

HDG THERMO HS

Brief description	Hydraulically thermally improved special mortar for geothermal probes	
Composition	Highly sulphate-resistant cement as per DIN 1164, selected mineral filling materials	
Technical characteristics	Very economical = low-cost consumption, excellent flow properties, easy to process, highly sulphate-resistant	
Packaging type	in 25 kg paper sacks or loose as silo product	
Technical specifications	Yield (= requirement per m ³)	approx. 1.25 kg/l cavity or 1250 kg per m ³ (approx. 20 litres per 25 kg sack)
	Dosage mixing water	approx. 440 litres per 1000 kg special mortar
	Water / solid matter ratio	approx. 0.44 (with good dispersion also > 0.44)
	Density of the pumpable mixture	approx. 1.79 kg/dm ³
	Marsh rate for 1000 ml	approx. 45 to 90 seconds with W/F = 0,44 (Depending on preparation)
	Pumpability	several hundred metres, depending on pump capacity
	Processing time	approx. 80 to 120 minutes
	Sedimentation after 2 hrs	< 2 % (in 250 ml glass cylinder)
	Firmness after 28 days, uniaxial	> = 6 N/mm ² (as per DIN 18136, cylind. test object)
	k(f) value after 28 days, triaxial	< = 1 x 10 ⁻⁹ m/s
	Heat conductivity with surface probe	> = 2 W / mK
	Frost resistance	given
	Other material parameters:	Bulk density approx. 1.35 kg / dm ³ Granularity < 0.3 mm Clay/bentonite content > 4 % When stored in a dry place, can be stored for min. 12 months

Instructions for use of HDG THERMO HS

In general, the following applies: The more intensive the digestion = preparation of the mixture is, the higher the quantity of water can be added per m³ and the more economical the use of the product. Suitable mixers are high speed compulsory mixers or colloidal mixers (generally batch mixers).

Otherwise, the known principles of injection and filling technology and the relevant standards and directives are to be observed.

For a high quality and above all economical preparation of the ready-mix "HDG-THERMO HS" at the place of installation of the geothermal probe, the following is to be observed:

- **intensive dispersion and shearing of the suspension**

Bentonites and clays are layered silicates which cause a slight settling in the fresh mixture, ensure the barrier effect and density (= lower $k_f(f)$ index) of the mixture, enable flowability and pumpability and regulate the viscosity. The very small clay particles must be "dissolved and sheared" by very intensive mixing and homogeneously distributed in the mixture. Suitable colloidal mixing machines usually have a connected load of > 7 kW and a throughput of > 2 m³/hr.

- **maximum utilisation of the quality of the filling mortar**

The clay and bentonite components in HDG-Thermo HS require very intensive mixing and good shearing to have the full effect. In practice, it has repeatedly been shown that a high speed, highly dispersing preparation allows low dosage (i.e. fewer kg per m³), which in term means very economical use. Selection of the right mixer provides long-term cost benefits.

- **correct dosage of the individual suspension components**

The condition for a high quality filling suspension is that the quantity of water in the mixing container is accurately filled and can be provided according to the dosage- instructions. A water gauge, a dipstick measured in litres or other measuring instruments are required for this. The addition of the relevant amount of HDG-Thermo HS in kg (or number of sacks) is then the second step to obtain a suitable end-product which meets the requirements.

- **no lumps, specks or adhesions in the mixing container**

Mixers, preparation machines and recirculation pumps which produce a heterogeneous mixture are not suitable for producing and processing the fill-ing suspension. After a mixing period of 1 - 2 minutes, the suspension must be free of lumps and specks in the container. Adhesions and coatings on the side or in the corners indicate insufficient mixed material and poor mixing.

- **easy checking of the quantity and quality of the suspension**

After the mixing process is completed, a sample is to be taken from the container and checked visually or by measuring (e.g. Marsh funnel) as compared with the first (calibration) mixture. As another simple way of checking, 1 or 2 litres of the suspension can be filled into a plastic bottle, glass cylinder or narrow beaker. Settling (= sedimentation) of the suspension in the vessel can be compared with the previously measured values after 2, 3 or 4 hours.

- **good mixing and pump capacity for fast filling**

For a hole of 150 mm Ø and a depth of 100 m, a filling quantity of ~ 2.1 m³ = 2100 litres (including an extra ~ 30 % for inaccurate measurement, washing, cleaning and rinsing losses) is required. Generally, the hole should be filled continually without interruptions in max. 2 hours . The mixer, pump, lines and personnel must be suitable for this.

- **fast and easy cleaning of the machine**

After completion of the filling work, it should be possible to clean the mixer, pumps, containers, lines and valves completely and free of residue. Hardened suspension residue which has not been removed can block the PE filling pipes with a diameter of 20 mm (or even larger) and as a result cause insufficient covering of the probe.

The information in this leaflet represents general information based on our experience and tests under standard conditions at the time of printing and do not take the concrete application into account. Tests were carried out with methods recommended by experts, technical directives or based on standards.

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Subject to change. 03/10

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