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Greater reliability in cooling lubricant filtration

VACUBELT[®] filter belt sets new standards in central system of automotive supplier

With its sophisticated product portfolio, the Schaeffler Group ranks among the world's leading technology companies, specializing in precision components and systems for engines, transmissions and chassis, as well as roller bearing and plain bearing solutions for industrial applications. At the Schweinfurt location, the cooling lubricant filtration of three lateral grinding machines used in transmission bearing manufacture has now been sustainably optimized. In the central filter system, a VACUBELT[®] 3354 polyester filter belt from GKD – Gebr. Kufferath AG replaces the plastic belt previously used. With considerably better durability, stability and service life, the new belt type helped the company achieve significantly higher supply and process reliability. This now qualifies it for use in further filter equipment at the integrated automotive and industrial supplier.

As one of the world's largest family businesses with 85,000 employees and 170 locations in over 50 countries, Schaeffler manufactures precision products that make a key contribution to the mobility of tomorrow in a multitude of applications. Whether in the drive train of motor vehicles, in high-speed trains, wind turbines or innovative solutions for the aerospace sector: high-tech-bearings from Schaeffler facilitate leading-edge motion in over 60 industry sectors. Yet impressive performance does not depend on component size, as miniature bearings measuring just a few millimeters are just as important in the production spectrum as large bearings with an external diameter of several meters. Beside these precision components,



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Schaeffler develops and produces complete system solutions for engines, transmissions and chassis that are used in numerous industrial and automotive applications. At its site in Schweinfurt, Schaeffler Technologies AG & Co. KG produces spherical roller bearings with a diameter of up to 1,600 mm for wind turbines, high-precision spindle bearings for machine tools, as well as a broad range of roller bearings for industry and the automotive manufacturing sector.

30 pressure belt filters in continuous use

In principle, a roller bearing comprises one outer ring and one inner ring with caged rolling elements – balls, pins or cylinders – sandwiched between the two that move on tracks. The cage keeps the rolling elements at an equal distance and thereby prevents them from touching one another. This design therefore transmits a load between two surfaces running in counter-rotation with little frictional resistance. Grinding is a key process in bearing ring production. Beside a precise system design, optimum cooling and lubrication performance are of central importance in ensuring the quality and cost-effectiveness of this process. The cooling lubricant dissipates the heat occurring during the machining process, reduces friction between the grinding discs and the workpiece, while at the same time removing the swarf and corundum particles released. To achieve high quality surface finishes and a long service life, the cooling lubricant needs to be permanently regenerated. For continuous cleaning and preparation of the cooling lubricants, Schaeffler therefore uses twelve central filter systems with around 30 pressure belt filters, each of which serves between five and one hundred systems depending on the respective process. They prepare 150 to 600 cubic meters of cooling lubricant per hour. Depending on the system size and application, the filters at Schaeffler operate with a fill quantity of 40 to 100 cubic meters. The throughput performance depends on the required viscosity of the cooling lubricant, the material to be machined, the type of



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machining and the required tolerances – for example less than 1 μm for spindle bearings. Schaeffler uses water-based emulsion as the cooling lubricant.

It all happens in ring manufacture

In transmission manufacturing, a pressure belt filter supplies three lateral grinding machines. On these systems, the lateral surfaces of the bearing rings (between 50 and 100 millimeters in length) are ground on the top and underside. The prepared cooling lubricant must therefore contain no more than 50 milligrams of dirt load per liter following its treatment. The target level is actually ten milligrams per liter. In addition to this, the cooling lubricant is heated to a defined temperature for process reasons. The increased viscosity created by this improves adhesion of the rings on the grinding machine's magnetic chuck. The coolant, loaded with abraded material and swarf, is transported from the manufacturing operations to the pressure belt filter's dirt tank and from there via a pressure pump into the filter chamber, where it is distributed on the belt using nozzles. The pressure forces the suspension through the filter belt, while the dirt particles are retained on its surface and form a filter cake. The cleaned cooling lubricant is then pumped from the clean tank back to the machining tools. The differential pressure rises with increasing thickness of the filter cake, which can reach a height of up to six centimeters. At 0.7 bars, supply of the cooling lubricant loaded with abraded material is automatically interrupted for regeneration of the filter. To this end, the filter cake is dewatered with compressed air for around two minutes, reducing its residual moisture content down to 40%. The pressure belt filters do not operate with closed, revolving filter belts. Instead, the system is fed from a roll of 50 meter long and 1.30 meter wide filtration mesh. After the filtration process, the soiled mesh is removed and cleaned. This filter surface is then drawn back into the filter. Only when the degree of soiling means that effective filtration is no longer guaranteed is the belt rolled



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up behind the system, exposing a clean and unused section of the filter belt ready for use in the system. To ensure the requisite process reliability, at least a pair of belt filters is fitted in each central system. While one system filters, the other is on standby ready for use at any time. This also allows periods of filter regeneration or downtimes during belt changes to be bridged, making what is actually a discontinuous process continuous.

