

100% form and force-locking gap compensation in hydraulic steel construction:

Metal polymer supports dam management at Sylvensteinsee

A former village sunken in Sylvensteinsee reappears: Alt-Fall in Upper Bavaria (Germany). Because for regular maintenance at the dam, the water reservoir near Lenggries had to be drained. Thus, after half a century, the foundations of the then flooded place came back to light. One of the maintenance challenges was to overhaul the guide rails of the dam's roll-up roller shutters, ensuring a 100% force-locking connection of the newly installed reinforcement on the guide rails.

The Sylvensteinspeicher is much more than an ordinary lake. "Far" is the apt word: the Sylvensteinspeicher extends with a length of seven kilometers and a width of two kilometers along the road from Bad Tölz to the Achensee.

As Bavaria's most important water reservoir, it forms the backbone of water regulation for the entire Isar Valley and thus also for the state capital and Oktoberfest metropolis Munich. In dry season, it ensures the adequate water supply of the Isar, which makes it ecologically indispensable for the entire area.

The dam of the lake stands on one of the Isar over time filled with debris and up to 100 meters deep erosion channel. With it the Sylvensteinspeicher dams up the side of the Isar and their side inflows Dürrach and Walchen. Its two hydropower plants generate 25 million kilowatts of environmentally friendly electricity every year.

Elaborate renovation of the roller shutters

Overall, the dam in the Isarwinkel tames over 124.3 million cubic meters of backwater. This enormous amount ensures an immense pressure on the roller shutters of the Sylvensteinspeichers. The sluices make it possible to precisely regulate the reservoir water and its controlled outflow at high tide or a low water increase in the Isar. As a key part of the traffic jam and flood system, the sluices therefore have enormous importance in the security concept.

For each discharge channel, two up to 21-tonne, six-meter-high contactors are installed directly behind each other: the upper roller shutter and the lower roller shutter. This dual system provides redundant security should one of the shutters fail. The massive roller shutters are moved up and down on 12-meter-long rails. After countless opening and closing runs in the past six decades, a more comprehensive overhaul has been scheduled as part of regular maintenance.

The lowering of the Sylvensteinspeicher in winter 2015/2016 was the ideal time for this work.

New guideways were supposed to guarantee the safe running on both of the upper and lower roller shutters.

Basically, there were three options for the renovation. First, the time-consuming removal of the old guide rails and the introduction of new ones. Second, the laborious grinding and reworking of the worn rails. And third, the doubling of the rails. While variants 1 and 2 were quickly discarded for cost and time reasons, doubling up was the most sensible solution in every sense.

In view of the high pressure load, however, it was absolutely necessary to produce a 100% form and force-locking gap compensation between the new reinforcement and the existing guide rail steel. The otherwise often common method of gap compensation with wedge plates or shim plates was out of the question in this highly demanding case. The disadvantages associated with this were too big. Thus, despite high time and machinery and costly adaptation, it is practically never possible to create a completely positive connection with wedge plates or shim plates. And therefore no force-locking connection. In addition, in the case of the Sylvensteinspeichers particularly frequently - in some places columns are only a few millimeters wide. Then it is almost impossible to bring wedge and shim plates.

One hundred percent, pressure-resistant and secure force-locking

The ideal solution for the one hundred percent force-locking between reinforcement and existing steel was provided by the polymer manufacturer Diamant Metallplastic with the material MM1018.

MM1018 is a polymer system that can be applied on site, which ensures 100% form and force-locking gap compensation in steel and bridge construction - for example on bearing seats, flange connections, top plates, bar and diagonal connections.

It is the only metal polymer with general building approval and with more than 1,000 applications worldwide in the metal industry.

In one work step, MM1018 provides 100 percent form and force-locking gap compensation, without mechanical processing and without the need for additional wedge plates or shim plates. This saves considerable time and personnel costs compared to conventional methods of gap compensation - with greater flexibility, sustainability and economic efficiency.

Requirement determines the application form

MM1018 is a two-component reaction resin system highly filled with special metallic materials. The material can be filled both pasty and liquid or injected. Both material variants offer the complete gap compensation without any mechanical preparatory work on the steel components, but differ fundamentally in the application.

In both phases of construction on Sylvensteinspeicher – on both the upper and lower roller shutters - the liquid version of MM1018 was used. In the liquid version, MM1018 is chosen primarily for the "reactive" application – that is, for the subsequent gap compensation in already installed steel structures. Here, the liquid polymer material is introduced via injection openings in the sealed gap. The air that is displaced from the gap escapes through vents.

The responsible steel constructor at the Sylvensteinspeicher and Diamant Metallplastic worked hand in hand with the installation of the reinforcements and the subsequent gap compensation. Luigi Di Gregorio, Senior Project Engineer at Diamant Metallplastic, explains: "The rail was perfectly prepared by the steel constructor with a repetitive hole pattern for the injection. This allowed us to inject MM1018 easily and very quickly. "

The liquid material is - as well as the pasty variant - usually fully cured and fully loadable within 24 hours at the appropriate ambient temperature.

The pasty material is suitable if the parts to be joined are not yet permanently connected to one another and a minimum working height of 20 millimeters can be set between the bearing

surfaces. It is applied in a cross-shaped manner to the metallic bright, freed from loose particles joining surfaces and then brought together. Excess material which has been pressed out of the now force-closed gap can easily be removed before curing.

Prerequisite: german general building approval

For each construction phase on the Sylvensteinspeicher, that means per roller shutter, Diamant Metallplastic only needed three days to apply its metal polymer MM1018, including curing.

Important for those responsible for the Sylvenstein project: MM1018 is the first product of its kind to have the general building approval of the German Institute for Building Technology (DIBt). In addition, MM1018 is recognized by the Deutsche Bahn and by the Waterway Authorities (WSV) and named in installation regulations.

Against this background, the responsible water authority Weilheim already defined in the tendering a metal polymer as the material to be used. According to the project managers, MM1018 met all the requirements of such a demanding application and was therefore the first choice for the safe gap compensation on the Sylvensteinspeicher.

Since May 2017, the roller shutters have been rolling on perfectly reconditioned rails, which will continue to be absolutely reliable in the future - and Alt-Fall has again sunk for many decades at a depth of 30 meters.