

Insights

PFISTERER Group **Profile**



Legal Notice

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Where pronouns are used in this company
profile, both women and men are intended.

Insights – PFISTERER Group Profile

- 3 Editorial
- 4 Company Profile
- 6 Industries
- 7 Applications
- 14 Technology
- 16 Manufacturing
- 18 Facts and Figures
- 19 Concentrated Know-How:
PFISTERER and
LAPP Insulators

Supervisory Board of PFISTERER Holding AG

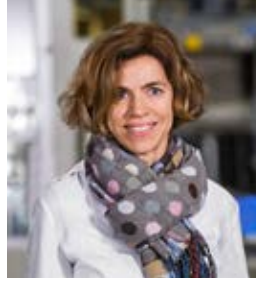
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Performance creates trust.

How do you measure whether a company deserves your trust? Our experience is that performance counts. To find out what the PFISTERER Group is doing for its customers worldwide, please read here:

What **challenges** we and our customers face, and what **solutions** we are finding for you, is shown in this view across the energy markets over the next two pages.

The result of our commitment to you is a **portfolio of services** that will ensure reliable current flow across the sensitive interfaces of the power supply network. We will introduce you to our **applications** from page 6 onwards.

There you will find **PFISTERER products that are still pioneering today**. From page 14 onwards, we will show you some insights into our innovative work. How we **manufacture** our products to **ensure their quality** can be seen from page 16 onwards.

We hope that your reading will increase your interest in PFISTERER **because we want to earn your trust through our commitment to you and your business, not just on paper.**

Sincerely,

Executive Board and Supervisory Board
PFISTERER Holding AG

Challenges for energy markets PFISTERER solutions Today and tomorrow



Power grids have been changing ever since people have been using electrical energy on a nationwide basis. In principle, that is nothing new. And yet this has always brought new challenges – today more than ever.

Energy consumption is rising, as is the number of electricity suppliers. Renewable energy sources are becoming increasingly important. Power has become an internationally traded commodity that must be transmitted in ever greater volumes over ever longer distances in new ways to more densely populated areas.

This means that the power networks must grow – quantitatively, qualitatively, and with more innovation. A critical success factor here is the quality of the countless, often nondescript, interfaces within the networks. Figures prove that the connection points are the foundation for security of supply, with poor workmanship in this area causing the majority of dropouts in power grids.

PFISTERER technology guarantees quality of supply and supports the progress of the grid. Our maintenance free contact elements have been ensuring a reliable flow of current for decades. Our high voltage products control high field strengths in confined spaces. Conceived as system solutions, they are designed to be flexible in use on a variety of lines and installations, whilst also remaining easy to install and environmentally friendly.

We are continually developing our skills for innovative solutions, for example with the acquisition of LAPP Insulators in October 2015. This strong brand, specializing in overhead lines, enables us as a corporate group to offer our customers a compact product program for silicone composite and ceramic insulator technology from one single source.

To ensure that we are close to the market, we are present where the market is – with our customers. We are represented internationally with offices in 18 countries, working closely with our customers in numerous projects.

By providing advice and assistance to our customers and keeping an eye on the markets, **as an independent family business we can act in the best interests of our customers, thinking in the long term and acting sustainably.** That's why we are seen as reliable partners. We find solutions for individual problems, developing them into standards where they have market potential. If a solution works, we optimize it, until the point is reached where new demands call for a break with conventional solutions. We have a tradition in developing and implementing entirely new concepts.

That means that PFISTERER fully focuses on its core competences.

