Talnahk / Haiger, February 2023.

SIEMAG TECBERG realizes further milestone for the development of the „Skalisty“ mine of NORNICKEL in Russia

With the successful completion of the rope up for a Koepe Winder 2021 and for a Double-Drum Blair Winder in 2022, SIEMAG TECBERG has realized the next important step towards the commissioning of the two hoisting machines.

The customer

PJSC MMC Norilsk Nickel (Public Joint Stock Company „Mining and Metallurgical Company Nornickel“) - hereinafter Nornickel - is Russia‘s leading metals and mining company, the world‘s largest producer of palladium and refined nickel, and one of the largest producers of platinum and copper. The Group also produces cobalt, rhodium, silver, gold, iridium, ruthenium, selenium, tellurium and sulfur.

The core activities of the Nornickel Group are focused on prospecting and exploration, mining, concentration and processing of minerals, as well as production, marketing and distribution of non-ferrous and precious metals. The products are supplied to over 30 countries.

The Group‘s production facilities are located in Russia (Norilsk Industrial Area, Kola Peninsula and Transbaikal Territory), as well as Finland. The Polar Division, located beyond the Arctic Circle on the Taimyr Peninsula, is Nornickel‘s main raw material base. It is connected to other regions via the Yenisei River, the Northern Sea Route and by air.

Nornickel Mining Complex Polar Division in Talnahk, Russia

Around Talnahk in northern Siberia, Nornickel operates a total of 6 mines in its Polar Division with a total of 36 shafts. SIEMAG TECBERG has supplied shaft hoisting technology for all 5 shafts of the Skalisty mine, most recently for the SKS1 shaft two hoisting machines (Koepe/Double Drum Blair), a clamping and lifting device, a friction winder and other extensive equipment.

Shaft hoisting technology precisely tailored to the specified production capacity

With the SKS1 shaft of the Skalisty mine, Nornickel is planning to develop deeper ore deposits and commissioned the SIEMAG TECBERG group with the supply of shaft hoisting technology for this mine, which at approx. 2,000 m is the deepest in Russia. An additional and demanding task for SIEMAG TECBERG in this project was to supply a complete shaft hoisting system as an overall system with a defined annual production capacity. Incidentally, SIEMAG TECBERG had proven its expertise in years before with many installations supplied to Nornickel and put into operation.

The future production operation is planned for 12 operating hours per day on 330 days per year and will be taken over by a Double-Drum BLAIR Winder with skip/skip conveying (drive power of 8,000 kW) for travel speeds of up to 14 m/s and a maximum payload of 30 tonnes.

In the service shaft, a 4-rope KOEPE Winder is used as a cage/counterweight system that moves payloads of up to 20 t at up to 12 m/s thanks to a drive power of 2,250 kW.

In addition to these two hoisting machines, SIEMAG TECBERG supplied further shaft hoisting technology such as brake systems, self-developed plain bearings, rope sheaves, hydraulic compensation rope sheaves, complete loading and unloading equipment as well as ropes and rope changing equipment, among other things.

For this contract, SIEMAG TECBERG transported a total of approx. 3,000 tonnes of equipment and materials to the mine site in Norilsk.

Rope laying successfully completed with modern SIEMAG TECBERG rope changing systems for both hoists

The initial rope up (and subsequent rope changes) is still one of the most risky tasks in the shaft. In order to speed up the complicated and dangerous processes in today‘s modern multi-rope systems with large depths and to be able to carry them out safely and without damaging the rope, appropriate aids are used. These include friction winder and clamping and lifting devices in particular. The principle of the friction winder is based on the transmission of forces from the two drums through friction to the rope. With these friction winder, ropes can not only be hooked into the shaft, but also pulled out.

