

Borealis Bus A/C Heat Pump with the Green Refrigerant R290

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euramm^on

refrigerants delivered by mother nature

Agenda

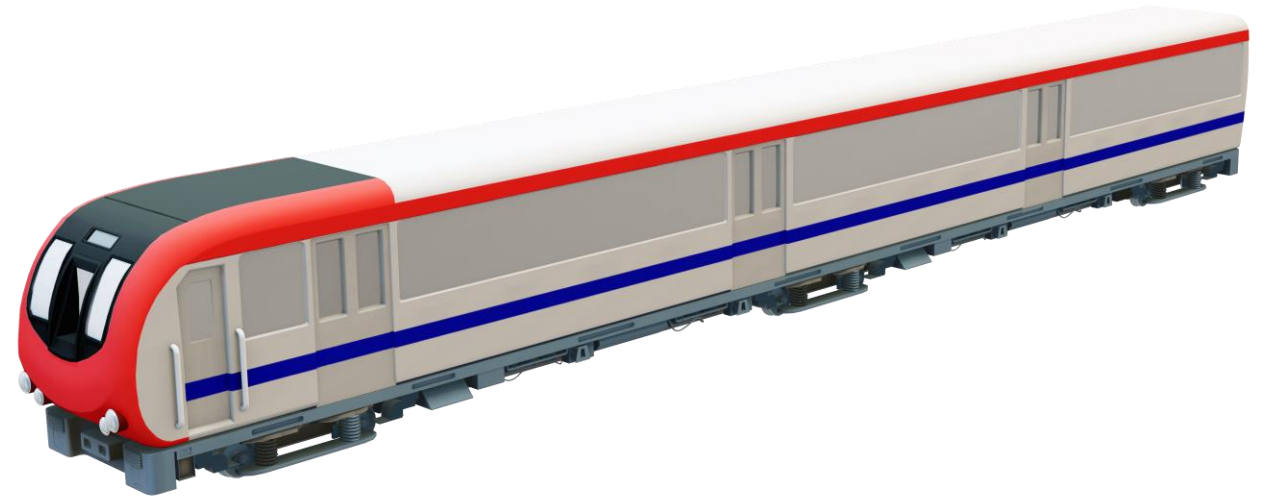
- Emerson Horizontal Compressor
- “Green” Refrigerant Overview
- Why 290?
- BOREALIS 2.0 Heat Pump
- Application

Medium Size Copeland Scroll™ Horizontal Typical Application

**Variable Speed For Buses
Reversible System Heating / Cooling**

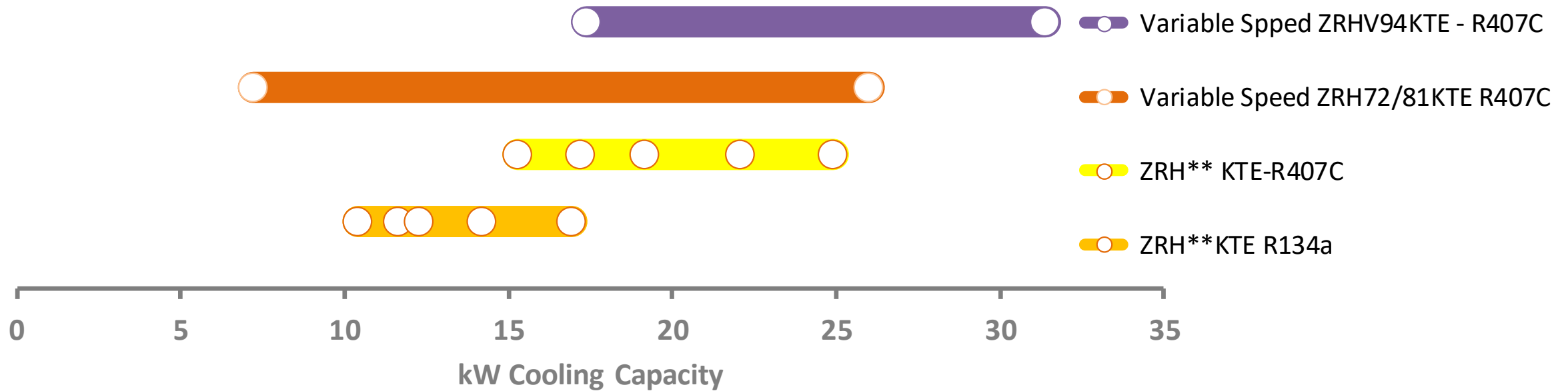


**Fixe Capacity
Cooling Only Metro / Train**



Large Line-up of Horizontal Scroll Fixe Capacity and Variable capacity

Horizontal Scroll Compressor Line-Up



Conditions EN12900: Evaporating 5°C, Condensing 50°C, Superheat 10K, Subcooling 0K

Horizontal Scroll ZRHV 72/ 81KTE

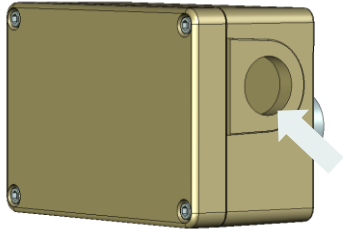
- **ID Card**

- Voltage : TFD and TF7
- 2 Sizes : 72 / 81KTE
- 2 Models Variable speed 72/81
 - ♦ AC Motor 25 / 100 Hz
 - ♦ Capacity Modulation 7 – 26 kW
- Height : 191 mm Length : 567 mm
- Weight : 49 kg
- T-Box Aluminium : IP67
- Min Evap : -30 °C
- Max Evap : 20 °C
- Sound Power : 72 dB

