CLADE

WILLOW RANGE

GROUND AND WATER SOURCE HEAT PUMPS

July 2025 //

June 2025 //

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Clade Willow Water and Ground source heat pumps offer highly efficient, low-carbon heating and cooling by harnessing energy stored naturally in the ground or water sources. These systems deliver consistent performance year-round, even in colder climates, making them ideal for buildings seeking long-term energy savings and reliability.

Clade's use of natural refrigerants provide a future-proof solution aligned with sustainability goals and decarbonisation policies. Their quiet operation, minimal visual impact, and high temperature output makes them suitable for integration with a wide range of emitters and systems for both new builds and retrofits.

With a modular format and a choice of refrigerants the Willow is flexible and adaptable to a range of operating conditions. Our team of expert Engineers will assist with the choices that will ensure a successful outcome for your project.

Model	Output at nominal conditions*
Willow 1 module	100KW
Willow 2 module	200KW
Willow 3 module	300KW
Willow 4 module	400KW
Willow 5 module	500KW

- PIC valve control for variable flow LTHW control
- Variable capacity output with inverter technology
- Modular units for resilience
- Future proof natural refrigerants, either r290, r600a or r744
- Full leak detection as standard
- External header for easy installation in either direction
- High temperature generation from 60 to 75°C
- Can be multiplexed using Clade Multi Controller

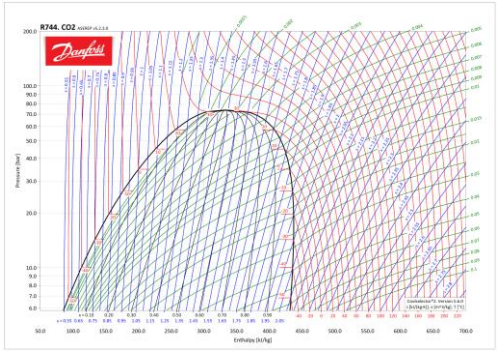
** Output capacity given as an example, depends on specific requirements.*

REFRIGERANT CHOICE //

At Clade we can use three different refrigerants for water and ground source heat pumps. This choice gives Clade unique flexibility in the design of our heat pumps so they can use and generate a wide range of temperatures and flow rates. The three refrigerants Clade use are:

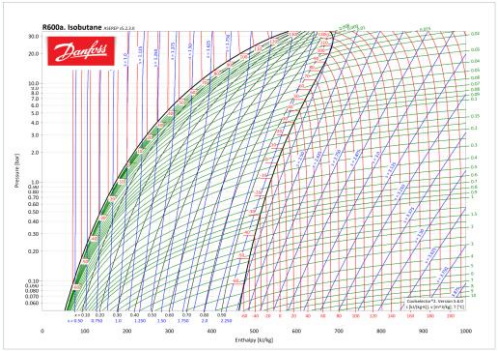
CO2, carbon dioxide, r744

CO_2 (R744) is a natural, non-toxic refrigerant with zero Ozone Depletion Potential and a Global Warming Potential of just 1, making it one of the most climate-friendly refrigerants available. It is ideal for high-temperature heat pumps, offering excellent performance in delivering hot water above 70°C, especially in cold climates. CO_2 systems operate at high pressures, requiring robust design, but benefit from high efficiency in heating-dominant applications and rapid defrost recovery. CO_2 is non-flammable and safe when used in properly engineered systems. Its widespread availability, stability, and regulatory compliance make it a reliable, future-proof choice.



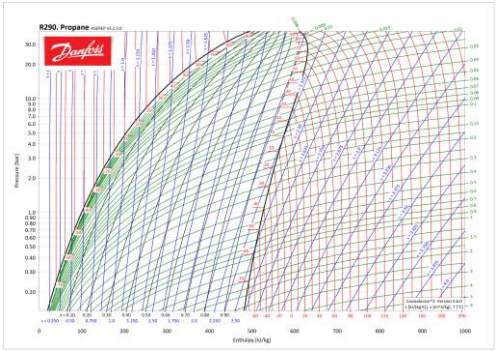
Isobutane, r600a

R600a (isobutane) is a natural hydrocarbon refrigerant widely used for its excellent thermodynamic efficiency and low environmental impact. With a **very low Global Warming Potential (GWP of just 3)** and zero Ozone Depletion Potential (ODP), it is an environmentally friendly alternative to traditional synthetic refrigerants. R600a offers **high energy efficiency**, enabling heat pumps and refrigeration systems to operate with lower power consumption. It performs well at low condensing pressures, reducing system stress and extending equipment lifespan. R600a is **non-toxic**, though flammable, which requires careful handling and safety measures in system design.

