PFISTERER Customer and Staff Magazine
Issue 1 **2013**

PFISTERER

connect

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Dr. Thomas Klein

Samuel Ansorge

Jörg Fries

Editorial

Knowledge is value

Theory and practice bring the greatest benefits when they are combined – that's our experience, and we will be reflecting that in this issue of CONNECT.
On page 16 we present an example of the successful fusion of development and market requirements, the HV-CONNEX surge arrester, which brings multiple benefits as a flexible system component for high-voltage equipment.
In the second part of our series of report on page 6, we explain the principles of contact technology, explaining how to apply basic knowledge to achieve conductor connections with a lifetime of four decades and more.
We will be making it clear that correct assembly is essential to the life of a contact. We will be showing which tool is the best one to use for 2DIREKT terminals on page 15, and for SICON screw connectors on page 14.
We hope that reading our magazine brings you many practical benefits.
We aim provide the best service we can, every day.

Sincerely,

Dr. Thomas Klein Samuel Ansorge Jörg Fries

PFISTERER Group Executive Committee

HV testing of cable runs often have to be carried out under difficult conditions. PFISTERER is prepared for this. With unique test equipment that has already proven itself in sophisticated cable projects for offshore substations. Thanks to our forward-looking organization, we can meet different test situations.

Whoever constructs turnkey high voltage cable systems will profit from a routine that excludes automatisms. PFISTERER has too. The company has been installing and testing high-voltage (HV) cable systems since 2008 and has again and again come up against complex limiting factors for which their Cable System Team has designed individual solutions – always in tight time frames and often on construction sites where many teams from the companies involved in the project are working in various trades at the same time.

That was how it was when working on the “substation” on the Borkum West II offshore wind farm platform in July and August 2012. PFISTERER installed the cable connections for two gas-insulated switchgear units, which will receive the power from the surrounding wind turbines, each with an HV transformer that will convert the voltage from 33 kV to 155 kV for transmission to land via an undersea cable. Part of the acceptance tests for these cable systems was a high voltage test to IEC 60840.

Prefabricated components make on-site high voltage testing easier.

Complex conditions. Highly professional HV tests.

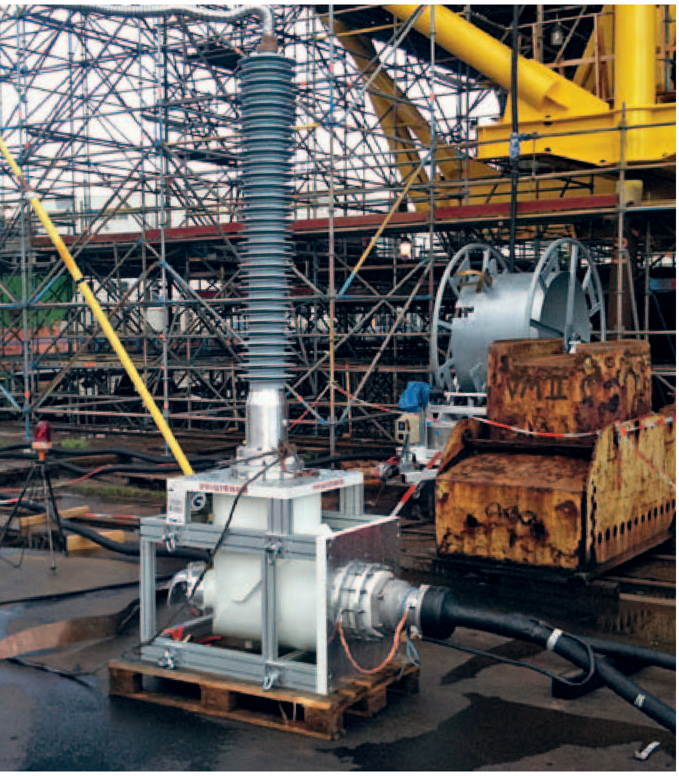
The required test voltage of 150 kV was generated by a test transformer that was transported to the site by truck. The challenge was to transmit the test voltage from the truck to the cable system. When working on offshore platforms, which initially take places in dry dock or while floating next to the wharf facility, the truck is usually not able to position itself sufficiently close to the cable system. PFISTERER has developed suitable test equipment for such situations, based on our own products, which are ideal for flexible test setups.

Testing with a Plan

At its heart is a test fixture with CONNEX open air bushings, which is transported to the site on a single axle trailer, positioned near the test transformer and connected to it via an overhead strand. The test voltage generated is transmitted via an HV rubber cable that is safe to touch. This is pre-assembled at both ends with a CONNEX connector, so it can be quickly connected via a CONNEX connector pre-installed in the test fixture and to the unit under test in a similar manner.

The rubber cable is wound on a mobile cable drum, which serves as a transport medium and a laying device. The advantage of the rubber cable that so far only PFISTERER has used for test cable puposes: With a bend radius of five times the outer diameter, it is considerably more flexible than conventional XLPE cable – and that too at icy temperatures of down to –20 ° C. This facilitates the laying of the test cable round corners and in tight spaces.

"However, apart from the equipment, what is important is having a forward-looking organization to work with," says Lutz Zühlke, head of the Cable System team at PFISTERER, "That's why we keep our customers informed of all the details that require their involvement right from the planning stage." A glance at the PFISTERER report on the on-site testing of HV cable systems shows that the company takes into account all eventualities and thinks with the interests of its customers in mind.



