CHILLVENTA

Chillventa Specialist Forums 2022
Chillventa Fachforen 2022

CONNECTING EXPERTS.

SOLSTICE® LOW GWP REFRIGERANTS

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THE FIRST R-1234ZE AND R-515B SCROLL CHILLERS TO REPLACE R-410A IN COMMERCIAL AIR-CONDITIONING

October 20, 2022

Honeywell

AGENDA

- Chillers roadmap
- New generation scroll compressors (R-1234ze / R-515B)
- Regulatory drivers
- Applications
  1. Comfort cooling/heating in commercial buildings
  2. Industrial process cooling/heating
- Conclusions

CHILLERS ROADMAP

Compressors available

Compressors available since Q2/2022

Application	Compressor Type	Incumbent Refrigerant	Installation	Interim Solution	Long Term Solution	Product Image
Chiller	Centrifugal	**R-134a** GWP=1430	Outdoor	**R-1233zd / A1** GWP = 1		
			Indoor			
Chiller	Screw / Oil-free	**R-134a** GWP=1430	Outdoor	**R-513A / A1** GWP = 631	**R-1234ze / A2L** GWP < 1	 
			Indoor	**R-513A / A1** GWP = 631	**R-515B / A1** GWP = 293	
Chiller	Scroll	**R-410A** GWP=2088	Outdoor	**R-454B / A2L** GWP = 466	**R-1234ze / A2L** GWP < 1	
			Indoor	**R-515B / A1** GWP = 293		

Where regulations do not allow A2L, an A1 <300 GWP is offered as long term solution

GWP of R-1233zd/R-1234ze (exempt from F-Gas) has been shown according to AR5

NEW GENERATION SCROLL COMPRESSORS

Refrigerants : R-1234ze / R-515B

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LONG TERM R-410A REPLACEMENT IN SCROLL CHILLERS

R-1234ze (GWP <1)

- No F-Gas quota requirement, meeting carbon emission targets
- Avoid HFC taxes and be eligible for public subsidies in certain EU countries
- PED (fluid cat 2) requires less registration process vs A2Ls (fluid cat 1)

R-515B (GWP < 300)

- The only non-flammable, GWP<300 solution : suitable for environments where there are limitations on the use of A2L refrigerants such as indoor installations of replacement chillers
- R-515B and R-1234ze : two equivalent products from compressor, oil and performance point of view

Additional Benefits

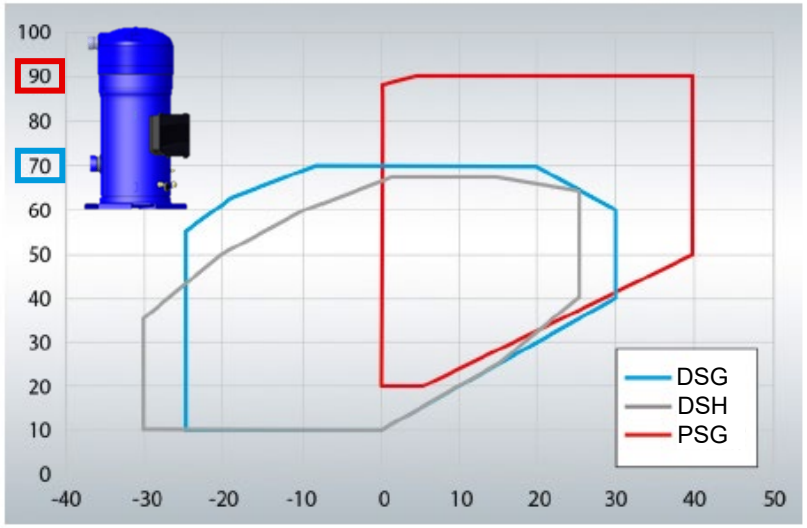
- Large operating envelope **with a hot water production above 80°C** (replacement of gas boilers in buildings)
- Enables heat recovery in datacenters (thanks to high evaporating temperature)
- Higher efficiency vs R-410A and R-454B chillers at similar unit size (footprint)
- Low running costs leads to low TCO (total cost of ownership)