Contacting high-current conductors, insulating high voltages – at all voltage levels and for all applications where high power must be transmitted reliably for decades. **And not only in the electricity supply industry, but also in transportation and manufacturing.**

The result: New products that become industry standards. Established services that explain why we are market leaders in challenging projects. Solid innovations that represent the highest level of technology that is economically feasible. **The bottom line: the best solutions for our customers' needs, both now and in the future.**

PFISTERER

Industries and Applications

PFISTERER is represented in all industries where high volumes of electrical power have to be transmitted safely and with limited losses over a period of decades. Energy producers, network operators and utilities rely on our services, as do rail and industrial companies. With our complete range of products and services for different applications, they can all be covered by just one source. Our wiring, connection and insulation systems for power lines mean that we offer the most comprehensive range of products anywhere in the world. On the following pages, you can see which applications we supply.

Energy producers



Network operators



Industry



Utilities



Rail

Application Overhead Lines



The planning and construction of complex overhead line systems requires expertise and the trust and cooperation of all stakeholders. PFISTERER is your system partner with global experience in the design and manufacture of insulator sets up to 1,100 kV.

We design and deliver both individual components and complete **insulator sets** on the basis of **porcelain and silicone composite insulators**. We can rely on more than 100 years of experience in the design of the systems

and use modern simulation models for electrical field characteristics and mechanical loads.

We have the best conditions for the efficient **development of complex custom solutions** such as space-saving insulated cross-arms or upgrading existing overhead line systems. Our range of services also includes **cable vibration damping** – from computer simulation to data acquisition using instruments specifically developed for this purpose, right through to implementation with the help of damping elements.

Our products for overhead line systems

- Porcelain and silicone composite insulators
- Fittings
- Complete insulator sets
- Vibration dampers
- Vibration meters
- Fittings for optical fibres
- Simulations of electrical field characteristics
- Simulations of static and dynamic mechanical loads
- Installation tools
- Voltage testers
- Earthing and short-circuiting sets



Application Cable Systems

Cable systems place particular demands on connection technology: They have to cover different cable types, be easy to install and require no maintenance for decades. PFISTERER cable accessories meet all of these requirements. They are available for almost all types of plastic-insulated cables up to 550 kV.

IXOSIL cable terminations are available using conventional oil-filled and modern dry slide-on technology. In the self-supporting version used with pylons, they can be pre-installed on the ground.

IXOSIL cable joints using proven slip-on technology can be installed in no time, giving maximum operational reliability.

The dry pluggable **CONNEX system** is touch-proof, maintenance free, suitable for outdoor use and submersible, making it the ideal connection for transformers and gas-insulated switchgear. Using gas-insulated **CONNEX joints**, pluggable cable branches can even be produced.

The installation of high voltage components requires extensive know-how and care. Our specialists have both, installing our sets for you anywhere in the world.

Our range for cable systems

- IXOSIL cable terminations up to 550 kV
- IXOSIL cable joints up to 550 kV
- Dry pluggable HV-CONNEX cable connectors up to 550 kV
- Voltage indicating systems
- Short-circuiting and earthing devices
- Assembly tools and test adapters
- Design and creation of complete high-voltage cable systems



Application Substations

Substations are complex key elements in power supply networks that must suffer only minimal power losses and enjoy maximum reliability. PFISTERER products ensure low-loss, maintenance-free and long-lasting connections across the whole transmission chain.

The dry pluggable CONNEX system makes power transformers completely pluggable. Touch-proof **CONNEX cable connectors** on both the upper and lower voltage side combined with the **CONNEX solid surge arresters** mean that enclosed stations are very compact.

For connections in the open air, **pluggable bushings** are also available. **MV-CONNEX multi-contact bushings** provide very compact and completely maintenance-free connections to the distribution network. In outdoor substations, **IXOSIL cable terminations and outdoor switchgear terminals** connect the individual components, while **porcelain and silicon supporting insulators** provide the required insulation. For installation and maintenance we provide **voltage testers** and customer specific ready assembled **earthing and short-circuiting sets**.

