT, R1233zd(E)



MHI ETI-Z
150~700RT, R1233zd(E)

TRANE離心式冰水主機



採用下世代HFO冷媒

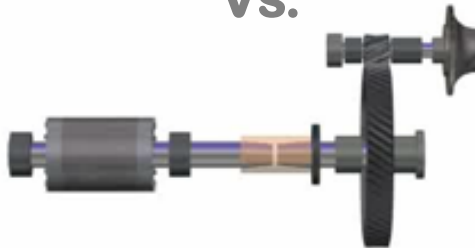
✓ 可靠

- 直接驅動，簡潔可靠
- 自適應控制，在惡劣工況下也能保持主機運轉

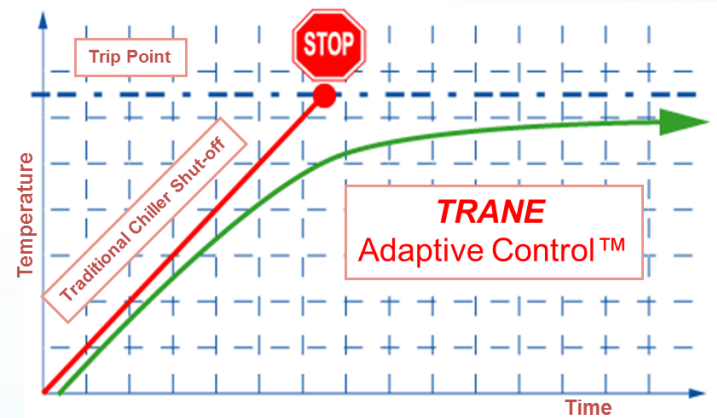


TRANE
CentraVac

Vs.



其他廠商



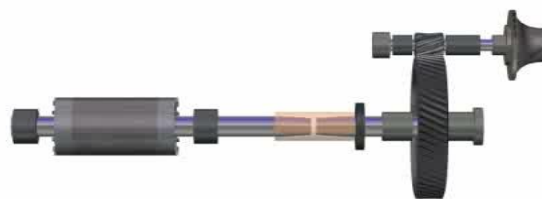
Trane CenTraVac™ 設計優勢



優點

高速齒輪驅動	<input type="checkbox"/>	低速直接驅動	<input checked="" type="checkbox"/>	最低的噪音和振動
開式電機	<input type="checkbox"/>	半密封電機	<input checked="" type="checkbox"/>	運行環境清潔
單級壓縮	<input type="checkbox"/>	多級壓縮	<input checked="" type="checkbox"/>	寬廣的運行範圍和超高的能效帶來更高的可靠性和經濟性
中壓冷媒	<input type="checkbox"/>	低壓冷媒	<input checked="" type="checkbox"/>	一次充填、終生使用