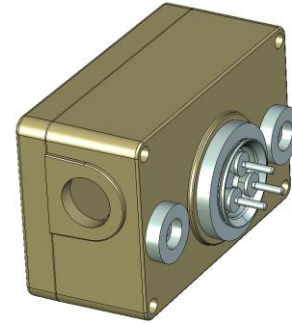


New Generation of Horizontal Scroll Design for Buses

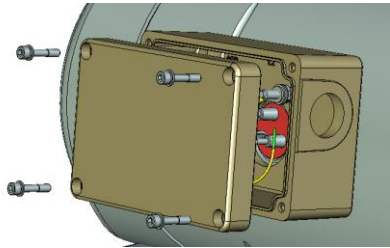
Aluminium Heavy Duty - IP 67 Terminal Box



M25-Cable Gland



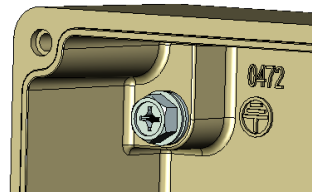
Back-Side Gasket



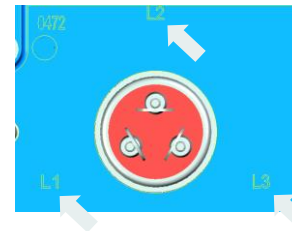
4 Closing Screws



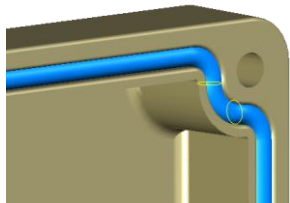
M6 –fixing Screw



