

Large Heat Pumps and Cooling systems using ultralow GWP refrigerants as substitution for R134a 使用超低GWP制冷剂替代R134a 的大型热泵和空调系统 应用介绍

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Danfoss Climate Segment

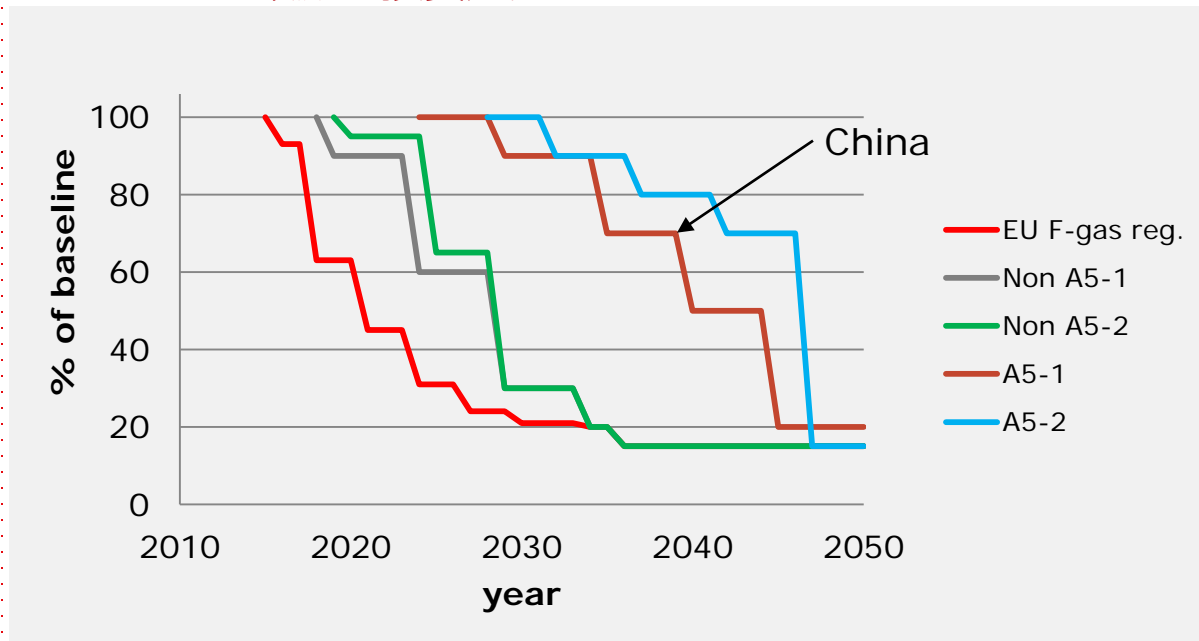
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The phase down of HFC "consumption"

