



IMPROVING CHAIN PERFORMANCE

Thomas Wagner, FB Ketten Austria, describes the overhaul of the portal scraper reclaimers at Lafarge's Wössingen plant in Germany, which resulted in improved wear life and performance.

In 1998, technicians from Lafarge's cement plant in Wössingen, Germany, contacted FB Ketten Austria for assistance on a project to reduce the engineering and maintenance costs of its two Bühler Miag portal scraper reclaimers. These machines use a series of scrapers attached to a chain to automatically reclaim material from a stockpile. As such, the quality of the chain and its associated parts are among the key factors affecting performance and operating costs. Chain specialist FB Ketten's engineers have decades of experience in dealing with conveyor chains across a wide range of arduous applications, including those similar to the Wössingen plant, and were able to combine their knowledge and expertise with calculations performed at the site to develop an optimal solution.

Table 1. Breaking load of FB M315 conveyor chain

ISO Standard	FB round riveted pin	FB welded pin only	FB welded pin and bush
315 kN	320-350 kN	380-410 kN	440-470 kN

Portal reclaimer return roller, buckets and FB conveyor chain at the Wössingen plant.



Portal reclaimer at the Wössingen plant.



The main way in which FB Ketten sought to reduce maintenance and replacement parts costs at Wössingen was to increase the service life of the three main components: the chains, the sprockets and the chain wear guides. FB Ketten's solutions were installed in 2006 (it took eight years to secure the investment needed at the plant) and now, eight years later, their true value has been proven.

Same size, significantly stronger

"To increase the service life of a conveyor chain, a customer might typically opt for a larger size chain – as the stronger the chain, the longer it will last before starting to fatigue. At the Wössingen cement plant, however, installing a larger size chain would have meant completely changing the drive and

attachments at considerable cost," said Thomas Wagner, Managing Director of FB Ketten Austria.

The company responded to the challenge by designing a heavy-duty roller conveyor chain, which possessed the strength of a larger size block chain, while still fitting the existing housing. A block chain typically has solid inner blocks into which two hardened and tempered feather steel wear bushes are pressed. The pin rotates on these bushes. FB Ketten's chain, however, is constructed of inner links with welded pins and bushes. By improving the cohesion between the chain components, the conveyor chains with welded pins and bushes have tensile strengths that are 30 – 50% higher than ISO Standard conveyor chains, as well as high durability against shock loads.

To ensure the weldability of the chain and avoid fatigue cracking, FB Ketten employed its FB800 steel for the link plates. "FB Ketten is one of only a few conveyor chain companies that uses materials specially selected with weldability in mind," Wagner added.

FB800 steel has a tensile strength of 800 N/mm² with a maximum 0.2% carbon content. Standard chains from other manufacturers are typically manufactured using St60, St70 or C45 steels with a 0.4 – 0.5% carbon content. The lower the carbon content, the stronger and more flexible the weld, increasing resistance to shock loads.

The welds are carried out by modern automatic welding robots that keep the temperature under tight control to produce consistent, high quality and reliable results that will stand the test of time. The high weldability of the materials also means that should an attachment become damaged it can be removed and a new one welded back in place without dismantling the chain, further helping to keep maintenance costs down.

The inner link design of the chain also provided a 10% higher bearing surface. This results in lower wear as the chain pull is divided over a much larger area. Furthermore, the weight of the chain was decreased. The new chain installed by FB Ketten was 24% lighter, reducing the total weight for one pair of chains by 1038.80 kg. This also reduced the chain pull and wear, as well as energy consumption.

The rollers further reduce wear, both on the chain and the chain wear guides, by reducing the friction coefficient. The friction coefficient between an inner block gliding on the chain wear rail is usually a minimum of 0.25 with good lubrication. With chain rollers, this coefficient can be reduced to 0.13.

"Just one of these features would have shown significant benefits over the lifetime of Lafarge's scraper reclaimer chains, but altogether they result in exponential advantages – a longer chain and chain wear guide life based on increased strength

and reduced wear, and lower electricity bills thanks to reduced weight and friction,” said Wagner.

Precision split sprockets

In a bid to minimise downtime due to maintenance and repairs, the company also installed a series of split sprockets. Split sprockets are advantageous when the engineering time taken to remove sprockets involves dismantling large parts of the drive or where multiple sprockets fitted on the same shaft need to be removed. Conveyor chain sprockets are also typically very large and heavy and may require the use of a crane to get the sprocket into place. The previous sprockets on the Lafarge reclaimers each weighed more than 160 kg.

“Many manufacturers produce this type of sprocket by splitting an existing sprocket and then joining the two sections together again,” Wagner explained. “For the engineer, this often results in a poorly assembled component, leading to uneven loading in operation and increased wear to the sprocket teeth, bore and keyways. As a result, many maintenance managers are reluctant to fit them.”

FB Ketten, however, manufactures high quality split sprockets as two separate segments. The two mating sections align perfectly to ensure long and trouble free operation. Made from special grade alloy steels, the tooth profiles are CNC-machined for close engagement,

are not flame cut and benefit from localised induction hardening in order for the sprockets to cope with the demanding environments. Unlike off-the-shelf sprockets, customers can also request design solutions such as special dirt clearance grooves at the base of each tooth profile to ensure there is little or no buildup of the conveyed material. This type of sprocket design is advantageous in many high wear industry applications, such as conveying cement. Lafarge’s sprockets were specially designed to avoid any costly modifications to the existing housing in the reclaimers.

Fethi Kuz, Planning Engineer at Lafarge Cement Wössingen, said: “We are very pleased with the outcome of this project. The lifetime of the chains and sprockets was increased to five years (38 600 hours) instead of two to three years (23 000 hours maximum) at almost the same product cost. As the new chain is 12 kg/m lighter and the friction is lower because of the roller, we have also seen a reduction in power consumption by the drive motor. By using the chain roller the wear on the chain guides has dramatically decreased.”

“We were so pleased with how well the upgrade went that we asked FB Ketten to carry out an upgrade to a second portal conveyor, which they completed for us in 2008 and which is still performing just as well as the first conveyor,” added Kuz. 🌐