Rope laying for the Koepe hoisting machine in shaft SKS1

The installation of the rope changing equipment for the Koepe hoisting machine in the SKS1 service shaft took place under the direction of SIEMAG TECBERG. For this purpose, 4 electrically driven rope reelers, the horizontal deflection sheaves and a friction winder were set up and anchored in a separate hall, which was erected by the customer adjacent to the shaft hall. Vertical deflection sheaves and a horizontal support were mounted on the shaft side. This serves to reduce the horizontal forces acting on the foundation. Through this measure, the horizontal forces can be almost completely neglected in the design of the foundation and the required foundation size is reduced to a minimum.

After the preparations were completed, the 4 new head ropes - starting from the rope reelers - were pulled through the friction winder, around the rope sheaves and the Koepe hoisting machine up to pit bank level.

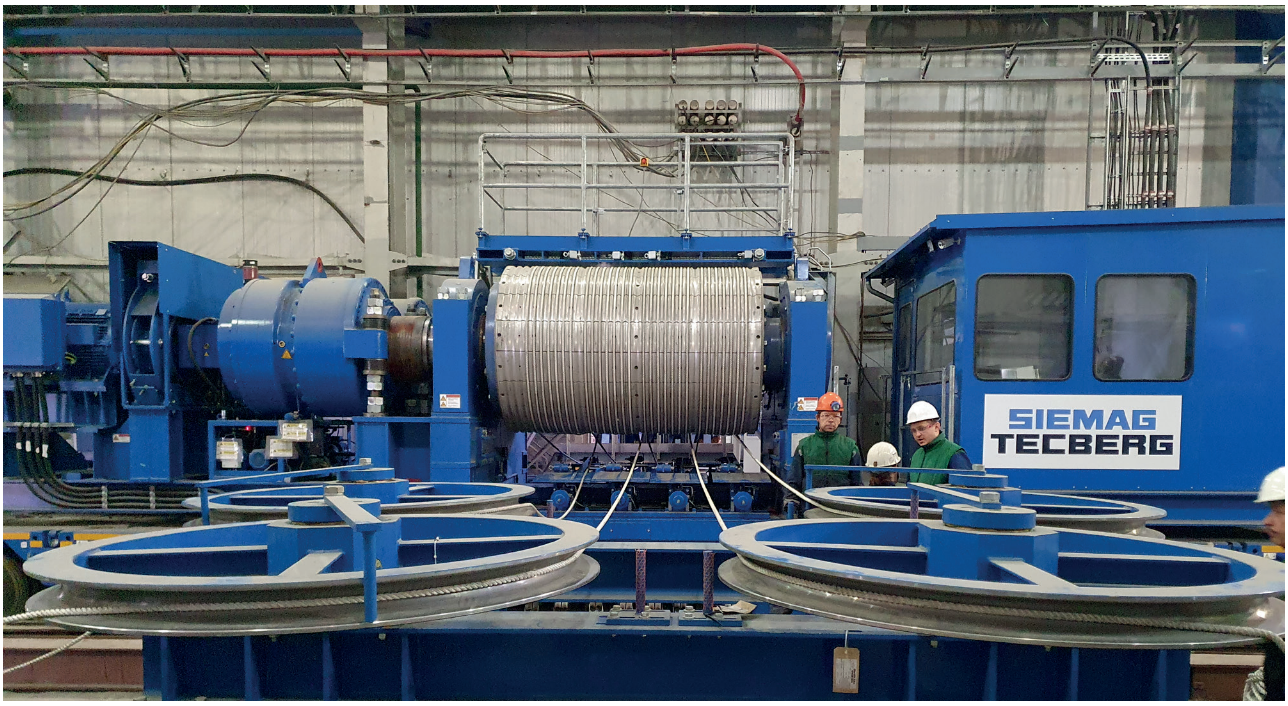

Fig. 1: View of the horizontal deflection pulleys in the foreground and the friction winder in the background.

There the ends of the ropes were tied into the rope harnesses. The rope manufacturer, Bridon Bekaert, was also on site during these operations and certified that the installation had been carried out with care and that the ropes had been handled professionally.