HFC 制冷剂削减计划

Encourages investment 鼓励了投资趋势



Legislation impacts refrigerant prices and technologies
法规影响制冷剂价格和技术

Sustainable cooling trends and drivers

制冷的可持续发展趋势及驱动力

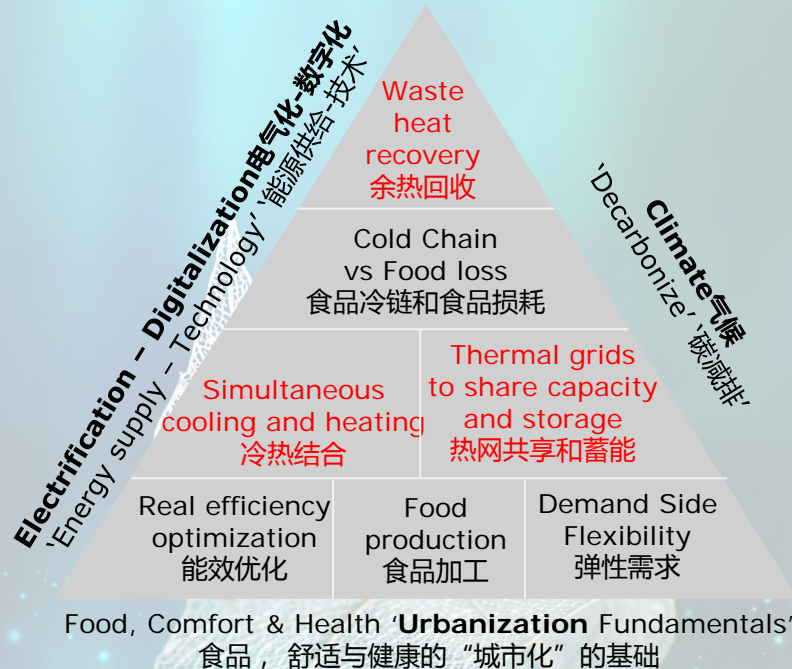
Vapor compression target future needs 面向未来的蒸气压缩制冷技术



Urbanization and decarbonization 城市化和节能减排

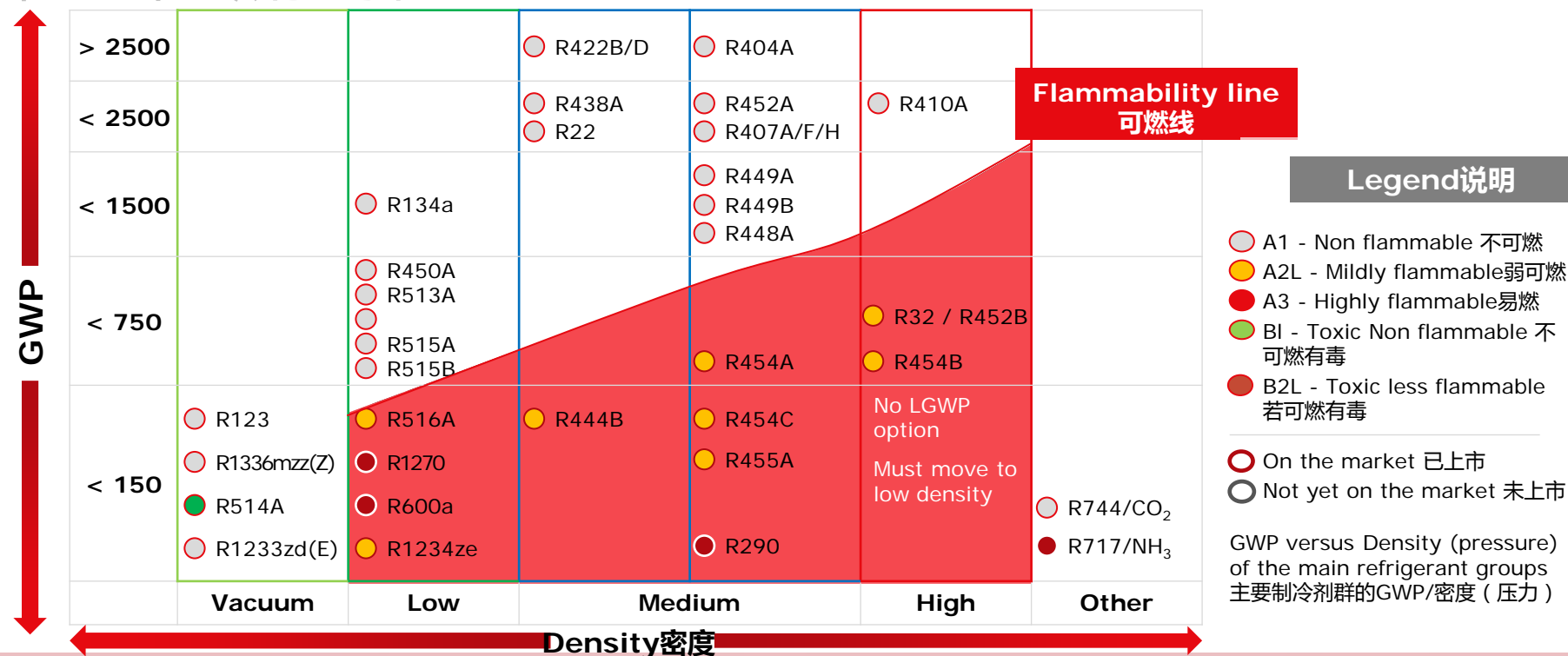
Adapting to renewable energy and electrification 使用可再生能源和绿色电力（风、水、太阳能）

