

Technical Article

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Henkel solutions for the automation industry and metal-working machinery

Adhesives solve challenges of robot manufacturers

— They can lift loads weighing tons, operate under harshest conditions and work 24 hours a day without a break. Since the early 1960s, robots have conquered the industrial world. These astonishing machines are increasingly constructed using adhesive technologies from Henkel. Now, even robot arm elements can be bonded with structural adhesives.

— The International Federation of Robotics estimates in its study “World Robotics 2012” that there were at least 1.1 million operational industrial robots worldwide at the end of 2011. This number is expected to reach more than 1.5 million units by the end of 2015. To increase performance, prolong lifetime and lower production cost, many robot producers are turning from traditional fastening methods like welding and riveting to different types of adhesive technologies.

— As in the case of any other machinery, robots must operate reliably. Their availability should be maximized, as downtimes are costly in most manufacturing processes. This is where Henkel technologies play a key role, not only cutting manufacturing costs but also providing solutions that increase machinery efficiency and dependability. From industrial robots to metal-working machinery or processing and packaging machinery, Henkel fulfills the most stringent manufacturer requirements. Henkel’s solutions are compatible with a wide variety of machinery fluids and working environments, and comply with different standards recognized across the industry.



Innovative manufacturing processes for robot and machine tool manufacturers

Henkel develops specific solutions for robot and machine tool builders. For instance, robot and automation system manufacturers like SAPELEM are incorporating the latest structural bonding technologies so as to both reduce weight and increase stiffness, and therefore enhance equipment accuracy. This is only feasible with assembly methods that evenly distribute stresses when joining dissimilar metals, or indeed composites and plastics. Material selection is not therefore restricted to a limited number of materials, and customers can base material selection on pure functionality criteria, enabling them to choose the most appropriate substrates.

Henkel also offers sustainable and cost-efficient guard manufacturing systems. For instance, safety and inspection windows can be assembled and sealed in one go using fast-cure flexible adhesives that need no primer and are free from potentially dangerous chemicals. Lighter panels and doors can also be manufactured without compromising their mechanical strength by using new designs that allow a more even and efficient load transfer. These methods are well known in other industries like elevator or even aircraft manufacturing, which benefit from significant production and transportation cost savings.

The use of adhesives enables manufacturers to incorporate new materials, combining their features in the most convenient way. For example, fast-cure flexible sealants exceed usual customer requirements through their ability to bond materials such as painted and bare steel, stainless steel, castings and glass. New designs also become possible, enabling producers to create new generations of readily marketable machines.

There are various technologies available, including flexible adhesives and sealants capable of joining and sealing dissimilar substrates of any size and finish. These bonding agents can absorb assembly stress and deformation resulting of effects like load transfer, impact, vibration or differential thermal expansion. Such constructions retain their structural integrity with even fragile elements such as windows contributing to overall structural strength. These solutions have been proven resistant to most industrial fluids, including cutting oils and emulsions. Machine tool manufacturers like KOVOSVIT MAS have benefited from such solutions over the years, providing equipment of superior quality and reliability to their end customers.

Another area where adhesives are finding new applications is in bed and frame construction. New materials offering low expansion coefficients, such as composites or polymer concrete (mineral castings) often need adhesives for certain assembly operations.

All these Henkel solutions meet the most stringent customer requirements, including mechanical performance, durability and chemical resistance against industrial fluids.

Lighter yet more robust robots and automation systems

A key manufacturing equipment segment today is industrial robots and automation systems. The faster and more reliable the robots, the higher the manufacturing output in automated lines. And here, again, the most modern assembly and sealing technologies can bring new robot design opportunities. Light materials like plastics and composites can be incorporated and joined with other materials by using structural adhesives. Even cast and carbon steel can be bonded together. Flanged joints in cast components can be sealed and reinforced using anaerobic liquid gaskets, thus upgrading their load transmission capability. In addition, Henkel's high-performance sealants enable robot manufacturers to build industrial robots for highly clean environments, or to prevent chemical ingress and mechanical damage in robots operating in harsh working environments. Even robot arms, lifting extremely heavy loads, are constructed with adhesives from Henkel.

Rollers used in automated line conveyors can also be manufactured using room-temperature-curing adhesive-based assembly systems, saving manufacturing costs and scrappage without compromising their mechanical performance.

Sealing of fluid systems

Henkel offers a comprehensive range of thread sealants and liquid gaskets to solve many of the common fluid sealing problems: from low-pressure fluid drainage or air recirculation systems that can be sealed with the high-performance yarns, to high-pressure hydraulic, lubricant and pneumatic supply connections with screw threads that require high-performance anaerobic sealants.

One of the latest innovations in Henkel's thread sealant family is Loctite 55 yarn. This grade shows all advantages of PTFE tape and hemp, but none of their disadvantages. Threaded connections are easily and instantly sealed, but allowing part repositioning if required. The ergonomic Loctite 55 application container enables operatives to seal around 10 times the number of threaded connections feasible with one PTFE tape reel, without the usual problem of sticky, dirty grease contaminating the hemp. The product was used, for example, in sprinkler systems recently installed in various new airport projects.

High-performance anaerobics to meet tough mechanical challenges

Henkel has been serving metal-working machinery builders since the 1950s, when anaerobic adhesives were first discovered and commercialized. The Henkel brand name Loctite stands for “lock tight” in reference to the most famous application of these anaerobic adhesives: the locking of threaded joints to prevent loosening due to machine or engine vibration.