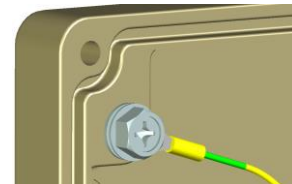
Internal grounding



Phase Lettering

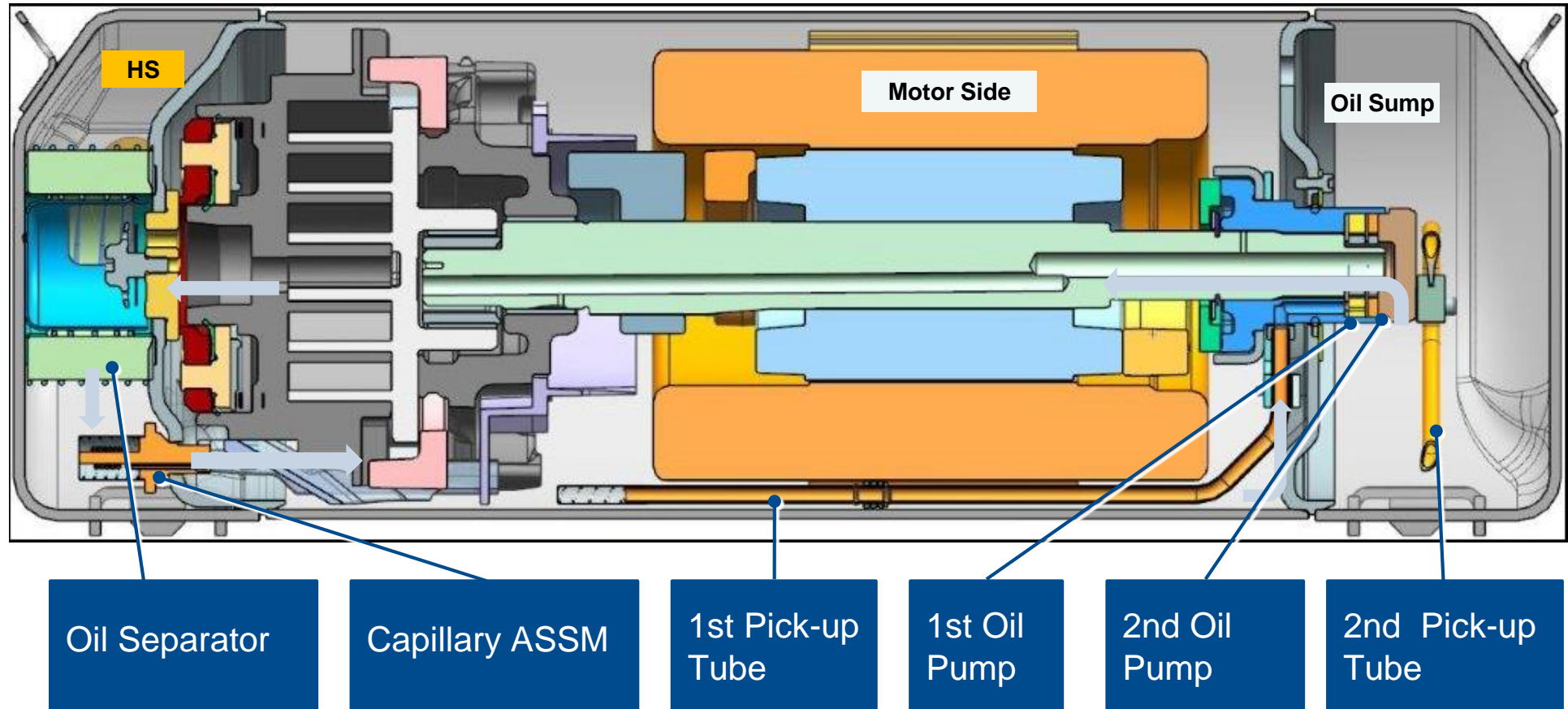


O-ring Gasket



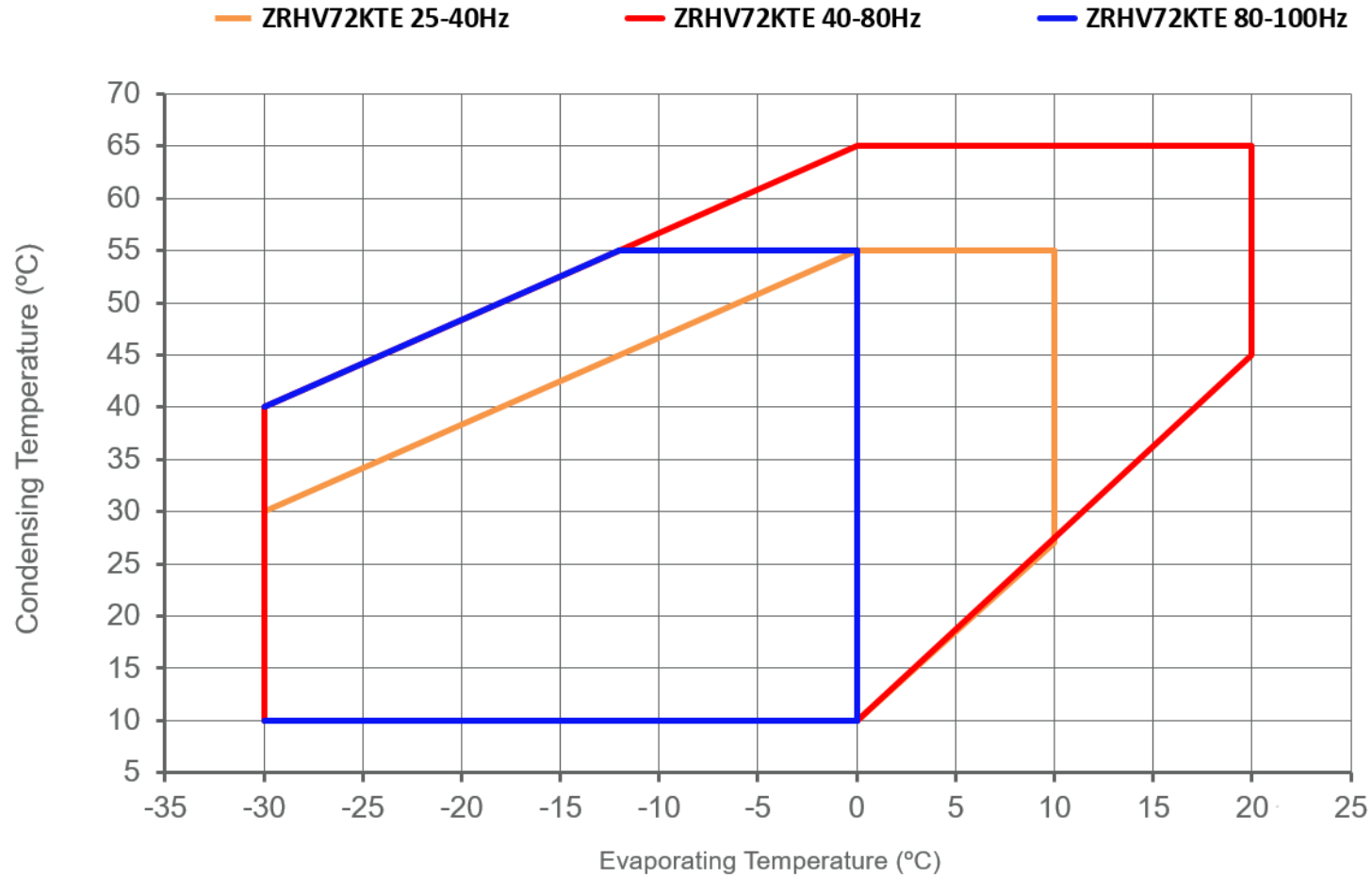
Cover Attached

ZRHV72/ 81KTE Unique Oil Circulation System



- Oil Separator Reduce Oil Circulation Rate (OCR) and Increase System Performance
- Unique Oil Circulation System, Increase Compressor Internal Oil Cycle and Improve Reliability

