SICON – The Bolted Connector with Stepless Shear Bolts for Low and Medium Voltage Cables

PFISTERER Kontaktysteme GmbH & Co. KG presents a completely new type of bolted connector for low-voltage and medium-voltage cable joints. The patented stepless SICON shear bolt allows the joint to be used with a wide range of cross-sections.

For the past several years clamps, connectors and cable lugs using screw technology have been developing rapidly. For good reasons: bolted connectors offer technological and practical advantages which compression connectors do not provide, for example a large cross-section range and ease of handling. This clamp technology is perfectly suited to the new multi-range cable joints. Fitting only requires a simple tool – literally in the twinkling of an eye.

In contrast to what is usually required in the area of compression connector technology, neither expensive special tools nor special connecting sleeves assigned to every cross-section and every cable type are necessary. This makes storage considerably easier and ensures quick availability when remedying malfunctions. The higher individual price of a bolted connector versus a compression connector is to a large degree balanced out by the fact that no special tools are required and storage and logistics costs are reduced.

Until now the best available innovation in the area of screw technology has been the multi-stage breakaway bolt. When the preset torque is reached the bolt breaks away, which is supposed to guarantee the ideal contact force and prevent the bolt from protruding above the connecting body. The structural strength of the multi-stage bolt – the integrated pre-determined breaking points – is at the same time its critical weakness. Each breakaway point disrupts the load-bearing thread, and the maximum clamping force cannot be made available.

Protrusion of the clamp screws must be prevented as this could damage the covering joint. To date multi-stage breakaway bolts have been used in an attempt to counteract the problem of the smallest possible protrusion of the clamp screw above the connecting body which, with the multitude of conductor diameters and...

**Advantages**

- Up to 30% increased contact force compared with conventional type terminals
- Friction disc for uniform friction and increased contact force
- Nothing protrudes
- Full utilisation of the thread loading for any size of conductor
- No special tool needed
- Smooth breakage of the shear bolt simplifies tightening process
- The remains of the bolt stay on the tool and can be disposed safely
- Suitable for fine-stranded Class 5 cables
A standard hexagon key is used to screw a threaded stud into the hole in the stepless thrust bolt. The force closure is not interrupted by any steps or notches in the bolt.

As the SICON bolt is screwed in, the friction disc at the base of the bolt breaks away. The bolt now turns on this plate, unlike with conventional bolts, no tip friction occurs on the conductor. The bolt’s torque generates the contact pressure almost independently of the conductor material. This way, significantly higher contact pressures are achieved with aluminium conductors and even fine stranded conductors are not damaged.

The SICON bolt continues to turn until the shear torque is reached. The thrust bolt is tensioned as it is screwed in and, on reaching the shear torque, it stretches axially and breaks off. Because the area inside the connector cannot break, it is always the weakest point outside of the connector that breaks. The SICON screw is designed such that this point is always located directly above the connecting body. In this way the smallest possible protrusion is attained, independent of the conductor that is to be connected.

**Risk of injury minimised**

When developing the new technology special attention was focused on safe assembly. The screw does not break with a shock like conventional breakaway bolts, it is instead slowly stretched to its limit. This considerably reduces the risk of injury during assembly. The screw head that has broken off remains seated on the pin wrench and does not roll away unchecked. Loose metal parts of this sort could become a serious safety problem in electrical installations.

The new screwed joints come in five variants with different cross-sections for low-voltage and medium-voltage lines and are used for conductor cross-sections of 10 to 630 mm². A commercially available Allen wrench, such as can be found in any toolbox, is all that is needed for assembly. Suitable powerful cordless impact wrench can also be used. For high-voltage joint boxes, there are special versions for conductors with cross-sections of up to 2000 mm².

