Highly-efficient energy recovery for controlled mechanical ventilation units

Combined thermal wheel + reverse-cycle heat pump solution

Efficient and sustainable air change solution

High-efficiency heat exchangers, electronic expansion valves, variable-speed rotary compressors and low GWP refrigerant fluids: all the ingredients needed to achieve energy excellence.

- Efficient recovery of energy from the exhaust air expelled from buildings;
- High-efficiency thermal wheels for recovering heat and humidity;
- Heat pumps with inverters capable of adapting their capacity to the instant energy demand.

Controlled mechanical ventilation units are designed to guarantee the right indoor air quality in buildings, and are equipped with heat exchangers for partial energy recovery. CAREL, in accordance with European Regulation no. 1253/2014, offers heat exchangers with an efficiency exceeding 73%.
For higher heat recovery, even above 100%, a heat pump can be added, equipped with CAREL products, also including the A3 ready version.

The condenser and evaporator, installed in series with the thermal wheel, together comprise a sustainable solution with high energy efficiency.
This system introduces clean air at the desired temperature into the building, improving indoor comfort and reducing the cost of air conditioning.

Compatibility with the latest refrigerants

Products designed for HFOs and highly-flammable natural refrigerants to meet the needs of unit manufacturers in terms of regulations such as F-Gas.

High efficiency and low power consumption

Combined use of EEV technology and variable-speed brushless motor compressors, to guarantee higher efficiency and lower energy consumption.

Thermal wheel with absorption rotor

Excellent heat and humidity transfer, in accordance with European regulation 12537/2014.

Operating conditions

Winter and summer operation

All bidirectional controlled mechanical ventilation units, with the return and supply ducts in cascade, can recover 100% of the heat from the air through a system comprising a thermal wheel and reverse-cycle heat pump. If the thermal wheel is equipped with an absorption rotor (made from hygroscopic material), humidity is also transferred between the two air streams. This means lower energy costs for:

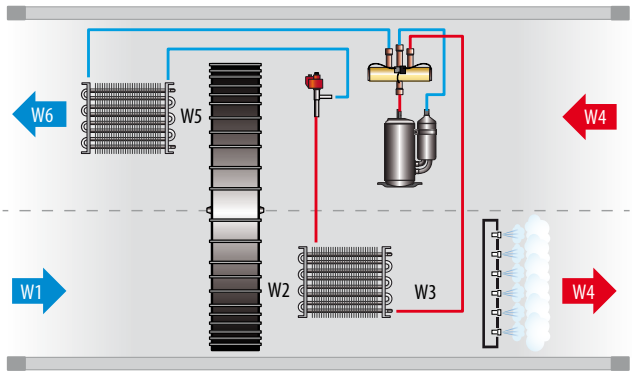
- humidifying the supply air in winter;
- dehumidifying the supply air in summer.

In any case, to ensure the right relative humidity value, it is recommended to install a CAREL isothermal humidifier.

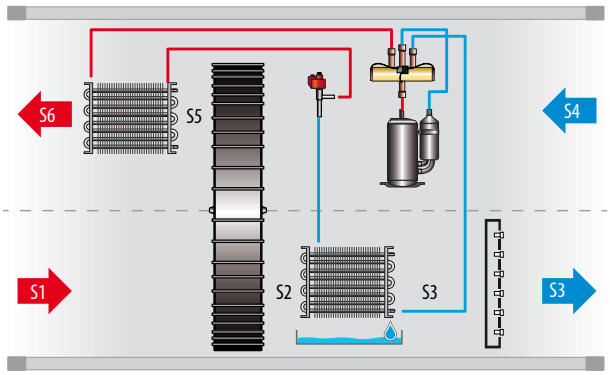
The heat pump equipped with electronic expansion valve and BLDC compressor manages the final step in controlling the system's heat requirements, adjusting the refrigerant flow-rate according to needs.

The psychrometric chart below shows the transformations of the humid air entering and leaving the system, for operation in winter case and in summer.