Head ropes laid with an impressive 2,180 m rope length

In the next step, the friction winder was used to lift the rope harnesses and attach them to the pre-assembled mine cage, which has a total installation height of 19.9 m and a dead weight of 38 t.

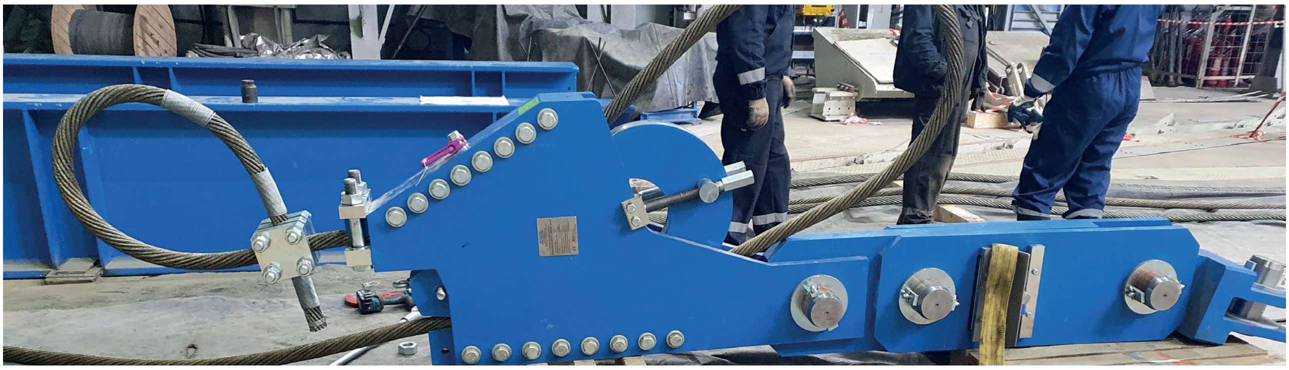

Fig. 2: Rope harness with bound rope end.

After the steel girders required for installation had been dismantled from the shaft area, the mine cage was able to make its first journey underground to the -1,989 m level.

Upon reaching this level, the world's longest Koepe head ropes with a length of around 2,180 m were successfully installed in the shaft. The clamping and lifting device safely took over the load of approx. 163 t from the friction winder in order to be able to cut the ropes to the required length. This enabled the binding into the rope harnesses on safe ground in the shaft hall.