Utilizing digital means 使用数字化工具（做优化的手段）



Main refrigerants at play 主要制冷剂概况

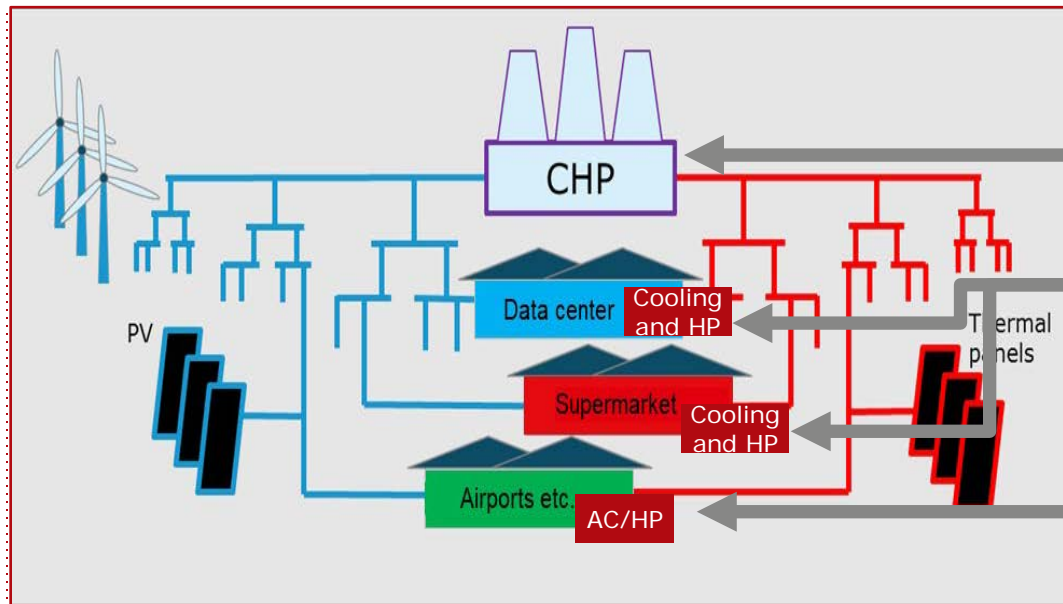
The future with A2L and A3 options 未来可使用的A2L和A3制冷剂选择



Thermal grids opens for combined heating and Cooling

开放热网整合供热和制冷

Sharing the thermal services is a Win/Win 热服务共享是双赢的局面



Grid design is often based on a central powerplant thinking 传统热网通常基于集中式热电厂的理念



With decentral suppliers of heating and cooling, networks can be smaller and more effective 基于分布式的供热和制冷的供给，网络可以更小，效率更高



Investments in grid capacity are optimized using existing resources 利用现有资源，热网的投资可以进一步优化

