

Technical Article

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Henkel solutions for mineral and rock extraction and processing machines

Adhesives and Surface Treatment solutions solve challenges of heavy machinery makers

It is a machine of superlatives: four floors high, 82 meters long or the length a high-rise building of 20 floors lying on its side. This monster is heavier than a dozen 747 jumbo jets and creeps forward through the earth behind a more than 9 meter tall rotary cutting head. What may sound like science fiction is, in fact, the description of a giant tunnel boring machine (TBM) that was constructed using adhesives from Henkel.

The machine, built by the German company Herrenknecht AG, drilled a 5.4 and a 3.9 kilometer tunnel in Kuala Lumpur in 2006. It is also cutting the Gotthard Base Tunnel in Switzerland. When completed, in 2017, this will be the longest traffic tunnel in the world with a length of more than 57 kilometers. It is also one of the most geologically challenging, as it crosses nine geological zones. The TBM cuts through granite and quartz, along fault lines and beneath a layer of dolomitic marble.

Henkel's threadlocker LOCTITE 243 is used to lock bolts in the machine, which has to withstand enormous pressure while it eats its way through the rock. The cutting head's power unit relies on a variable number of single engines. The upper flange ring, main bearing and the transmission case are all cemented in multilayer laminations using LOCTITE 586. The task was to secure and upgrade the torque capacity of the flanges on the main drive by 2 to 2.5 times. And finally, for thread sealing in the machine, LOCTITE 577 is used.

Solutions for all types of manufacturing machinery

The use of adhesives for the construction of all kind of machines, from cars to airplanes and from refrigerators to computers, is standard industrial practice nowadays. Adhesives are increasingly replacing traditional joining systems like welding and riveting. The stress on adhesives in heavy machinery like the Herrenknecht TBM, or machines used for mining, is enormous. Manufacturers therefore prefer products from Henkel, the world's largest adhesives maker.

From mineral and rock extraction and processing to metal-working machinery, Henkel fulfills the most stringent requirements at every machinery manufacturer. Henkel's solutions are compatible with a wide variety of machinery fluids and working environments, and comply with different standards recognized across the industry.

Furthermore, Henkel is also a world leader in providing surface treatment solutions to the heavy-duty equipment sector. The enormous and expensive machines produced by this branch of industry have to withstand the effects of time in harsh environments. Henkel offers corrosion protection solutions for all types of metals, cleaning for maintenance and repair operations, and a unique primer coating for steel.

Innovative manufacturing processes for mining and rock processing machines

Henkel develops specific solutions for builders of machinery used for mineral and rock extraction and processing. Its extensive experience in the maintenance of these machines gives the company a privileged perspective, enabling it to understand typical failure causes. This know-how leads to integral solutions from machine assembly to maintenance, which result in major cost savings during the machinery's entire life cycle. Henkel's solutions are not just used in the factories where the equipment is manufactured. They are also available to maintenance workshops through various distributors and official dealerships. This guarantees that only the best solutions are applied at every stage of a machine's life; an added-value advantage that has led many customers to select Henkel as the technology partner of choice.

Sacrificial coatings based on polymer composites to protect areas subjected to wear and corrosion are a case in point. These coatings can be applied during the manufacturing process, creating a value-added solution for end users because they can then reapply the same grade on worn areas during subsequent maintenance. This simple procedure prevents damage to structural parts, prolongs machinery service life, increases operational efficiency, and prevents costly downtimes.

Flexible adhesives and sealants

Henkel's range is not limited to wear and corrosion protection solutions. The use of flexible adhesives and sealants is also gaining momentum in the mining and rock processing equipment industry. Henkel's versatile product family for such applications accommodates a wide variety of materials that need to be bonded and sealed at the same time. Moreover, new, modern fast-cure flexible sealants promote both higher outputs and improved equipment quality. Their natural adhesion exceeds usual customer requirements, as they bond materials such as painted and bare steel, stainless steel, castings and glass. Henkel products are used, for example, to build driver's cabins requiring anti-dust protection.

Sealing of fluid systems

Henkel offers a comprehensive range of thread sealants and liquid gaskets to solve all fluid sealing challenges. From low-pressure fluid drainage or air recirculation systems that can be sealed with high-performance yarns, to high-pressure hydraulic, lubricant and pneumatic supply connections whose threads need high-performance anaerobic sealants.

One of the latest innovations in Henkel's thread sealant family is LOCTITE 55 yarn. This grade has all the advantages of PTFE tape and hemp, but none of their disadvantages. Threaded connections are easily and instantly sealed, allowing part repositioning, if required. The ergonomic Loctite 55 dispenser enables workers to seal around 50 times the number of threaded connections feasible with one PTFE tape reel, without mixing sticky, dirty grease and hemp. The product has been used, for example, in sprinkler systems in recent airport projects.