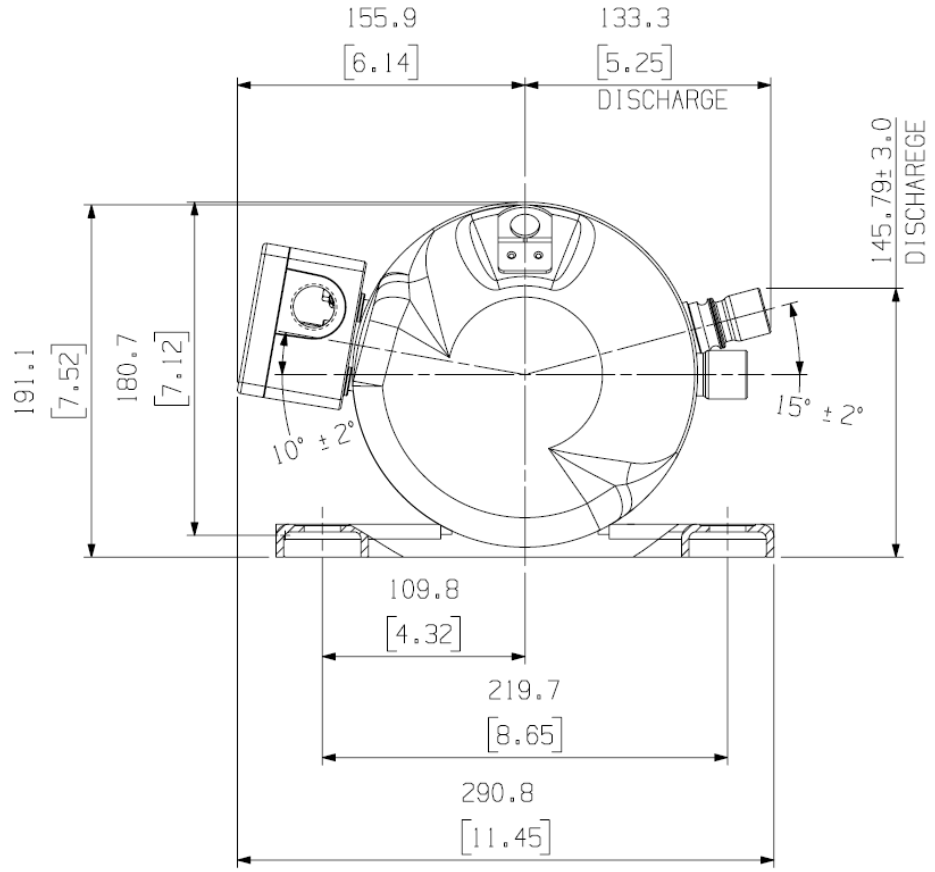
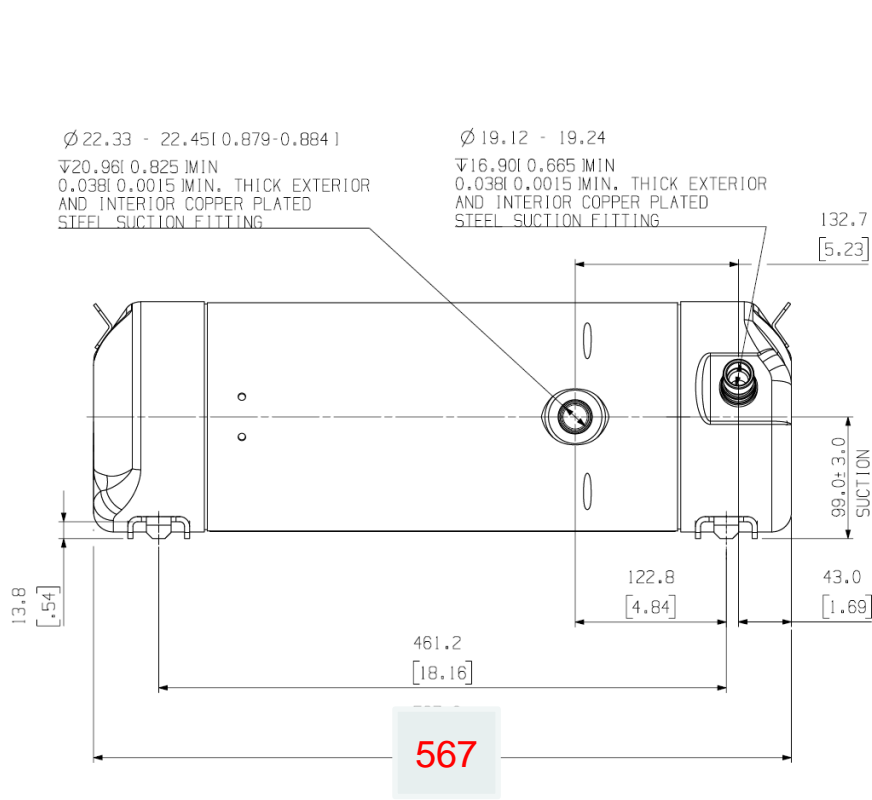
Wide Operating Envelope ZRHV72/81-TX7