A key component: The transition from the overhead line to the test cable – using a modular assembly made up of elements of the HV-CONNEX system.

"Apart from the equipment, what is important is having a forward-looking organization to work with."

Lutz Zühlke, head of the Cable System team at PFISTERER

Long-lasting contacts, thanks to the right design & installation

Knowledge is only useful when it is implemented. This second report on the principles of contact technology demonstrates, with the aid of terminals that have been in service for a long time, how the life expectancy of conductor connectors can be improved, with lifetimes of up to four decades and longer being achieved, despite the natural aging of the contact. The preconditions for this are that the connectors are designed according to the right principles and are installed correctly.

The general rules for the design of a connector are wide and varied and the trade-offs are complex, as demonstrated by the following design principles. On the one hand, the design must ensure specific contact properties are adhered to under all operating conditions, while on the other, production costs must remain within acceptable limits. Fulfilling both rules confronts the manufacturer with diverging requirements, even when he is selecting materials:

Steel, for example, is cheaper than aluminum. Moreover, with a stronger steel clamp, the required initial force to contact a conductor can be produced more easily than with an aluminum clamp. However, taking account of the need for a durable connection, steel loses its appeal: Steel connectors offer a higher resistance to current as it flows through the contact points. The result: Higher temperatures, that promote the aging of the contact (for details see Part 1, CONNECT 1/2012).

The choice of materials also depends on the need to prevent, as far as possible, a permanent mechanical deformation of the connector body when the contact is being made. Doing so would affect the mechanical functions of the terminal and speed up the processes of creep, flow and settling which weaken the contact (for details see Part 1, CONNECT 1/2012). Another important factor is the length, thickness and width of the connector components – with the right choice, the required contact force can be achieved without permanent plastic deformation of the connector body. And even with metallic coatings, it is important to find the right balance: The coating thickness and material must be chosen so that electrical properties such as low contact resistance can be achieved, there is a corrosion protection effect and costs remain reasonable.

Tolerances without tolerance

The sophisticated interaction of materials and design is manifested most clearly in the central factors of contact force and resilience. The contact force must be large enough to minimize the initial resistance that exists when the contact is made. Furthermore, sufficient contact force must remain throughout the entire life of the connection and the temperature-induced elongation of the conductors must be held in check, otherwise this will lead to micro-movements between the conductor and the contact parts, leading to mechanical abrasion and fretting and eventually to contact failure (see Part 1, CONNECT 1 / 2012).

At the same time the material and design should be such that the system can “breathe thermally”. When heated, aluminum expands more than other metals. Result: If aluminum conductors are connected with a “rigid” copper or steel clamp, they do not have enough space to stretch, the conductor flows away but does not return to its original shape on cooling. Over several heating and cooling cycles, the electrical contact degrades gradually until total failure occurs.

To master this balancing act between force and flexibility, contact equipment manufacturers need to learn to understand stretching, as there has been a widespread replacement of copper conductors by aluminum conductors. In the time of this changeover, PFISTERER developed the V-terminal with integrated resiliency – then a novelty, now a standard product. It allows for thermal breathing, firstly by using aluminum for the clamping body, as aluminum conductors and the terminal body have the same thermally induced expansion behavior (inherent elasticity). Secondly, the clamping body is deformed as the screw is tightened at defined points so that elastic deformation occurs, which acts like a pre-stressed spring (design elasticity). Configuring the way in which contacts are made provides sufficient contact force using screw technology, which also prevents the longitudinal movement of the conductor in the terminal.

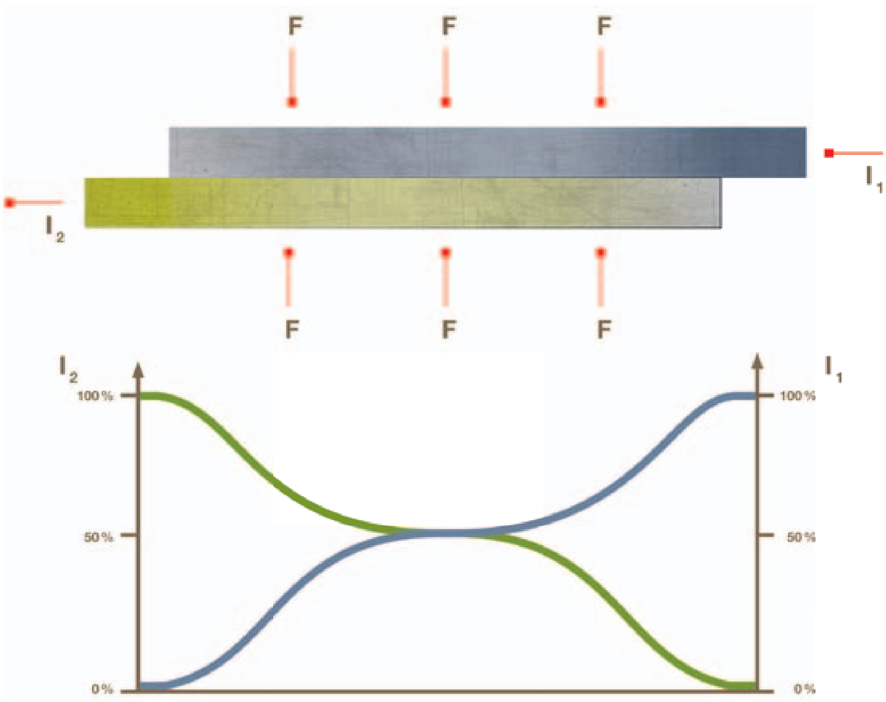


Figure 1: Ideal arrangement of the contact elements: Donati’s rule of current commutation shows that the current density of a connection is not the same at all points: The commutation takes place for the most part at the beginning and at the end of the overlapping surfaces of the conductors. Ergo: The contact areas (zones, lines, points) are placed as close as possible to the beginning or end of the clamp.