High-performance anaerobics to meet mechanical challenges

Mining and rock extraction and processing machinery is continuously evolving to satisfy industry demands. And here anaerobics play a key role in guaranteeing the performance of the mechanisms operating within the machinery.

Henkel has been serving metalworking machinery builders since the 1950s, when anaerobic adhesives were invented and first commercialized. The Henkel brand name LOCTITE refers to the most famous application of anaerobic adhesives: the locking tight of threaded joints to prevent vibration and loss of clamping force.

Threadlockers as cheap as washers

LOCTITE anaerobics have dramatically evolved since those initial formulations, thus keeping Henkel at the cutting edge of the associated technology. Properties such as high temperature resistance, with ratings of around 200 °C in many grades, compatibility with oily surfaces, and low surface sensitivity – to ensure that most grades will cure even on inactive surfaces like stainless or passivated metals – have been progressively incorporated in the products that make up Henkel's portfolio. This improved surface tolerance makes LOCTITE anaerobics the first option in both manufacturing and maintenance environments.

Threadlockers are well known to machinery builders, though their use is still associated with heavily loaded bolts. Threadlockers are as cheap as a washer, but much more efficient at bolt clamping force retention. And it is worth remembering that vibration is not the only source of bolt loosening. Temperature change, pressure fluctuations, part surface settlement, etc. are further causes. The superiority of threadlockers in countering such phenomena has increasingly convinced manufacturers to use them instead of washers and other mechanical solutions.

Anaerobics as a means to prevent fretting corrosion

Fretting corrosion is another problem that can be prevented by using anaerobics. Flanges sealed with liquid gaskets not only prevent leakages or the ingress of fluids, but also reinforce the joint against local shear stresses, preventing any micro movement. With transversal forces being effectively countered, load transfer capability is actually improved without any design change or, even more important, with no need for any kind of surface finish upgrade.

Finally, cylindrical joints can also be secured with much greater efficiency by using anaerobics. The stress distribution achieved is much more even, preventing all typical fatigue-related failures that occur when keyways and other mechanical systems are employed. Compared to welding, there is no modification of adjacent metal properties due to exposure to high temperatures, and no residual stresses are created. Finally, the need for balancing and turning processes is dramatically reduced, as parts can be aligned while the adhesive is curing.

The use of anaerobic adhesives is not only restricted to heavily loaded parts like shafts and gears or rollers, as bearings and static joints can also be assembled using such retainers. Bearings assembled only with anaerobics are better aligned and have no residual stresses to cause distortion later on. As a result of these benefits, the survival probability and durability of these mechanical elements increase dramatically.

Instant assembly of small parts

Not long after the introduction of anaerobics, another super-adhesive technology was added to the LOCTITE range: that of cyanoacrylates, or “superglues.” These adhesives were soon being used by machinery builders to bond materials like plastics, rubbers and others used in parts like guards and door wiper seals. Today, Henkel’s cyanoacrylates are unmatched in performance and manufacturing speed. Indeed, the latest developments have resulted in their temperature resistance increasing by 50 percent to 120 °C, with fixture speed amounting to just a few seconds under most working conditions. No competitor products can measure up to this performance. Temperature resistance is not only noticeable in the neighborhood of the upper limit of 120 °C, as these adhesives feature higher strength than the competition even at temperatures around 50 °C and 60 °C, where most grades show a dramatic decrease in strength.

Noise and vibration management

Some heavy machines engender huge dynamic forces accompanied by high vibration and noise. The use of flexible adhesives instead of sound insulating matting in the construction of body panels can greatly reduce noise and vibration transfer. However, only the most modern structure-borne sound deadening coatings can efficiently absorb truly heavy vibration. Such materials – available from Henkel – can be sprayed onto the metal surfaces at room temperature, thus reducing both handling effort and manufacturing cost.

Tool manufacturing

Not only can better machine construction components be manufactured at lower cost, replaceable components like drilling tools and cutting wheels can also benefit from Henkel’s products. Henkel’s surface treatment solutions reduce cutting tool manufacturing costs thanks to less cutting fluid replenishment, less need for bactericide additives and longer cutting tool lifetimes. Cutting tool manufacturers like Walter AG and AB Volvo have documented the benefits of Henkel’s sustainable high-performance cutting tool treatments. Similarly, Henkel’s structural adhesives bring superior performance and lower process costs to grinding wheel manufacturers.

Machine installation

When it comes to machine installation on stable foundations, Henkel is able to satisfy the highest standards required by the marine engineering industry and other industrial customers. Henkel’s Germanischer Lloyd-approved chocking and allied solutions are also available to mining and rock equipment installers, with training, support and applicator homologation services part of the package.

