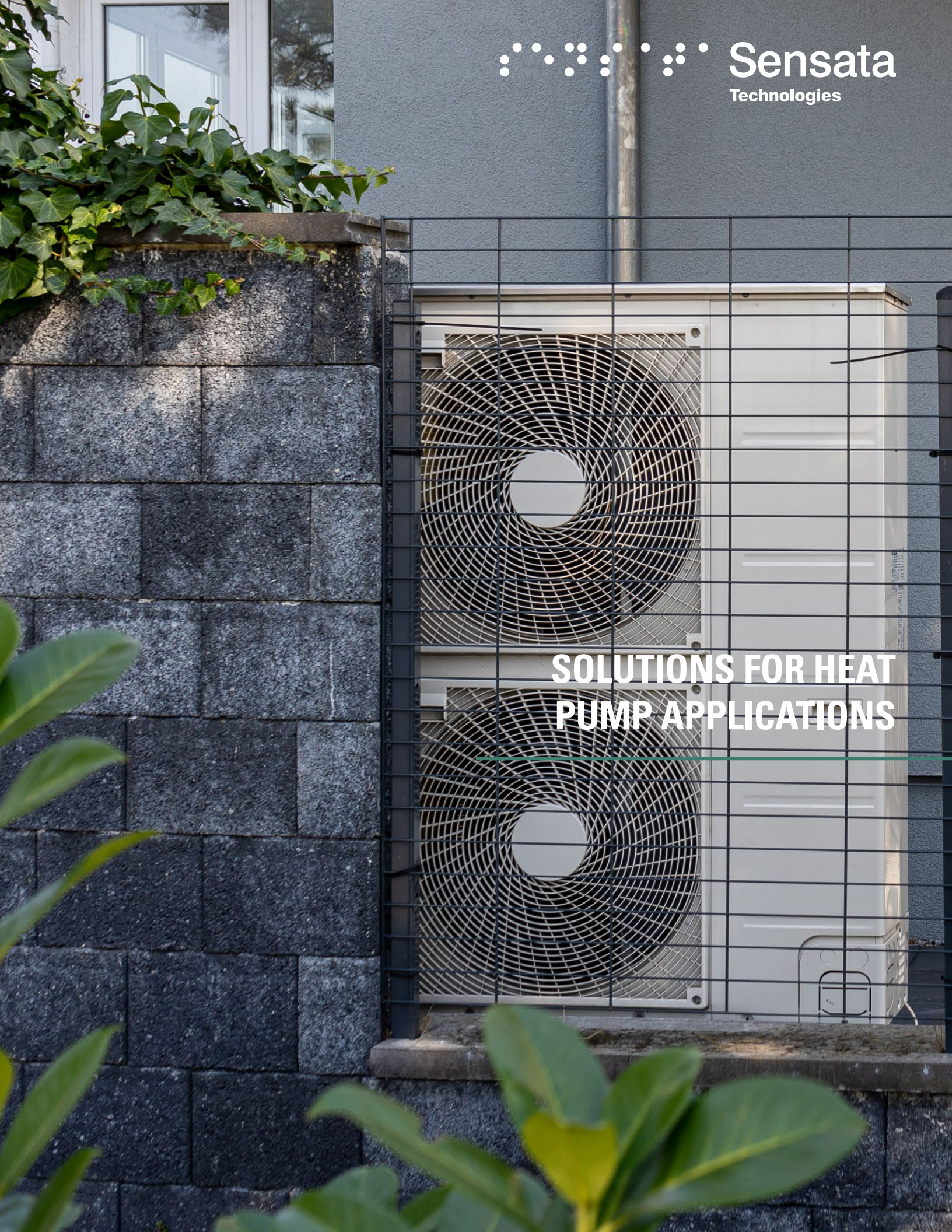




**Sensata**  
Technologies

**SOLUTIONS FOR HEAT  
PUMP APPLICATIONS**





# HEAT PUMPS SEE GLOBAL EXPANSION

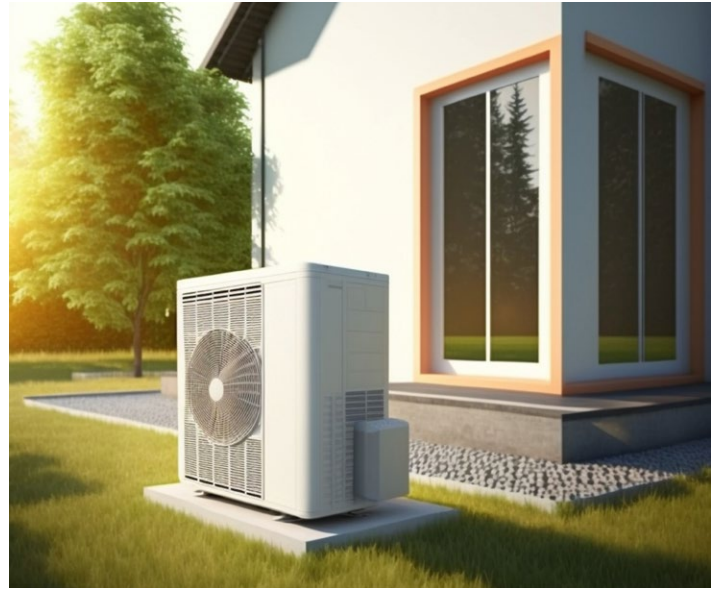
As part of ongoing efforts to impact climate change, the HVAC industry is a significant area of focus around the globe.

Taken as a whole, heating and cooling account for nearly half of energy consumption in the European Union. In addition, 70 percent of that output is generated by fossil fuels, such as natural gas-driven boilers for heating.

This large effort has been crystallized into a focus on increasing heat pump use across the globe, with many European countries at the forefront of this shift.

Rather than utilizing fossil fuels such as natural gas the supply of which is subject to geopolitical issues heat pumps are part