Optimum force. Suboptimal results?

Another finding: Sufficient contact force is not enough. For example, when aluminum is used, it oxidizes easily. Here, the contact zone must be designed so that the non-conductive oxide layers of the contact edges or teeth are penetrated. This method results in a purely metallic contact, ensuring the unhindered flow of current from one conductor to another. Another important criterion is the arrangement of the contact edges or teeth in the terminal area. The Donati rule for current commutation shows that they should ideally be positioned where the natural commutation is highest (see Figure 1).

And sometimes optimal force is too much force. For example, when spring washers are inserted between the screw and the connector body, bringing elasticity. Where connectors are made of aluminum or plastic, this effect is removed if the installation has been carried out incorrectly: When the screw is tightened, it creates a high pressure load on a relatively small area, and under the tightening pressure, the spring washer located here burrows into the "soft" connector body, so that the required spring function is lost. The only solution in this situation is to place a flat steel washer between the connector body and the spring washer. This distributes the force over the entire contact area and prevents the washer sinking in (see Figure 2).

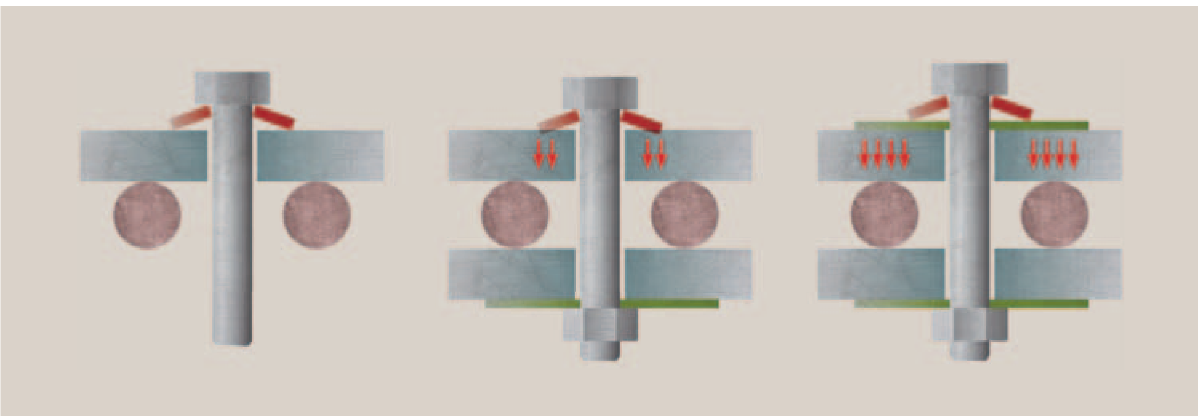
Correct installation – lower risks

And even when the vital elasticity is present through design, installation errors can endanger the long-term stability of the contact. One rule for installation is: Remove contamination and oxide layers on the contact areas by cleaning and brushing. In addition, use contact greases or pastes – especially under critical environmental conditions. They protect the actual contact zones against the ingress of air, water and salt and thus against oxidation and corrosion. Added to this is that in the case of bolted connections, it is only the proper lubrication of the screw that can ensure the optimal conversion of the applied torque into the required contact force. How significant the loss of force can be when the grease is forgotten or wrongly applied can be seen in table 1.

Careful preparation means that electrical contact can be maintained for decades.

Contact protection paste prevents the oxidation of the points of contact.

Figure 2 shows a classic installation error:



1. A spring washer is inserted between the screw head and a connector body made of aluminum or plastic.

2. Under the tightening pressure, the screw sinks into the „soft" connector body and loses its resilience

3. Solution: a flat steel washer is placed between them (3). It distributes the initial force that has been introduced over a wider area and prevents the screw from sinking in.

Since installation is often carried out under difficult conditions and with time constraints, manufacturers of contact technology endeavor to eliminate installation errors through suitable connector designs, or at least minimize their consequences. So, for example, some manufacturers only supply pre-greased screws. Another method is giving a metallic coating to the terminals or contact zones. Tin coatings are an economic solution that provides added reliability, if insufficient cleaning and greasing has been carried out. When penetrated by the contact teeth, the waxy tin retreats and closes up around the contact points again after the contact has been made. The electroplating process may automatically remove any oxide layer that may be present on aluminum surfaces.

Many findings – one clamp

The implementation of these and other findings were already carried out in the 1960s in the ABC tapping clamps from PFISTERER (Figure 3): The application-specific matching of screw, screw greasing and torque results in the required initial force being achieved. When tightening the screw, the contact teeth bite into the conductor insulation and the conductor, thus creating defined, bare contact points. The shape of the metallic contact plates (elasticity) guarantees a permanent contact force. Contact plates are tin plated to create improved and reliable contacts with slightly oxidized aluminum conductors.