LONG TERM R-410A REPLACEMENT IN SCROLL CHILLERS

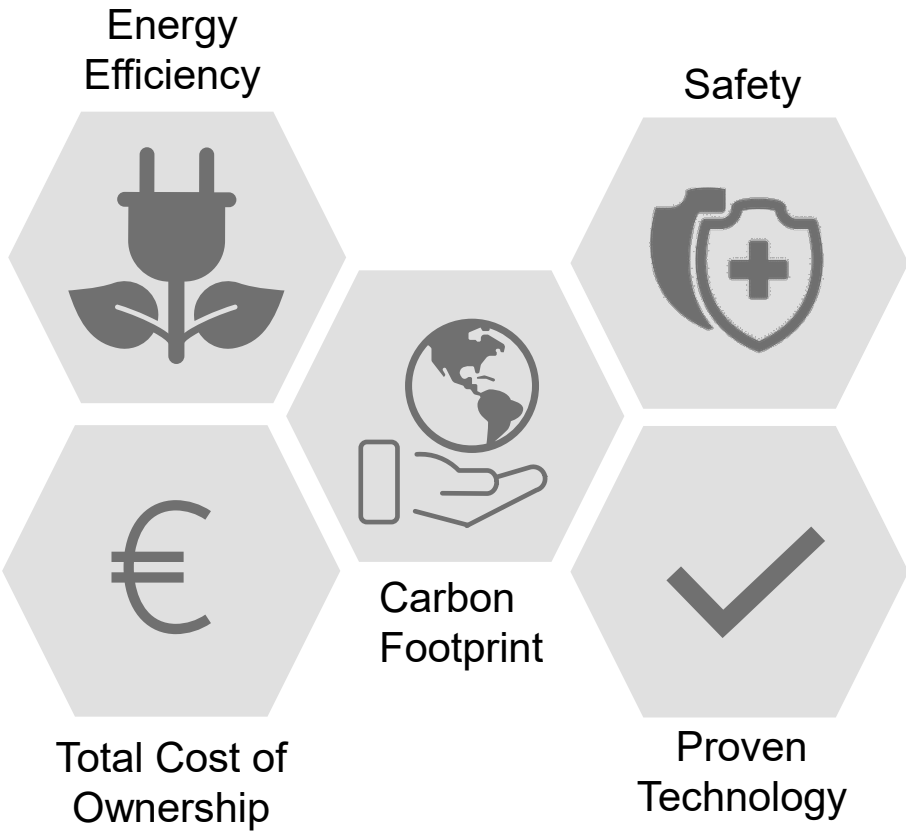
R-1234ze / R-515B = End Game Chillers and HP

70 kW **R-1234ze/R-515B** 20⁺ MW

Scroll **Screw** **Centrifugal**



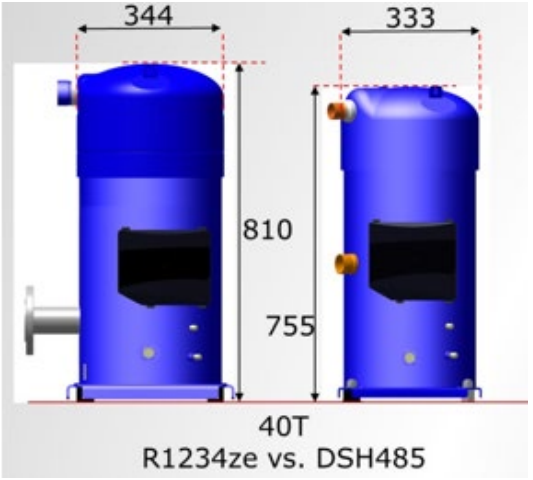
- Available from Q2/2022 (including High Temperature models)
- 4 sizes matching the commercial R-410A capacity (DSH range) at similar compressor shell size