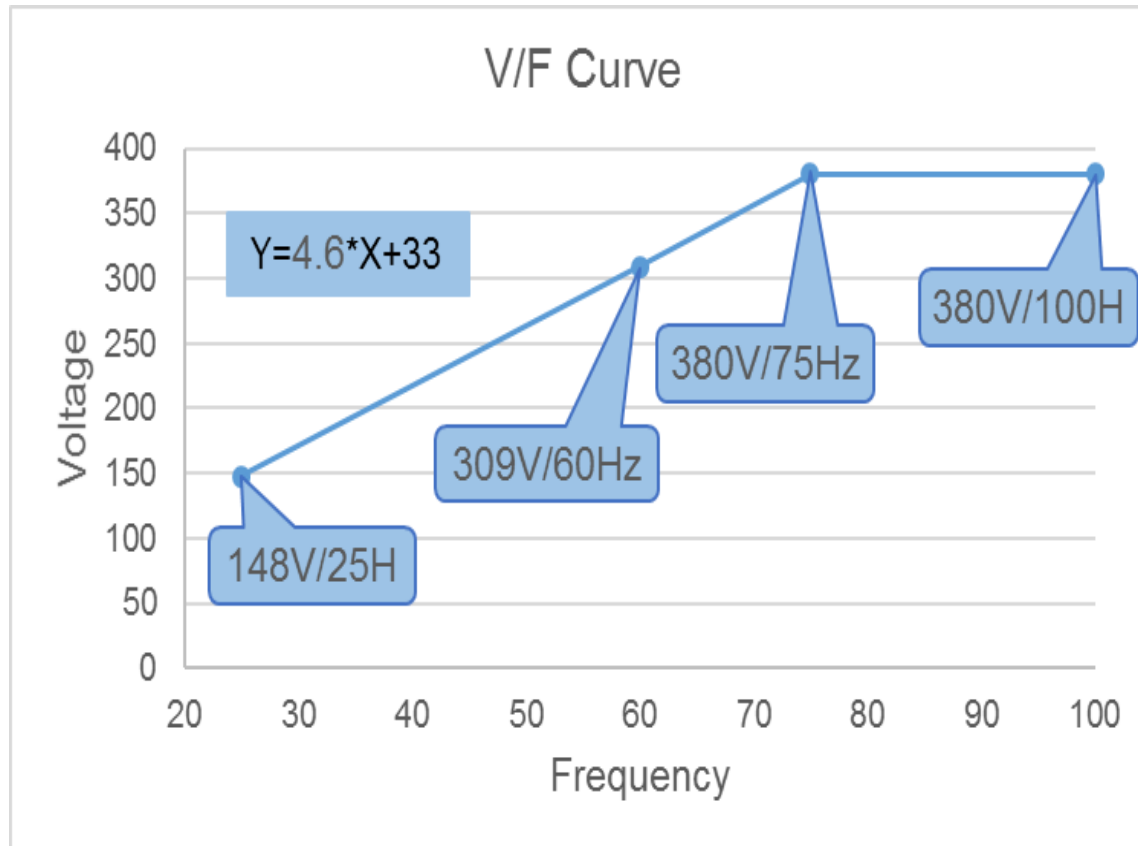
- Wide Operating Envelope for Heat Pump application and cooling

ZRHV72/81KTE - Dimension – Height Bellow 200 mm

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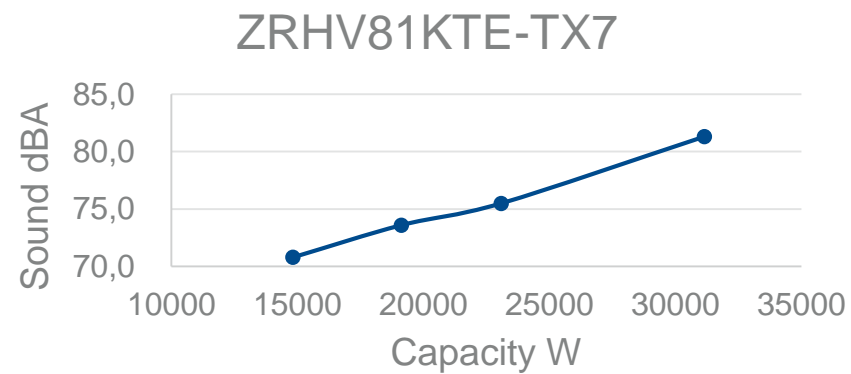
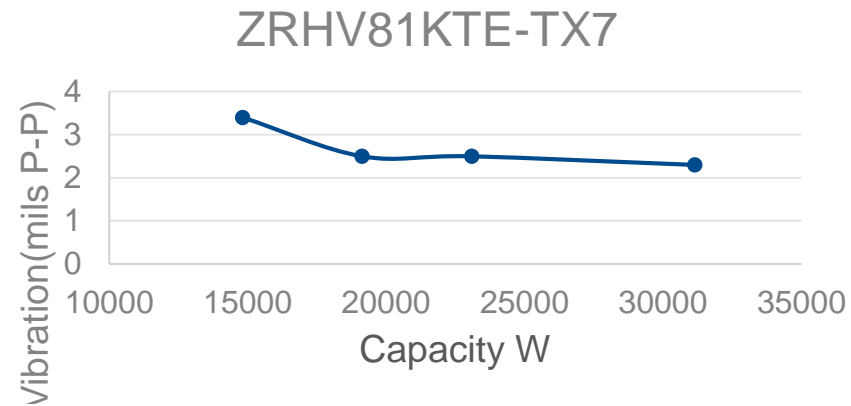
Dedicated Moto Version for VFD installation