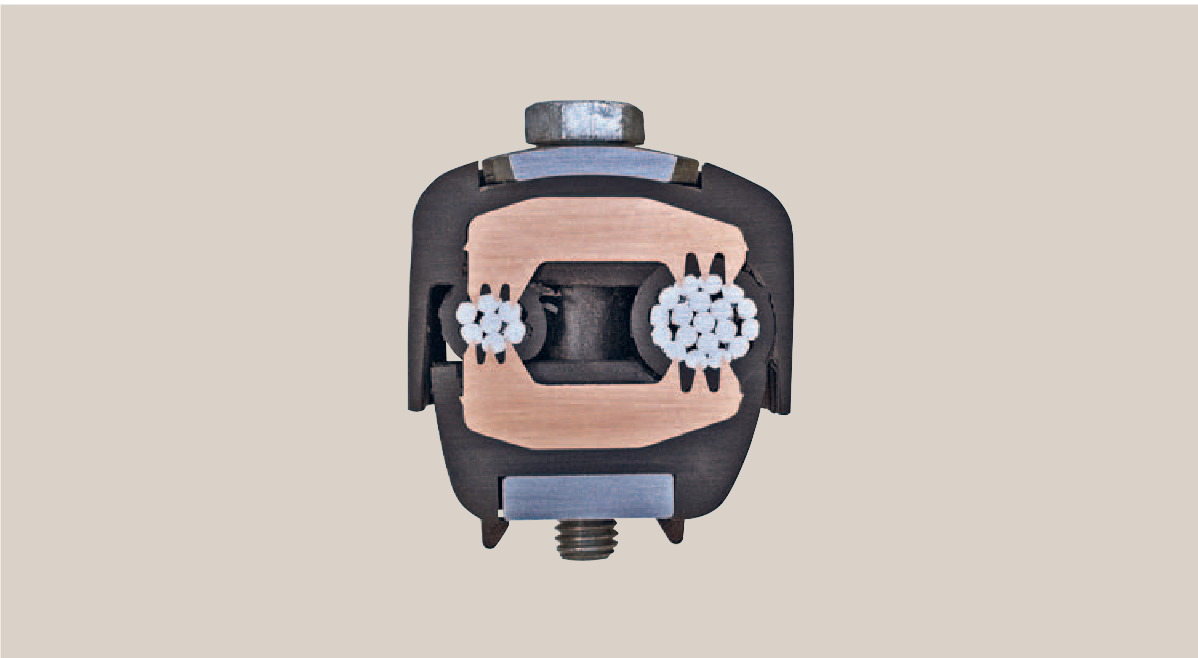


Figure 3: Even in ABC branch terminal from the 1960s, all the design criteria for modern terminals were taken account of.

The contact plates are embedded in a plastic connector body, reducing costs and improving reliability. In addition, a steel plate is integrated.into the connector body directly below the screw heads. Without this, the plastic body would be exposed to excessively high mechanical loads in the small area under the screw head. This design is still the basis for more advanced tapping terminals such as the ISICOMPACT from PFISTERER, where the pressure plate is also designed to act as a spring element.

One specification – many parameters

The construction principles illustrated by the ABC tapping terminal are used in many design rules, which are reflected in the specifications of both manufacturers and users. The long term transmission capability of a contact, for example, is often defined by the initial force that has to be applied to produce the connection, or over the length of the existing lines of contact, or the surface of the contact points that have been created.

One user specification, for example, calls for a 120 kN initial force to be transmitted per ampere at a conductor capacity of 1000 A in the terminal of an outdoor switching station. In order to meet this, the manufacturer must take account of the various influences that affect one another, such as the materials used for the screw, nut and washer, their surface characteristics (uncoated, galvanized, greased), the pitch of the screw thread, the number of screws and the tightening torque.

From initial values to the design

This process is carried out with the help of a table of empirical data. Starting with a standard screw made of hot dip galvanized steel, size M12 and strength category 8.8 results in a nominal torque of 80 Nm (see Table 2), which is incorporated as a neutral factor of 8.0 in the calculation of the design of a screw connector.

If an aluminum nut and A-2 washer are chosen, this combination of materials gives a required initial force equal to the clamping force of 3.8 kN per 10 Nm of tightening torque, for a thread greased with Vaseline (see Table 3). Multiplying these two values gives an initial force of 30.4 kN per screw. To achieve the required 120 kN, four screws are used, which results in 121.6 kN, meeting the specification.

Fine tuning and innovation

It is different if the user requests the use of screws in steel group A2 or A4 and the strength category 80. An average tightening torque of 75 Nm is allocated to them (Table 2). So with the same nut and washer material, four screws would reach a clamping force of 3.8 kN per 10 Nm of tightening torque (Table 3), so “only” 114 kN.

For an experienced designer this is no problem, because every parameter includes a tolerance. In this case, the missing 6 kN can be achieved by using another grease that converts the torque into the required clamping force even more efficiently than Vaseline. Innovative manufacturers, however, claim to have moved beyond this. In addition to the principles mentioned here, their latest generation of connectors achieve even greater efficiency with higher safety and greater flexibility in use.