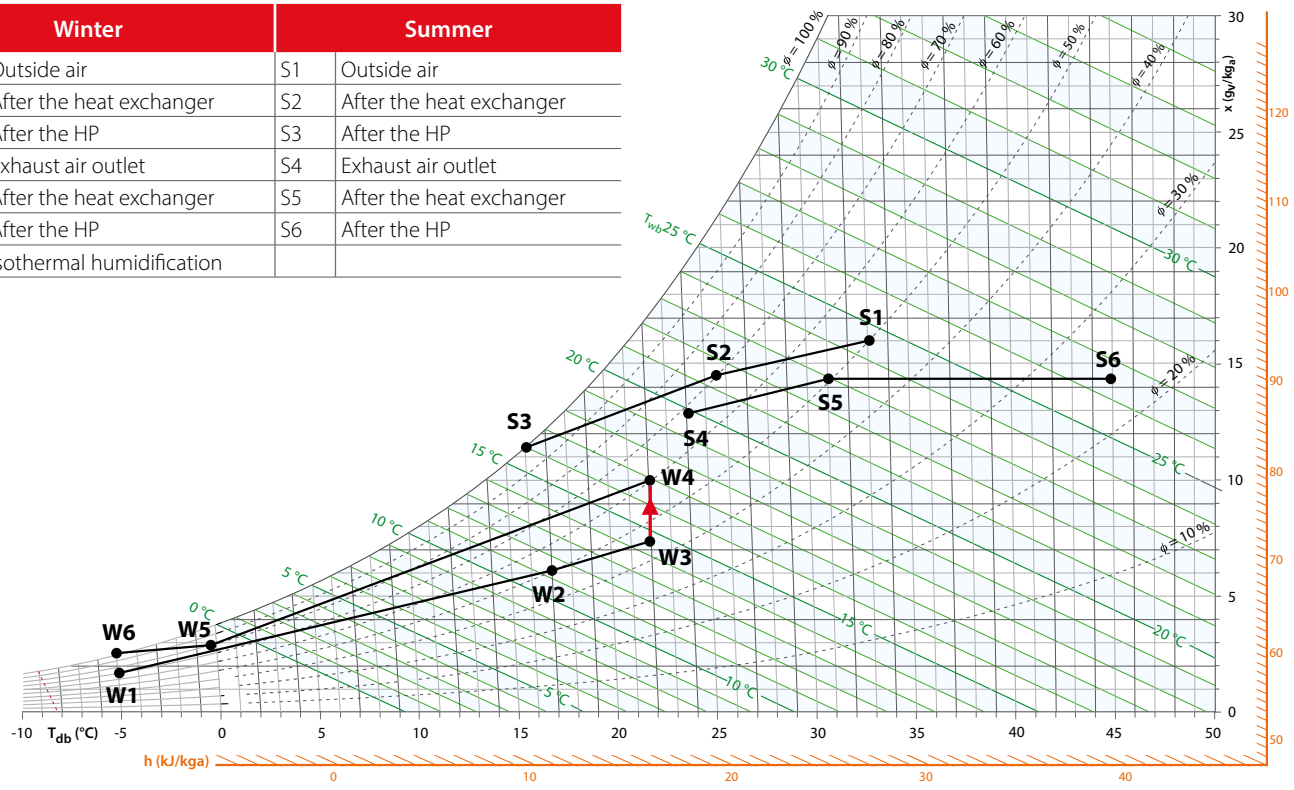
Winter



Summer



Winter		Summer	
W1	Outside air	S1	Outside air
W2	After the heat exchanger	S2	After the heat exchanger
W3	After the HP	S3	After the HP
W4	Exhaust air outlet	S4	Exhaust air outlet
W5	After the heat exchanger	S5	After the heat exchanger
W6	After the HP	S6	After the HP
W3-W4	Isothermal humidification		



System components

CAREL products for compact, safe and high-efficiency controlled mechanical ventilation units with heat recovery (MVHR): from the controller to the rotary compressor.