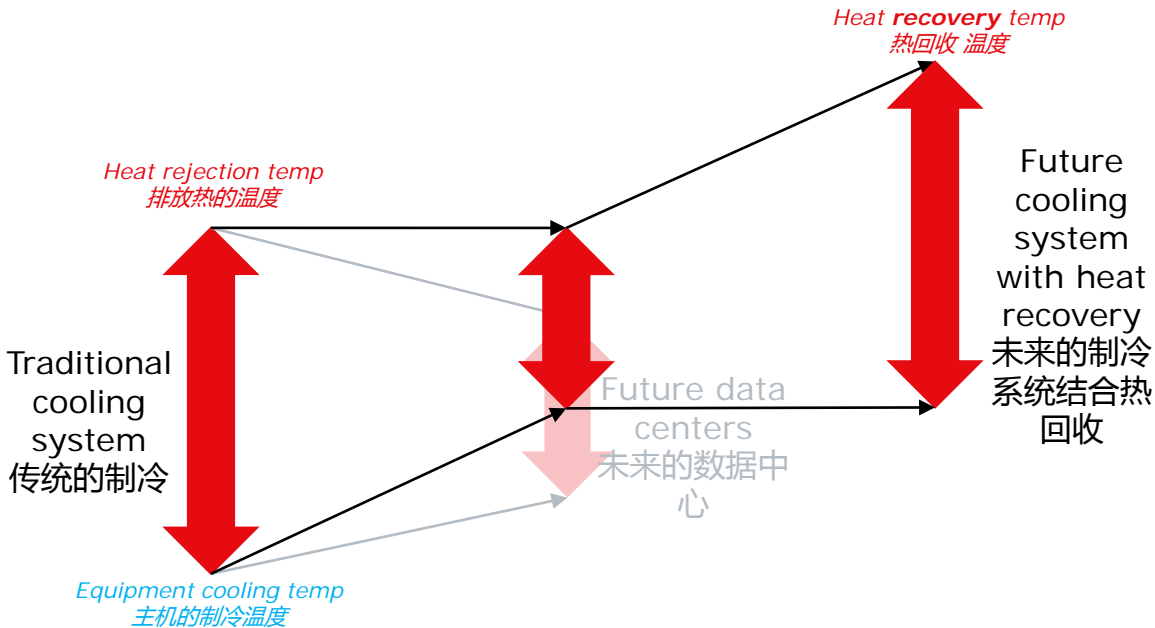
Source Danfoss

Enterprise Data Center with Heat Recovery for Heating 企业级的数据中心运用热回收来供热

Increased Cooling Temps for Efficient Recovered Heat 不断提升的 冷却温度助力高效热回收

Alternative to Increase both cooling and heat rejection temperature 同时提高制冷和制热温 度的手段