Our substation range

- Dry pluggable HV-CONNEX cable connectors up to 550 kV
- Dry pluggable HV-CONNEX outdoor bushings up to 362 kV
- Dry pluggable HV-CONNEX surge arresters up to 145 kV
- Dry pluggable MV-CONNEX multi-contact bushings up to 52 kV
- Self-supporting IXOSIL cable terminations, conventional or dry
- Outdoor switchgear terminals
- Porcelain and silicone composite supporting insulators
- Voltage testers and single-pole phase comparators
- Earthing and short-circuiting sets
- Installation tools



Application

Energy distribution

For cable distribution networks that have developed over generations, flexible connection elements are needed that harmonize with a variety of cable types and make installation errors practically impossible. That means that all connection elements must operate with low losses and be maintenance-free over decades. Such as PFISTERER screw connectors.

SICON bolted connectors for medium voltage cables have some unique advantages, thanks to their state of the art technology. Optimal contact force, irrespective

of conductor material, assembly without special tools and without any protrusions on the connector body.

2DIREKT transformer terminals reduce the number of transition points and thus the power dissipation and sources of faults.

For underground distribution networks, we offer **ISICOMPACT**, the most compact and easiest to install branch connection in the world. For this we provide the ideal **installation tools** for the job together with **voltage testers** and customer specific ready-assembled **earthing and short-circuiting sets**.

Our energy distribution range

- SICON bolted connector with stepless shear bolt
- 2DIREKT terminals for distribution transformers
- Components for low- and medium-voltage cable
- Dry pluggable MV-CONNEX cable assemblies for distribution transformers
- Porcelain and silicone composite insulators
- Voltage testers
- Earthing and short-circuiting sets
- Installation tools



Application

Railway Catenary Systems

Reliable and maintenance-free catenary systems are essential for the smooth operation of electrified railways and trams. PFISTERER offers a complete range of approved components for this application as well.

Modern railways place new demands on contact systems. High speed routes with numerous tunnels require tensioning devices that easily fit into the tunnel geometry. Tram routes, however, are increasingly designed accord-

ing to aesthetic criteria. **TENSOREX**, the spring-operated tensioning system offers solutions for both applications.

Our proven **silicone composite insulators** are – unlike conventional glass and porcelain insulators – unbreakable, self-cleaning and very light. **Terminals** and custom made **droppers** using screw or compression technology are part of our traditional range, based on 40 years of development and operating experience.

For this purpose, we also provide **installation tools and voltage testers plus earthing and short-circuiting sets.**

Our range for catenary systems

- Terminals and droppers
- Porcelain and silicone composite insulators
- Overhead suspensions
- TENSOREX contact wire tensioning systems
- Tools
- Voltage testers
- Earthing and short-circuiting devices



Application

Industrial Applications

The efficiency of an industrial plant is largely determined by achieving minimum downtime and developing precise solutions. PFISTERER helps – with customized connection components for electrical drives and power systems.

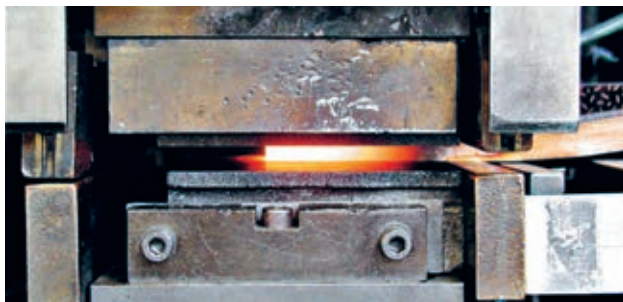
The quicker you can replace drive components such as motors or power converters, the lower the downtime and the costs. Using the pluggable **PLUG connection system** you can create the ideal conditions for this. It produces clearly defined system boundaries and allows complex

systems to be built using a modular and pre-assembled type of construction.

Special needs require special products. Highly specialized connection components are needed in automotive and railway engineering, as well as in industrial applications and transformer technology. Our **OEM special program** provides the right solutions – flexible connection elements that compensate for vibration, shocks and temperature fluctuations together with contact and connection elements in an almost limitless variety of shapes.