of the larger transition toward an electrified world, and part of the IEA's push toward a net-zero emissions scenario by the year 2050. Globally, the net-zero emission goal would require 600 million heat pumps in place by 2030 – which would account for 20% of heating needs worldwide – roughly triple current volumes.

(Source: IEA Report - Technology and innovation pathways for zero-carbon-ready buildings by 2030. Sept. 2022)



## LEGISLATION, INCENTIVES AND OTHER EU PROGRAMS

In addition to the guidelines and goals set across the region, many countries have created regulations and/or incentives to support the transition to heat pumps – with the REPowerEU Plan stating a goal of installing 10 million heat pumps between 2023 and 2027.

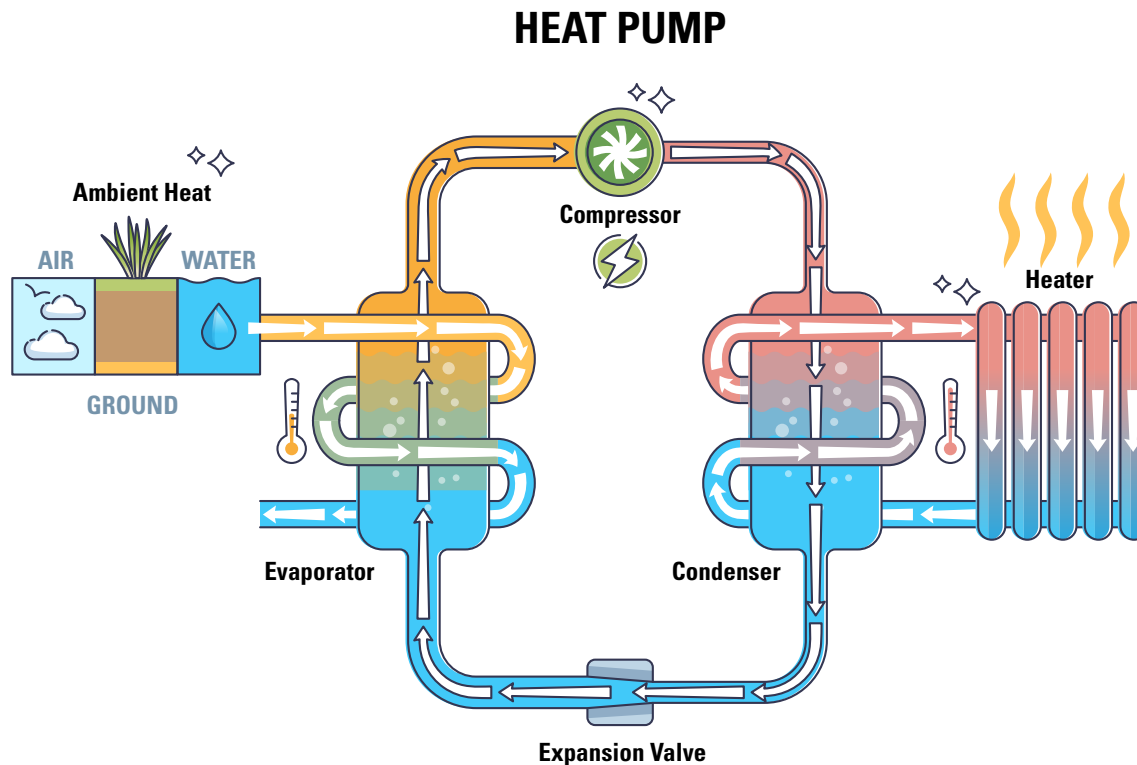
Some of these programs and regulations include:

- Gas Boiler Bans - France, Austria, Ireland, Luxembourg, and the United Kingdom have passed bans on installing gas boilers in new buildings in the future. In addition, Germany, the Netherlands, and the UK have passed future bans for gas boiler installation in all buildings.
- Financial Incentives – A variety of countries have created incentives for residential and commercial buildings to switch to heat pumps, with grants, income tax or VAT rebates, and various loan programs available in more than 30 countries worldwide.
- Energy Cost Incentives – Germany provides specialized electricity rates for consumers utilizing electric heating (reducing costs by 20%)
- Fossil Fuel Taxes – Netherlands is aiming to increase taxes on natural gas by more than 40 percent by 2026



# HEAT PUMP FUNCTION

As with other HVAC platforms, heat pumps function by manipulating the pressure of a refrigerant to alter its state from a liquid to a gas. Different than a traditional air conditioning unit, however, heat pumps are bi-directional. The system can compress the refrigerant outside and cause it to absorb heat from an exterior source and bring it into the home to heat the air or hot water tank through the hydronic loop. After giving off that heat, it then moves through an expansion valve, where the pressure is reduced and the temperature drops accordingly. This frees the refrigerant up to absorb more heat from its heat source and continue the cycle.



But it can also utilize a reversing valve to achieve the opposite – compressing the refrigerant inside the home to serve as a heat sink, cooling that air and transferring the heat energy outside during warmer months.

## COP SPOTLIGHT

The efficiency of heat pumps is classified by their Coefficient of Performance (COP), which is a ratio of the amount of heat generated by the system divided by the energy taken in by the system (in this case in the form of electricity).

Natural gas condensing boilers generally cannot achieve performance ratings of 110% (COP of 1.1).

While a number of different factors impact the COP of the unit – which can vary daily depending on the outside environment – the latest heat pump designs can deliver COPs in the heating cycle of 4 or 4.5, meaning they are able to generate more than 4x the amount of energy they consume.

This is a critical aspect of the overall sustainability of the technology, since electricity from the grid has already lost a significant portion of the energy generated during transmission. This transmission loss is also why there is a continued sustainability focus on the power generation side, as local renewable energy generation would drive down transmission loss from the larger grid system.

$$\frac{\text{Amount of Heat Generated}}{\text{Energy Utilized}}$$

# HEAT PUMP SYSTEM CONFIGURATIONS

There are different heat pump configurations available in the market today, each with varying advantages.



## Monobloc Heat Pump System

In a monobloc system, both the hydronic and refrigerant loops are located outside in one large, combined unit, with only hot and cold water piping entering the home. While a more expensive unit generally, it is easier to install since the entire refrigerant cycle is self-contained.



## Split Heat Pump System

In a split heat pump, the indoor and outdoor units are connected via piping, which allows both units to be smaller and less expensive. However, this approach does require more specialized installation to ensure the most efficient operations.



## Hybrid Heat Pump System

May often be used in older houses and/or where climates are less favorable, where a split heat pump unit is combined with a condensing boiler. In these systems, the heat pump provides heat for the vast majority of the time, but in more extreme situations, the boiler can automatically provide supplemental heating.

# REFRIGERANTS FOCUS

Different heat pump solutions around the world use a variety of refrigerants based on their specific application and other environmental needs.

While systems in past decade may have used hydro-fluorocarbon (HFC) compounds, the high global warming potential (GWP) of those refrigerants has led to the development of other platforms.

Many systems across Europe utilize R290 (also known as propane), while others may utilize R32 or other refrigerant blends such as R454a/b/c (sometimes generically referred to as A2L refrigerants). Each of these choices may involve mitigation systems due to flammability concerns or pressure needs required to drive refrigerant compression within the system.