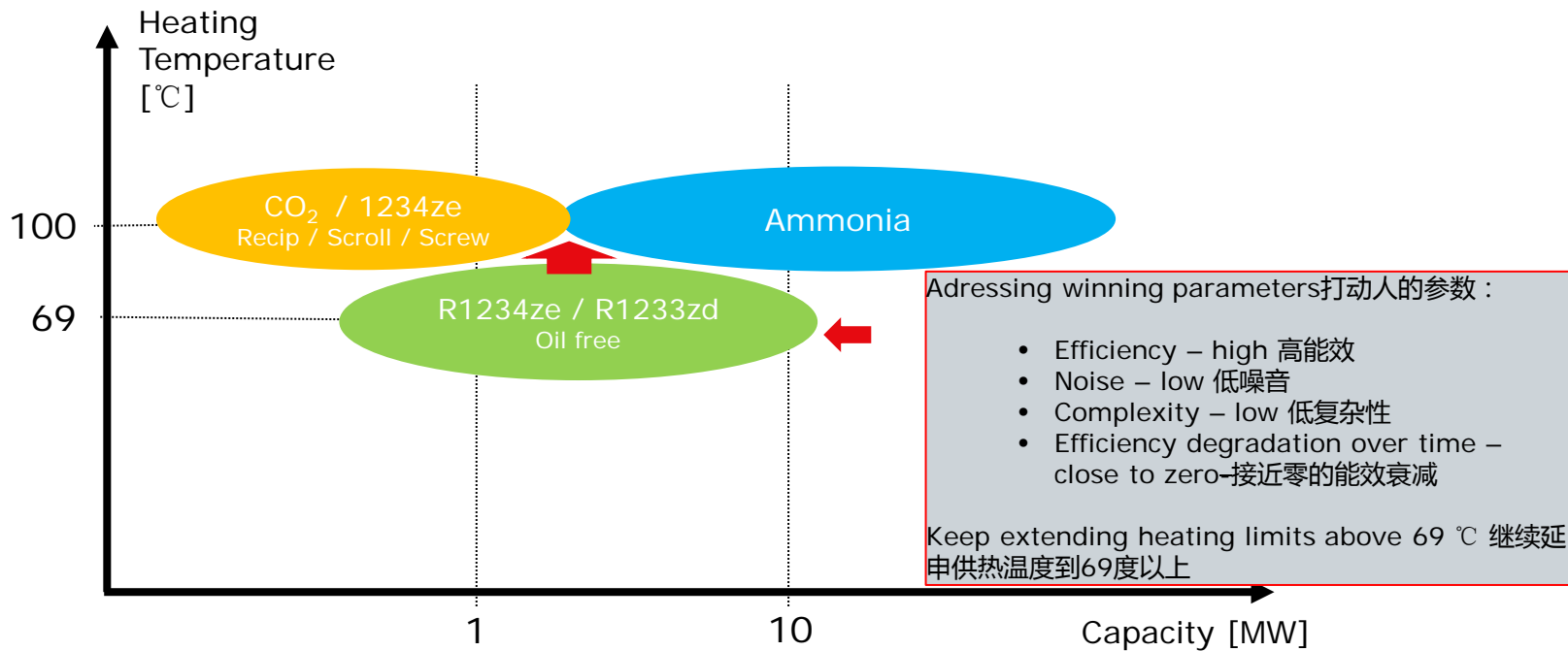
- As higher temperature/liquid becomes more mature 更高的温度/液体，技术更成熟
- Increase both cooling and heat rejection temperature 同时提高制冷和制热温度
- Enables efficient heat recovered at useful temperature 使得在合适温度下的高效热回收成为可能



Heating Temperature Demand and Capacity

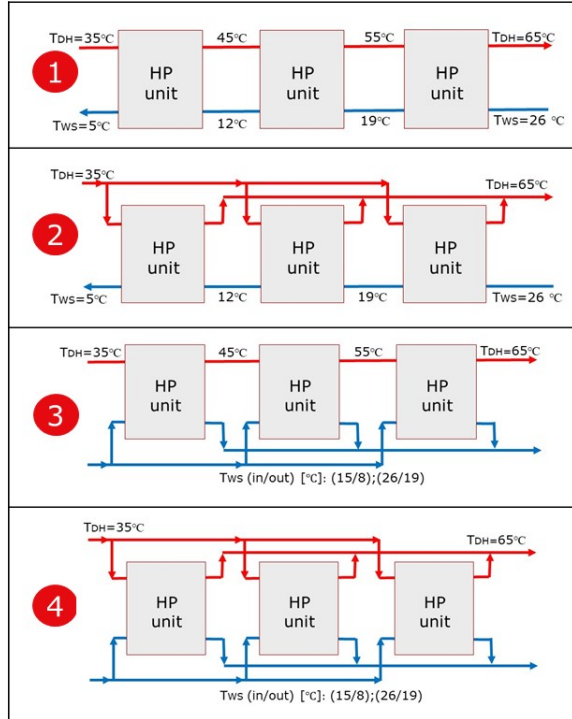
供热温度需求和能力

Basic parameters to address with low GWP refrigerants 低GWP制冷剂的基本参数



COP comparison – 7 Water Source HP set ups

7种水源热泵技术的COP 比较



Source Danfoss

COP # System change 不同系统的COP

1

4,7 # Centr. Oil free无油离心系统 / 1234ze(E)
4,0 # Screw螺杆系统 / NH3

2

3,9 # Recip活塞系统 / CO2

3

5,4 # Temp WS 26;19°C
3,9 # Temp WS 15;8°C
Centr. Oil free离心式无油系统 / 1234ze(E)