- 380/3/75Hz per the V-F curve.
- Standards out of shelf drive to be used

Vibration And Sound Level

Excellent Vibration level



Vibration Video



Transport sensitive to vibration addressed

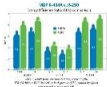
BOREALIS Heat Pump with with „green“ Refrigerant R290



„Green“ Refrigerants

Refrigerant	GWP	Boiling @ 1 bar [°C]	Density @ 1 bar [kg/m ³]	Lat. Heat @ 1 bar [kJ/m ³]	Critical Temp. [°C]	Critical Pressure [bar]	Safety Class	Remarks
R744 (CO ₂)	1	-57*	13.6*	4713*	31	74	A1	High pressure (200bar)
R1270 (Propylene)	2	-48	2.32	1022	91	46	A3	flammable
R290 (Propan)	3	-42	2.37	1016	97	43	A3	flammable
R717 (Amoniak)	0	-33	0.86	1204	132	113	B2	toxic flammable
R1234yf	4	-29	5.85	1055	95	34	A2L	flammable

Why R290?



GWP 3



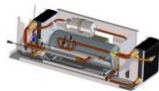
Similar pressure range compared with R134a



State of the Art in Commercial & Industrial Applications



Copper and Aluminium Material can be used



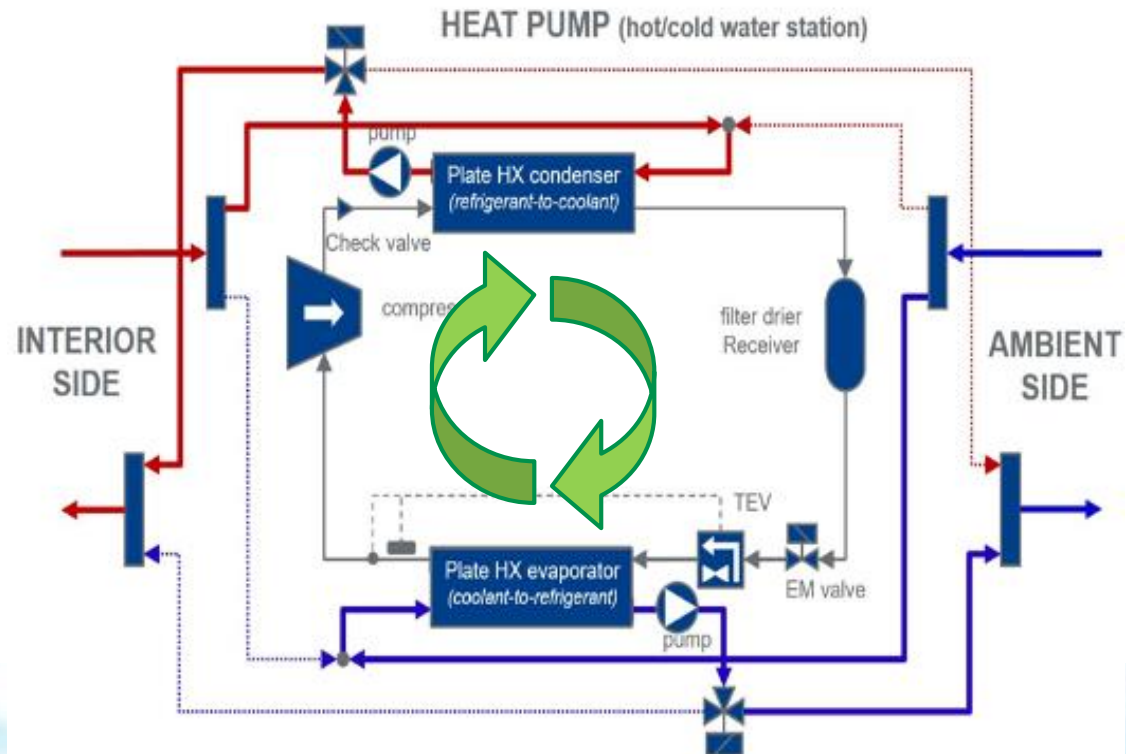
Hermetic Refrigerant Cycle (no direct evaporation)

