



Technical data sheet – Calidutherm®

Usage

At the place of use, Calidutherm® is mixed with water to produce a suspension that flows and can be pumped. The precise volume of water depends on the hardness of the water used and the mixing energy input of the mixer-pump unit. 25 kg of Calidutherm® can be mixed with a volume of 11 – 15 litres of water. A perfect suspension is achieved by adding a volume of 15 litres of water per 25 kg of Calidutherm®. If necessary, for example if the geology contains a large number of crevasses, smaller volumes of water may also be used. The pressing equipment (pressures) forms the limit for this.

Calidutherm® is mixed in a forced mixer until it is completely dissolved. The ready-metered water placed in the vessel and the corresponding quantity of Calidutherm® is added whilst the mixer is running. After mixing the homogenous suspension is grouted by tremie method through a grouting hose from the well bottom to the well mouth. At the well mouth it is important to ensure that the suspension has the specified density.

Material details

Calidutherm® is a read-mixed dry product for the production of pressing suspensions for ground heat sensors in accordance with VDI 4640/Page 2.

Calidutherm® is made of natural clay minerals, blast-furnace cement and quartz sand and supplied in paper sacks with valves in quantities of 25 kg ready for use. Calidutherm® is to be stored on a dry place.

The grain size of the quartz sand component is < 0.5 mm and is finely dispersed.

Properties for health and water protection

Calidutherm® contains only natural ingredients. It complies with the specifications of TRGS 613 and DIN EN 196-10 of < 2ppm in soluble Cr VI. The analysis values of Calidutherm® show that it contains 0.000005 – 0.000006% of soluble chromium VI. This means that Calidutherm® can be described as chromate-free.

The safety data sheet that complies with 91/155/EEC contains all the relevant features that are exclusively characterised by the content of blast-furnace cement contained in the product.

A chemical safety test has been conducted (eluate).

3-component mixture

Cement: Its cement component (blast-furnace cement CEM III/B 32,5 N LH/HS/NA) makes Calidutherm® sulphate-resistant (in accordance with DIN 1164, Part 10) and frost-resistant down to approx. -15°C which means that it satisfied a major requirement of VDI 4640.

Clay mineral: Improved flow properties, no water elution, no drop in the pressing level, because of the regulations applicable in some of the German States the proportion of swellable clay minerals (smektites) with is limited to 5%.

Quartz sand: In the form of ground quartz, very fine and evenly distributed: High heat conductivity and, as a result of its great fineness, low wear on the mixer-pump unit.

Technical benefits

The flow properties of Calidutherm® have been improved to such an extent that it produces a compression of the ring chamber of the ground heat sensor without cavities. The possibility of cavity formation caused by different swelling capacity or delayed water elution has been excluded. This means that completely encased ground heat sensors can be produced using Calidutherm®.

Calidutherm® hardens much more quickly than conventional pressing materials. If the suspension comes to rest after the compression in the bore hole, the thixotropy which then takes place quickly ensures that small cavities are bridged. This counteracts the migration of the suspension in ground water. This therefore prevents the ground water suffering adverse influences. Drilling through ground water levels quickly separates them. Calidutherm® allows ground heat sensors to be compressed into a permanently watertight state.

Calidutherm® remains plastic even after it has set and offers static safety for the ground heat sensor in the event of normal geological activities (settlement and displacement).

A uniformly grouted geothermal probe optimally coupled with the geology provides a more uniform heat exchange and thus a better thermal conductivity of the system over the entire operating time. Calidutherm® heightens the efficiency of the system consisting of soil, grouting material and probe.

Optimized thermal conductivity

All properties of Calidutherm® are adjusted so that the grouting provides for a permanent thermal efficiency of the geothermal probe.