Contact forces from screws

Screw	Greasing	Force in kN at a torque of 56 Nm	80 Nm
A2 F70	without	21.8	28.6
A2 F70	Vaseline	19.8	27.4
A2 F70	M 50 G	29.3	39.6
8.8 hdg	without	17.1	25.7
8.8 hdg	Vaseline	24.8	31.7
8.8 hdg	M 50 G	21.9	32.1
8.8 electroplated tin	without	18.9	22.9
8.8 electroplated tin	Vaseline	32.5	47.0
8.8 electroplated tin	M 50 G	29.4	43.0

Table 1 reveals details that have a big impact: If there is a failure to lubricate the screw or it is performed incorrectly, the torque introduced cannot be sufficient to create the required contact force. Result: A loss of force of up to over 50%.

Tightening torques

Thread	Tightening torques for screw material in Nm	
	■ Unalloyed or alloyed steels hot dip galvanized (hdg) ■ Strength category 8.8 ■ $R_{P\ 0.2\ MIN.} = 640\ N/mm^2$	■ Rust and acid resistant steels, steel group A2 or A4 ■ Strength category 80 ■ $R_{P\ 0.2\ MIN.} = 600\ N/mm^2$
M 6	9.5	9
M 8	23	22
M 10	46	43
M 12	80	75
M 14	125	120
M 16	195	180
M 18	280	260
M 20	390	370

Table 2 summarizes the tightening torques for different screw materials.

Clamping forces in kN for each 10 Nm of tightening torque, thread greased with Vaseline

Screw	Nut	Washer	M8	M10	M12	M16
St hdg	St	St hdg	4.5	3.6	3.0	2.3
St hdg	Al	St hdg	4.8	3.8	3.2	2.5
St hdg	Al	A2	5.7	4.5	3.8	2.9
St hdg	Cu/Rg/Ms	St hdg	4.5	3.6	3.0	2.3
A2/A4	St	A2/A4	4.3	3.4	2.9	2.2
A2/A4	A2/A4	A2/A4	4.1	3.3	2.8	2.1
A2/A4	Al	A2/A4	4.3	3.4	2.9	2.2

Table 3 gives the required clamping forces for selected combinations of materials as a function of tightening torque for a thread greased with Vaseline.

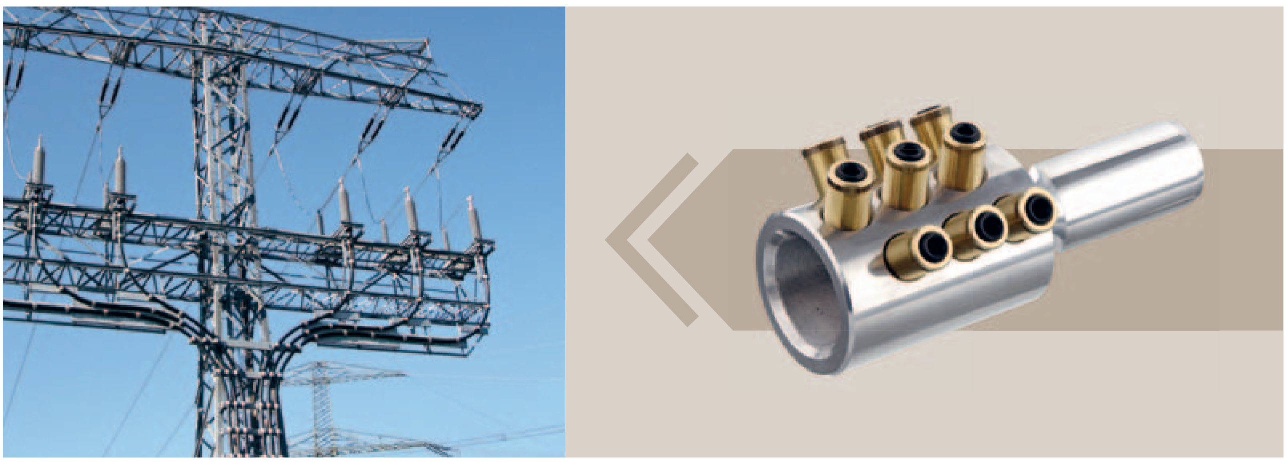
Large cables. High voltage. All under control with SICON.

SICON screw connectors are increasingly used in the high voltage range and with large cable cross-sections. And for good reason: the new connection concept brings many application opportunities and advantages compared to the compression method. This is not only appealing to users and installers. Other manufacturers of cable accessories are using SICON as a standard component.

Anyone who is connecting up large cable cross sections using compression technology knows the pitfalls of this method. The larger the cross-section, the larger and heavier the compression machine and the press tools, the latter weighing in at up to 100 kilos. They are therefore difficult to handle on site. When crimping terminals, the crimping tools often need to be hoisted by crane onto the mast cross arm. When working underground, it is often tight in two locations: Cable trenches provide hardly any room to move, and there are few places to position the crimping tool.

There are many better alternatives provided by PFISTERER, for example SICON head armatures for cable terminations and SICON connectors for underground and aboveground cable connections. The SICON connectors are constructed to be used with commercially available joints, so that their outer diameter corresponds to that of the cable insulation. The benefit is that the joint can be easily pushed over the connector. In addition, there is no need for stress relief devices. These are used to cover any sharp edges that may result from crimping.

