

Serial Pump Installation leads to Higher Performance

Two main factors determine the performance of a pump: Maximum flow and maximum head (or lift). The maximum flow indicates the highest possible volume under ideal circumstances. Usually this means an outside temperature of 15°C, a homogenous medium and pumping completely on the flat. This third factor directly affects the maximum head: The greater the incline or distance, the higher the demand for power. If a project calls for vertical pumping, the pump needs to generate enough flow speed to lift the weight of the water column. In addition, the specific weight of the medium as well as its viscosity will play a role in selecting the right pump.

120 metre riser pipe

Sometimes construction projects require a level of performance, which cannot be fulfilled by any one pump. One example is the Koralm tunnel in Austria, which at 32.8 km will be the longest rail tunnel in the country. It will connect the cities of Klagenfurt and Graz following a route that will cut down journey times substantially. Its construction presents a serious geotechnical challenge. Exploration tunnels are currently being built to evaluate the feasibility of the route, which will pass at depths of up to 1200 metres.

Construction companies Max Bögl Bauunternehmung and Swietelsky Baugesellschaft are already on site carrying out this initial phase of the project. Starting from the west portal, the 2.6 km long 'Mitterpichling' section is close to completion. Work has also begun on the 6 km long 'Paierdorf' connection tunnel, where the ground water had to be delivered upwards via the supply shaft - a true show of strength bearing in mind the 120 metre vertical climb involved. Considering the scale of the task it was unsurprising that no single-solution pump could be found at an acceptable cost.

To solve such problems, experts from pump manufacturer Tsurumi developed an efficient cascade connection system. Two rising pipes are installed in the shaft and smaller pumps are fitted at 40 metre intervals. The units are equipped with a pressure relief valve, so that the accumulated water does not damage the mechanical seal.

At the base of the shaft the abrasive ground water is channelled into a basin, into which the lowermost pumps are submerged. This solution has delivered such positive results that the operating company are now using 17 Tsurumi pumps in the €145 million project.

The pumps to be used come from Tsurumi's KTZ-range. These multi-purpose pumps, designed for tough jobs, are best-sellers for the global market leader whose European operation is headquartered in Düsseldorf, Germany. The company's range includes 250 models offering delivery volumes of up to 50 cubic metres per minute or 170 metre head. The model currently installed on the 'Paierdorf' site has an 11 kW motor power and is equipped with a four inch coupling, which can deliver 1440 litres per minute.

Failure-free dry running

Many of the KTZ's components are made of special cast iron, which improves their resistance to abrasion. Further technical features distinguish the Japanese pumps from their European counterparts. The unit's dry-run capability is of utmost importance: If water delivery is interrupted because the water level in the basin is nearing zero, then there is no risk of a KTZ pump overheating and breaking down, even though it is no longer being cooled by the pumped liquid. This can be a particularly difficult issue in cascade connection, since the pumps are often sited at inaccessible locations because of the nature of the work. Owing to the huge economic and safety implications of failure risks, Tsurumi manufactures its pumps with a preventative double interior mechanical seal and inhouse developed oil lifter. Additionally, an insulated shaft sleeve keeps the medium away from the shaft, to prevent mechanical wear from day one. With design features like this aimed at protecting components from wear and tear, the pump can operate continuously at full power – an important benefit which has proven popular with operators.



Vertical Pumps: "Riser pipes in the supply shaft: Four small Tsurumi pumps installed in series are all that's needed to ensure drainage vertically upwards through the tunnel"



Horizontal Pumps: "Horizontal booster pumps in the Bleßberg Tunnel"



Sediment gives no pumping problems "Silt Pumping: Large particles of sediment in the medium pose no problems for cascade-connected pumps"



900 metre stretch of pumping in "The Bleßberg Tunnel: chains of pumps reaching 900 metres and more are possible when connecting pumps in series"



All in one KTZ pump "An all-in-one solution: Tsurumi's multi-purpose KTZ pump."

Horizontal pumping

Another application for Tsurumi pumps saw the manufacturer take a new direction during the construction of the 8.3 km long Bleßberg rail tunnel, which will house the new high speed line between Nürnberg and Erfurt in Germany. Lead contractor Bickhardt Bau AG required a dewatering over a horizontal distance of 930 metres. Tsurumi engineers installed the reliable KTZ-pumps, on this occasion opting for the smaller KTZ35.5 model. With only a 10% height differential to overcome between the tunnel head and the entrance, pumps were installed every 150 metres to serve as a booster in the delivery flow, giving problem-free drainage. The 5.5kw KTZ235.5 comes equipped with a smaller three inch discharge, and offers a delivery of 1100 litres per minute – more than sufficient for the project.

Difficult terrain does not always necessitate powerful and expensive pump technology. Tsurumi offers small, mobile multi-purpose pumps, which are equally suitable for these kinds of application, not least because they are versatile enough to be re-used at other locations on the same the project. Whatever the ultimate purchase decision is, the chosen pumps should always be dry-run capable since continuous operation is vital to meet the demands of most drainage projects.

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