Backing material

Another important technology commonly used in mineral and rock processing equipment relates to backing material. The benefits of such products over other traditional solutions as a means of consolidating wear liners in crushers and mills were demonstrated decades ago. However, the expertise that Henkel has accumulated over the years in this domain is second to none. Henkel's comprehensive range comes with the best in professional support, ensuring that the right grade is selected for each machine type.

Metal pre-treatment

Expensive and complex machines have to last! As a world leader in metal pre-treatment, Henkel offers a wide variety of corrosion protection solutions under the Bonderite brand. Benefits are three-fold: high-performance conversion coating before painting, cost-effective solutions, and innovations that also care for the environment.

Autodeposition coatings

Modern chemical autodeposition processes have evolved into a powerful alternative to cathodic dip coating (e-coating). Especially in cases where uniform coating of interior surfaces and edges is required, or where powder top-coating is used, they can deliver significantly better corrosion protection results. Around the globe, companies have therefore opted for the non-electric autodeposition technology from Henkel, a sustainable coating process that also completely avoids the use of hazardous heavy metals. Recently, this technology has gained the highest approval level at a leader in mining and construction equipment manufacturing.

Cleaners

Henkel offers a wide range of cleaners, both for production and for the subsequent maintenance of equipment and tools. Inadequate pickling or degreasing prior to conversion or anticorrosion coating will lead to a poor paint adhesion and fast corrosion of the equipment. Our BONDERITE cleaner range contains all acid, alkaline or neutral cleaners needed in order to guarantee an optimal result. It is also important to keep vehicles and tools clean and in good shape in the production environment. Regular cleaning is therefore a must. Henkel offers a broad pallet of cleaners adapted to your circumstances and needs. They will contribute to maintaining a safe and clean working environment and prolong the service lifetimes of machines and tools. Henkel can advise on the right maintenance cleaners for any particular form of contamination.

Henkel operates worldwide with leading brands and technologies in three business areas: Laundry & Home Care, Beauty Care and Adhesive Technologies. Founded in 1876, Henkel holds

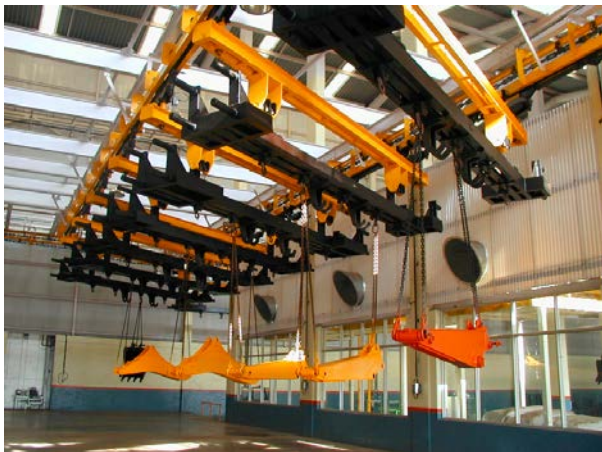
globally leading market positions both in the consumer and industrial businesses with well-known brands such as Persil, Schwarzkopf and Loctite. Henkel employs about 47,000 people and reported sales of 16,510 million euros and adjusted operating profit of 2,335 million euros in fiscal 2012. Henkel's preferred shares are listed in the German stock index DAX.

Photo material is available at <http://www.henkel.com/press>

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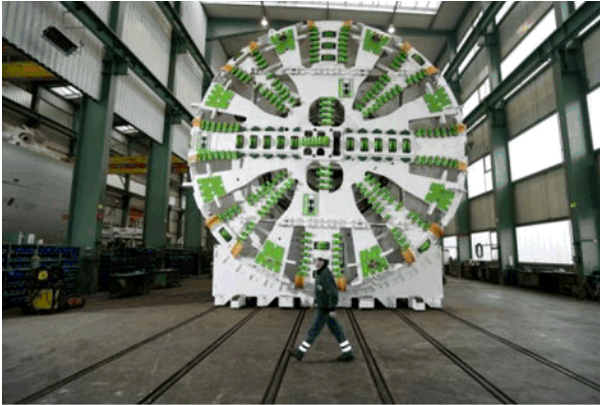
The following material is available:



Henkel's metal pre-treatment and autodeposition coatings are used on many heavy-duty machines such as excavators.



Henkel's innovative technologies – here in the form of high-performance anaerobics – enable machinery manufacturers to improve the power transmission capacity of their flanged joints without any additional design change.



Henkel's threadlocker LOCTITE 243 is used to lock bolts in giant tunnel boring machines that have to withstand enormous pressures.



Products from Henkel are used in heavy mining machinery.



Henkel engineers provide on-site support for the maintenance of mining and rock processing equipment. Decades of experience in this field mean Henkel can significantly help machinery builders to improve the efficiency and availability of their machines.