

DRIVE

NEWS ABOUT COUPLING TECHNOLOGY

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SHORT AND SIMPLE

Innovation and the continuous quest for improvement repeatedly result in new pioneering achievements.

The universities as well as the coupling manufacturer were impressed by the positive test results. They far exceeded anything published in current trade literature or coupling catalogs.

In the future, these results now guarantee all users of SERVOMAX elastomer couplings the benefit of oscillation-damping torque transfer even in high-speed drive trains.

Wishing you a pleasurable reading experience,

Tobias Wolf
Product Manager, R+W

CIRCUMFERENTIAL SPEED OVER 500 KM/H

The goal of achieving continuously more productivity while maintaining adequate flexibility has top priority for most designers of mechanical systems and machines. The first criteria is, and will continue to be, the control over work piece processing speed.

The trend in this field is clearly toward higher drive speeds. In the meantime, speeds in the range of 50 000 rpm are being attained. These high-performance drives increase the productivity of processing machines by both an increase to feeding speed as well as inc-

reased acceleration. Both of these aspects in combination with maintaining feeding force culminate in a faster, therefore higher, production of parts. The drive components, as especially exemplified by the layouts of high-speed asynchronous machines,



are powered by converters that have a high switching frequency and maximum bus power. In addition to transmissions and spindles, couplings are required as connecting elements to compensate for dimension tolerances.

State-of-the-art technology

Ninety percent (90 %) of the connecting elements used in recent years were, and are, torsion-rigid couplings. Current literature shows that the design and rigidity of, for example, metal bellows couplings are ideally suited for these loads. The challenge here is that incurred resonances at these high speeds increase tremendously. These resonances cannot be damped by metal bellows couplings. This coupling manufacturer located on the lower Main River – who has been able to market vibration-damping couplings for speeds up to 20 000 rpm – has now gone a step further. Despite the availability of extensive professional literature about elastomer couplings and the knowledge accumulated by renowned universities, a series of experiments were initiated to determine „Just what speeds really are possible with elastomer couplings?“

Experimental setup and criteria

Since such an experiment series has never been made public and no documents were available for reference, the initial challenge was to establish criteria and a setup for conducting the experiments. It was important to keep the conditions in these experiments as close to real implementations as possible. One of the initial questions to be resolved between R+W engineers and the university commissioned to perform the experiments was which state of the elastomer insert (loaded or unloaded) represents the highest level of centrifugal force. No professional literature was available to help decide this question. Elastomers (in this case TPU) increase their strength under pressure loads (e.g. torque transfer), therefore the experiment series simulated a unloaded condition of the coupling. Continuously changing loads occur in

a drive train that produce large torque fluctuations between 0 % and 100 % (acceleration moments, etc). The driven side of the coupling was connected to a conventional asynchronous motor powered by a frequency converter. This provided infinitely variable rotary speeds between 0 and 4000 rpm. Pulleys and high-performance belts (10:1 ratio) were used to provide translation to required speeds beyond 20 000 rpm. To round out the setup, special bearings were mounted on the shafts for the coupling to allow practical simulation at speeds of up to 40 000 rpm.

The numbers speak for themselves

SERVOMAX elastomer couplings from the coupling manufacturer R+W Antriebselemente GmbH can be employed in high-speed drives at speeds up to 50 000 rpm. The elastomer material used exhibits only minimal outward movement even under the influence of enormous circumferential speeds (outer diameters from 16 to 140 mm). The only special measure to be taken is a balancing of the hubs (connecting points to the shafts), the rest of the coupling is standard. In the future, this means that additional guide rings or support rings for the elastomer insert can be waived altogether.

Where elastomer couplings are currently rated for torque transfer of 60 Nm at speeds up to 14 000 rpm, a rating for speeds up to 40 000 rpm (depending on Shore hardness) will be offered in the future. This represents almost a 300 % increase of the permissible operating speed! The results of these practical experiments are currently being used to create simulation software applicable to all conventional coupling sizes. The finite elements structure of the elastomer insert combined with a simulation of the TPU cross-linking chain makes it possible to produce customer-specific calculations for the given application range of the coupling. In addition to centrifugal forces, operating temperatures can also be included in the calculation. These test results can be used by designers to avoid the need to perform various test series. ■