## Refrigerants

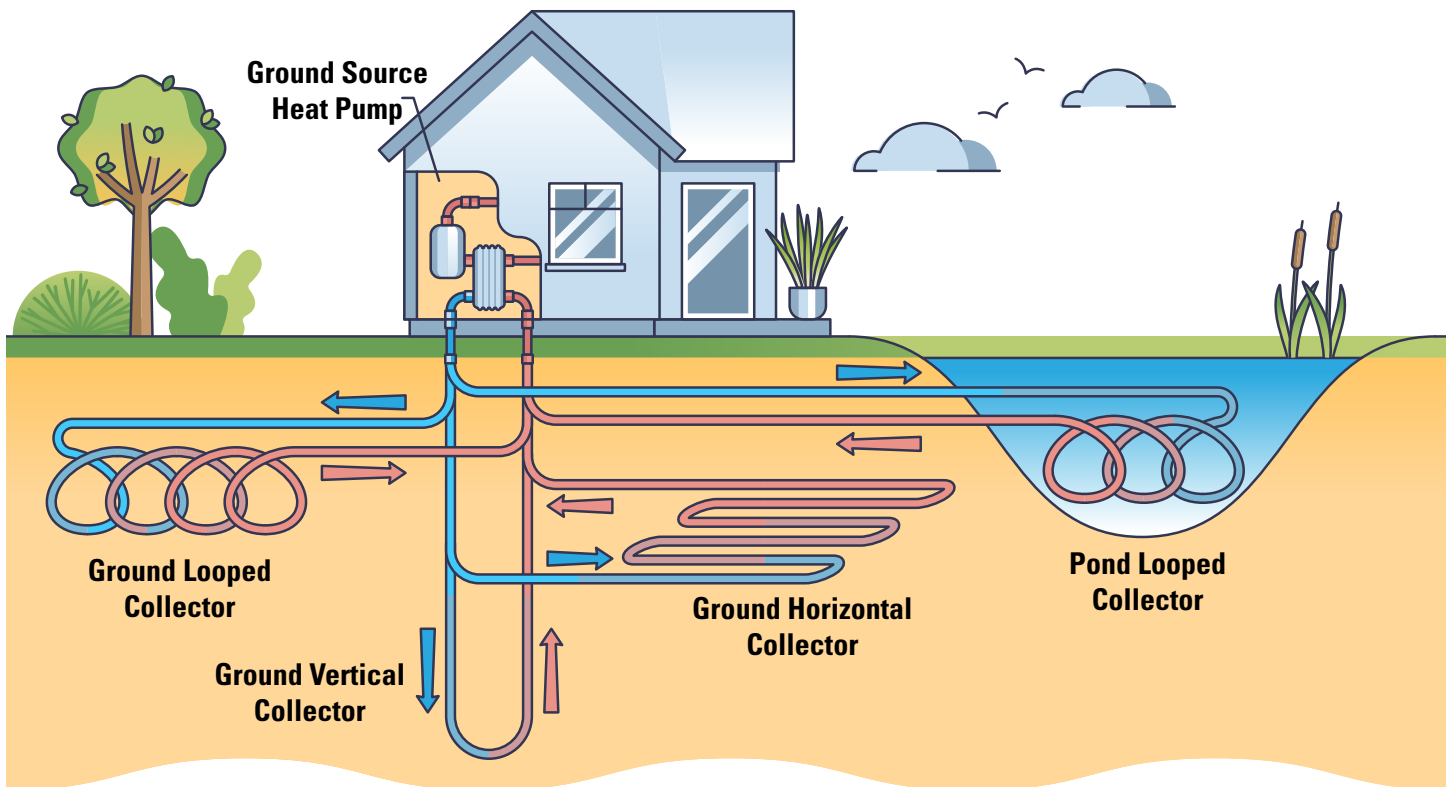
- R290
- R32
- R454a/b/c

# HEAT SOURCES

Heat pumps function by taking heat from one source and transferring it to the desired area.

Systems can be designed to use the outside ambient air as the source, but also harvest heat energy from the ground or nearby water source, such as a river, canal, or pond. This geothermal heat pump approach can generate better COP efficiency results – especially during colder months when the temperature difference between the outside air and the low-pressure refrigerant is not as significant

## GROUND SOURCE HEAT PUMP TYPE









# SENSATA SENSORS AND SWITCH PRODUCTS DESIGNED FOR HEAT PUMPS

Sensata has been a trusted supplier of HVAC and refrigeration manufacturers for decades, with trusted pressure, temperature, and other components that are designed to deliver reliable performance that drives maximum efficiency in a challenging environment for sensors.