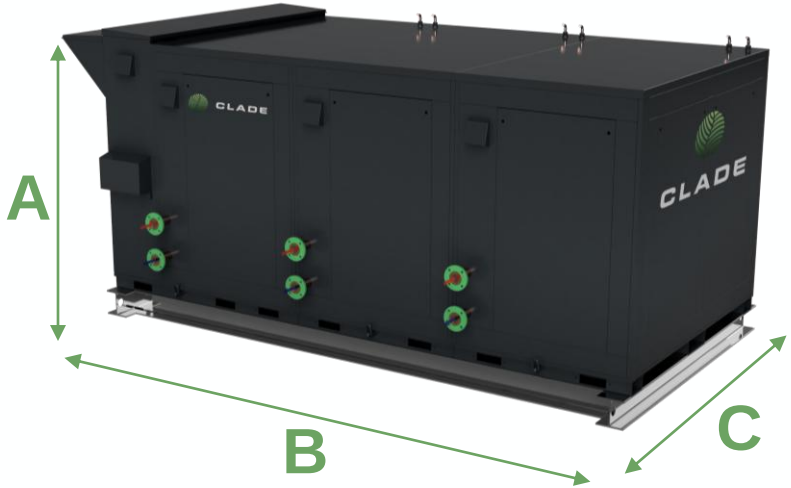


Propane, r290

Propane (R290) is a natural hydrocarbon refrigerant known for its excellent energy efficiency, low Global Warming Potential (GWP of 3), and zero Ozone Depletion Potential. It operates efficiently across a wide temperature range, making it highly suitable for residential and commercial heat pumps. R290 allows for compact, low-charge system designs and is particularly effective in delivering strong performance even in extreme climates. While it is flammable, modern safety standards and component designs ensure safe, reliable operation.



DIMENSIONAL INFORMATION //



Unit	Height ‘A’ (mm)	Width ‘B’ (mm)	Depth ‘C’ (mm)
Willow 1	2382	1915	2400
Willow 2	2382	3315	2400
Willow 3	2382	4715	2400
Willow 4	2382	6115	2400
Willow 5	2838	7515	2400

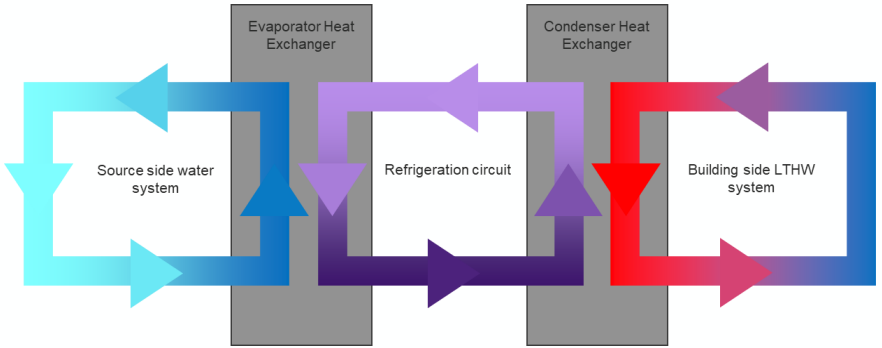
n.b. Other housing formats may better suit the specific application therefore the design of a specific heat pump may differ depending on the requirements agreed during design.

CONTROL //

A Pressure Independent Control Valve (PICV) controls and regulates the flow of water in a hydronic system while maintaining a set flow rate even when the system pressure fluctuates. It combines the functions of a differential pressure controller and a control valve into a single unit. This allows for automatic balancing and precise control of flow of water over the internal heat exchangers which is matched to the compressor speed in order to maintain optimal efficiency and temperature output.

By combining variable water flow (PICV) and variable refrigerant flow (inverter driven compressor) Clade heat pumps are able to maximise efficiency over a wide range of operating conditions.