齒輪驅動/開式驅動



其他廠商

簡潔的直接驅動



TRANE

經由設計簡單化 實現可靠性！

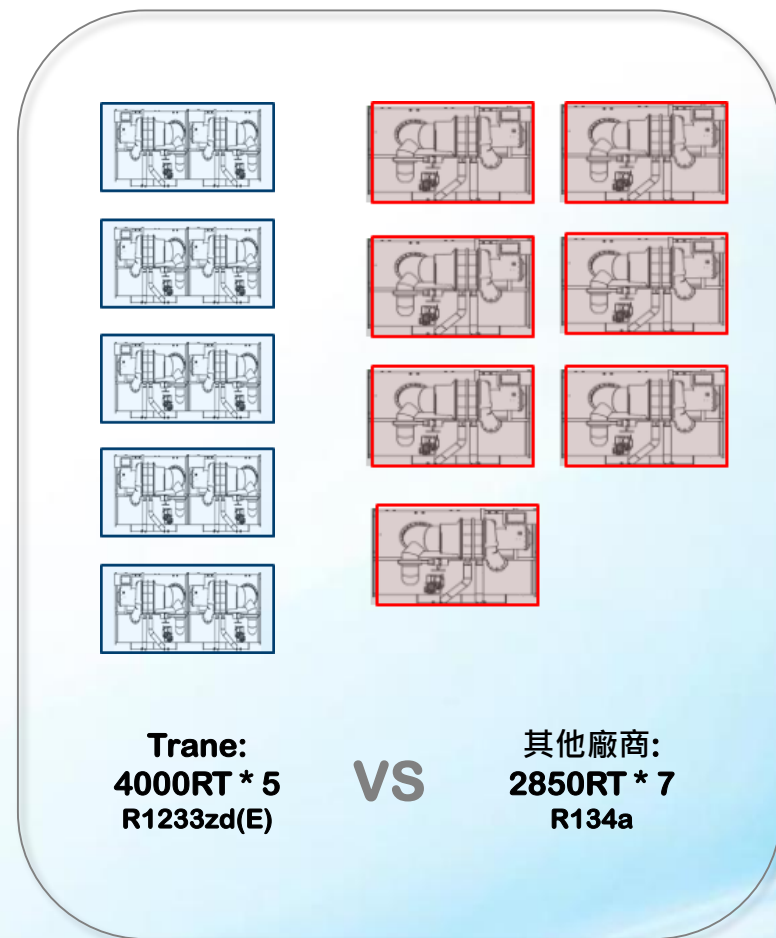
TRANE離心式冰水主機



採用下世代HFO冷媒

✓ 冷凍噸範圍廣

- CDHH3050單機高達4,200冷凍噸，能夠減少主機台數，節省冰機房占地面積和接水管路，可以滿足區域供冷、商業綜合體、大型工業設施和基礎設施等客戶對大冷凍噸離心式冰水主機的需求。
- 從350到4,200冷凍噸，採用超低GWP值HFO冷媒，全系列低碳解決方案。
- CDHH3050雙機頭主機內部兩個迴路為串聯逆流排列，效率更高，控制更為簡潔。



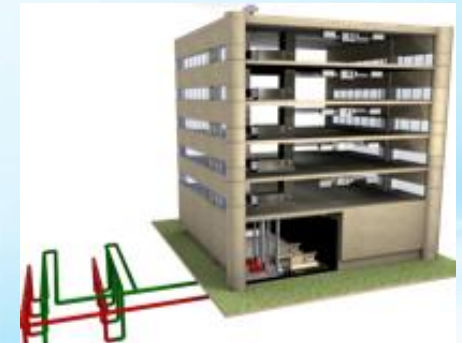
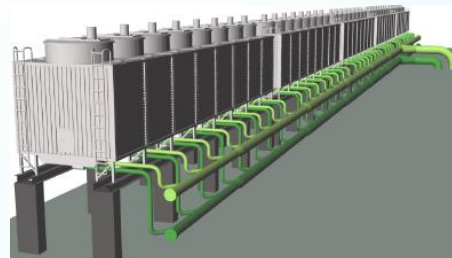
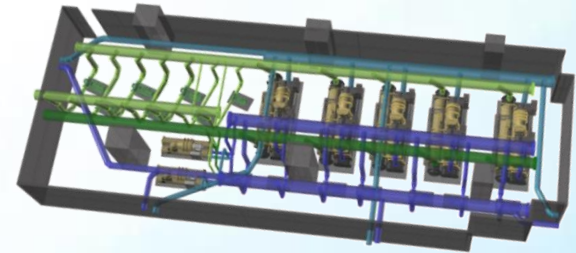
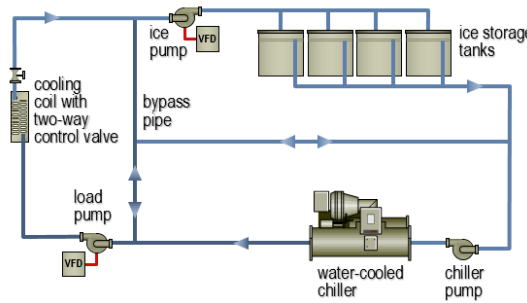
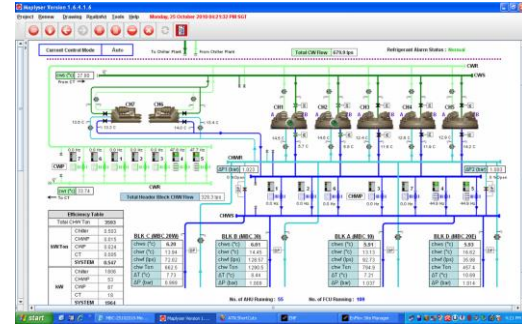
TRANE離心式冰水主機