Machine tools and robots are continuously evolving to satisfy new industry demands. Trends like miniaturization or energy efficiency are strongly pushing industrial machinery manufacturers to create more precise equipment without compromising key aspects such as reliability or productivity. And to achieve this, machinery manufacturers need to thoroughly ensure that all mechanical components are accurately dimensioned and operate within close tolerances under normal service conditions.

Threadlockers as cheap as washers

Loctite anaerobics have dramatically evolved since those first old formulations, thus keeping Henkel right at the cutting edge of the associated technologies. Properties such as high temperature resistance (up to around 200 °C in many grades), compatibility with oily surfaces and low surface sensitivity – which means most grades cure even on inactive surfaces like stainless steel or passivated metals – have been progressively incorporated into Henkel’s product range. This improved surface tolerance makes Loctite anaerobics the first option in both manufacturing and maintenance environments.

Threadlockers are well known by machinery builders, though their use is still associated with heavy-duty bolting. Threadlockers are as cheap as washers, but much more efficient when it comes to retaining a preset bolt clamping force. And it is worth noting that vibration is not the only cause of bolt loosening, with temperature change, pressure, component settlement and other phenomena also playing their part. The superiority of threadlockers has led to manufacturers increasingly using them instead of washers and other mechanical solutions.

Fretting corrosion prevention through the use of anaerobic sealants

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 affectively countered, the load transfer capability is actually upgraded without any design change and, even more importantly, with no need to improve the surface finish.

Cylindrical joints also benefit from the use of anaerobic adhesives. Stress distribution becomes much more even, thus avoiding the fatigue-related failures that typically occur when keyways and other mechanical systems are used. There is no heat input to affect the properties of the parent metal, and no residual stresses are created, unlike in the case of welding. Finally, the balancing and turning processes are dramatically minimized, as parts can be aligned while the adhesive is curing.

Rollers, too, can be now manufactured with this cheaper and more sustainable system. Customers like Vanderlande Industries B.V. in the Netherlands are benefiting from anaerobic retainers, enabling them now to make their transportation rollers more reliable and simpler to manufacture. The bond line evenly dissipates the dynamic loads occurring during roller operation, and fatigue-related failures are thus more reliably prevented.

Rollers of all sizes and functions including those used in conveyors, lamination systems, wrapping and thermoforming processes, converting equipment or calendaring machines, can be manufactured using this system. The same principle can be applied to the bearings and the drive gears of such rollers, which otherwise have to be assembled with interference fits. Part slippage is not unusual, but can be easily prevented by simply applying a fluid anaerobic retainer with no need for any design change: a simple addition to make the mechanism more reliable and avoid costly malfunctions.

Retainers are not only restricted to heavily loaded parts like shafts and gears or rollers; for bearings and static joints can also be assembled using anaerobic retainers. Bearings assembled with anaerobics tend to be better aligned and have no residual stress. As a result of these benefits, the longevity and durability of these mechanical elements increases dramatically.

Instant assembly of small parts

Not long after the advent 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 other materials used in parts such as guards and door wipers or tags. Today, Henkel's cyanoacrylates are unmatched in performance and manufacturing speed, with the latest developments having increased their temperature resistance by 50 percent to 120 °C and fixture speed to just a few seconds under most working conditions. No competitor products can equal 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 competitor products even at temperatures around 50 °C to 60 °C, where most grades show a dramatic decline in strength.

Noise and vibration management

Some heavy machines such as metal-forming equipment create heavy-duty dynamic forces, high vibration and noise. The use of flexible adhesives instead of sound insulating mats in the construction of their panels can reduce noise and vibration transfer. However, only the most advanced coatings designed to attenuate structure-borne sound can efficiently absorb the strong vibrations that occur. Such materials can be sprayed onto the metal surfaces at room temperature, reducing manual operations and manufacturing costs.

Tool manufacturing

Not only can better machine construction components be manufactured at lower cost with Henkel's technologies. Disposable components like cutting tools and grinding wheels can also benefit from the company's products.

Henkel's surface treatment solutions reduce cutting tool manufacturing costs thanks to less cutting fluid being required, reduced bactericide additions and longer cutting tool life. Cutting tool manufacturers and users like Walter AG and AB Volvo have shown the benefits of Henkel's sustainable high-performance solutions. And Henkel's structural adhesives also 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 specified by the marine industry and other industrial customers. And Germanischer Lloyd-approved solutions are offered to mining and rock equipment installers, including training, support and applicator homologation services.

Machine maintenance

Henkel's expertise in both OEM and MRO environments is a valuable asset for machinery builders, enabling them to plan preventive maintenance on installed machines and provide added value to their end customers. Specifying sound maintenance procedures is key to guaranteeing machinery availability and preventing costly downtimes. Henkel's experience in the maintenance arena has considerably helped some OEM customers to include innovative solutions such as sacrificial wear coatings in areas subjected to heavy abrasion.

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:



Some robot manufacturers now use innovative assembly solutions that enable them to combine dissimilar materials – even incorporating new substrates. The result: better performing equipment at lower cost.



Machine tools are now assembled using the most modern adhesive and sealant technologies.



Chemically resistant bonding and sealing solutions help machinery manufacturers guarantee equipment performance even under the harshest conditions.



Modern thread-sealing solutions based on technical yarns (Loctite 55) allow instant seal. The overall assembly process is significantly faster and the great repositioning capability of the product virtually eliminates unforeseen leakages.