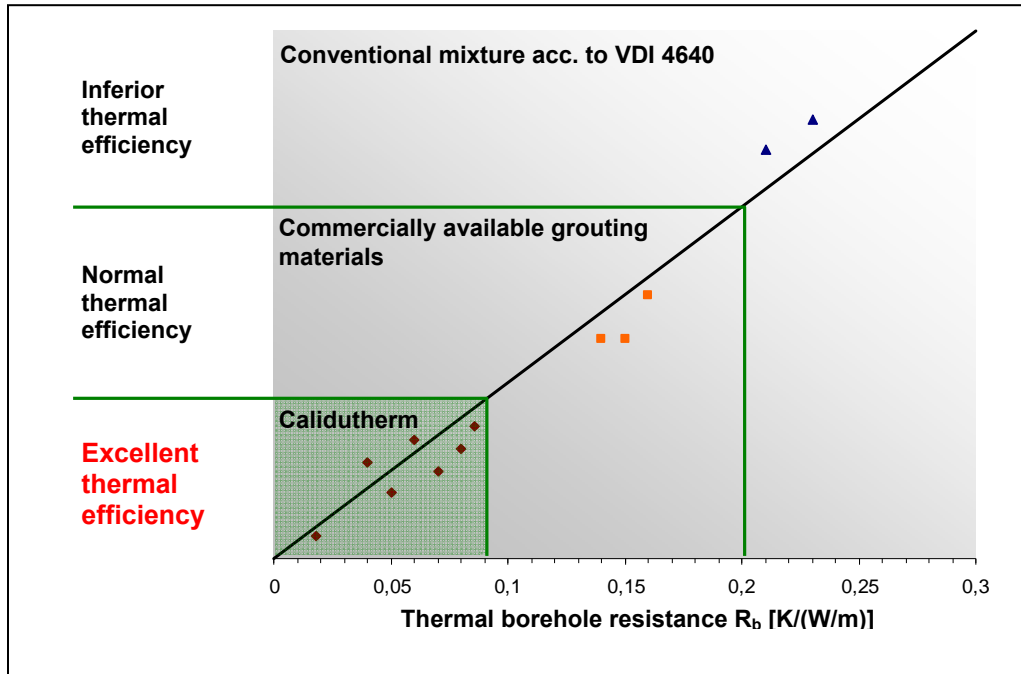
The thermal efficiency of the entire system depends to a large extent on the heat to be transferred between geology and heat carrier fluid with low loss over the entire surface of the probe tubes and the well. It can only be reached by a

completely homogeneous grouting of the probe and when the probe remains connected to the geology over the entire period of plant use.

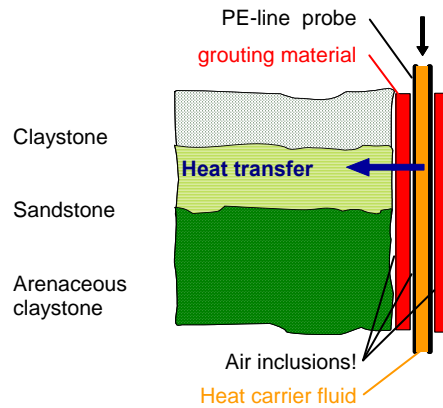
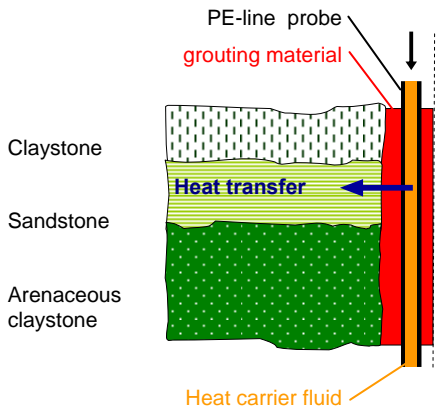
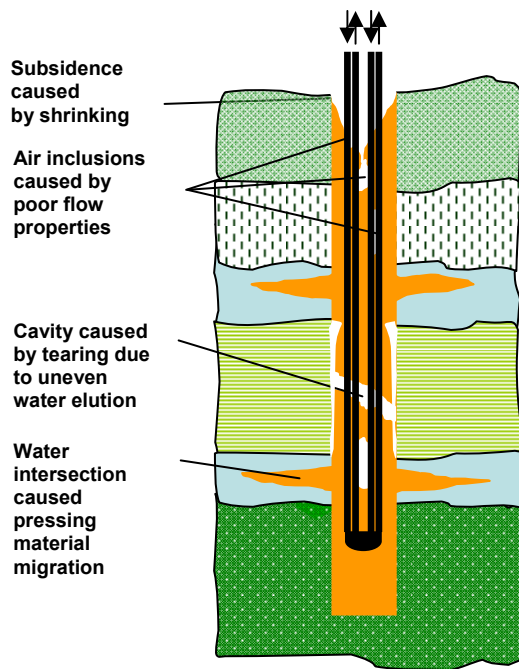
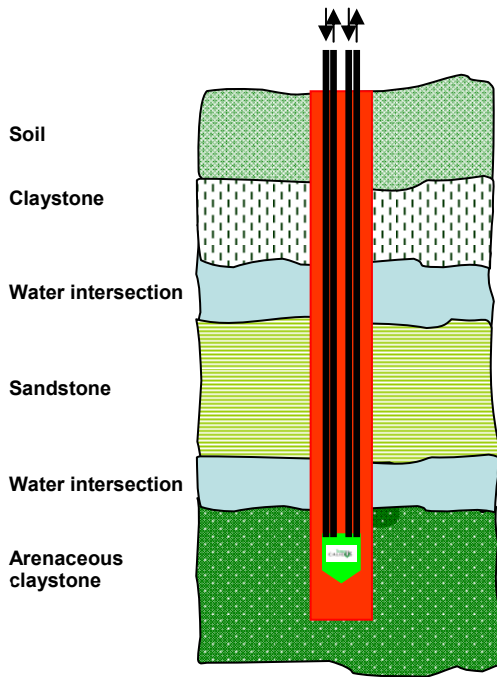
With Calidutherm® the permanent connection to the geology is achieved by an optimized clay and mineral mixture combined with adjusted excellent flow and resistance properties. So, shrinkage and swelling of the grouting material under fluctuating underground moisture conditions are avoided.