採用下世代HFO冷媒

✓ 全方位的系統節能方案

- 大溫差小流量
- 一次泵變流量
- 冷卻水塔優化
- 儲冰
- 熱泵
- 熱回收



TRANE 下世代 R514A 離心機實績



- 台灣, 電子業, 500RT *4, 650RT*1, 1,000RT*4 ,1,250RT*3
- 台灣, 商業建築, 500RT *2
- 台灣, 紡織業, 500RT *1
- 日本, 包裝材料, 400RT *1
- 日本, 食品業, 330RT *1 ,340RT *1, 2,200RT *1
- 日本, 電子業, 500RT *1
- 印度, 酒店, 550RT *1
- 孟加拉, 製藥業, 800RT *1
- 香港, 高等教育, 1200RT *1
- 香港, 商業建築, 400RT *1, 500RT *1, 1,200RT *2
- 馬來西亞, 商業建築, 1,000RT *1
- 斯里蘭卡, 商業建築, 700RT *2
- 菲律賓, 商業建築, 650RT *4
- 越南, 製造業, 995RT *1
- 新加坡, 資料中心, 1,300RT *6
- 澳大利亞, 醫院, 570RT *3



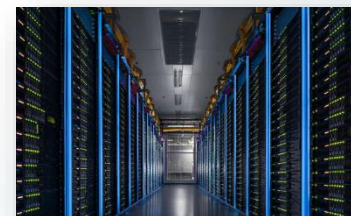
截止目前僅亞太地區已經有**超過200台**主機的訂單

TRANE 下世代 R1233zd(E)



離心機實績

- 台灣, 電子業, 1,750RT*1, 2,000RT*20, 2,200RT*5
- 台灣, 醫院, 1,000RT *2, 1,200RT*3
- 日本, 電子業, 8,00RT *1, 1,000RT*3, 1,500RT*1, 2,00RT*24, 2,500RT*9
- 日本, 工業, 550RT *1, 800RT*1, 1,000RT*1, 1200RT*1
- 新加坡, 電子業, 1,500RT*3 ; 生技業, 650RT*2, 2,000RT*2
- 新加坡, 化工業, 1,000RT*4
- 新加坡, 資料中心, 1,500RT *2
- 香港, 醫院, 1,500RT *3 ; 博物館, 1,100RT *4
- 馬來西亞, 電子業, 2,000RT *2 ; 化工業, 750RT*1, 1,500RT *5
- 泰國, 化工業, 1,500RT *2
- 印度, 化工業, 1,500RT *3
- 澳大利亞, 商業建築, 1,000RT*1, 1,200RT*2 ; 運輸樞紐, 1,200RT*2
- 中國, 區域供冷, 3,500RT *6
- 中國, 電子業, 2,000RT *1 ; 化工業, 1,900RT*4
- 中國, 資料中心, 1,800RT*2



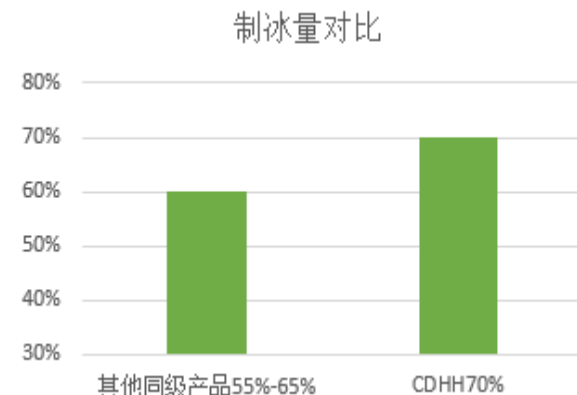
截止目前僅亞太地區已經有**超過100台**主機的訂單

CVHH/CDHH案例- 集中供冷 (北京)



