Pumped storage power plant Ritom, Piotta (CH)
Pre-Excavation Grouting

Client	Ritom SA
Main Contractor	Consorzio Marti-Ferrari Ritom, CH-6776 Piotta
Execution of works	Renesco GmbH, Abt. Marti Geotechnik
Construction period	November 2019 – September 2020
Contract sum (grouting only)	1.8 Mio. €

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Object description

The Ritom power plant in Switzerland is being renewed. Via a new water intake at Lago Ritom (1’847 m) and a new, altogether 2’300 m long pressure tunnel, electricity will be produced above ground in the new power plant in Piotta (1’001 m).

Injection / Grouting works

During the excavation of the lower pressure tunnel, there was a strong water inflow at a relatively early stage of construction, which made rock injections necessary as sealing measures. The fissures, whose opening width varied greatly, were filled with a hybrid injection developed by Renesco itself, in which a two-component polyurethane resin is added to the cement suspension. The bore holes, usually 25 m long, were injected in two stages. By using this procedure, the water inflow could be significantly reduced. The pre-excavation grouting running ahead as the tunnel excavation continued, prevented a renewed increase in the inflowing water volumes.

Scope of work

- Cement CEM 52.5 R: 135,000 kg
- Polyurethane resin: 35,000 l
- Number of drill holes: 480 pcs.

Hybrid Injection

The newly developed hybrid-injection method sees the cement slurry mixed with polyurethane resin just before being injected into the borehole. As a rule, the proportion of polyurethane resin varies between 0% and 40%, and can be progressively increased or decreased during injection. The resin pump switches on and off automatically. This innovative injection control mechanism allows engineers to adjust the positive properties of cement and polyurethane resin to the exact hydrogeological conditions in the rock.

If an immediate increase in pressure is detected in a borehole when pure cement slurry is injected, no polyurethane resin is added as the cement slurry will be sufficient to seal the smaller fissures. However, if the injection agent drains out without an increase in pressure or if there is any leakage into the tunnel, polyurethane resin is added. The polyurethane-resin-cement slurry hybrid is then able to seal even larger fissures with high water ingress in the tunnel. Pure cement slurry subsequently penetrates the smaller fissures as part of the same process.

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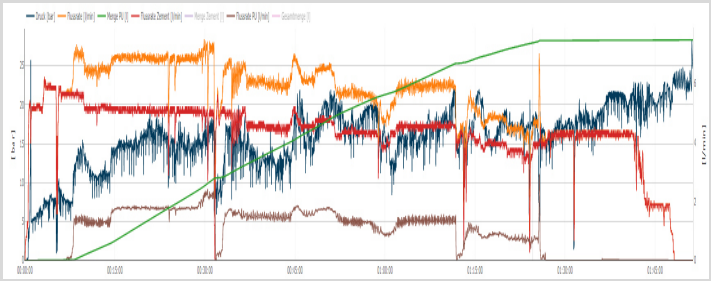

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1. Water ingress while excavation / Packer installation
2. Hybrid system
3. Hybrid - Injection record