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Product Information

3M™ Friction Shims for Automotive Applications

Formerly known as EKagrip®

3M™ Friction Shims create possibilities for lightweight and compact design while increasing potential load and peak torque in bolt connections.

Properties

Especially in the automotive industry, there is a general move toward compact, lightweight designs that must never theless be totally reliable. Typical applications are central bolt designs in crankshaft and camshaft applications, continuous variable timing, balancer shaft modules, as well as shaft-to-collar connections. The demand for maximum power density, i. e. the transmission of ever greater forces and torque in increasingly compact designs, poses a major challenge to engineers. In friction joints, the given coefficient of static friction imposes definite physical limits on power transmission capabilities. These limits can be overcome with friction-enhancing coatings. When friction joints are designed, physical parameters such as overall size and surface pressure usually can only be varied in a tight window. Load transmission capability in friction joints is thus limited by the friction coefficient of the mating materials. But many applications require higher levels of power transmission. Therefore new ways of enhancing power transmission capability need to be found. One approach is to apply a nickel diamond coating either to the actual parts of the joints or to friction shims for installation in the joint. Depending on other application parameters, the coefficient of static friction can even exceed 0.6, resulting in a greatly increased load transmission capacity.

Processing

3M™ Nickel Diamond Coatings consist of an electroless nickel matrix in which a specified quantity of diamond particles of defined size is embedded. These coatings can be applied either to the joint components directly or to thin shims for installation in the joint. After coating, the parts are heat-treated to relieve inherent tensile stresses and to impart sufficient diamond retention strength.

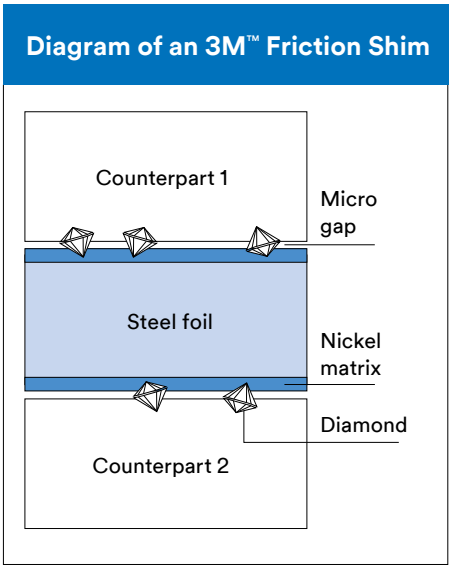

Fig. 1: Tribosystem with 3M™ Friction Shim

Fig. 2: Contact surface of friction joint with 3M™ Friction Shim after assembly and disassembly

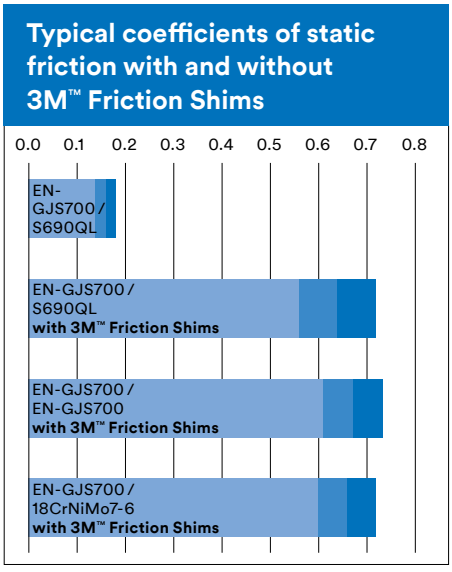

Fig. 3: Results of series of tests on the coefficient of static friction (the shaded areas of the bars show the variation)

Assembly

Assembly, i.e. applying the bolt preload on a crankshaft with a central bolt design, causes the diamond particles to press into the softer surface of the counterpart. As a result, a micro scale form fit is created between the base part and its counterpart (Fig. 1 and Fig. 2). The key parameters influencing the extent of micro scale form fit are the counterpart material, the counterpart surface roughness and the applied surface pressure. Figure 3 shows typical coefficients of static friction for various material combinations with and without an 3M™ Friction Shim.

Applications

3M™ Friction Shims offer a simple but very cost effective way to transmit up to four times higher torques than conventional systems. And there is no need to modify the joint design. In production are a variety of engine applications mainly focusing on crankshaft, camshaft and balancer shaft module. Further applications are steering, suspension, transmission, chassis and body.

Many car manufacturers, such as Audi, BMW, Chrysler, Daimler, Ford, GM, Mazda, Porsche, VW and Volvo are relying on 3M™ Friction Shims in their designs. By now there are already millions of friction shims on the road. In addition to automotive applications, 3M™ Friction Shims and Coatings are widely used in demanding motor sports applications.

3M Technical Ceramics
Zweigniederlassung der
3M Deutschland GmbH
Max-Schaidhauf-Straße 25
87437 Kempten, Germany
T +49 (0)831 5618-0
F +49 (0)831 5618-345
info.technical-ceramics@3M.com
www.3M.de / Technical-Ceramics

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