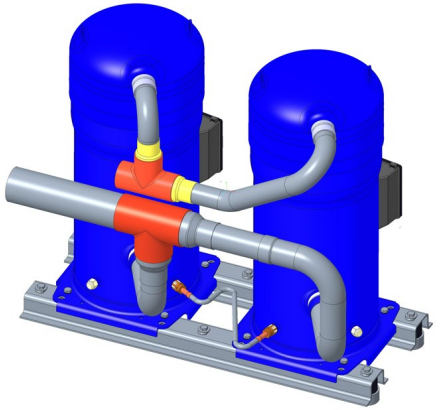


LONG TERM R-410A REPLACEMENT IN SCROLL CHILLERS

50Hz data	DSG480	DSG380	DSG295	DSG240
Displacement (cm^3/tr)	1270	1027	816	663
Weight (kg)	197	176	140	134
COP Full load (vs. R410A)	3.48 (+8%)	3.35 (+7%)	3.42 (+8%)	3.45 (+11%)
COP Part Load* (vs. R410A)	6.02 (+1%)	5.92 (+2%)	6.05 (+3%)	6.11 (+6%)
Acoustic (ARI 50Hz) ±3dBa	90	89	86	85

* Te/Tc/SH/SC : 4/32/10/0 rating





- Up to 8% higher SEER vs traditional R-1234ze screw systems (system simulations by Danfoss and Honeywell)

LONG TERM R-410A REPLACEMENT IN SCROLL CHILLERS

Availability for R-1234ze and R-515B in 2022			
Components	• Optimised scroll compressors	• Braze plate heat exchangers • Micro-channel heat exchangers	• EEV • 4-way valve
Chiller capacity range	• 70 - 800 kW		
Applications	• Commercial air-conditioning	• Industrial processes • Datacenter cooling	• District Heating

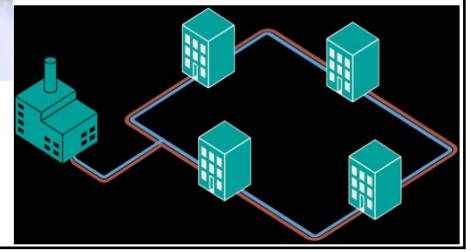
LONG TERM R-410A REPLACEMENT IN SCROLL CHILLERS

Opportunities for OEMs	
Stand-out against NBA	• Very low GWP versus R-410A, R-32 or R-454B
R-515B	• Non-flammable solution to replace R-410A chillers inside the buildings
Performance	• Improved performance compared to standard R-1234ze chiller with screw compressors
New markets	• Market penetration in small industrial cooling as a replacement for ammonia
Meet carbon emission targets	• District heating, boiler replacement with the introduction of Green Deal

REGULATORY DRIVERS

EUROPE

REGULATORY DRIVERS (EU)

Commercial Buildings	Industrial Processes	Data Center Cooling
 	 	 

EU

- F-Gas HFC phasedown: 69% overall reduction by 2024 / 79% overall reduction by 2030
- HFC prices expected to increase with year-on-year lower quota availability
- Denmark, Spain, Norway are taxing GWP on new installations or refurbishment works
- Several other EU countries have tax model defined but not yet adopted by the government
- Green Deal to eliminate fossil fuels: Some EU countries such as BEL, NL, UK already banned fossil fuels in new buildings
- Zero-carbon policies of global companies who opt for ultra low GWP solutions in datacentre and industrial process applications

APPLICATION
AIR-CONDITIONING & HEATING

Commercial Buildings

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1a Value proposition in commercial buildings (new build)

R-1234ze / R-515B reversible heat pumps are able to reduce carbon footprint

New System

R-454B or R-32 chiller for cooling operation

or

Boiler needed for heating operation

HP with integrated cooling & heating

R-1234ze HP can cover cooling and heating operation

No need for extra boiler

Lower Total Cost of Ownership €

- ✓ Low CAPEX without extra boiler cost
- ✓ Low OPEX
  - ✓ Eliminating boiler use with low COP
  - ✓ High COP in heating
  - ✓ R-32/R-454B cannot replace boiler operation due to lower T_{cond}

Lower Carbon Emissions

- ✓ Lower carbon footprint eliminating boiler
- ✓ Fossil fuels already banned for new builds in certain EU countries
- ✓ Avoid HFC related bans or taxes
- ✓ Be eligible for public subsidies in certain EU countries

1b Value proposition in commercial buildings (renovation)

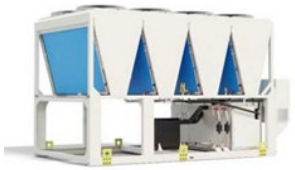
R-1234ze / R-515B reversible heat pumps are able to reduce carbon footprint