4

4,6 # Temp WS 26;19°C
3,5 # Temp WS 15;8°C
Recip活塞系统 CO2

COP

COP is a major parameter for DH system operators
区域供热系统，COP 是主要参数



Temperature lift depends on local heat source
温度提升依赖本地热源



Oil Free systems show promising COP values
无油系统显示了值得信赖的COP 价值

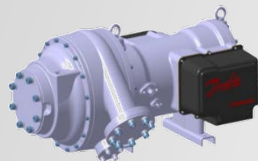


Danfoss Oil-Free Compressor Technology 丹佛斯无油压缩机技术

Dynamic Compression 'Lift' Defined “温升” 的定义



- Lift – Temperature difference between Saturated Suction (SST) and Saturated Discharge (SDT)
温升-饱和吸气(SST) 和饱和排气(SDT)的温差
- Three main groups with application overlap
三类产品，无缝涵盖不同应用



Standard 标准

Applications应用:

- Water-cooled chillers 水冷冷水机
- Evap-cooled chillers 蒸发冷冷水机

Compressors压缩机:

- TTS400, TTS700
- TGS390, TGS520
- VTT1200
- VTX1600

Up to 50°C

~32 K design
设计温升
(~57F)

~42 K max
最大温升
(~76F)

Down to ~4°C



Medium中温

Applications应用:

- Air-cooled chillers 风冷冷水机
- Water-cooled chillers 水冷冷水机
- Evap-cooled chillers 蒸发冷冷水机
- W-W heat pumps 水水热泵
- High-temp process 高温工业冷水机

Compressors压缩机:

- TTS300, TTS350
- TGS230, TGS310, TGS490

Up to 63°C

~42 K design
设计温升
(~76F)

~57 K max
最大温升
(~103F)

Down to -10°C



High高温

Applications应用:

- Air-cooled chillers 风冷冷水机
- W-W heat pumps 水水热泵
- A-W heat pumps 风水热泵
- Mid-temp process 中温工业冷水机
- Thermal storage 蓄热

Compressors压缩机:

- TTH375
- TGH285

Up to 69°C

~55 K design
设计温升
(~99F)

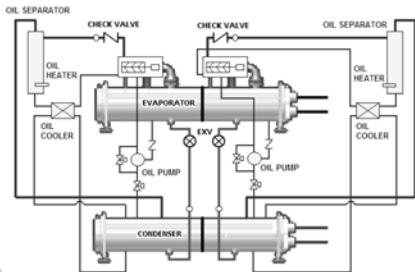
~65 K max
最大温升
(~117F)

Down to -18°C

The benefits of Oil-Free Compressor Technology 无油压缩机技术相比有油压缩机的好处 vs Oiled Compressors

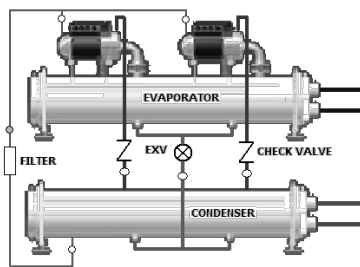
Reduced Complexity 降低复杂度

Oiled system 有油系统



VS

Oil-free system 无油系统



High Efficiency vs Screws 相比螺杆更高效

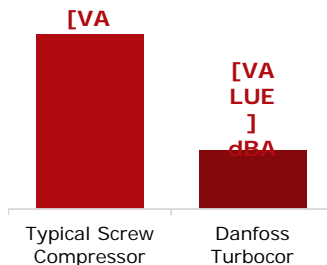
Up to 40% improvement in part load efficiency (IPLV) vs traditional fixed speed screws

相比传统定频螺杆，在部分负荷下能效提升高达40% (IPLV)



