# JANSEN powerwave single-u

Maximum performance. For sure.



### Maximum performance: Advantages at a glance

Geothermal probes with JANSEN powerwave technology offer the highest attainable performance. Their corrugated pipe enables improved energy absorption from the ground coupled with fast and secure installation.

### 1

Corrugated pipe

Simulations and practical evaluations show that, with corrugated pipe probes, geothermal systems can be designed to be smaller and therefore more cost-efficient. The reasons for this are turbulent brine flow – the mechanical turbulence equates to approx. 80% higher Reynolds number – and the 20% larger surface than with conventional smooth pipes.

### 2

### Large storage capacity

With their brine volume of over 4½ l per meter of probe, the JANSEN powerwave U-loops offer all the advantages of a storage probe. This storage capacity ensures optimal heat exchange with the ground even during downtimes. In combination with a low hydraulic resistance the efficiency of the heat pump is significantly increased, both at peak load and in cyclic operation.

### Easy assembly

Segments of smooth pipe every 100 cm enable the probe length to be flexibly adjusted and a secure connection to be established with the connecting pipes using conventional fittings (e.g. electrofusion fittings). The JANSEN powerwave single-u is supplied ready-toinstall in standard lengths. Conventional probe reels can be used for installation.

#### Safety probe foot

The Jansen safety probe foot is welded prior to delivery. It has a simple, robust bracket for the proven Jansen loop weights, which can be coupled in any number as required, and enables installation as a single- or double-u loop. No welding work required on site. In comparison to conventional geothermal probes, the JANSEN powerwave single-u delivers measurably superior heat transfer performance. For example, the Institute for Energy Technology at the University of Applied Sciences Rapperswil has scientifically established that the JANSEN powerwave 63 mm corrugated pipe transfers heat more than twice as effectively as a 63 mm smooth pipe.

### Heat transfer of corrugated pipe vs smooth pipe

| Temperature [K] | 273.60 |
|-----------------|--------|
|                 | 273.55 |
|                 | 273 50 |
|                 | 273.45 |
|                 | 273.40 |
|                 | 273.40 |
|                 | 273.35 |
|                 | 273.30 |
|                 | 2/3.25 |
|                 | 273.20 |
|                 | 273.15 |
|                 | 2      |
|                 |        |
|                 |        |

### Storage capacity of different probe types

This benefits the system over a long lifetime. This is also the case with the brine temperatures, which are higher on average during operation, as the high storage capacity slows down the cooling process.



Calculation basis: 25% MEG, 100 m probe length, 4 kW heat pump refrigeration capacity





## For sure: No bore hole centring aid required



Independent assessments\* show: The corrugated structure interlocks with the backfill, giving JANSEN powerwave geothermal probe boreholes the best possible seal. Conventional installation methods are entirely adequate here without the need for a manual centring aid. The sealing effect is based on the functional principle of a labyrinth seal. The peak of the corrugated wave also provides built-in spacing to the borehole wall, thus naturally preventing flaws in the backfill or other channels through which water could rise. The hydraulic conductivity of the borehole system is close to zero, so there is optimal protection if there is ground water in the area.

The solid probe foot is also ideally suited for mud and hammer drilling. The corrugated form also gives the pipe greater stability, while providing convenient flexibility.

Clean, free from odours and noise emissions and without visual restrictions, geothermal energy is a sustainable environmentally friendly solution. Jansen is an expert in the development and production of efficient, resource-saving geothermal solutions, which can be used for generations. As a Swiss manufacturer and with the advantages of the JANSEN powerwave system, JANSEN guarantees top quality and durability.

\* Top marks in the EWS-Tech 2017 research project (Solites, Karlsruhe Institute of Technology, European Institute for Energy Research, Baden-Württemberg Ministry for the Environment, Climate and Energy), p. 271 et seqq.



### Scientifically proven: JANSEN powerwave supplies more power

The strong performance of JANSEN's powerwave geothermal systems can be integrated into the planning of the overall system. The result is geothermal probe bore holes that are demonstrably more affordable.

One important factor in calculating the required probe length is known as the 'thermal borehole resistance'. This specifies what temperature difference is required between the brine and the ground in order to transfer the heat capacity to be made available for the heat pump. The lower the thermal borehole resistance,

Comparison of typical borehole resistances

the better the heat transfer. Since current standards and guidelines stipulate that a certain brine temperature must be maintained over the course of 50 years, the borehole resistance is therefore ultimately a key indicator for how effectively the available temperature in the ground is utilised. Thanks to the

increased surface and turbulent flow. the thermal resistance of JANSEN powerwave corrugated pipe is unmatched, which means it requires fewer bore metres to provide the required heat output and thermal energy.

