

**Residential heat pumps**  
High-efficiency solution for  
propane units





# Complete solution for the management of heat pumps in residential application

System developed to obtain the highest results in terms of energy efficiency and promote environmental sustainability by using devices compatible with low GWP natural refrigerants.

- Integrated management of BLDC compressors and electronic expansion valves;
- High flexibility and modularity for different needs;
- Basic software as starting point for the development of custom solutions;
- Compatibility with the use of natural refrigerants and HFOs (A3 Ready).

Due to the greater availability of energy from renewable sources and the need for the rapid decarbonisation of heating systems, there has been an exponential growth in the heat pump market.

Increasing attention to environmental protection is driving the use of low GWP natural refrigerants, however these are often highly flammable.

CAREL's products are suitable for use with the latest A3-classified flammable refrigerants, meaning much faster certification of the heat pump, and the possibility to manufacture the high quantities of units required by the market.



## Compatibility with the latest refrigerants

Compatibility with HFOs and 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 BLDC compressors to ensure higher efficiency and lower power consumption (high SCOP).



## Compressor + inverter system qualification

Functional safety across the entire operating range of the compressor. Tested and certified solution

## Software and tools for developing your own ideas

CAREL provides "c.solution - residential Heat Pump", an application program for the management of heat pumps that can control high-efficiency devices (inverters, valves...) while at the same time guaranteeing system protection (evaporator defrosting, frost protection...).

The software can be used in the initial configuration, or adapted to suit the layout of the customer's unit in a few simple steps.

By using the c.suite development tool, designed as independent modules, a team of professionals can work simultaneously on the same project, reducing development times.

c.suite



## c.suite workflow



c.strategy



c.design



c.factory



c.field

### Main functions provided by the software

- Primary water (heating/cooling) and domestic hot water.
- Air-to-water/water-to-water models supported.
- Management of high efficiency devices: power+ inverter and compressor, EEVs.
- Modulating control of external devices (fans, pumps, heaters).
- Smart control of operating limits.
- Additional functions: defrost, frost protection, Legionella prevention, set point compensation based on outside temperature.
- Other specific functions typical of residential market.
- Compatible with PGD\*, pLDPRO, PGDX user interfaces.



See our website and YouTube channel to stay up-to-date with the latest news and the entire CAREL offering

 YouTube

# System components

The ready-to-use CAREL solution for managing the cooling circuit of air-water and water-water heat pumps, consisting of reliable, safe and highly-efficient devices.

1



## Programmable controller (μPC3\*)

- High configurability of the I/O mix for high flexibility;
- Up to 2 built-in driver for the management of electronic expansion valves (EEV);
- RS485 and Ethernet ports for high field connectivity and BMS;
- Compatibility with traditional and natural refrigerants (A3 ready).





### 2 Electronic expansion valve (E<sup>2</sup>V-F)

- High-precision control of refrigerant fluid thanks to the valve shutter;
- Two-way valve with high performances on both directions;
- Hermetic valve with stepper motor usable with ATEX stator;
- Compatibility with traditional and natural refrigerants (A3 ready).



### 3 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 the guaranteed maximum output power (-20T60);
- Compatible with traditional and natural refrigerants (A3 ready).



### 6 HMI user interface

- 6-button semi-graphic terminal with monochromatic 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).



### 5 Pressure transducers (SPKT\* / SPKS\*)

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



### 4 AVIC rotary compressor

- Twin rotary technology combined with BLDC electric motor;
- Wide operating range, with evaporating temperatures down to -35°C and condensing temperatures up to +82°C;
- Range suitable for residential heat pump applications;
- Available for both traditional gases, such as R410A or R32, as well as for R290.



# AVIC rotary compressor for R290

CAREL's offering includes an exclusive range of rotary compressors: environmentally **friendly** because it uses R290, **efficient** thanks to BLDC technology, with **specific** capacities suitable for residential applications, and **flexible** to adapt to multiple climatic conditions.

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

The CAREL proposal has been further extended and completed 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.