## PRESSURE PRODUCTS


### Ceramic Sensors

PRODUCT		FEATURES	FUNCTION
	116CP	<ul style="list-style-type: none"> <li>• Cost effective</li> <li>• Compact design for hydronic loop</li> <li>• Drinking water safe option</li> </ul>	Pressure monitoring for circulation loop
	81/82CP	<ul style="list-style-type: none"> <li>• IP67 Available</li> <li>• ATEX Certified</li> <li>• Durable, compact design</li> <li>• R290 compatible</li> <li>• Voltage output 0-5Vdc</li> </ul>	Discharge or suction pressure monitoring, compressor control
	87/88CP	<ul style="list-style-type: none"> <li>• Wide range of housings, seals, and pressure ranges</li> <li>• ATEX Certified</li> <li>• 4-20mA current output</li> </ul>	Discharge or suction pressure monitoring, compressor control
	2CP5	<ul style="list-style-type: none"> <li>• Durable, compact design platform</li> <li>• Pressure ranges up to 750psi</li> <li>• Voltage output 0-5Vdc</li> </ul>	Discharge or suction pressure monitoring, compressor control

### Hermetic Sensor



PRODUCT		FEATURES	FUNCTION
	2HMP	<ul style="list-style-type: none"> <li>• Rugged seal ideal for outdoor environments</li> <li>• Reliable, hermetic design</li> <li>• IP67 Available</li> <li>• R290 compatible</li> <li>• Voltage output 0-5Vdc</li> <li>• ATEX Certified</li> </ul>	Discharge or suction pressure monitoring, compressor control
	5HMP	<ul style="list-style-type: none"> <li>• Rugged hermetic seal</li> <li>• Custom pressure ranges available- -0.8 to 0 barG up to max pressure of 10 to 50 barG</li> <li>• IP67 Available</li> <li>• 4-20mA output</li> </ul>	Discharge or suction pressure monitoring, compressor control

### Pressure Switches



PRODUCT		FEATURES	FUNCTION
	PS80	<ul style="list-style-type: none"> <li>• Hermetically sealed automatic reset pressure switch</li> <li>• Flexible set points</li> <li>• ATEX Certified</li> <li>• R290 compatible</li> </ul>	High- and low-pressure cut-off

# TEMPERATURE PRODUCTS


## Thermostats

PRODUCT		FEATURES	FUNCTION
	1NT	<ul style="list-style-type: none"><li>• Industry-standard thermostat with Klixon snap-acting disc</li><li>• Automatic or manual reset options</li></ul>	Defrost thermostat and temperature limit switches (for example to prevent compressor overheating)
	3NT	<ul style="list-style-type: none"><li>• Snap-acting thermostat</li><li>• Dry-sealed design with easy mounting clip</li><li>• ATEX Certified</li></ul>	Defrost thermostat and temperature limit switches (for example to prevent compressor overheating)

## Temperature Sensors

PRODUCT		FEATURES	FUNCTION
	3000 SERIES	<ul style="list-style-type: none"><li>• RTD or thermistor technology</li><li>• Low-cost probe assemblies</li></ul>	Outdoor air discharge, or suction temperature sensing
	4000 SERIES	<ul style="list-style-type: none"><li>• Class AA PT1000 RTD</li><li>• IP69K</li></ul>	Outdoor air discharge, or suction temperature sensing

## HVAC REFRIGERANT LEAK DETECTION

PRODUCT		FEATURES	FUNCTION
	RGD	<ul style="list-style-type: none"><li>• 15+ year lifetime with no degradation</li><li>• Fast response time (&lt;10 seconds T25, &lt;30 seconds T90)</li><li>• Low power consumption (&lt;40mA)</li></ul>	Detection of A2L refrigerant gas leaks



## QUALITY, PERFORMANCE, AND SCALE TO SUCCEED

Across its entire product portfolio, Sensata delivers the components our HVAC customers rely on to enable their designs of today and their concepts of tomorrow.

Our sensors are the fundamental building blocks needed for a cleaner, more efficient, electrified and connected world.



## ABOUT US

Sensata Technologies is one of the world's leading suppliers of sensing, electrical protection, control and power management solutions with operations and business centers in twelve countries. Sensata's products improve safety, efficiency and comfort for millions of people every day in automotive, appliance, aircraft, industrial, military, heavy vehicle, heating, air-conditioning and ventilation, data, telecommunications, recreational vehicles and marine applications. For more information, please visit the Sensata website.

Copyright © 2023 Sensata Technologies, Inc.

10/2023

## CONTACT US

### REGIONAL HEAD OFFICES:

#### United States of America

Sensata Technologies Attleboro, MA

**Phone:** 508-236-3800

**E-mail:** [support@sensata.com](mailto:support@sensata.com)

#### Netherlands

Sensata Technologies Holland B.V. Hengelo

**Phone:** +31 74 357 8000

**E-mail:** [support@sensata.com](mailto:support@sensata.com)

#### China

Sensata Technologies China Co., Ltd. Shanghai

**Phone:** +8621 2306 1500

**E-mail:** [support@sensata.com](mailto:support@sensata.com)

[sensata.com](http://sensata.com)