Programmable controller (c.pCO*)

- Built-in valve drivers for EEV control;
- Configurable I/Os for high flexibility;
- RS485 and Ethernet ports for connectivity to field devices and supervisors;
- Compatibility with traditional and natural refrigerants (A3 ready);
- Dedicated SW solution.

HMI user interface

- 6-button semi-graphic terminal with black and white display (pGDn);
- Touch screen graphic terminal with 65K or 16M colour display, depending on the model (pGDx);
- Available for indoor and outdoor applications;
- Compatibility with traditional refrigerants and specific versions for natural refrigerants (A3 ready).

Thermal wheel (Klingenburg RRU ECO-Hugo series)

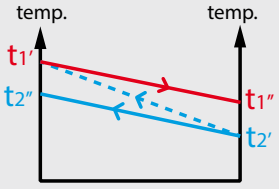
- Galvanised carbon steel frame, maximum dimensions 2550 mm HxW;
- Aluminium rotor with zeolite coating for efficient moisture transfer;
- Vertical installation.

Pressure transducers (SPKT* / SPKS*)

- High EMC immunity for precise measurement;
- Can be installed directly on the piping, eliminating the need for fittings and joints;
- Availability in screw-on and weld-on versions;
- ATEX certification and compatibility with traditional and natural refrigerants (A3 ready).

European regulation no. 1253/2014

Klingenburg-brand CAREL products can achieve efficiency levels that are higher than the minimum required by the European regulation. The higher the efficiency of the heat exchanger, the closer the cold fluid outlet temperature (t2″) will be to the hot fluid inlet temperature (t1′).



$$\eta = \frac{Q_{exchanged}}{Q_{max}} = \frac{(t''_2 - t'_2)}{(t''_1 - t'_2)} \geq 73\%$$

Power+ inverter (PS2*)

- Specific design for driving BLDC compressors;
- Compressor protection in the event of a fault ensured by class B certified FW and the dedicated STO safety input;
- Wide temperature range with guaranteed maximum capacity delivered (-20T60);
- Compatibility with traditional and natural refrigerants (A3 ready);

Electronic expansion valve (E²VF)

- Highly-precise control of refrigerant flow via equipercentile profile of the valve member;
- Two-way valve with excellent performance, regardless of the direction of fluid flow;
- Hermetic valve with stepper motor, usable with ATEX stators;
- Compatibility with traditional and natural refrigerants (A3 ready).

AVIC rotary compressor

- Twin rotary technology combined with BLDC electric motor;
- Wide operating range and wide frequency range;
- Availability for both R32 and R290.

F-GAS

On 20 February 2024, the new F-gas regulation was published in the official journal of the European Union. Air handling units equipped with a heat pump come under the "Self contained ACHP" category. Based on the unit's capacity, starting from 2027, a progressive ban on the use of gases with a GWP >150 is expected. Natural fluids such as R290 and R600a require design precautions, however as their GWP is virtually zero, they are not among the gases prohibited by the new regulation.

	2027 to 2029	2030 to 2031	2032. to .20xx
Self contained ACHP (≤12 kW)	<150 GWP		No F-gas
Self contained ACHP (12-50 kW)	<150 GWP		
Self contained ACHP (>50 kW)	-	<150 GWP	

AVIC rotary compressor

The CAREL proposal includes an exclusive range of rotary compressors: **suitable** for R32 and R290 refrigerants; **efficient** thanks to BLDC technology; **flexible,** covering multiple application conditions.

- **Qualification**: free with CAREL inverters
- **Availability**: in stock at CAREL
- **Exclusivity**: Europe

沈阳中航机电三洋制冷设备有限公司
AVIC ELECTROMECHANICAL (SHENYANG) SANYO REFRIGERATION EQUIPMENT CO., LTD.

The CAREL proposal has been further extended with the addition of the AVIC rotary compressor.

The partnership with AVIC allows CAREL to offer an efficient, tested and certified solution in terms of compressor-inverter combination.

AVIC EM SANYO manufactures more than 6 million rotary compressors a year. The company was founded in 1990, with solid roots in Sanyo, still a valuable partner in the areas of design, production and quality.

