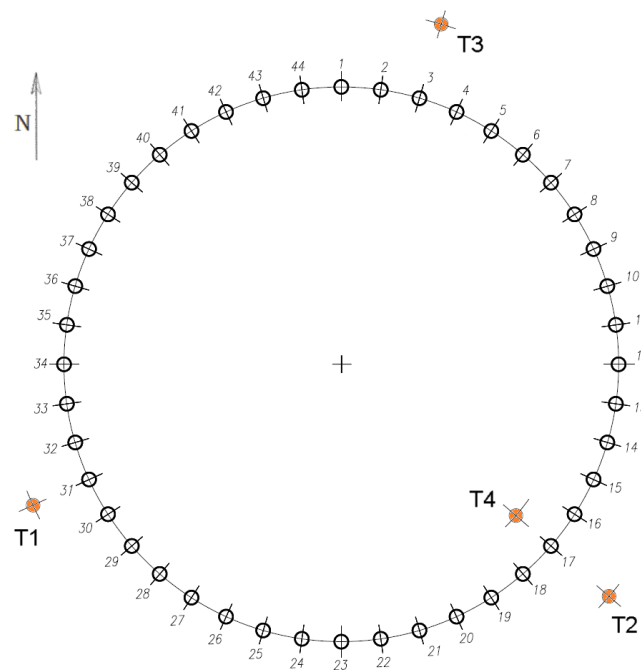


Fibre optic leakage monitoring of ground freezing in a shaft construction

The freezing shaft method is one of the safest shaft sinking methods under the influence of unstable and water-bearing overburdens. A fibre optic temperature measuring system enables the monitoring of the freezing process. Thus, the thermal properties of the rocks, inhomogeneous zones of temperature distribution, influences by aquifers, failure of freezing pipes and the general temporal frost propagation can be monitored and determined.

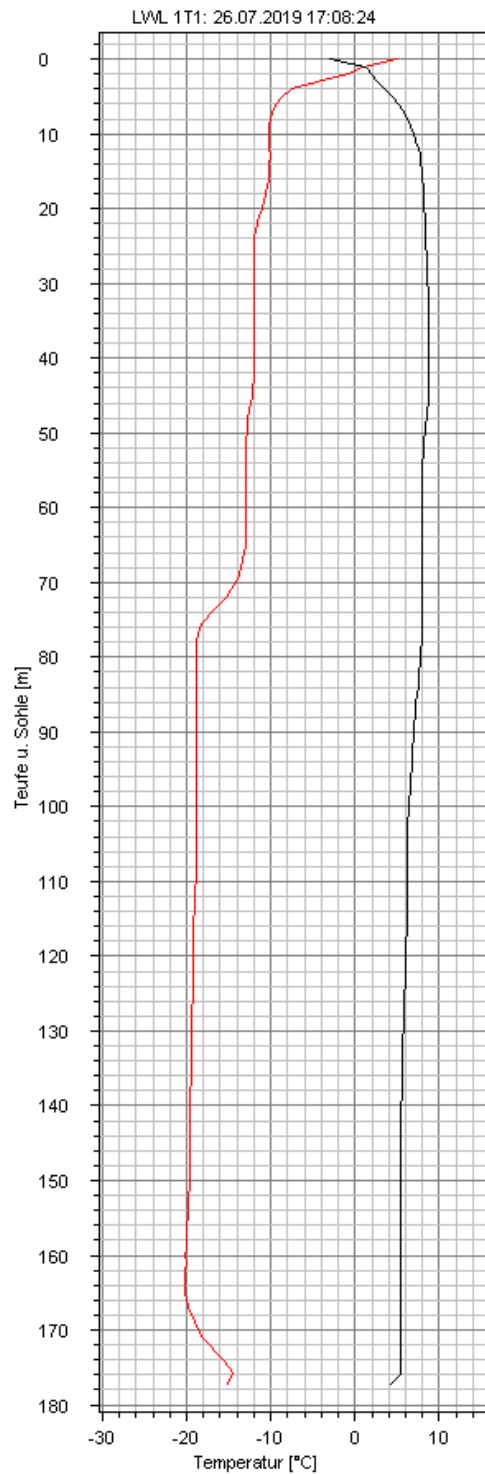


Shaft with position of four temperature soundings

The temperature monitoring system can be used for data analysis, plausibility checks and visualization. With a spatial resolution of 0.5 m and a temperature resolution of 0.1 K, leakages can be located exactly.

In addition to the temperature monitoring system, alarms via e-mail or SMS can be set. Alarms can warn in case of fibre optic cable damage, data failure, deviation from a reference profile, or abrupt temperature change.

The diagram shows two temperature profiles. The temperatures before the freezing process are shown in black and the temperatures after the starting of the freezing process are shown in red.



Temperature profile before (black) and during (red) the freezing process