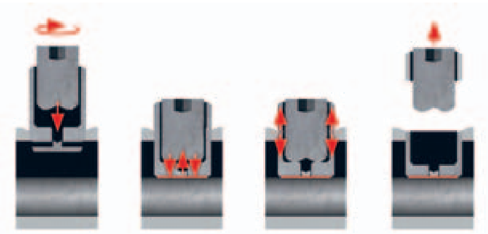
Because of the fixed relationship between the compression sleeve and the conductor diameter as regards size and material, crimping tools are also less flexible in use – a disadvantage, in view of the diversity in the world's power grids. With SICON screw connectors, it is different. Each variant serves several conductor diameters with just one connector. And more: For the first time, with SICON, PFISTERER has succeeded in achieving the defined contact forces independently of the conductor material and surface treatment.



SICON screw connectors are also suitable for use on HV cable terminations.

Ideal force for many conductors

An important step forward, in particular when expanding a network, is that it is not possible to predict which conductor material will be encountered and the extent to which the surface is oxidized. The friction that results from making a contact, also known as the coefficient of friction, strongly influences the proportion of the applied torque that is converted into contact force. To ensure there is always sufficient contact force, in all SICON connectors PFISTERER uses stepless shear bolts with integral pressure plates.



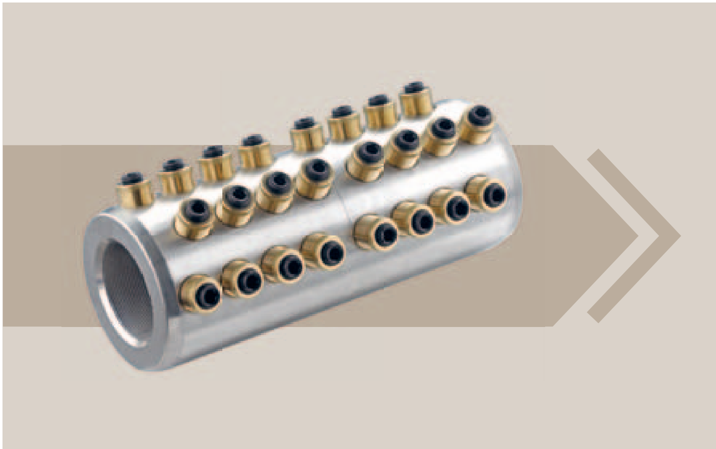
During the decisive last few turns, the pressure plate causes the screw to turn on the plate and not on the conductor. The effect is that the friction coefficient of the conductor does not affect the contact force that is generated. The frictional forces between the screw and the pressure plate are, however, a known quantity to the manufacturer, as it has been predefined with both the material and greasing. Thus using the design parameters of the screw, the contact force can be adjusted very accurately according to the torque. Thanks to the stepless design of the patented SICON bolts, they only shear off when the predefined torque is reached. The shearing off takes place without any protrusions from the screws being left behind, which eliminates time-consuming filing.

High acceptance, new applications

These and other benefits explain SICON's high market acceptance. After almost ten years of success in the medium voltage range, PFISTERER has gradually applied this connection concept to high voltage applications. The latest product is the standard version of IXOSIL joints and terminations with the IEC 61238 certified SICON XXL version for up to 2,500 mm². Joints equipped with SICON have passed many customer- specific type tests.

"Furthermore, positive customer feedback and use by other cable accessory manufacturers has confirmed the SICON connector concept," said Martin Schuster, Senior Advisor at PFISTERER, "And whoever carries out the calculations comes to the conclusion that the initial extra cost for screw connector is quickly compensated for by taking into account the required investment in various presses and crimping tools and the associated maintenance costs."

Martin Schuster, Senior Advisor at PFISTERER



SICON connectors: conductor cross sections up to 2,500 mm² with SICON XXL for high voltage joints.

PRACTICAL TIP: Impact wrenches for SICON installation

Many users prefer a battery operated impact screwdriver for installing screw connectors. But they are not all suitable. Because to use them correctly, there are many criteria that must be considered: Torque, pulse frequency, battery capacity, hammer mechanism and more. Furthermore, the tool inserts must be of the right quality.

In order to facilitate the proper selection, PFISTERER has tested various impact wrenches to assess their suitability. The following overview shows which wrenches have been specifically approved for fitting SICON screw connectors and terminations, and some of the suppliers from where you can obtain them.

Suitable impact wrenches

Impact screwdriver	Manufacturer	Distributed by, for example
C 18 IW	Milwaukee	PFISTERER
IT 10000-033	Hitachi	TE connectivity
ASKO Compact BTW 250 RFE	Makita	Nexans Power Accessories Germany GmbH
ASKO Compact BTW 151 RJEX	Makita	Nexans Power Accessories Germany GmbH

Further details can be downloaded in the summary of these installation tips on the PFISTERER website: www.pfisterer.com

Furthermore, only those tool inserts should be used that are approved for use with impact screwdrivers – so-called “impact sockets”. These differ from standard “ratchet sockets” as follows:

- One piece construction using special steel and manufactured in one piece
- Safety holder: Bore and ball groove or safety ring
- Square drive as per DIN 3121, ISO 1174 - G 12.5 (½")

And for easy handling, here are two important installation tips from PFISTERER: Where a screw cannot be removed with a motor driven tool – for example, because the tool is worn or there is insufficient power – the following approach should be used: Installation should be completed with a tool that can be operated manually.