Old System

R-410A chiller
for cooling operation

Boiler needed for
heating operation

Replacement System



R1234ze (outdoor) HP or
R515B (indoor) HP can cover
cooling and heating operation

Existing boiler can be used
as back-up (if needed, only
in very cold days)

Lower Total Cost of Ownership €

- ✓ For indoor installations, R-32/R-454B requires risk mitigation with extra ventilation and leak detection equipment
- ✓ Low OPEX
  - ✓ Eliminating boiler use with low COP
  - ✓ High COP in heating
  - ✓ R-32/R-454B cannot replace boiler operation due to lower T_{cond}

Lower Carbon Emissions

- ✓ Lower carbon footprint eliminating boiler use
- ✓ Avoid HFC related bans or taxes
- ✓ Be eligible for public subsidies in certain EU countries

INDUSTRIAL APPLICATIONS

Process cooling/heating and energy recovery

2 Value proposition in process cooling/heating

High performance with safety

	NH_3	R1234ze
GWP	+	+
Toxicity	-	+
Delivery time	-	+
Established Performance	+?	+
Easy Maintenance	-	+
First Cost	-	+
Overall	-	+

With HFO there is no need for safety concessions when going Green

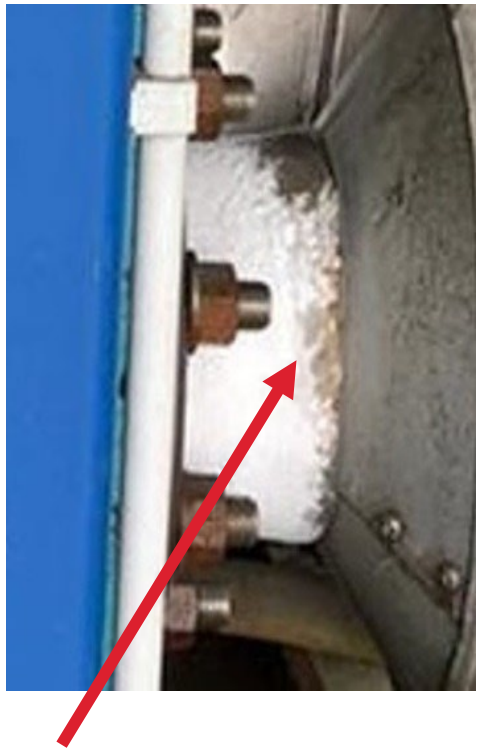
Benefitting from Serial Production, quick delivery time vs NH3 chillers
Chiller rental possibility due to fast delivery

Improved and proven performance vs NH3

€

Lower Capex
Minimal maintenance requirements

NH_3 PHYSICAL PROPERTIES IMPACTING COP



Oil leak,
bottom of glycol HX

- Not miscible with oil
- Needs oil separators
- Even with best oil separator (98% efficient), 2% oil still carry-over in the system
- Oil doesn't return to compressor with liquid (immiscible) but accumulates in cold areas like glycol HX
- Result ➡ Drop in HX coefficient and chiller efficiency

- Highly hygroscopic
- Water penetrates easily when servicing
- Difficult to remove by vacuum pumping
- COP and cooling capacity heavily affected by water content in the circuit
- NH_3 systems require SS pipes rendering bad heat transfer

Oil and Water: Biggest Culprits for Less Efficient NH_3 Systems

CONCLUSIONS

Market Requirements

✓Reducing carbon emissions

✓Reducing GWP of fluids (F-Gas/Kigali)

✓More energy efficiency

✓Zero carbon policies of companies

✓Taxes on high GWP HFC

Applications

- **Cooling/Heating of commercial buildings**
- **Industrial process cooling/heating**
- **Datacenter cooling**
- **District heating**

✓R-454B provides fast conversion with improved GWP vs R-410A

✓R-1234ze as a long-term solution (Scroll / Screw / Centrifugal)

- ✓ **R-1234ze scroll compressors by Danfoss available since Q2 2022 for chillers from 70 to 800 kW**

✓R-515B : for applications requiring A1 (Indoor Replacement Chillers), R-515B will be the only low GWP option below 300

THANK YOU

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