0.200 Ξ ground-brine <sup>0.150</sup> [M/Yu 9 Temperature difference resist 0.100 ehole 0.050 (1)(2) (2) (1)0.000 Ο 32 mm 40 mm JANSEN JANSEN Double-u Double-u powerwave powerwave single-u double-u

Temperature difference between ground and brine at 40 W/m extraction; borehole resistances calculated with EED: 100 m probe length, volumetric flow 1'200 l/h with 25% MEG, conventional backfill (0.8 W/mK) (1) Laminar flow, Source: EED and VDI4640 S.39 (2) Turbulent flow due to mechanical turbulence



The lower thermal resistance of the JANSEN powerwave corrugated pipe probes leads to a lower temperature loss in the circulating brine. It can therefore be stated that geothermal probes with JANSEN powerwave technology provide more energy in any soil. The system

particularly benefits from higher brine temperatures on days with a high energy requirement, when the heat pump has long operating hours. It is precisely these peak load times that are crucial in deciding on the system's size. The benefit provided by the JANSEN powerwave

### Performance comparison



Simulated using EED, model parameters as per VDI 4640-2:2019 with 2 probes, 25% MEG, 3 MJ/m<sup>3</sup>K heat capacity of the soil, 1800 operating hours.

In the vast majority of cases conventional smooth pipe probes show a laminar flow at cold brine temperatures, and therefore need to be sized as such with low absorption rates. In contrast, JANSEN powerwave corrugated pipe probes have mechanically agitated, turbulent flow behaviour. In combination with the large surface, the JANSEN powerwave single-u therefore has outstanding heat absorption.

can be included in recognised calculation and simulation programs and enables the installation of shorter probes. This in turn produces a higher calculated heat extraction rate in W/m.

The data should be seen as guideline values for a common example situation. For more information on planning, see page 10. Speak to our team of technical advisors!

### Proven in practice: Outstanding efficiency and lower investment costs

Assessments of reference systems clearly show that the JANSEN powerwave single-u provides savings benefits thanks to its higher level of efficiency. On one hand, the annual energy consumption, and in turn the operating costs, are reduced. On the other hand, shorter/fewer boreholes can be implemented, which reduces the investment costs.

### Reliable planning, reliable systems

For the detached house 'Schellenberg' in Liechtenstein, two conventional 32-mm double-u probes with a length of 125 m each were originally planned for a heat pump with 10.6 kW heat output. Thermal simulations were able to demonstrate that, when using JANSEN powerwave single-u geothermal probes, a bore length of 100 m per bore is more than sufficient in this case, which equates to a reduction

of 20%. At the end of 2015, the system was commissioned and temperature records started. The month of January 2017 was the coldest month for 30 years according to meteorological records; despite this, the measured brine temperatures to the heat pump never fell below +4°C - an outstanding result that underlines the excellent performance of the JANSEN powerwave.

Brine temperatures to the heat pump



#### Direct comparison

For the property 'Kampen' 2 probes were installed at 100 m in sandy, ground water-rich soil: a conventional 32-mm U-loop and a JANSEN powerwave single-u. Volumetric flow and temperature measurements show that the JANSEN powerwave single-u supplies two to three times as much energy, even at higher brine temperatures - much to the customer's delight.

### Monitoring extract





### Feasibility despite bore depth restrictions

Many of the projects realised in recent years have something in common in that, despite supposedly doubtful feasibility due to bore depth restrictions, JANSEN powerwave single-u was still able to provide an effective geothermal heat solution with a limited space requirement. One example of this is a major project in Sommerach, Bavaria.



jansen.com/sommerach



### Technical planning data

The JANSEN powerwave geothermal heat pipe is made from the latest generation of high-quality, crack-resistant PE 100 RC-material using innovative production technologies. The products are certified in line with the current quality standards and meet the requirements e.g. of SIA 384/6, VDI 4640, and other relevant industry standards. The individual factory certificate can be accessed online at jansen.com/probecertificate

With a full product range including tools for filling and welding, fittings, and accessories from manifolds to antifreeze, Jansen offers compatible components for successful construction sites and functioning complete systems. Prices and technical data can be found in our current price list.



If you would like to know how you can implement your geothermal project with JANSEN powerwave geothermal probes, please contact one of our technical consultants. Jansen is your partner for planning and construction site expertise.

### **NEW**

For easier planning with JANSEN powerwave single-u geothermal probes: download the data package with the current EED data set →jansen.com/powerwave





#### General conditions of contract

Please be aware that our current applicable general conditions of contract apply to orders unless otherwise agreed in writing. Our general conditions of contract, in their current applicable version, are available for you to read and download at <u>www.jansen.com/avb</u>.

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