Whether using a manual or a battery operated impact wrench, under no circumstances use a socket wrench extension. The risk is that the screw breaks off earlier than it should. This results in the defined torque not being reached, and therefore the contact force needed to produce a contact that will have a long service life is also not achieved.

Only certain impact wrenches are suitable for the installation of shear off bolts.

PRACTICAL TIP: 2DIREKT installation easily and safely

Proper installation requires proper tools. It is the same when you are connecting 2DIREKT transformer terminals: When tightening the clamping screws the transformer terminal must be fixed. Gripping with a pipe wrench is strongly discouraged, as it will damage the surface of the 2DIREKT terminal.

A simple solution is to use a counter-holder made of wood or plastic in the screw hole – a hammer shaft is usually suitable. A professional solution that can be created by any user, and one which PFISTERER discovered together with a customer, is a bolt turned from fiberglass-free plastic (the white bolt in the picture) that fits into the conductor hole and can be easily and safely used as a lever.

PFISTERER would be pleased to send you the technical drawing of this on request. Just contact us at info@pfisterer.com, keyword “2DIREKT”.

HV-CONNEX: Safe from surge

NEW: NOW UP TO 145 KV

PFISTERER is completing the CONNEX cable connector system with HV-CONNEX size 4 (up to 72.5 kV) and 5-S (up to 145 kV) surge arresters, providing a system solution that brings multiple benefits for the high-voltage range: Solid insulated and pluggable, these arresters make it possible to achieve the optimum surge protection design for transformers and gas-insulated switchgear (GIS).

Every transformer is designed for surges – up to the limit, allowed by its practical and economic design. However, in operation, there are frequently surges that threaten to exceed these design values. The most common causes are lightning strikes or the abrupt switching of a GIS at full load. This results in transient surges that can reach several million volts and overload the coils inside a transformer, and at worst, can destroy it mechanically. A common antidote is an arrester, which takes up the surge and converts it to heat.

The design of a surge arrester is complex as it depends on many factors, including the earthing system, the distance between the arrester and the equipment that needs protection, the anticipated surge and the network topology. Here, clear parameters come up against unknown factors. Although there are statistical studies concerning the regional occurrence and frequency of certain types of lightning, the question remains: Where exactly will which lightning strike actually hit and with how much energy?

Protection at the Hot Spot

Not only that. Transient surges propagate as traveling waves. Although they diminish with each meter traveled, they can also increase as a result of superimposed reflections where there are changes in the line impedance, such as at the transition point from the overhead line to a bushing or a cable termination. Thus the traveling wave nature of transient surges limits the protected zone offered by arresters. This means that optimal protection is achieved when the arrester is installed directly on the transformer that needs protection or directly on the GIS, from which a surge may start.

Air-insulated or gas-insulated arresters are in widespread use. The former require a lot of space because of the striking distances required and the necessary mounting structures. A solution that is hardly feasible in urban areas. Gas insulated arresters in turn have a negative effect on the SF_6 gas footprint. Installation involves expensive oil and gas work that must be carried out by specialized professionals, and connecting them requires an additional connection to tap the high voltage potential.

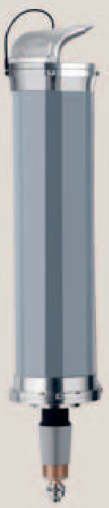
HV CONNEX surge arrestors installed in a power transformer.

CONNEX. One system. Many benefits

Plug-in HV-CONNEX surge arresters are different: Their insulation and field control consists of solid silicone, so no environmentally damaging liquids or insulating gases are involved. Where there is no internal gas pressure, there are also no pressure vessel regulations to be observed, and gas monitoring is not required. The solid insulation also allows a compact, space-saving design to be employed. Other benefits of the pluggability of the CONNEX system: If the cable connecting sockets are pre-installed on the device-side, there is no need for oil or gas work when connecting via the cable-side connector. This allows transformers and GIS to be pretested by the manufacturer before delivery.

The connector system also makes it easier to remove the surge arrester quickly and easily, for example after a short circuit due to overloading or when performing a dielectric test on the transformer. If the installation is positioned suitably, the socket can also be used for insertion of a test device. Last but not least, the combination of solid insulation and pluggability results in the CONNEX system offering complete protection against contact and is maintenance free – a safety plus for humans and animals, as the wiring is protected from the elements. The bottom line: The ideal solution for connecting transformers and GIS.

Power transformers using HV CONNEX surge arrestors need only a limited installation area.



New HV CONNEX surge arrestors now also available at up to 145 kV operating voltage.

At a glance: HV-CONNEX surge arrester sizes 4 & 5-S

For protection of metalclad switchgear and transformers which are fitted with plug-in connections in accordance with EN 50180/50181.