超大型區域供冷專案

- **超大裝機容量:** 近200,00RT
(CDHH+CDHG雙機6台主機搭配)
- **超低製冷溫度:** -6.5°C , 在額定製冷需求下可有效降低冰盤管的初步投資和占地面積
- **超高製冷量:** 製冷工況下可提供常規工況下冷凍噸的70%以上, 可大幅節約運轉費用。



CVHH/CDHH案例— 隧道冷卻 (法國)



- 用於冷卻海底隧道
 - 3台CDHH雙機頭，
總冷凍噸8,500冷凍噸
 - 隧道內溫度很高，
冰水主機為隧道提供冷卻，
以避免列車車廂內過熱或設備失效
- TRANE為客戶帶來：
 - 耗能低
 - 維護成本低
 - 超低GWP冷媒，為環境保護盡一份心力



Certificate of Product Ratings

AHRI Certified Reference Number : 3686151 Date : 07-01-2018 Model Status : Active

Brand Name : TAICANG CENTRAVAC 50 HZ
Model Designation : TCVHG1100

Rated as follows in accordance with the latest editions of ANSI/AHRI Standards 550/590 (I-P) with Addendum 3 and 551/591 (SI) with Addendum 3 for Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle and subject to rating accuracy by AHRI-sponsored, independent, third party testing:

Refrigerant Used : R-123 R-514A
Compressor Designation : 920, 1100
Compressor Type : Centrifugal
Selection Software Name : TOPSS

Selection Software Issue Date or Code : Rev Level 10095
Hertz : 50
Country of Origin : China

**CVHG1100
R514A**

Certificate of Product Ratings

AHRI Certified Reference Number : 7116235 Date : 07-01-2018 Model Status : Active

Brand Name : TAICANG CENTRAVAC 50 HZ
Model Designation : TCVHH 1550

Rated as follows in accordance with the latest editions of ANSI/AHRI Standards 550/590 (I-P) with Addendum 3 and 551/591 (SI) with Addendum 3 for Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle and subject to rating accuracy by AHRI-sponsored, independent, third party testing:

Refrigerant Used : R-123 R-1233zd(E)
Compressor Designation : 1550, 1050, 950
Compressor Type : Centrifugal
Selection Software Name : TOPSS

Selection Software Issue Date or Code : Rev Level 10095
Hertz : 50
Country of Origin : China

**CVHH1550
R1233zd(E)**

Certificate of Product Ratings

AHRI Certified Reference Number : 8767343 Date : 07-01-2018 Model Status : Active

Brand Name : TAICANG CENTRAVAC 50 HZ
Model Designation : TCVHF910 (50 HZ AFD)

Rated as follows in accordance with the latest editions of ANSI/AHRI Standards 550/590 (I-P) with Addendum 3 and 551/591 (SI) with Addendum 3 for Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle and subject to rating accuracy by AHRI-sponsored, independent, third party testing:

Refrigerant Used : R-123 R-514A
Compressor Designation : 650, 77, 09 0
Compressor Type : Centrifugal
Selection Software Name : TOPSS

Selection Software Issue Date or Code : Rev Level 10095
Hertz : 50
Country of Origin : China

**CVHF910
R514A**

Certificate of Product Ratings

AHRI Certified Reference Number : 7116238 Date : 07-01-2018 Model Status : Active

Brand Name : TAICANG CENTRAVAC 50 HZ
Model Designation : TCDHH 3050

Rated as follows in accordance with the latest editions of ANSI/AHRI Standards 550/590 (I-P) with Addendum 3 and 551/591 (SI) with Addendum 3 for Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle and subject to rating accuracy by AHRI-sponsored, independent, third party testing:

