

ELECTRICAL + ELECTRONICS FEATURE

Rethinking electrical screw connections

Electrical screw connections have become critical components in modern applications – from eMobility to data centres and industrial power distribution – with a direct influence on electrical safety, energy efficiency and system reliability. Classic fastening elements often lead to loosening, heating and energy losses, as well as design compromises, which is why teckentrup is taking a completely different approach with its multifunctional NSK systems, designed to combine several functions within a single component.

A single electrical contact gland can influence transition resistance, power loss and temperature development.

With increasing power and energy density, electrical contact glands are becoming mechanically and electrically coupled functional systems. Preload force, elastic resilience, friction and contact pressure interact directly. This is exactly where teckentrup SLI embeds its multifunctional NSK systems.

The design of many electrical contact glands is still based on construction principles from times when current densities and thermal loads were significantly lower. The focus was on mechanical retention and geometry, while the permanent maintenance of stable contact pressure was hardly taken into account. Under today's operating conditions, this approach poses a risk. Even slight decreases in contact force lead to a disproportionate increase in transition resistance, resulting in local power losses and heating, which further accelerate settling, creeping and relaxation processes. The connection enters a self-reinforcing ageing process that is often only recognised when damage occurs.

In torque controlled assembly, most of the tightening torque is consumed by friction

in the thread and under the screw head. The actual effective preload and contact force is calculated as the difference and is extremely sensitive to variations in the coefficient of friction.

This leads to widely varying contact pressures, especially in electrical contact glands with short clamping lengths, soft conductor materials, such as copper or aluminium, as well as low tightening torques. Unstable contact forces not only mean mechanical uncertainty but also fluctuating transition resistances and increased thermal loads.

In practice, classic spring rings and two part combinations of flat washers and spring rings continue to be used in these applications. These solutions increase the number of interface surfaces, leading to greater settling amounts within the connection. At the same time, this combination causes additional friction coefficient variations that are difficult to control without providing a defined elastic reserve. The assembly effort also increases and process reliability decreases – resulting in a contact force that becomes increasingly random. This is particularly critical for electrical contact glands, as there is a risk not only of loosening, but also of heating and energy losses.

Another aspect of classic securing elements is their functional conflict of objectives. Conventional solutions are designed either for anti-rotation securing or for spring-loaded resilience, if available. However, both functions are rarely fulfilled at the same time. The use of anti-rotation securing elements with a profiled contour or a two part



design even increases the setting amounts. In this context, it is advised to use only anti-rotation elements when there is a risk of loosening, as recommended in old standards. This is strongly discouraged for electrical screw connections.

In electrical contact glands, however, both properties are required in parallel. Sufficient elastic resilience is necessary to keep the preload and contact pressure stable despite embedding, creeping and temperature cycles. At the same time, the connection must be reliably secured against loosening in order to maintain the contact pressure built up under vibrations and thermally induced relative rotational movements. Classic securing elements can often lead to design compromises.

In contrast, the NSK systems developed by teckentrup SLI deliberately take a different approach. NSK's latest generation, NSK-EL, is designed to combine several functions within a single component, providing defined and reproducible friction coefficients, alongside proven elastic spring characteristics, to ensure consistent clamp load behaviour during assembly and in service. At the same time, their geometry enables a large, even pressure distribution, which contributes to joint stability while offering reliable protection against slackening and self-loosening by rotation. By minimising the number of electrical interface surfaces, NSK-EL solutions also support stable electrical performance.

When it comes to critical connections, normative classification, and practical relevance, interrelationships have been recognised in safety critical industries. DIN EN 17976 requires the use of effective securing elements with a spring function for electrical screw connections. In addition, VDI 2230 allows friction coefficients, preload force dispersions and elastic resilience to be taken into account in calculations. NSK systems enable the standard compliant, traceable and practical design of electrical contact glands – without additional components and without increased installation complexity.



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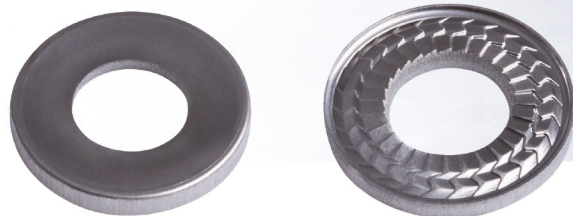
"With electrical contact glands now functional systems that are crucial for safety and energy efficiency. Traditional securing elements and two part solutions that increase setting values, as well as installation costs and risks, are reaching their limits, especially with increasing power density," underlines teckentrup. "NSK systems offer a multifunctional, single piece system solution that simultaneously addresses contact pressure, preload force, loosening resistance and energy efficiency. For retailers and users, this means greater safety, lower risk of failure and permanently stable electrical contact glands." +

www.teckentrup-sli.de

NSK-EL

Effective securing of electrical contact glands for slotted hole fastenings

- ✔ Multifunctional screw locking solution
- ✔ Protection against slackening and unscrewing
- ✔ Increased elastic resilience of the screw connection
- ✔ No damage to soft counter surfaces and optimal contact pressure



Electrical contact glands
Make them future-proof!

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