Possible applications:

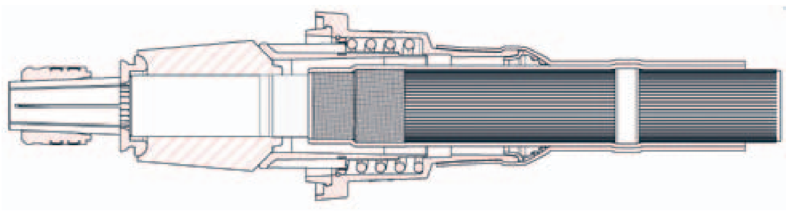
- Connecting a transformer via a cable line to the overhead line
- Connecting switchgear via a cable to the overhead line
- Connecting a switchgear via a cable to other resources
- Voltage levels up to U_m = 72.5 kV or U_m = 145 kV
- Max rated voltage U_R = 72.5 kV or U_R =145 kV

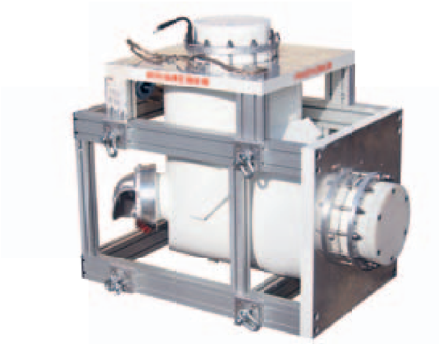
Features & Benefits

- Active part constructed with no spark gaps, using metal-oxide resistors without spark gaps
- Resistors with high thermal stability
- Corrosion-resistant and shock proof thanks to aluminum and fiberglass housings, so also
- Hermetic encapsulation of the active components against environmental influences such as humidity or pollution
- Insulation of the active parts from the metallic housing by means of silicone rubber sheathing
- Maintenance-free, as solid insulated
- Outdoor resistant
- Any mounting position
- Plug-in
- Bursting disc with rotatable exhaust port for defined pressure relief in the event of overload

More information on the PFISTERER website: www.pfisterer.com

News





HV-CONNEX corner joint: For simple HV testing

For on-site testing of HV cable runs or HV systems, test joints are used which are connected to the device under test on one side and to a bushing on the other, through which the test voltage is applied. With straight test joints, the layout of the bushing is often horizontal. The disadvantage is that the bushing is too close to the ground to meet the clearance requirements, and a complex substructure is needed.

It is much simpler with the HV-CONNEX corner joint for up to 245 kV from PFISTERER. Thanks to the arrangement of its two connectors at a 90-degree angle to each other, the bushing can vertical and set up accordingly, so it is not close to the ground and substructures are no longer needed.

HV-CONNEX connectors: 3 new variants for thicker insulation

The HV-CONNEX cable connection system is following the trend of thicker cable insulation: After the introduction of the CONNEX connector variants in sizes 2, 3 and 3-S that meet this requirement, PFISTERER is now supplying sizes 4, 6 and 6-S with a modified insulator.

With the new CONNEX connector variant in size 4, cables with a diameter of up to 78.5 mm over insulation and a cross-section of up to 1,600 mm^2 can be connected. Such cables are to be found in several regions of the world, such as France, parts of North Africa and the USA.

The new CONNEX connector variants in size 6 cover cables with a diameter up to 113.5 mm over insulation and a cross section of up to 2,500 mm^2 – a type of cable that is increasingly common, in particular in Russia and Asian countries.

Silicone Composite Insulators – a book for professionals

In the book “Silicone Composite Insulators”, authors Dr. sc. ETH Konstantin O. Papailiou and Dr. Frank Schmuck have summarized nearly 40-years of experience with PFISTERER SEFAG with overhead lines and in particular with the silicone composite insulator products. The reference book provides a comprehensive introduction as well as being a reference work for practitioners. The English version is now available (Springer, 495 pp., 484 illustrations, ISBN 978-3-642-15320-4).

PFISTERER – Top Partner for Siemens

PFISTERER has long been a trusted supplier to Siemens AG. The company's status as a "Preferred Supplier" was recently confirmed by the inclusion of PFISTERER in the "Forward Procurement List" of Siemens' top suppliers, a list that includes many well-known corporations. The conditions for inclusion include high quality, the strategic importance of the products and key account management.

Inclusion on the FP list not only reaffirms vendor status but also deepens the partnership between Siemens and its suppliers. Siemens supports its partners in, for example, implementing energy efficiency measures.

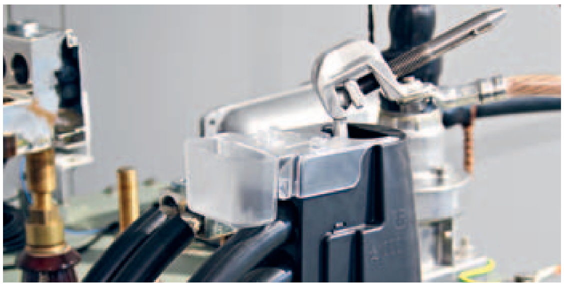
SIEMENS

Norbert Fink,
Key Account manager at PFISTERER
for Siemens.

2DIREKT: Contact protection with fixed ball point

When working on distribution transformers, they must be short-circuited and earthed in accordance with the five safety rules. The earthing and short-circuiting kit is easy to connect to the fixed ball point (see upper picture), which is positioned on the pressure screw of the 2DIREKT transformer terminals.

For the contact protection coverage of the fixed ball point as well, before and after maintenance, PFISTERER now supplies the new earthing hood cover made of transparent plastic as an accessory to the well-known black 2DIREKT cover.



This can be easily opened with an insulating pole from a safe distance so that you can easily reach the protruding fixed ball point for connecting the earthing device from all sides.

Once maintenance is complete, the earthing hood cover can just as easily closed again with the insulating pole and all the live parts of the 2DIREKT transformer connection are covered and touch safe when in operation, including the fixed ball point (see picture below).