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REMOVING OF SELF-UNTWISTING AND WEAKENING OF TIGHTENING EFFORTS IN CORRESPONDING BOLTED CONNECTIONS OF JOINTS OF METAL-WORKING LATHES

While working under load a bolted connection may become weak as a result of two processes, namely, by reducing the effort of tightening caused by settling and fluidity, or as a result of a self-untwisting bolt or nut, due to the relative movement of these elements.

According to two possible causes of a prior tightening effort reduction some locking elements are used. Such elements are divided into two groups by purpose (removal of sediments and removal of self-untwisting) and into four subgroups based on a design (spring elements, the elements with geometric locking, the elements with power locking, the elements using glue).

It is known that the bolted connections which are statically loaded, don't require compulsory locking, because they possess self-locking. At the same time, additional locking is compulsory for the screw-thread connections which are dynamically loaded.

There are two basic ways to eliminate self-untwisting (locking). The positive (or hard) locking takes place when the part that stoppers is connected to the part that is stoppered by a hard link which is called a stopper; unscrewing of a stoppered component is impossible without shear, fracture or deformation of a locking element. This method includes locking with pins, with washers, with knitting wire, with various locking mechanisms.

The second method is to create increased friction between the component which stoppers and the component that is stoppered. This method is called the friction locking & includes locking with lock nuts, with elastic washers, with self-locking nuts. The friction locking is less reliable than positive. There is always a danger of a friction force reduction and, as a result, weakening of a connection happens.

The weakening as a result of settling may occur even at a room temperature immediately after assembly. Under the settling we understand the jam (alignment) microasperities on the surface of a thread connection and on the basic side of a nut or a bolt head.

According to various causes of weakening of the previous tightening, it's necessary to take the following steps:

- elimination of settling, that is, the increase of connection susceptibility in the entire range of the previous tightening efforts;

- elimination of settling aims to minimize decrease in the previous tightening efforts that are caused by expected settling or fluidity of relevant materials of a connection. This can be achieved by increasing compliance of bolts or fasteners. The corresponding design and the application of the previously tightened elastic elements can provide great malleability. The third way that ensures the necessary after-tightening

efforts is the fact that the efforts of the previous tightening of a bolted connection are selected based on expected settling.

To compensate settling it's also possible to use materials with shape memory. They are the metal alloys which undergo martensitic transformations that cause unusual physical and mechanical properties (shape memory effect, super elasticity, high damping capacity, etc.). This class of materials received the common name alloys with shape memory effect (SME). The essence of use is the application in screw-thread connections of such materials pre-heated above the temperature of martensitic transformation. After cooling the material remembers its form, if you deform the material and then heat it to the temperature of reverse martensitic transformation, the material will change to its original form, thus, compensating the settling.

We are going to develop a variety of structures and mechanisms to prevent the self-untwisting and compensating of settling in screw-thread connections and we plan to study their efficiency as well.