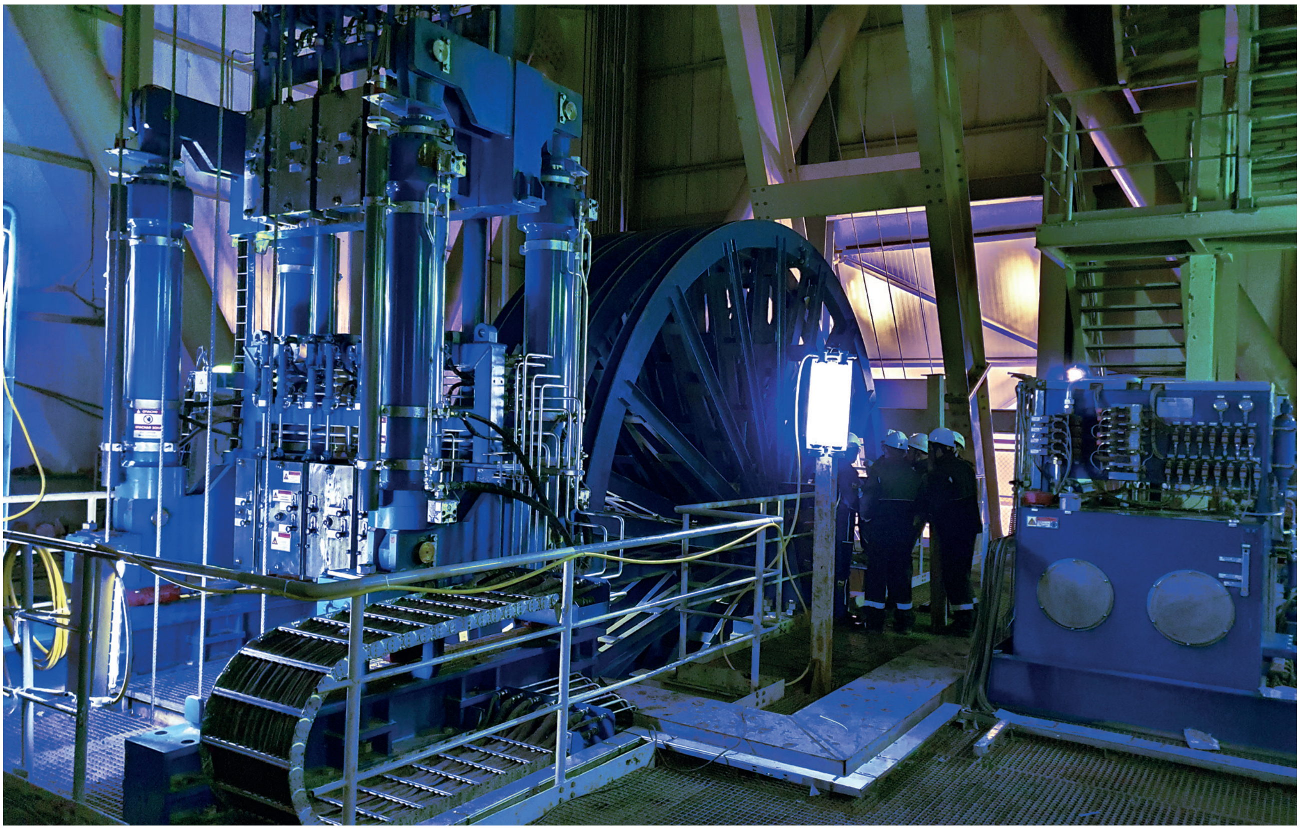

Fig. 3: Clamping and lifting device for handling hoisting ropes in one operation.

In order to be able to hold the head ropes and the mine cage securely for the duration of the tail rope installation, the four head ropes were clamped in the lower clamping beam of the clamping and lifting device and the load was thus statically fixed. This procedure is comparable to the use of rope catching clamps, but does not require any further preparatory work and is carried out purely by hydraulic reclamping in the clamping and lifting device.

In a next step, the remaining pieces of the head ropes were moved out of the friction winder and the drum linings were replaced in order to be able to hook in the tail ropes. The rope reelers were equipped with the tail rope drums. After completion of this preparatory work, the 3 tail ropes were fitted with tail rope harnesses, hooked in simultaneously to the shaft sump by means of a friction winch, taken up again from there and attached to the mine cage. At approx. -4.5 m in the shaft cellar, the tail ropes were intercepted, then cut to the required dimension in front of the friction winder and tied into the second set of tail rope harnesses.

The pre-assembled counterweight was then placed in the shaft. The clamping and lifting device was now used to lift the mine cage and thereby attach the head rope harnesses, which were still hanging freely in the shaft, to the counterweight. As the last step for the time being, the counterweight was lifted off the installation girders by means of a clamping and lifting device and the teil rope harnesses were attached to the counterweight in order to close the Koepe system.

After transferring the load from the clamping and lifting device to the hoisting machine, the rope laying was completed successfully, without incident and absolutely on time, and **the world‘s deepest Koepe hoisting machine** was ready for operation.

Fig. 4: Mine cage (still without lower floor) in the head frame, to the left of it a vertical deflection sheave, to the right of it the discharge bunker for skip conveying. The cage support is partly visible under the cage.

