



# FOCUS

Case study  
Special underground  
mining

## 3600 KW FREEZING SYSTEM FOR RUSSIAN POTASSIUM MINING



EFFICIENT REFRIGERATION TECHNOLOGY IN ACTION

## 3600 kW freezing system for Russian potassium mining



Ground-freezing technology is increasingly used for shaft sinking during new mining projects, since the frozen earth makes drilling advance both more easily and more quickly. L&R Kältetechnik GmbH & Co. KG designed and built a freezing system with a freezing power of 3600 kW for Russian potassium mining. The system cools the brine introduced into the freezing boreholes down to a temperature of  $-38\text{ }^{\circ}\text{C}$ .

Lean freezing the ground is an elegant method of simplifying shaft sinking. It is the only way to safely maintain ground water out of the shaft due to the ice ring that forms around the latter. There is less formation of dust, and the method allows better control of the drilling. Thyssen Schachtbau GmbH has gathered a lot of experience with this method and commissioned L&R Kältetechnik GmbH & Co. KG with the construction of systems for a mining project in Russia.

Potassium salts are extracted in the region of Perm and processed into fertilisers and



**Schematic representation of the freezing system**

other projects by the local chemical industry. Thyssen Schachtbau was to install two new shafts with a diameter of 7.50 m each and a depth of several hundred metres into the earth. In preparation, smaller boreholes of 270 m in depth were first driven into the earth in the vicinity of the future shafts. They hold the piping for the cold brine, which flows through them at a flow temperature of  $-38\text{ }^{\circ}\text{C}$ . This brine freezes the ground and considerably facilitates shaft sinking.

The freezing system planned by L&R with a total freezing power of 3600 kW does not work with ammonia ( $\text{NH}_3$ ) as is normal for systems of this capacity, but instead with the cooling agent R507A, which is neither toxic nor flammable and thus offers very high



*The cold symbol has a double meaning in this case: in winter, temperatures in the Perm region can fall to  $-30\text{ }^{\circ}\text{C}$ ; the average temperature in January is  $-20\text{ }^{\circ}\text{C}$ . So the entire freezing system must be designed to ensure that it does not freeze up.*

operational safety. In addition, it has a high specific cooling capacity and is well suited for deep-freezing applications. The coolant used is a potassium formiate called Tyfoxit F50.



**Massive pipelines branch off from the pump house to the individual containers where the freezing systems are located.**



**View of the construction site**

The use of dry, air-cooled condensers instead of the normal wet cooling towers is also quite special. One of the advantages of the concept proposed by L&R is that the cooling water does not have to be treated and there is no risk of a freeze-up even during the very low ambient temperatures in winter.

The efficiency factor of the freezing system is optimised by a VariKon control. It adapts the condensation temperature to the actual outside temperatures, which opens up a massive potential for saving energy, especially at low temperatures, and also delivers more cooling power, which in turn speeds up the freezing of the soil. Another element that contributes to energy saving are the modern, semi-thermal Bitzer screw compressors. Their capacity is infinitely variable from 50

to 100%. One of the greatest advantages of those semi-thermal compressors is the unrivalled low maintenance effort.

L&R was able to demonstrate in advance that this rather unusual concept is highly efficient from an energy point of view and at the same time provides a higher safety

level as well as high availability options. The systems were pre-assembled in containers in Sundern and then installed and put into operation in a very short time.

After three months of operation, the ground was frozen to such an extent that the actual shaft sinking could begin. The ground-freezing system now keeps the temperature of the soil below freezing for the entire construction period of two years and thus provides one of the main requirements for speedy and safe shaft construction. A remote maintenance system allows remote monitoring and, if necessary, rapid intervention by L&R in case of malfunctions. ❄️



# Competencies



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## PLASTICS AND RUBBER INDUSTRY

A plastic-parts manufacturer operating about 100 injection moulding machines recorded frequent machine failures that were caused by the aging refrigeration system. Renovating the system didn't just reduce the number of failures; the improved cooling allowed the injection-moulding machines to operate with shorter cycle times, enabling our customer to increase their output by 10-15%.

## SURFACE TECHNOLOGY AND ELECTROPLATING

An advanced refrigerant, higher cooling capacity and significant energy savings were the objectives pursued by Koenigsdorf Oberflächentechnik GmbH & Co.KG in Wolfhagen when they decided on a new refrigerating system.

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## FOOD PRODUCTION

Refrigeration is one of the main energy consumers in chocolate production. Retrofit projects can achieve savings of up to 50% – an investment that gives the user a clear amortisation period. L&R Kältetechnik cooperates with two companies that specialise in this sector.

## CHEMICAL AND PHARMACEUTICAL INDUSTRY

We have the best references in the cryogenics sector, including for the storage of blood plasma. For these particularly challenging applications, we plan and design completely redundant refrigeration systems with correspondingly high safety features.

## SPECIAL UNDERGROUND MINING

Ground-freezing systems are becoming increasingly common in mining projects when sinking shafts. A freezing system with a capacity of 3600 KW was developed and constructed for a Russian potassium mining project which cooled cold brine to a flow temperature of -38 °C.

**L & R KÄLTETECHNIK**  
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