The thermal conductivity of Calidutherm® is markedly better than that of conventional grouting materials. Under lab conditions a thermal conductivity of approx. 2 W/mK can be demonstrated.

Thermal Response Tests show an excellent thermal efficiency of geothermal probes grouted with Calidutherm®. These geothermal probes feature a very low thermal borehole resistance (also see figures below).

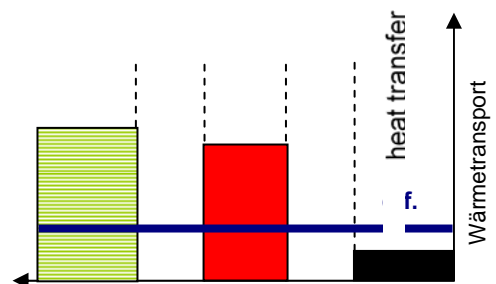
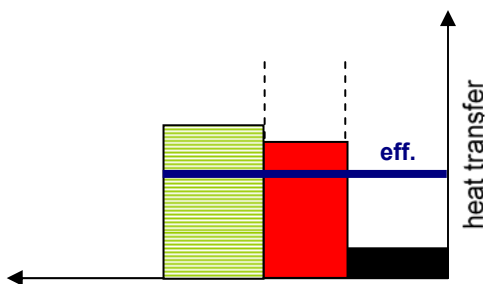


Verified measurements of geothermal probes applying the Geothermal Response Test



λ rock	λ grout	λ PE
e.g. 2.3 W/(mK)	abt. 2 W/(mK)	0.38 W/(mK)

λ rock	λ air	λ grout	λ air	λ PE
e.g. 2.3 W/(mK)	0.02 W/(mK)	abt. 2 W/(mK)	0.02 W/(mK)	0.38 W/(mK)



Benefits derived from using a read-mixed product

The mixing ratio of the components under VDI 4640 is always kept constant for Calidutherm® and is checked during production.

It is not possible for metering errors to occur on the site.

Calidutherm® allows metering to be adjusted to suit consumption. No surplus residues of raw material components and finished suspension are created at the backfilling point.

The provision of the ready-mixed Calidutherm® means that a considerable amount of time can be saved on the site since there is no need for the individual metering of ingredients. This makes it possible to continue pressing at all times.

Mixing in a mixer-pump unit is fully homogeneous as a result of the careful selection of the components. Lump formation that would result in the filler hose being blocked is thus avoided.

The amount of cleaning work required for the mixer-pump unit is considerably reduced compared to conventional pressing materials. This means shorter cleaning times on the site.

Calidutherm® meets only of the main conditions for the automatic production of the pressing suspension because not a single component has to be mixed on the site.

Yield and suspension density

1 m³ of pressing material = 1032 kg of Calidutherm® + 619 litres of water at a ratio of water : Calidutherm® of 0.6.

Suspension density (for a mixing ratio of water : Calidutherm® of 0.6): 1.65 kg/litre

All data shown in the product data sheet were measured values obtained under laboratory conditions with the usual measuring tolerances. Said data and their application in suitability tests or similar are intended to find out whether the product is suitable for certain applications and as design aid. Guaranteed properties within the legal meaning cannot be derived from it. Principals shall not be released from their responsibility to do their own tests and take their own decisions. The latest issue of this data sheet shall be applicable.