SIEMAG TECBERG group

Rope laying for the Double Drum Blair Winder in shaft SKS1

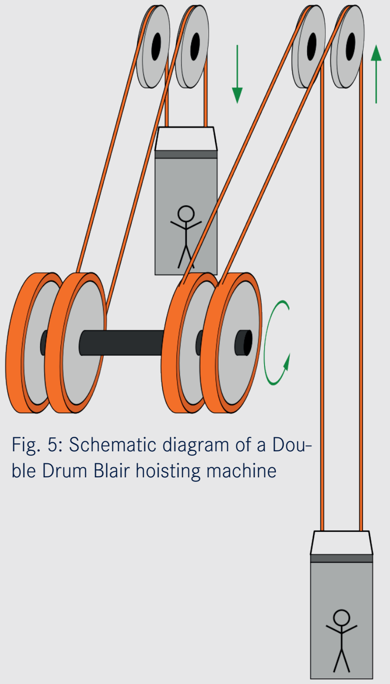

Fig. 5: Schematic diagram of a Double Drum Blair hoisting machine

Excursus

The conveying principle of the Double Drum Blair winder

Each drum on this machine has two winding areas, each winding area accommodating one rope.

Each of these ropes is attached to the drum on the one hand and to the hoisting equipment on the other hand by means of a rope harness.

The rope load of the two ropes is balanced by means of rope load compensation sheaves. The rope load compensation sheaves consist of two rope sheaves, each mounted on hydraulic cylinders, which are hydraulically connected to each other for rope load compensation.

Preparations

The installation of the rope changing equipment for the Double Drum Blair winder in the SKS1 production shaft also took place under the supervision of SIEMAG TECBERG.

For this purpose, 4 electrically driven rope reelers, the horizontal deflection sheaves and a friction winder were set up and anchored in a separate hall, which was erected by the customer adjacent to the shaft hall. Vertical deflection sheaves and a horizontal support were installed on the shaft side.

Spooling of all 4 hoisting ropes onto the loose and the fixed drum of the Blair winder

After these preparations, the first 2 head ropes were connected with auxiliary ropes, pulled through the complete tower section with auxiliary winches and finally attached to the hoisting machine's loose drum. Afterwards, the hoisting ropes were carefully spooled onto the loose drum with the hoisting machine.

During this process, the hoisting machine is operated with torque control and pulls the ropes against the friction winder. This ensures that the hoisting ropes are spooled with a defined pre-tension. The same procedure was then used to wind a further 2 ropes onto the fixed drum of the hoisting machine.

After rope installation was completed, the complete rope changing equipment (interceptor beam, transport frame of the skip, deflection sheaves) was immediately dismantled, as the equipment was protruding into the shaft section of the Koepe system and blocking the operation of the Koepe hoisting machine.

Fig. 6: Head ropes wound in the fourth layer on the Double Drum Blair winder.

Tie ropes into the rope harnesses

To tie the hoisting ropes into the rope harnesses, they were marked accordingly, the rope ends were secured against untwisting, cut off and tied into the rope harnesses via the wedge-type rope capple. Afterwards, the rope harnesses were pulled into the head frame with auxiliary winches for the following skip assembly.