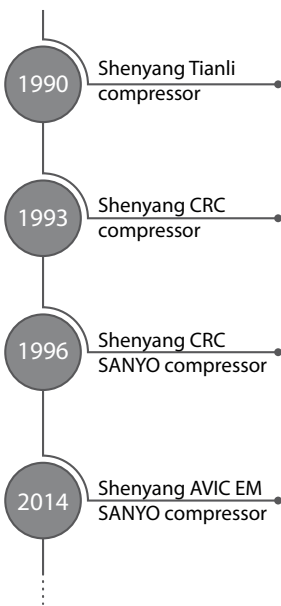
AVIC EM SANYO manufactures more than 6 million rotary compressors a year. The company was founded in 1990, with solid roots in Sanyo, still a valuable partner in the areas of design, production and quality.

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.

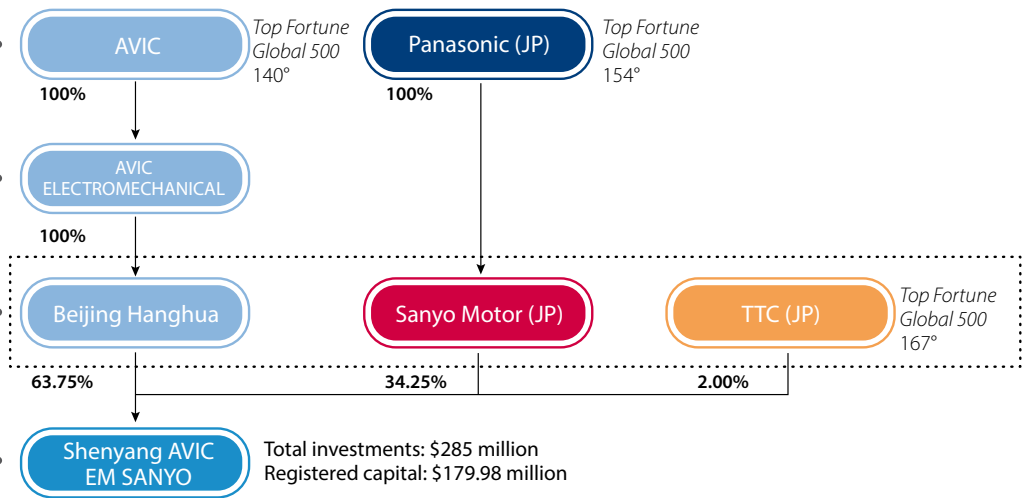
Today, the natural evolution of this experience is the new R290 range, which CAREL has approached with the desire to offer the market a tested, high-performance inverter-compressor solution.