All Willow heat pump systems are equipped with a Pressure Independent Control Valve in each module for both the source and sink sides and do not include an internal circulating pump. The pumps must be specified by the system designer to provide sufficient flow at full and minimum load conditions.



During the specification and design phase Clade's expert Engineers will require the following information to make the initial selection;

- Source water temperature
- Source water flow rate
- Any restrictions on the rejected water conditions
- The building flow temperature required
- The building return temperature

Using this information the refrigerant, heat exchangers and compressors can be specified to exactly match the use resulting in the most efficient heat pump possible.

The PIC valves will then be set to control the relative flow rates of the source and building water systems in order to keep the refrigerant in the optimal operational zone.

EXAMPLE WATER AND GROUND SOURCE HEAT PUMPS //

Mine water for heating & hot water

Heating Capacity	300KW
Source water temperature	15°C
Refrigerant	r290
Output temperature	70°C

Cascade heat pump temperature boost

Heating Capacity	120KW
Source water temperature	47°C
Refrigerant	r600a
Output temperature	84°C

District heating temperature boost

Heating Capacity	225KW
Source water temperature	60°C
Refrigerant	r600a
Output temperature	80°C

ABOUT THIS INFORMATION //

Performance may vary based on climate conditions, installation quality, and specific usage patterns. Actual energy savings may differ from estimates.

Professional installation is required to ensure optimal performance and compliance with local building codes. Improper installation will void the warranty.

Regular maintenance is necessary to maintain efficiency and performance. Failure to perform recommended maintenance may reduce system lifespan and efficiency.

Efficiency ratings (COP) are based on standard testing conditions and control patterns. Actual efficiency may vary depending on operational conditions and geographic location. COP are instantaneous figures not averaged over any period of time which may include defrost and other system variables.

Heat pumps are designed for specific use. Using the product for unintended purposes may result in suboptimal performance or damage.

Noise levels produced by the heat pump may vary based on the installation environment and operating conditions. Sound pressure figures are for free field without the specifics of the site application.

Please refer to the user manual and installation guide for detailed information on operation, maintenance, and safety instructions.

Clade continually innovate to improve our products, the information in this document are valid (excepting typographic errors) at the time of publication. Availability, specification and performance are subject to change from time to time and without warning.

Any technical advice provided is for informational purposes only, unless specifically covered by a purchase order, and is based on our current understanding and available information. While we strive to ensure the accuracy and reliability of the information provided, it is not intended to be a substitute for professional advice or services tailored to specific circumstances.

By utilising this advice, you acknowledge that it is provided "as is" without any warranties or guarantees, express or implied, regarding its completeness, accuracy, reliability, suitability, or availability.

We strongly recommend consulting with a qualified professional before implementing any advice or making any decisions based on the information provided.

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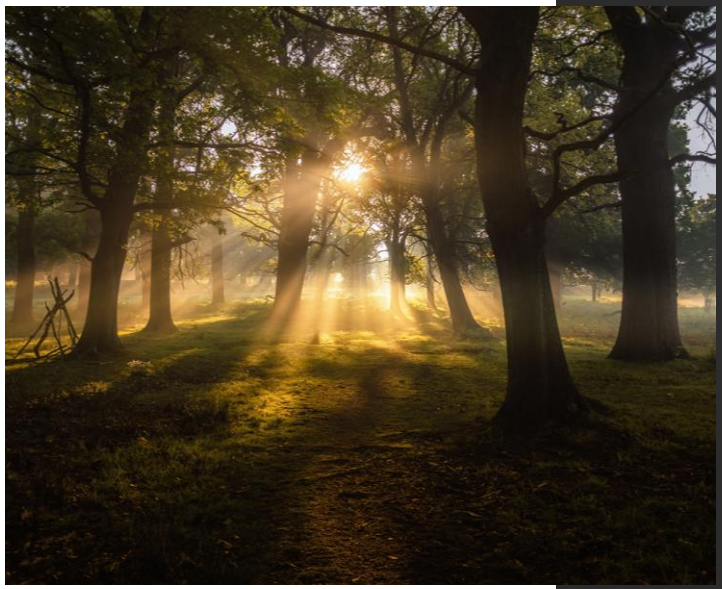

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