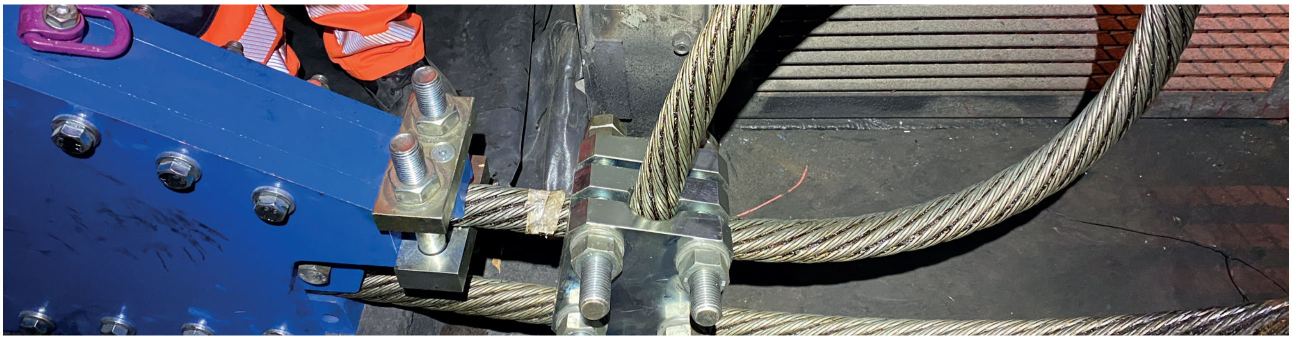

Fig. 7: Hoisting rope tied into a wedge-type rope capple. With wedge-type rope capples, the rope tightens automatically due to its load and the frictional connection with the open wedge socket.

Mounting the two skips

The next step was to connect the harnesses to a hitch, which in turn was attached by round slings to skip no. 1, which had previously been moved into position in front of the head frame by means of a mobile crane truck and the overhead crane in the shaft hall.

By means of the hoisting machine, the skip was now lifted and slowly pulled into the head frame until it was hanging vertically. A mobile crane additionally lifts the foot frame of the skip and guides it accordingly so that the skip does not drag across the beams or the hall floor.

The skip‘s mounting frames were then removed, the skip was moved to zero level (= pit bank level) and lowered by means of an interception beam. Now the nylon cables could be removed and the cable harnesses attached directly to the skip.

The steps described above are repeated exactly for the assembly of the 2nd skip. After a successful lifting and driving of the skip for test purposes, the skip was moved to the loading facility for the first time - accompanied in parallel by a drive of the Koepe hoisting machine in the neighbouring service shaft.

The rope laying for the Blair hoisting machine in the SKS1 production shaft was also successfully completed on time and without incident under the supervision of SIEMAG TECBERG.

Fig. 8: By means of the overhead crane in the shaft hall, which is attached to the installation frame of the skip, the skip is precisely positioned in front of the head frame.

