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Theoretical principles

When planning and configuring brine earth heat exchangers for use as geothermal power near the surface, the specific thermal capacity of the earth, its thermal conductivity, density, diffusion of water and water vapour and the above ground and underground conditions are decisive for the removal of heat from the earth.

Underground, installations, cable lines, drains etc. should be noted. Above ground, property borders, buildings, trafficability and vegetation must be noted.

The geological structure is of great importance to laying work. The laying depth and space and the possible specific extraction rating of the ground collector depend on this.

Since ground temperatures at a depth of 1 m may reach freezing point and at a depth of 2 m the volume of heat supplied by the earth's surface actually starts to decrease, the depth of laying should be between 1.2 m and 1.5 m.

The diagram shows temperature levels down to a depth of 20 m. This shows temperatures at a depth of 1.2 m - 1.5 m fluctuating over the year between 7 °C and 13 °C. This temperature level can be used very effectively for heating purposes in winter and for cooling purposes in summer.

Annual temperature level down to a depth of 20 m

- ① 1st quarter
- ② 2nd quarter
- ③ 3rd quarter
- ④ 4th quarter

Version, laying and commissioning

Specialist requirements of staff

The ground collectors should be laid and commissioned in accordance with

VDI 4640 and the associated safety fittings installed in accordance with DIN 4708 Central warm water heating systems.

The ground collectors can be laid following an individual laying plan or, more cost-effectively, when producing the foundations. Two circuits of a maximum length of 50 m are placed around the foundations to ensure that pressure losses are not too high.

To be able to securely rule out the possibility of damage to the ducts, the collector ducts should be placed in a bed of 0.4 m of sand. The other advantages of this kind of laying are that there are no air inclusions which reduce conductivity and that the ground is able to absorb more dampness.

Laying ducts

The material characteristics result in the following application technology characteristics:

- PE 80 ducts must be protected from stone loads and must therefore be back-filled with sand.
- The permissible minimum bend radii depend greatly on the temperature at the time of laying.
- When laying, the necessary laying spacing must be observed.
- The circuits must be of the same length to ensure even flows through the circuits.
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Filling the collector in with sand

When laying ensure that the circuits are connected in parallel and that the laying spacing needed is observed.

The circuits must be of the same length to ensure even flows through the circuits and so that costly regulation is not needed on the distributor.

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Brine circulation pump

A circulation pump with a maximum displacement height of $H = 4$ m and a set brine flow rate of 0.15 - 0.20 m³/h will provide a sufficient brine mass flow. The circulation pump we specify, Grundfos UPS 25-40-180, delivers this brine mass flow if the speed level is set to position II or higher.

The distributor, safety fittings and appropriate air extraction should be provided at the system's highest point. The change in volume experienced by the heat carrying medium should be compensated for through the use of appropriate measures. The system is operated at a maximum operating pressure of 1.5 bar. The resultant change in volume experienced by the heat carrying medium, between approx. 0.8 and 1 % of the system volume, should be compensated for with an expansion tank membrane in accordance with DIN 4708. To prevent overfilling, a component-tested membrane safety valve should be fitted. A pressure gauge with min. and max. pressure marks should be fitted for pressure monitoring.

Laying ducts

The work involved in laying ducts, including the hydraulic connection to the brine/air heat exchanger, should be undertaken and supervised by suitable, experienced specialists.

The building firms tasked with the laying work must have the competence required to do the work and must be able to prove this.

Competence is considered to have been proven when the building firm carrying out the work has the corresponding DVGW approval in accordance with DVGW GW301 and GW303 and/or DVGW GW331.

Process sheet W400-2 and the rules of the employers' liability insurance associations and/or safety at work inspections and the general technical rules applicable to building work of VOB Part C following DIN 18300, DIN 18303 and DIN 18307 must be observed for all laying work and testing. Particular attention should be paid to compliance with EC Directive 92/57/EEC and the Construction Site Ordinance.

Storage

Ducts made from PE can only be stored for limited periods if left in direct sunlight. Experience has shown that they can be stored in the open for up to 2 years without their strength characteristics being affected.

If stored outside for longer periods or if stored in areas with high levels of direct sunlight, storage offering protection from the sun will be needed. Contact with harmful media (see supplementary sheet 1 for DIN 8075) should be avoided.

Bundled coils should be stored horizontally and not on top of one another. If stored in this way, it is essential that the ground under them is free from stones. If bundled coils are stored vertically, these must be secured to prevent them from falling over (risk of accident).

The ducts should be stored such that their insides cannot be dirtied. The shutters should therefore only be removed upon installation.

Special points relating to working with bundled coils

When unwinding bundled coils, note that the ducts may shoot off like springs when the attachment is loosened (risk of accident).

Since considerable forces are released when working with larger diameters, proceed with care.

Checking the ducts

Before fitting, check the ducts for damage incurred during transport and storage.

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Ducts with sharp-edged damage or with scoring and scratches of a depth of more than 10 % of the wall thickness must not be fitted.

Mechanical connections (compression connections)

Ducts made from PE can be quickly and securely connected using metal or plastic compression fittings. Only fittings which satisfy the requirements stated in DIN 8076 and DVGW VP 600 may be used for the installation work.

The guidelines of the relevant manufacturer must be noted when installing other compression fittings.

Pressure testing

Before being commissioned, the ducts must be subject to internal pressure testing in accordance with DIN EN 805 or the DVGW process sheet W400-2.

Pressure tests should be conducted by specialist staff who have the relevant knowledge of duct technology, conducting pressure tests, measurement technology and the safety regulations.

Intended use

The brine EWT control unit may only be used for the applications described above.

We assume no liability for any applications other than those for which we provide descriptions.

Hydraulic connection plan for EW brine earth heat exchanger

Plan for laying collectors

Diagram of laying plan

- PE-HD ducts must be protected from stone loads and must therefore be back-filled with sand.
- Sand bed of at least 0.2 m / 0.2 m.
- Permissible bend radii depend greatly on the temperature at the time of laying.
- PE-HD 32 x 2.9 20 °C 0.7 m
- 10 °C 1.2 m
- 0 °C 1.7 m
- R1/V1 = 50 m
- R2/V2 = 50 m

Individual laying plan

Diagram of laying plan

- PE-HD ducts must be protected from stone loads and must therefore be back-filled with sand.
- Sand bed of at least 0.2 m / 0.2 m.
- Permissible bend radii depend greatly on the temperature at the time of laying.
- PE-HD 32 x 2.9 20 °C 0.7 m
- 10 °C 1.2 m
- 0 °C 1.7 m
- R1/V1 = 50 m
- R2/V2 = 50 m

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Approvals required (VDI 4640 Sheet 1)

- In accordance with § 3 Paragraph 3 No.2 Letter b of the Federal Mining Act, geothermal power is considered equal to natural resources free for mining.
- When planning, building and operating power generation plants for making thermal use of underground areas, the rules governing water rights and state planning objectives must be observed.
- The clauses of the Water Resources Act (WHG) apply in conjunction with state water legislation and administrative rules these involve.
- DIN 4708 Central warm water heating systems.