Refrigerant Used : R-123 R-1233zd(E)
Compressor Designation : 3050, 2250, 1750
Compressor Type : Centrifugal
Selection Software Name : TOPSS

Selection Software Issue Date or Code : Rev Level 10095
Hertz : 50
Country of Origin : China

**CDHH3050
R1233zd(E)**

Certificate of Product Ratings

AHRI Certified Reference Number : 3686152 Date : 07-01-2018 Model Status : Active

Brand Name : TAICANG CENTRAVAC 50 HZ
Model Designation : TCDHG

Rated as follows in accordance with the latest editions of ANSI/AHRI Standards 550/590 (I-P) with Addendum 3 and 551/591 (SI) with Addendum 3 for Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle and subject to rating accuracy by AHRI-sponsored, independent, third party testing:

Refrigerant Used : R-123 R-514A
Compressor Designation : 1750, 2250
Compressor Type : Centrifugal
Selection Software Name : TOPSS

Selection Software Issue Date or Code : Rev Level 10095
Hertz : 50
Country of Origin : China

**CDHG2250
R514A**

其它廠商的新冷媒離心主機



19DV, 400~800RT, R1233zd(E)



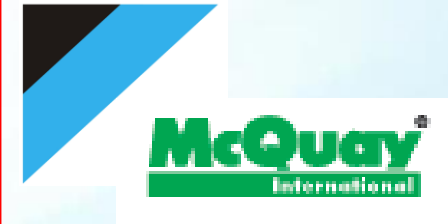
19XR/XRV, 200~3400RT, R513A



- ETI-Z, 150~700RT, R1233zd(E)
- GART-ZE, 300~5000RT, R1234ze



- YMC², 165~1000RT, R513A
- YK, 250~3000RT, R513A
- YZ, 165~1000RT, R1233zd(E)



R1233zd(E) 離心機
(尚未正式發佈)



- TG Series, R1234ze
- TT Series, R513A

- 根據《蒙特利爾議定書》關於削減HFCs的吉佳利修正案，全世界一百多個國家均已承諾將逐漸削減HFCs的排放。
- 幾乎所有的主要冰水主機製造商和壓縮機製造商都已經認識到這一趨勢，並且陸續推出採用下一代HFO冷媒的冰水主機。
- 隨著R514A和R1233zd(E)主機的推出，TRANE下一代冷媒系列離心式冰水主機將能夠提供從350到4,200冷凍噸，採用超低全球暖化潛值(GWP)的HFO冷媒，全系列低碳高效解決方案，進而使客戶實現環保、高效、可靠、安全的目標，引領業界儘快朝向超低GWP環保冷媒的轉變。

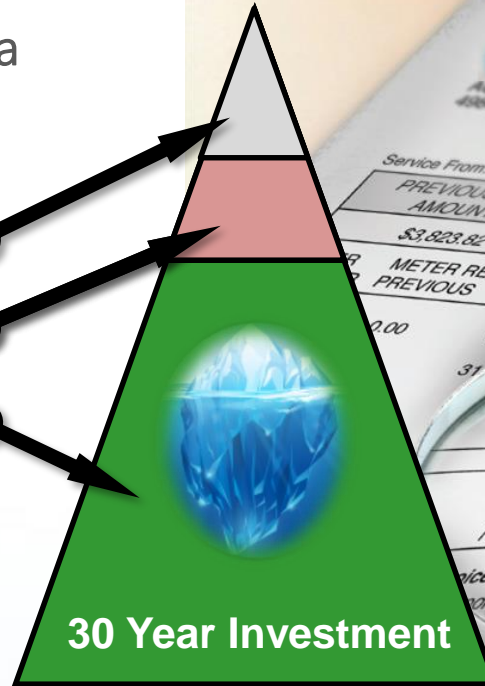
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維護保養	6.6%
運轉費用	88.5%



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- “Demand” (kW) - rate of electricity used **50%**
- “Energy” (kWh) - quantity of electricity used **50%**
- Other charges
 - power factor
 - ratchets rates
 - time of use
 - seasonal (winter & summer)

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