BOREALIS 2.0 Heat Pump

No reverse refrigerant flow

No direct heat transfer Air / Refrigerant

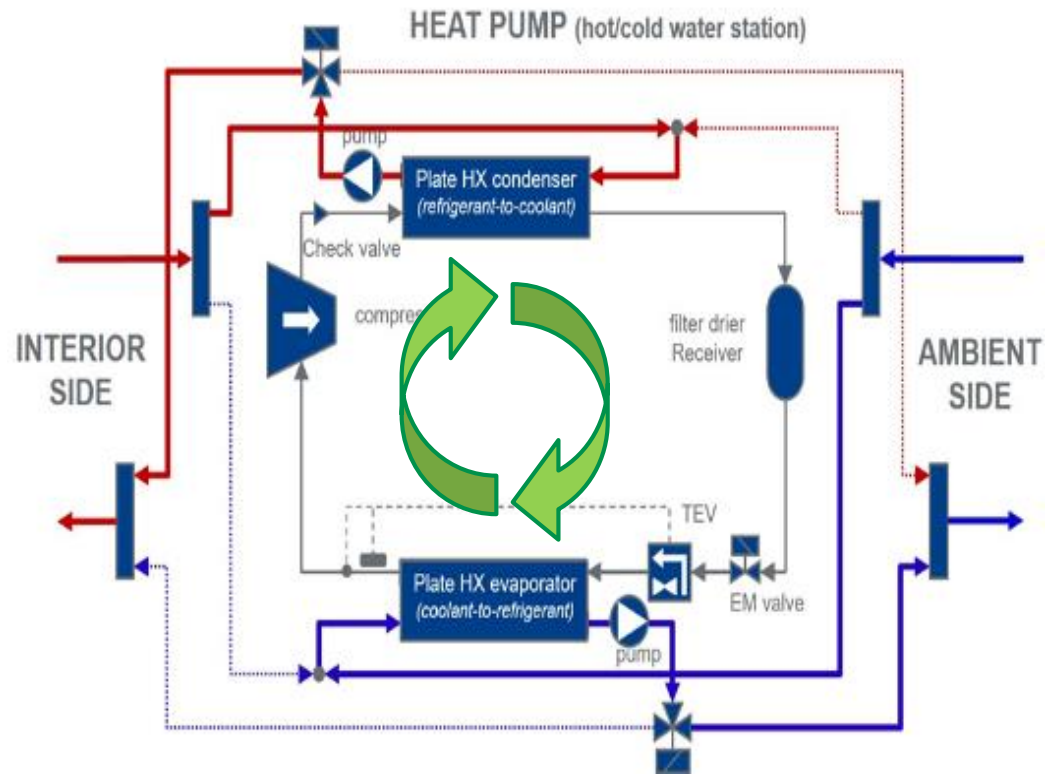
Modular System



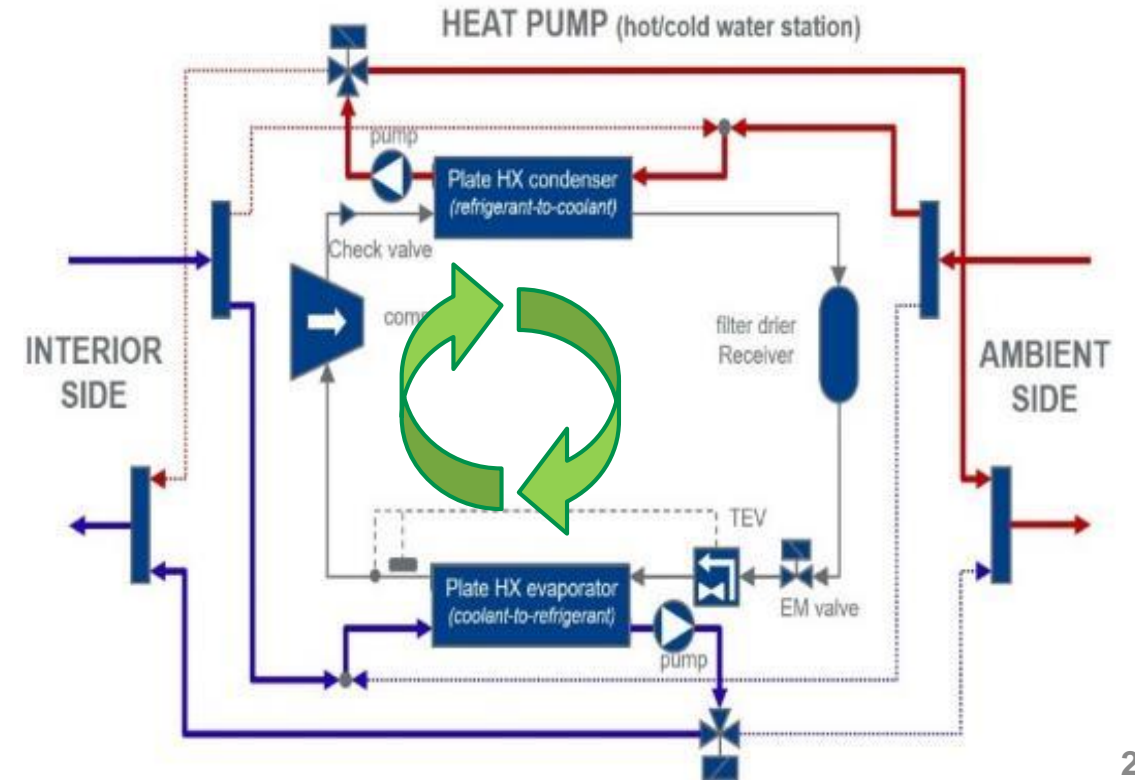
Bi-directionale Water Loop

Reverse Water Loop

HEATING



AC



BOREALIS 2.0 Heat Pump



Low weight



Compact design



Integrated Battery Temperature Control



Scroll Compressor



Waste Heat Utilization



„Green“ Refrigerant R290



BOREALIS 2.0 Heat Pump



Cooling Capacity 26 kW



Heating Capacity w/o waste heat 16 kW



Heating Capacities with waste heat 22 kW



Control Voltage 18 – 32 VDC



Battery Power 450 – 800 VDC



Refrigerant Charge R290 ~ 1500 g



Temperature Range +45 °C – -15 °C*



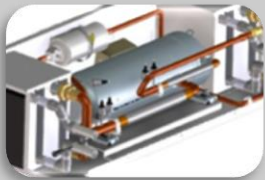
*with waste heat utilization

BOREALIS 2.0 Heat Pump

R290 Safety Concept EN 378



Minimum Refrigerant Charge 1,5 kg R290



Hermetically sealed refrigerant loop

- Bended refrigerant pipes w/o fittings