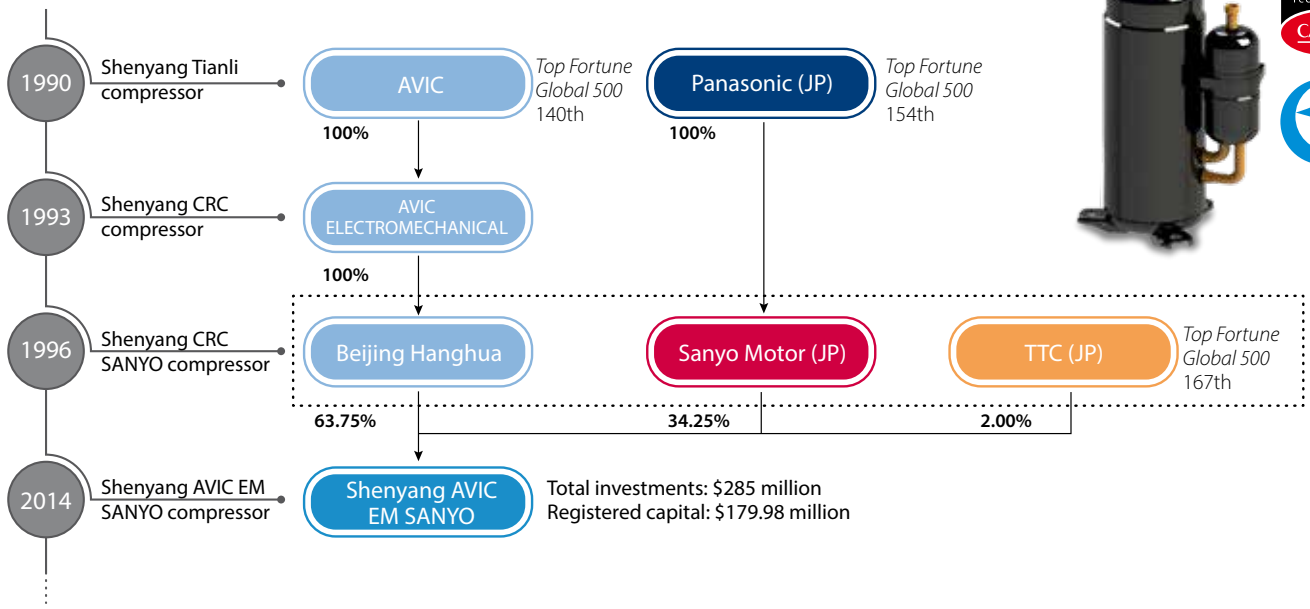
Indeed, the company can boast almost 60 years of experience in the field of rotary compressors for HVAC applications. In the mid 1980s it was the first company to launch a twin solution combined with permanent magnet electric motors.

Today, the natural evolution of this experience is the new R290 range, which CAREL has approached with the desire to offer the market a tested, high-performance inverter-compressor solution.

History

- 1990 — Shenyang Tianli compressor
- 1993 — Shenyang CRC compressor
- 1996 — Shenyang CRC SANYO compressor
- 2014 — Shenyang AVIC EM SANYO compressor

Shareholding structure



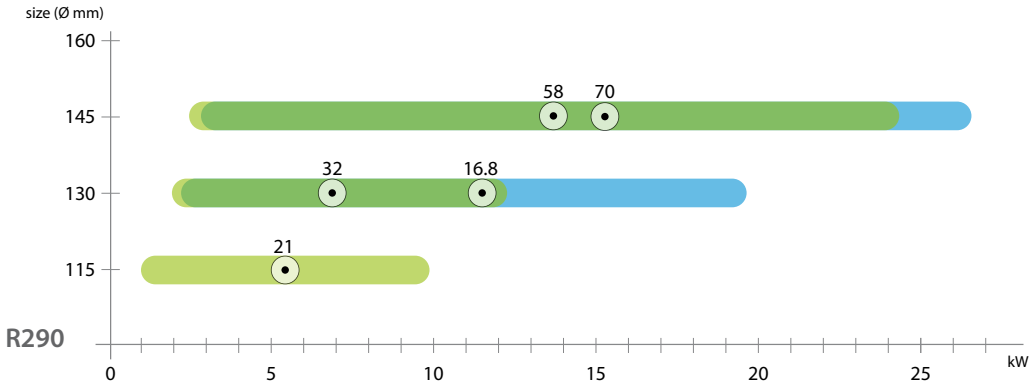
some other numbers...