Filter belt stability prevents kinks and tears

In the past, Schaeffler always used a polypropylene belt in its pressure belt filter. However, regular problems with bent edges or irreversible longitudinal kinks in the belt which reduced its useful life motivated the production engineer responsible, Ralf Kuberek, to look for alternative solutions in the market. During this search, he got talking with the filter belt experts from GKD at the end of 2015. He was so impressed by the company's product presentation and consultancy expertise that he immediately decided to install a test belt on the central filter system for the lateral grinding machines. The belt was delivered just two weeks later and then installed in the pressure belt filter at the start of 2016. The VACUBELT[®] 3354 filter belt was ultimately chosen, as its pore size of 150 µm met Schaeffler's requirements perfectly. This belt type allows efficient filtration without addition of filtration aids. With air permeability of 1,300 l/m²/s, it is highly permeable. The smooth surface of the specific mesh design made of polyester monofilaments also guarantees easy cleaning, as well as good cake discharge. For Ralf Kuberek, however, the benefit that tipped the balance in favor of the VACUBELT[®] was its high degree of lateral stability thanks to the significantly thicker weft wire. At 0.9 millimeters, the belt is more than twice as thick as the belt type previously used. Initial fears that the thicker monofilaments might potentially compromise the seal of the filter chamber proved completely unfounded, as did the worries that the sealing flaps would lead to irreversible kinks in the mesh. It was possible to readjust the chamber seal accordingly without any



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great effort. The higher weight and transverse stability make the VACUBELT[®] significantly more controllable than the softer cloth previously used, which is of key importance for this system design. After all the belt is not fixed in place, but is instead only positioned tautly in the filter chamber. Outside the chamber, it is only held at the side by lifting beams. Kinks, such as those regularly encountered with the old filter belt due to a lack of control, made the belt narrower and thereby more difficult to fix in position. As such, there was always a risk of leaks occurring. Thanks to its greater material thickness, the new belt retains its shape and directional stability permanently without kinks. Problems with bent edges due to skewed running or even formation of tears, such as those regularly encountered with the previous belt type, are now a thing of the past with VACUBELT[®] 3354. Due to the relatively large ball passage of the filter pumps, rings used to find their way into the filter again and again, where they would cause tears in the thinner cloth previously used. A tear in the center of the cloth would typically go unnoticed until the filter failed or was only discovered when the cloth was at the top by chance during a visual inspection – with the result that grinding sludge kept reaching the clean tank unhindered until the tear was fixed. Unlike the previous filter belt, the welded edges of the GKD belt do not fray.

Greater reliability and less consumption mean greater efficiency

While the previous belt had a maximum useful life of seven months, the VACUBELT[®] filter belt is still performing its task to the complete satisfaction of Ralf Kuberek after almost a full year. The new belt is also significantly more efficient in use, as the 50 meter long filter cloth previously used was totally spent after seven months, while the VACUBELT[®] filter belt of the same length was only around 60 percent used up after the same period. As a consequence, the number of cycles that can be completed before the used filter belt section is no longer capable of providing the necessary differential pressure is significantly higher with the GKD product – while delivering



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comparable results in residual dirt analyses. Ralf Kuberek is therefore very positive in his summary of the product: "The GKD belt meets our expectations of improved stability in full." The sustainable kink resistance demonstrated in the test run means significantly higher process reliability in real world operations. Together with the discernibly increased supply reliability resulting from the significantly longer useful life, the VACUBELT® filter belt meets cost-effectiveness and efficiency requirements in an unprecedented scope. Ralf Kuberek's conclusion is therefore clear: "Given these properties, the belt could potentially also be used for some of our other filter systems." The excellent cooperation with the filter belt experts at GKD is also essential: "They provide me with prompt and professional advice that I can rely on in any situation," he comments.

11.167 characters incl. spaces

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The owner-run technical weaver GKD – Gebr. Kufferath AG is the global market leader for metal and plastic woven solutions as well as spiral fabrics. Four independent business divisions bundle their expertise under one roof: Industrial Mesh (woven metal mesh and filter solutions), Process Belts (belts made of mesh and spirals), Metafabrics (façades, safety and interior design made of metal fabrics) and Mediamesh® (transparent media façades). With its headquarter in Germany and five other facilities in the US, South Africa, China, India and Chile – as well as its branches in France, Great Britain, Spain, Dubai, Qatar and worldwide representatives, GKD is close to markets anywhere in the world.

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