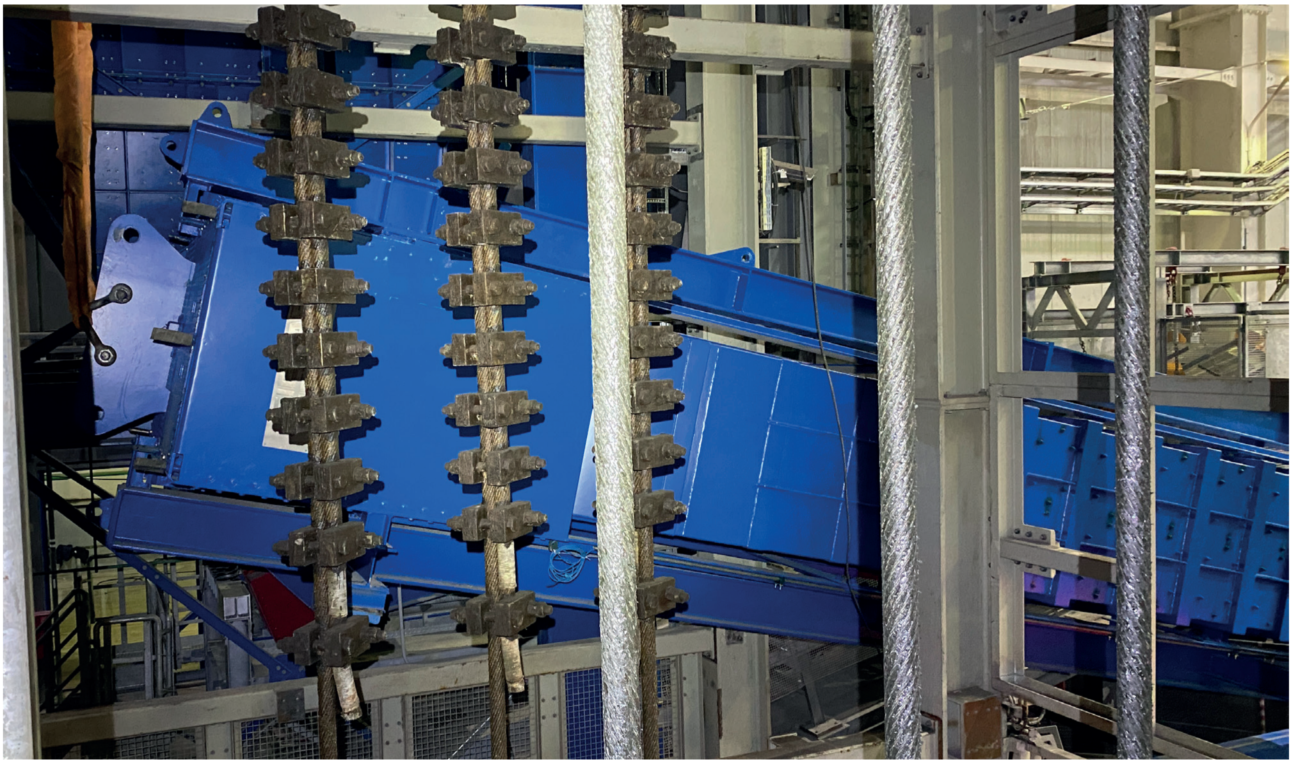

Fig. 9: Lifting and pulling the skip into the head frame is done with the hoisting machine.

Fig. 10: In the picture on the left a skip in the head frame with directly attached rope harnesses, in the picture on the right the two drums of the Blair hoisting machine with fully attached ropes.

The Company

The SIEMAG TECBERG Group supports its customers in the commodity markets and transport infrastructure with energy-efficient and intelligent hoisting technology as a world's leading supplier in this field.

Whether in the extraction of precious metal and industrial metal ores to supply green technologies with the necessary natural resources, or in the extraction of mineral salts for the production of mineral fertilisers - SIEMAG TECBERG Group's system-integrative overall solutions always convince with excellent engineering know-how, extensive system tests of the equipment with factory commissioning on heavy-duty test fields and digital service concepts including condition monitoring and service management.

The technical focus of the SIEMAG TECBERG Group is on the development, design, manufacture, commissioning and technical service of shaft hoisting systems for the vertical and inclined conveying of raw materials. In doing so, the SIEMAG TECBERG Group has distinct engineering competences for mechanics, hydraulics, drive and automation technology. Unique reference projects worldwide demonstrate the overall plant competence and leading position of the SIEMAG TECBERG Group. The group offers knowledge-based services for the supply of customized machinery and equipment for the following industrial applications:

Hoisting and conveying technology

- OEM Shaft Hoisting Technology for Underground Mines and -Waste Deposits
- OEM Material Handling Technology
- Systems Integration Automation and Drive Technology

Cooling

- Cooling and Ventilation Technology for Underground Mines, Waste Deposits and special Tunnels
- Systems Integration Controls and Automation

The niche specialist's technology emerged from a forge founded in 1871 in Siegerland, which produced equipment for local ore mining and the iron and steel industry in the german-South Westphalian Siegerland region. Following a management buy-out out of the SIEMAG-Weiss-SMS network 2007, SIEMAG TECBERG was founded by Jürgen Peschke, who is CEO and Controlling Shareholder of the SIEMAG TECBERG Group.

The SIEMAG TECBERG Group is represented on all continents by at least one subsidiary and works together with cooperation partners worldwide. In addition to the headquarters with the assembly plant in Haiger (Germany) north of Frankfurt am Main, other locations are situated in Rugby (UK), Katowice (Poland) and Moscow, Norilsk, Berezniki and Belgorod (Russia).

Further sites with own assembly plants are located in Tianjin (China), Sydney and Mayfield East (Australia), Johannesburg (South Africa) and Milwaukee/Denver (USA). The group employs about 405 people worldwide.

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