COMPANY PROFILE

Tailor made winches for deep mining

Winches and hoists play a pivotal role in many mines and mining projects around the world. For underground constructions and deep mining, winches and drives are essential for efficient and safe operations, writes Gilbert Domig, the technical director and MD of Gantner Seilbahnbau GmbH. Such winches and drives are specifically fabricated, for the needs of each site and purpose of operation, by very specialised engineering and manufacturing companies. This article presents the usage of shaft winches, taking as an example the electro-hydraulic rope winch which was specifically designed as the emergency egress shaft winch for the Roseberry mine in Tasmania.

Gantner Seilbahnbau GmbH, founded in 1948, has been developing and constructing winches that are employed in a wide variety of applications. Today, Gantner is established as a full service, winch manufacturing company that offers a complete service from the development to the eventual start-up of the winch, including every intermediate production step.

SHAFT WINCHES

Shaft winches are one of the major winch-categories upon which Gantner focuses. Such winches are essential in deep mining, as well as in the hydro-power industry at dam penstocks, where drift shafts with an inclined grade, are common. Winches can be used in many instances from vertical to inclined shafts, and of course they are used for many different purposes: material handling, when mined material needs to be brought to the surface; for service purposes when replacement material is brought in via the shaft; when manpower is lowered to complete maintenance works; and for rescue purposes. This latter application is one of Gantner’s specialties, and one in which it has a wide range of experience fabricating winches with the highest of safety features thereby permitting the transportation of personnel.

CASE STUDY: RESCUE SHAFT WINCH, TASMANIA

During 2014, Gantner received an order from a mine operator in Tasmania for the complete development and construction of a deep mining shaft winch, with the additional criteria that it be suitable for rescue purposes. As such the facility was designed to lift and lower (in the shortest time possible) a rescue capsule up-down a 500m vertical mine shaft.

The work was undertaken on behalf of the Mancala Group, a mine planning company from Melbourne, Australia. The winch needed to fulfill several strict criteria to comply with
Australia’s safety standards regarding its construction, functionality and integrated control system.

It took a year from project launch to the installation and commissioning of this 100% Ganter winch.

**TECHNICAL FEATURES**
The rope drum has a diameter of 865mm and its width is 820mm. The line pull is a constant 30kN, the rope is 565m in length and the line speed reaches 1m/sec. The drive capacity is 37kW and the brake power amounts to 2.2kW.

The haul rope diameter is 16mm with a minimum breaking strength of 210kN.

The winch consists of a massive base frame with integrated attachment points for the housing of high-quality SKF bearings. These bearings carry the drum unit with the main shaft being powered by a hydraulic drive.

The drum unit consists of a drum with screwed on half shells provided by Lebus, which results in a perfect winding result. The design of the winch was carried out by experienced in-house technicians.

Line pull, rope length, rope layers and drum width have to seamlessly mesh with each other. Massive drum flanges absorb the lateral forces of the rope layers; the rope movement is horizontal.

The rope winch is designed according to “Supply Functional Specification,” as well as the principles of the MDG33 and the MDG2005. The winch is constructed for use between a temperature range of 0° to +45°C.

**SAFETY FEATURES**
Understandably, this shaft winch project is in line with Australian standards. In addition, different international standards and directives, such as exerts of the Ropeway Directive, have been applied.

All components have been designed and calculated by Ganter with the calculations verified by an independent civil engineer. During production, strict quality management ensured the proper execution of all aspects of the work from design, electrical planning and manufacturing through to assembly, thereby ensuring the perfect construction and performance of the finished winch.

Essential safety features of this winch are two disc brakes which individually are able to provide the necessary power for the braking process. Each disc has two hydraulically controlled brakes produced by Svendborg.

A large number of rope-end terminations secures the rope of the winch, so any unintentional release or slide is impossible.

Another safety feature is the redundant valve design. Hence – in the unlikely case of component failure – a second valve will take over that role. The same principle applies to all other control components.

**CONTROL SYSTEM**
The design and programming of the control system, as well as the electrical and electronic wiring is done in-house. Only quality components which are approved by the majority of countries are used, however, special attention is made to adhere to local regulations and customer needs. One special requirement, was the interface regulation with the customer’s existing control system and the evaluation of signals.

**THE STRUCTURE OF THE WINCH**
The machine itself consists of the winch unit’s drive assembly and the operating panel. The drive assembly consists of a basic sub-structure with an enclosure in which the drive motors, hydraulic pumps and control facilities are built. The winch unit consists of a base frame on which the rope drum with drum axis and drive motor is fastened. The drive motor is supported over a torque bracket with a load measuring device within the base frame. Four disk brakes, which carry the force over the brake flange onto
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the rope drum directly, are controlled by means of two separate circuits. The connection between drive assembly and winch unit occurs via a supply pipe in which hydraulic hoses and control wires are conducted. The operating console allows full control and monitoring of the machine.

QUALITY & SAFETY – A CLOSE RELATION FOR SHAFT WINCHES

The quality of the winch - its functionality, materials employed, method of manufacture and (of course) the control system itself, are all essential for the overall safety rating. The whole development and fabrication process followed the ISO 9001 and OHSAS 18001 standards. Accurate and quality testing of every single part and process, as well as a focused material inspection regime (including material certification) were part of the project.

The mine planning company, who were responsible for the correct installation and functionality of the rescue winch, was present at the first start-up and testing phase at Gantner’s production facility. This ensured that the required level of quality could be approved well before the mine installation. This close cooperation between the producing company and the customer was fundamental for the success of this complex project.

TECHNICAL DETAILS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drum diameter</td>
<td>865mm</td>
</tr>
<tr>
<td>Drum width</td>
<td>820mm</td>
</tr>
<tr>
<td>Line pull (empty drum)</td>
<td>30kN</td>
</tr>
<tr>
<td>Line pull (full drum)</td>
<td>30kN</td>
</tr>
<tr>
<td>Rope diameter</td>
<td>16mm</td>
</tr>
<tr>
<td>Minimum break load</td>
<td>210kN</td>
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<tr>
<td>Power</td>
<td>37kW</td>
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<tr>
<td>Braker power</td>
<td>2.2kW</td>
</tr>
</tbody>
</table>

Winch unit

The drive of the machine consists of the following components:

- Rope drum (1)
- Brake block (2)
- Thrust stop (3)
- Base frame (4)
- Pin clamping set (5)
- Rope drum support (6)
- Torque arm (7)
- Hydraulic motor (8)
- Force measuring rod (9)

Gilbert Domig is the technical director and MD of Gantner Seilbahnbau GmbH, the winch technologies specialist, based in Sulz, Austria. Having gained considerable experience in engineering and mechanical construction in a variety of fields and sectors, Domig has more than 20 years’ experience designing and creating high-performing winches in engineering with wire rope systems. Domig aims to find the most creative ideas and to convert these into high performance winches.

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GANTNER is a specialist in the design, development and manufacturing of winches. Founded in 1948, GANTNER disposes of a great experience and know-how and expertise for all kind of winches. Winches are safe and reliable machines that enable the handling of material in challenging situations. Quality, safety and highest standards in all aspects are fundamental and necessary.

GANTNER is specialized on a focused development and construction for the winch and its purpose, designing tailor-made winches that meet the customer’s requirements at 100%.

The portfolio includes various kinds of winches, including rescue winches, shaft winches and service winches for material handling as well as for personnel transportation in mining and the construction industry.

GANTNER is certified in
- Quality - ISO 9001:2015
- Safety - OHSAS 18001:2007
- Environment - ISO 14001:2015

MINING WINCHES