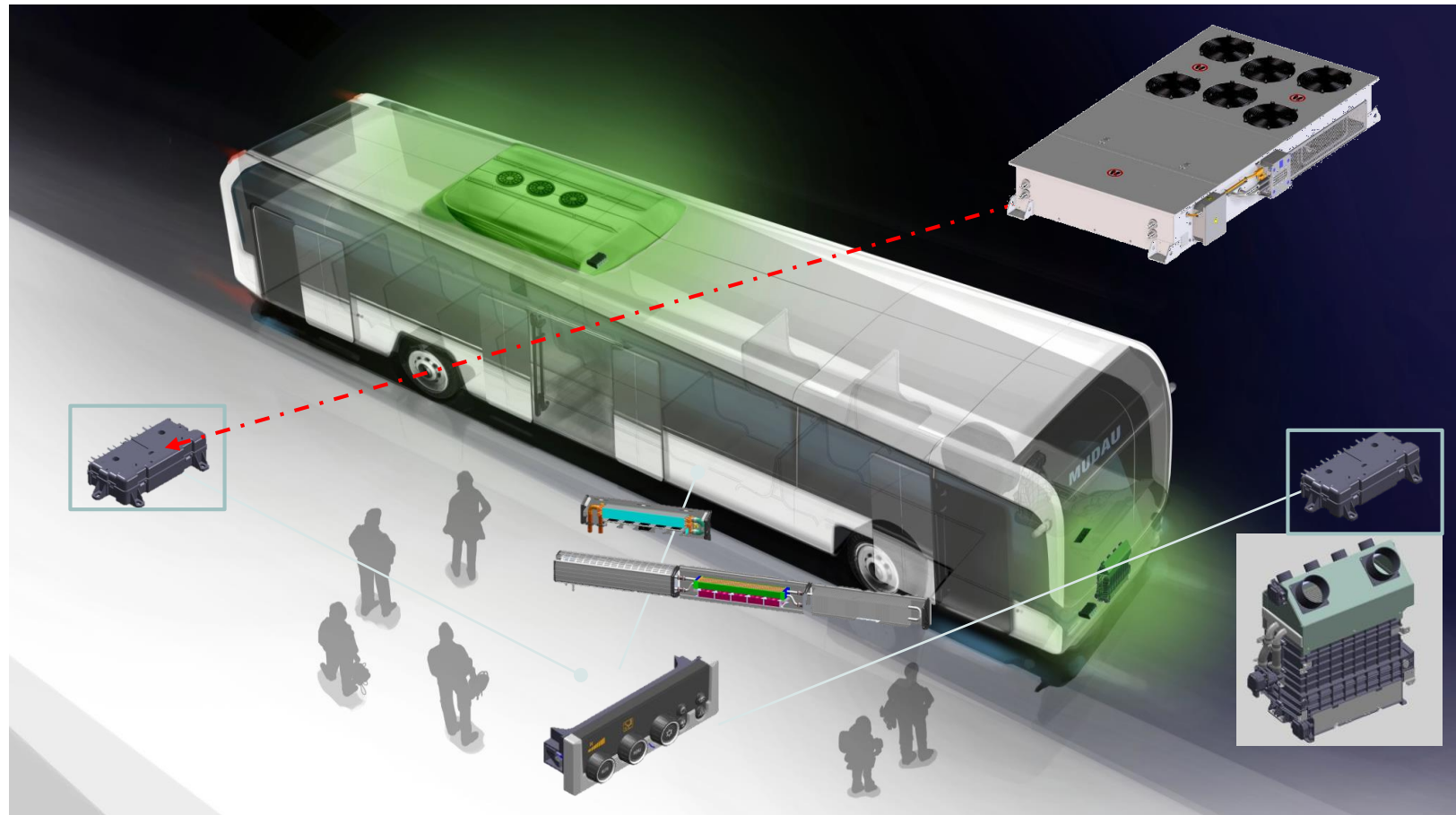
Enclosed Refrigerant Module



- No ignition sources
- Automatic Ventilation
- Pressure, Temperature Sensor and Pressure Switches accord. ATEX-Standard
- High Pressure Safety Valve with controlled release in case of Accident
- Indirect Heating and Cooling w/o direct Emissions into the Passenger Compqartment



Application



Application Research Project



Hochvoltantriebe mit integrierter SiC-Leistungselektronik für Nebenverbraucher in Elektrofahrzeugen

Gefördert durch:



Bundesministerium
für Bildung
und Forschung



ebmpapst



Teilvorhaben AURORA:

Optimierung einer Wärmepumpe für den Einsatz neuartiger Motorentechnik auf Basis kompakter Hochvolt-Motorentechnik mit integrierter SiC-Leistungselektronik

eurammon is always available as sparring partner for questions on refrigeration with natural refrigerants.

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refrigerants delivered by mother nature