## History



## Shareholding structure



## some other numbers...

1990



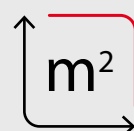
Year of foundation

>2,200



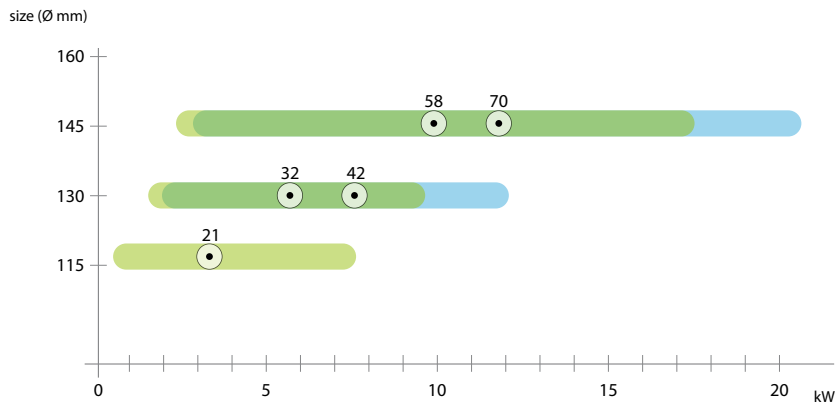
Employees

142,000



Total indoor area

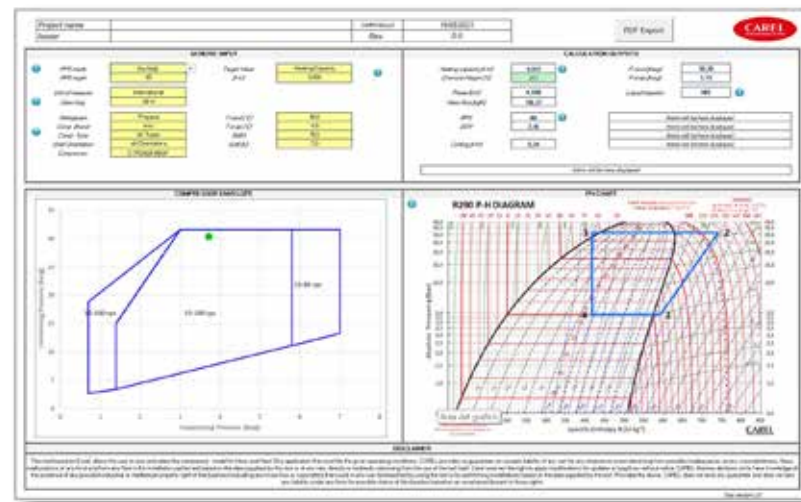
## Capacity range - heat pump mode



0/75 °C= evaporation temperature/condensing temperature  
 10/5 K= superheat/subcooling  
 ● = efficiency values at 60 rps

## Compressor verification software

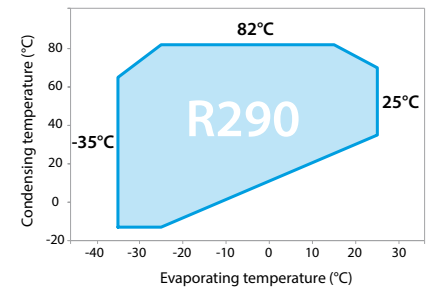
CAREL provides software for verifying compressor performance. Easy, intuitive and highly useful.



## Main technical specifications

Model	210	320	420	580	700
Size (mm)	115	130	130	145	145
Displacement (cm <sup>3</sup> /rev)	21	32	42	58	70
Vmin - Vmax (rps)	8 - 120	15 - 100	15 - 100	15 - 100	15 - 100
Single-phase power supply - 230 V	●	●	●		
Three-phase power supply - 400 V		●	●	●	●
PED class	I	II	II	II	II

## R290 compressor verification software



## Operating range

Evaporation temperature: -35T25 °C  
 Condensing temperature: -13T82 °C

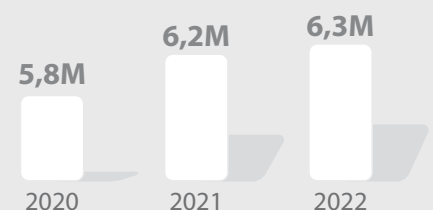
## Tests conducted in the laboratory

- 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

CAREL INDUSTRIES HQs  
Via dell'Industria, 11  
35020 Brugine - Padova (Italy)  
carel@carel.com



## Authorized distributor

### Arion S.r.l.

Sede operativa:  
Via Pizzo Camino, 28  
24060 Chiuduno (BG) - Italy  
www.arionsensors.com

### HygroMatik GmbH

Lise-Meitner-Straße 3  
24558 Henstedt-Ulzburg - Germany  
www.hygromatik.com

### RECUPERATOR

Via Valfurva 13  
20027 Rescaldina (MI) - Italy  
www.recuperator.eu

### C.R.C. S.r.l.

Via Selva di Pescarola 12/9  
40131 Bologna - Italy  
info@crc-srl.net  
www.carel.com

### Klingenburg GmbH

Brüsseler Str. 7  
45968 Gladbeck - Germany  
www.klingenburg.de

### Sauber

Via Don Doride Bertoldi, 51  
46047 Porto Mantovano (MN) - Italy  
www.sauberservizi.it

### ENGINIA S.r.l.

Viale Lombardia, 78  
20056 Trezzo Sull'Adda (MI) - Italy  
www.enginiasrl.com

### Klingenburg International Sp. z o.o.

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PL-58-100 Świdnica, Poland  
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### Senva

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OR 97006, Stati Uniti  
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