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**Materials, no manufacturer has succeed doing satisfactorily.** Even with standardised conductors there is a multitude of possible pairings, for example, in accordance with DIN VDE 0276-603 there are mathematically 98 variations for the commonly-used 50 mm² – 240 mm² connector when all of the cross-section levels, conductor shapes and conductor materials are taken into account. However, a step screw only has 3 steps. The result: either the screw breaks away too low, and the thread bearing capacity is not used to its full extent, or it breaks away too high, and the protruding remainder must be filed off. Furthermore, conventional multi-stage breakaway bolts do not provide for the different material-dependent torque requirements for aluminium and copper conductors. Due to all of these disadvantages compression connectors are still being used in many areas.

**“Smart” breakaway point**

None of these disadvantages arise with the new SICON screw technology as it is based on a completely different principle from the multi-stage breakaway bolt. Although the continuously adjustable clamp screw covers large line ranges, it is still supposed to generate an optimum level of contact force and leave behind a smooth and even fracture surface after breaking away. PFISTERER solves the problem with a two-part screw design: a threaded stud that is screwed into the actual thrust bolt causes the screw body to overstretch, and when the break-away torque is reached the thrust bolt is stretched axially and broken off. Because the area inside the connector cannot break, it is always the weakest point outside of the connector that breaks. The SICON screw is designed such that this point is always located directly above the connecting body. In this way the smallest possible protrusion is attained, independent of the conductor that is to be connected.

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PFISTERER is a leading supplier to the companies providing power for private and public use and to their sub-contractors. The company has been family-owned ever since its establishment in 1921 in Stuttgart. PFISTERER develops, produces and supplies components and systems for connecting, joining, branching and switching electrical energy networks. Under the guidance of PFISTERER Holding AG in Winterbach (Germany) the 15 companies in the PFISTERER Group with around 1200 employees generated a turnover of approximately €250 million.

Technical features

- Large clamping range: 10 – 95 mm²; 25 – 150 mm²; 50 – 240 mm²; 95 – 300 mm²; 185 – 400 mm²; 300 – 630 mm² (others on request)
- Conductor channels with transverse grooves and protection against conductor oxidation
- Blind hole designed as pressure-resistant oil barrier for oil cable
- Contact technology type-tested electrically and mechanically to IEC 61238-1
- Compact design: rounded edges and flat transitions, suitable for slide-on and shrink joints
- Suitable for aluminium- and copper conductors
- Centric cable guide with different centring sleeves

Optimum contact force for all conductor materials

Different conductor materials have different requirements with regard to the breakaway torque. When the screw is tightened, a part of the applied torque is converted to frictional force between the conductor and the screw head, and the remainder provides the contact force on the conductor. Aluminium conductors create a high degree of head friction, and the residual contact force is relatively small. There is the risk that the necessary contact force is not attained during long-term use due to setting procedures. In contrast, copper conductors create a low degree of head friction, and the residual contact force is relatively large. This contact force creates an equally large counteracting force on the thread. There is the risk that the screw thread is broken.

For this reason the breakaway torque for conventional screws is always a compromise between the optimum torques for aluminium conductors and copper conductors. With the SICON screw, on the other hand, the contact force is independent of the conductor. On the lower end of the screw there is a friction disc which is connected to the screw by means of a thin link. When the screw is screwed in the link breaks, and the friction disc and screw can now move opposite to one another. When screwed in further, the screw turns on the friction disc which remains stationary on the conductor. The contact force that is created as a result of the applied torque is therefore independent of the conductor material.

In this way, and by using the full thread length, with aluminium conductors the SICON screw achieves a 30% higher contact force than conventional step screws. The new screw design offers an additional advantage: the individual wires of finely stranded conductors are not able to be damaged as a result of the screw friction. The friction disc is moulded such that it is connected to the screw and can still move together with it even when it is unscrewed again.
Tap connectors

Connectors with oil stop

Bolted cable lugs

Accessories

Subject to change as required by technical progress.

Any type of customized connectors with SICON technology on request.

Cable joints, cable terminations, cable glands, cable cleats
Feeder pillars, fuse links, arc flash, cable rollers, cut-outs

11kV 33kV cable joints & cable terminations
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