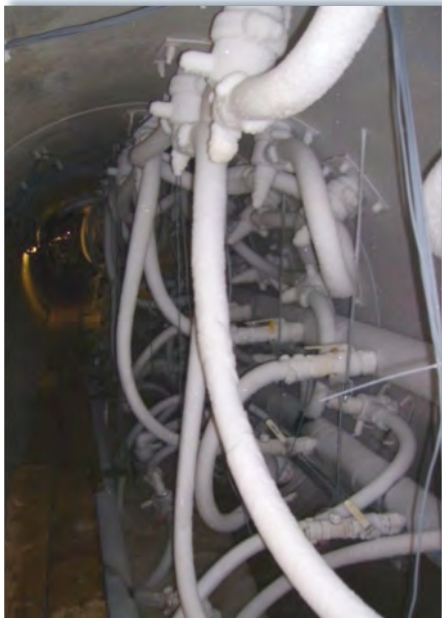


Job Report

Going down into the depths with ARCTOS

CO₂ / NH₃ soil-freezing containerised refrigeration unit

Nowadays buildings grow not only upwards but also deeper into the ground. Underground construction works are often hampered by ground water ingress. Utilising our soil-freezing refrigeration systems, ARCTOS offers the possibility of freezing the soil around the construction site. This ice shield protects the building site during construction works against penetration by ground water and ensures static safety.



For this purpose a pilot tunnel is drilled. From this tunnel freezing lances supply refrigerant (down to -45°C) to the soil-freezing location. Once the calculated volume of soil has been frozen, the construction work can start and during the construction work the over ground refrigeration system continuously freezes the soil. When the work is completed, e.g. a concrete shield protects the underground cavity (tunnel, shaft).



Example: special container with soil-freezing unit

The mobile brine cooling system is assembled in a special container as a cascade refrigeration system utilising reciprocating compressor units. The low stage refrigerant is NH₃ and the high stage is CO₂.

The CO₂ / NH₃ cascade refrigeration system is used for cooling brine (CaCl₂, 30 %). The brine is employed for freezing the soil, when excavating cross connections between tunnel arms. The cascade refrigeration system has been selected enable lower cooling temperatures. To facilitate these options, different brine types are required. The temperature limits are TYFOXIT F 50 for -50°C or CaCl₂ (30%) for -45°C.



40 ft container with CO₂ / NH₃ soil-freezing containerised refrigeration system



Why a cascade refrigeration system?

The cascade refrigeration system is widely used where low temperatures must be attained economically and within compressor application ranges. Thus a low temperature refrigerant (e.g. CO₂) is used in the lower cascade stage. The evaporator of this stage is used as a condenser for the upper cascade stage which contains a different refrigerant (e.g. NH₃).

Technical data

Refrigerant	NH ₃ (R717) / CO ₂ (R744)
Refrigerant charge	max. 100 kg NH ₃ / max. 200 kg CO ₂
Cooling capacity Q ₀	275 kW
Heat transfer medium (brine)	CaCl ₂ , 30%
Brine inlet temperature t _{s1}	-33°C
Brine outlet temperature t _{s2}	-38°C
Brine volume V _s	57.3 m ³ /h
Heat rejection medium	water / air
Water inlet temperature t _{s3}	+27°C
Water outlet temperature t _{s4}	+31°C
Compressor manufacturer	GEA-Grasso
Compressor type	reciprocating compressor
Plant container	40 ft container housing the brine cooling unit, pumps, control devices and switchboard.