



Case Study

Heavy Duty Conveyor Drives - Industrial Gear Units at “Linthal 2015” Hydroelectric Plant Construction

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To stabilize the power grid, Swiss supplier Linth-Limmern AG extends its existing Limmern power plant by a pump storage system. Most of the necessary installation is situated underground, and during construction a huge amount of rock material had to be moved. Read here how that happened.

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“Linthal 2015” construction in progress: pumped-storage infrastructure is an invaluable element of assuring reliable power supply.
(Pictures: © Marti Technik)

In an extremely demanding construction project in the Alps, almost 600 m inside the mountain, large chambers have been excavated to form the new, high-capacity pumping station of Switzerland’s largest hydroelectric undertaking in modern times. Mastering a 45 degree incline and a height difference of approximately 180 m, two belt conveyors transported approximately one million tons of excavated material over the course of three years. They were driven by

heavy-duty industrial gear units from Nord Drivesystems which, now that their job in the Alps is done, are being recommissioned for their next assignment. Power consumption typically peaks at midday and in the evening and dwindles down at night. Power distribution networks must therefore be regulated to ensure reliable supply. Complicating this task, the emphasis on developing wind energy plants in coastal regions brings about an increase in the so-called stochastic energy, which cannot be reliably planned due to random wind conditions. In contrast to nuclear power plants and river-based hydroelectric power stations, which are the main source of energy in Switzerland, pumped-storage plants can rapidly respond to changes in demand. Unlike conventional hydropower plants with only an upstream reservoir, pumped-storage stations cannot just generate energy at peak times but also store excess power. They have two reservoirs at different altitudes. Water flowing from the upper reservoir powers turbines connected to generators. The electrical power is fed into the grid while the water flows into the lower reservoir. At low-demand times, it is pumped back into the upper reservoir using power from the grid. For instance, excess wind power generated in off-peak times can be used to pump water back into the upper reservoir. If there is no wind during the day, the pumped-storage stations can cover the power deficit.

Record Infrastructure Project

Swiss energy supplier Axpo is close to finishing the demanding large-scale Linthal 2015 construction project. Switzerland's largest hydroelectric undertaking will increase the overall output of the existing Linth-Limmern power facility from 480 MW to 1480 MW. A new underground pumping station will pump water from the Limmernboden reservoir at an altitude of 1860 m above sea level into lake Muttssee about 600 m higher up. Kraftwerke Linth-Limmern AG, a member of Axpo Holding AG, is overseeing the project. The scope of Linthal 2015 includes the construction of a new large dam that will increase the storage volume of the upper lake from the present 9 to 25 million m³. The existing compensating reservoir at an altitude of about 800 m is being expanded. Work has been carried out at different altitudes, but for the most part inside the mountain where a new underground pumping station and extensive tunnel system are being constructed. The machinery chamber is located at an altitude of about 1700 m and some 600 m into mountain. It is 150 m long and 30 m wide with a maximum height of 53 m. A separate transformer vault is about 130 m long, 20 m wide, and 25 m high. Additionally, there are numerous water tunnels, parallel pressure shafts, and other service tunnels.

Drive Systems for Conveyors



Two conveyors in one tunnel: the upper belt moved downwards and the lower one went upwards.

The huge chambers for the pumping station were excavated from top to bottom. Work proceeded rapidly in an intensive 3-shift, 24/7 operation. Every day, about 800 m³ of rock were removed. The excavated material was reused in the construction project. Two S-conveyors each transported about 500 tons of

material per hour over a distance of about 260 m with a steep incline of 45 degrees and a height difference of around 180 m. A first conveyor transported the excavated material down to a crushing plant. It was driven by a Nord industrial gear unit with brake control, which also generated electricity. A second conveyor transported the crushed material up to the gravel plant, where it was stored or directly used as construction aggregate for the dams and for concrete. Over a total of three years, these conveyors transported approximately one million tons of material. Placed to the right and left of this conveyor system and connected by a common shaft, two Nord industrial gear units with a 250 kW output moved the belts at 2.2 m/s.

Heavy-duty Gear Design



Nord manufactures industrial gear units for output torques up to more than 242 000 Nm with a one-piece housing, achieving relatively compact dimensions and maximum resilience.

The industrial gear units for this huge construction project were based on Nord's tried-and-tested one-piece housing design with no joints that are subject to radial forces or torque. The gear case is machined from a single cast-iron block. It integrates all bearing seats. This design provides for high precision, rigidity, and strength. The overlapping bearing offset allows for more compact gear cases and larger roller bearings that guarantee a long operating life. The industrial gear

units in the “Linthal 2015” project featured IP55 ingress protection.

Customer-oriented Solutions

The supplier of this complete drive solution was Getriebebau Nord AG, Switzerland, a member of the Nord Drivesystems Group. The drive specialists from Arnegg near St. Gallen place much value on close cooperation with customers. Guido Eigenmann, manager at Nord Switzerland, says: “We provide customer benefits – not just products. We offer a comprehensive service package and provide maintenance training, so that the customer knows what to look out for.



One of the two SK 12407 industrial geared motors that were used to drive the belts; the NORD design allows mounting on all six sides, providing maximum flexibility.



The other of the two SK 12407 industrial geared motors that were used to drive the belts.

It is particularly important for us to supply complete systems which are highly efficient and economically priced. Many users require not just drive components,

but rather complete, ready-to-use system solutions. We tailor our drive solutions to each individual application.” Nord Drivesystems was commissioned by the plant constructor Marti Technik, a subsidiary of the Swiss Marti Holding AG and a provider of customized solutions focusing on underground construction work.

Ready for the next Challenge

After the completion of the conveying tasks, the Nord industrial gear units were disassembled by Marti Technik, and are now awaiting their next assignment. Ernst Kuster, head of maintenance and responsible for the conveyor systems at Marti Technik, says: “In compliance with the instruction manual, we changed the oil once, but that was the only maintenance measure we had to take over the course of three years. The Nord gear units performed brilliantly. Nord Drivesystems has cooperated with us very well. All of our requirements were catered for. The short delivery time is also remarkable - the built-to-order drives were delivered after about ten weeks. All in all we are very satisfied - a very good cost-benefit ratio, excellent support before and after sales.”

About the Author

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