Quiet Operation vs Screws 相比螺杆更安静运行

- Up to 8 dBA quieter vs typical screw compressor
- No expensive sound attenuation required
- No pure tone noise effect in 1/3 octave bands



Less Maintenance 减少维护

Required Maintenance 需要维护的地方

Frequency 频率

Check Oil Pressure 油压检测	Daily 每天
Check Oil Level 油位检测	Daily 每天
Oil Filter Change 油过滤器更换	Twice/year 一年两次
Conduct Oil Analysis and Submit to OEM 给OEM出具油分析报告	Quarterly 每季度
Inspect and Confirm Oil Pump Operation 检测油泵运行状态	Every Week 每周
Inspect Oil Sump Heaters 油加热器检测	Every Week 每周
Oil Change 换油	Annual 每年
Inspect Oil Sump Strainers 油池滤网检测	Every 5 years 每5年
Acidity Test on Oil 油酸度检测	Annual 每年

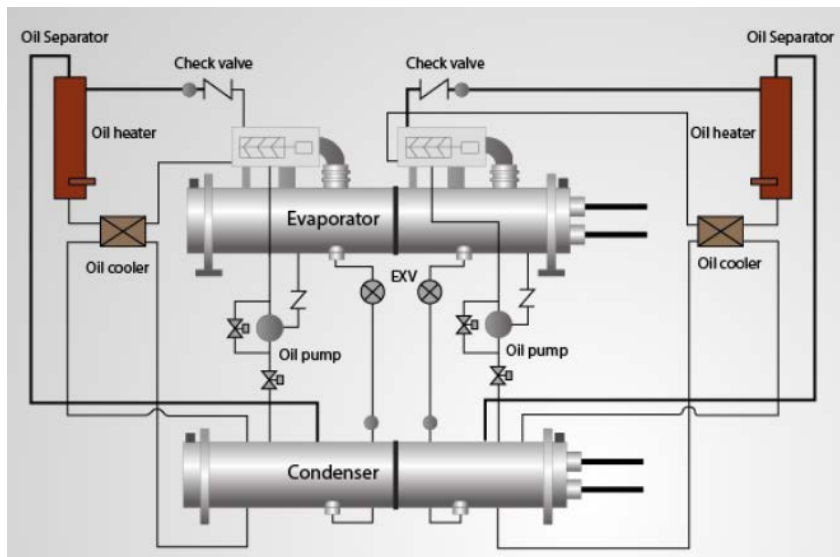
Danfoss Turbocor® Oil Free Compressors

丹佛斯 天磁® 无油压缩机

Simple Design 简化设计

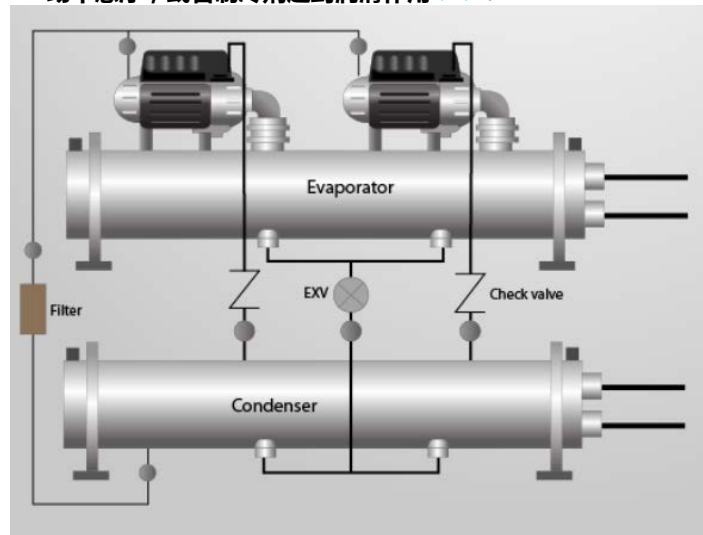
Traditional Oiled Chiller 传统有油冷水机组

Oil is required to lubricate bearings which are used to support rotational and linear movement of the rotor 需要油来润滑轴承，轴承要支持转子的轴向和径向的移动



Oil Free Chiller 无油冷水机组

Oil is not required since the motor shaft levitates in a magnetic field or uses refrigerant for lubrication 不需要油，电机轴在磁场中悬浮，或者制冷剂起到润滑作用 ???