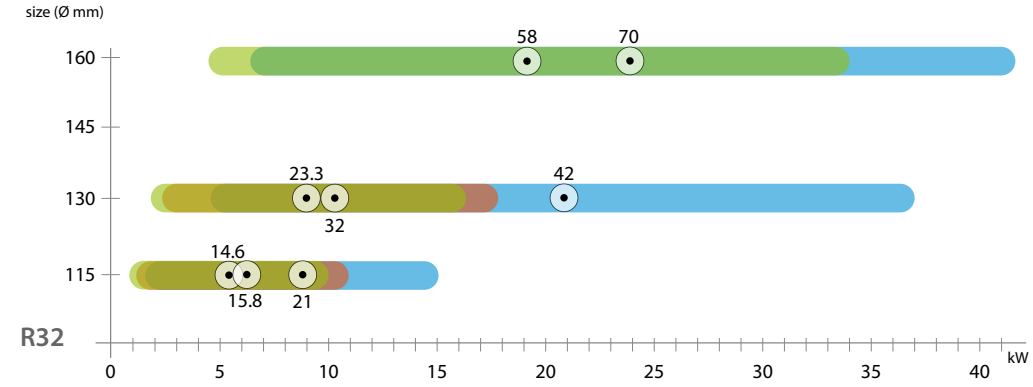
1990
Year founded

> 2,200
Exployees

142,000
m^2
Total indoor area

Capacity range - chiller mode





7.2/54.4 °C= evaporation temperature/condensing temperature

11.1/8.3 K= superheat/subcooling

⊙ = efficiency values at 60 rps

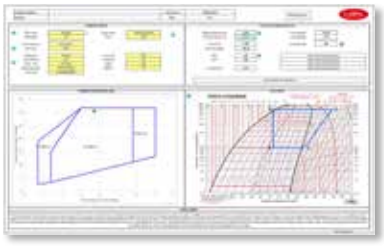
Main technical specifications

Model	210	320	420	580	700
R290					
Size (mm)	115	130	130	145	145
Displacement (cm³/rev)	21	32	42	58	70
Vmin - Vmax (rps)	8 - 120	15 - 100	15 - 120	10 - 120	10 - 120
Single-phase power supply - 230 V	●	●	●		
Three-phase power supply - 400 V		●	●	●	●
PED class	I	II	II	II	II

Model	146	158	210	233	320	420	580	700
R32								
Size (mm)	115	115	115	130	130	130	160	160
Displacement (cm³/rev)	14.6	15.8	21	23.3	32	42	58	70
Vmin - Vmax (rps)	8-150	8-130	8-120	15-120	15-100	15-120	15-100	15-100
Single-phase power supply - 230 V	●	●	●	●	●	●		
Three-phase power supply - 400 V					●	●	●	●
PED class	I	I	I	II	II	II	II	II

Compressor verification software

CAREL provides software for verifying compressor performance.
Easy, intuitive and highly useful



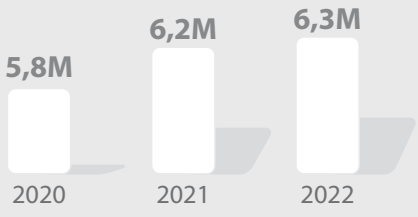
Tests conducted in the laboratory

- Calorimeter
- Test bench for electric motors
- Anechoic chamber
- Vibration analysis
- Accelerated life cycle tests

Research and development

- Two Research and Development centres:
  - Shenyang, PRC since 1990;
  - Gunma, JP since 1968
- over 200 technical staff

Units manufactured



over 10 million - annual production capacity
Fully automated production lines

Headquarters

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