Danfoss Turbocor® Advantages 丹佛斯天磁® 优势

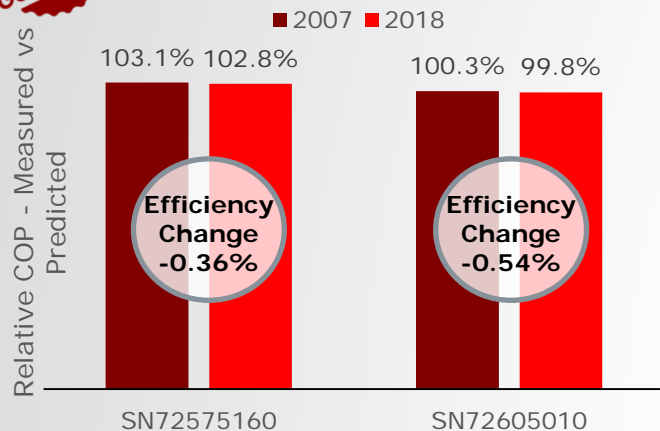
Consistent Performance over the Lifetime 在整个生命周期保持始终如一的性能



- < -0,6% variation in energy efficiency over 11 years 运行11年后，能效仅衰减不到0.6%
- No Variation Above Any Measurement Uncertainty!!! 在不同的测试情况下，也没有什么不同!!!
- Turbocor® Magnetic Bearing Compressors Means No Wear In & No Wear Out 天磁®磁悬浮压缩机意味着没有任何磨损



Compressor Performance after 11 Years of Operations



TT300 Compressor Performance over Time				
Serial Number	72575160		72605010	
Year Tested	2007	2018	2007	2018
Age (years)	0yrs	11yrs	0yrs	11yrs
SST	5.8	6.0	5.3	5.4
SDT	36.3	36.3	36.0	36.1
Input Power Measured	46.8	48.0	48.7	49.0
Massflow Measured	101.1	103.2	100.2	100.3
Massflow Target	98.0	100.4	99.9	100.1
vs Target	103.1%	102.8%	100.3%	100.2%
Change		(0.36%)		(0.09%)
COP Measured	5.68	5.66	5.41	5.39
COP Target	5.51	5.51	5.40	5.40
vs Predicted	103.1%	102.8%	100.3%	99.8%
Performance Change		(0.36%)		(0.54%)

DO MORE WITH LESS 少即是多

Cooling to reduce direct and indirect emissions

用制冷的方式来减少直接和间接排放



Key take-aways

要点概括

The Energy transition will mean new vapor applications arise – especially on the heat pump side which can be combined with cooling applications . 能源转换意味着新的蒸汽压缩式制冷应用的产生-特别是热泵应用，可以同时兼顾制冷

A variety of low GWP refrigerant – both natural and low GWP synthetics - are available for different types of heating purpose and having different heat sources—众低GWP制冷剂-天然的和低GWP合成制冷剂选择-适用于不同的采暖需求和热源

Centrifugal Oil free solutions using R1234ze or R515B are very suited for MW operation and decentralised placements due to low noise levels and very high efficiencies. 适用R1234ze 或者R515B 的离心式无油解决方案，由于噪音低，能效高，非常适合于MW 级别的应用和分布式的应用

Danfoss product roadmaps are targeting the variety of exciting solutions for the massive growth of vapor compression expected to happen for the next years丹佛斯产品的发展路线将致力于开发适合多种多样激动人心应用的产品，我们期待在接下来的几年，蒸汽压缩的应用将会有长足的发展