Our range for industrial applications

- PLUG high-current connector systems
- Flexible connectors
- Busbars
- Insulators



Application Renewable Energy

Renewable energies are fundamentally changing the structure of electricity generation and distribution. On land, small to medium producers are replacing conventional power plants, while powerful large plants are now being established offshore. PFISTERER is providing the necessary modularity in system design with both proven and new components.

In offshore substations for wind farms, complex technology must be fitted into a confined space. **The CONNEX connector system for medium and high voltage cables** is ideal for this application as it is touch-proof, compact,

maintenance-free and resistant to salt water. So far it is the only system certified by DNV GL for use offshore. This technology has proven to be just as useful in the often extremely cramped conditions in substations of hydropower plants.

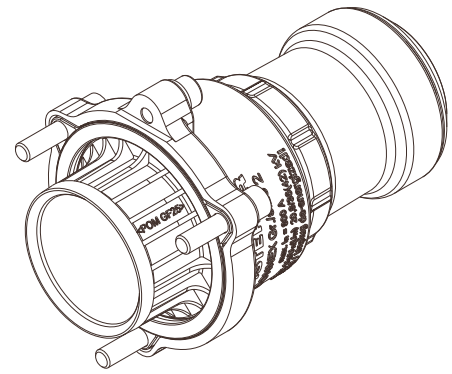
When it comes to wind turbines on land or at sea, pre-assembled, hot-swappable modules are needed, made possible by the **PLUG high-current connector system**. And with our easy to install medium and low-voltage connectors, small and medium sized onshore plants can be connected up efficiently.

Our renewable energy range

- HV-CONNEX: Offshore certified cable connection system for high voltage cables
- MV-CONNEX: Offshore certified cable connection system for medium voltage cables
- PLUG pluggable high-current connector system up to 6.6 kV
- Design and construction of cable systems for offshore substations
- SICON bolted connectors for medium voltage cables
- 2DIREKT transformer connection terminals for distribution transformers
- Voltage testers
- Earthing and short-circuiting sets.



Core competence Technology



Contacting high-current conductors and insulating voltages – that's what we do. Here we cover the entire spectrum, from "little matters" such as contact disks to overhead line projects that run into millions. We carry out innovative work at all stages of development and thoroughly test every new solution in our laboratories.

We develop standard products from our individual solutions. With our experience in the field, we optimize well-proven equipment still further. And if the number of new requirements is such that a rethink is required, we break with convention, even our own, and develop completely new approaches.

With new materials such as the use of silicone as an insulating medium, where PFISTERER pioneered its introduction to the energy industry. Or with new plastic/metal combinations such as in the ISICOMPACT branch terminal. Compared to pure metal designs, they offer much greater freedom of design, improving ease of assembly whilst maintaining contact quality.

With new technologies such as stepless shear bolts in SICON connectors, dry high voltage end closures or the TENSOREX spring-based contact wire tensioning system.

1968

SCK

PFISTERER invents the screw compact terminal. Starting in the late 1960s, it is used to connect all new buildings in Germany to power grids laid underground.



1969

Compact fuse switches

PFISTERER receives a patent on compact fuse switches for low voltage distribution, using new plastic distribution boxes, a novelty at the time.



1975

MV-CONNEX

PFISTERER is granted the patent for the CONNEX cable connection system for medium voltage applications. This development enabled medium voltage connections with factory-tested components to be used in a modular construction for the first time.

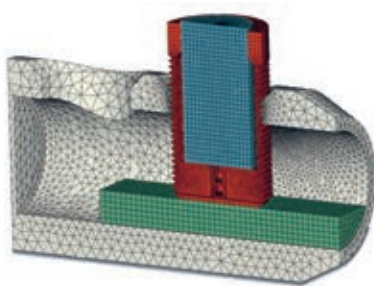


And also with completely new solutions such as the dry pluggable CONNEX surge arresters for high voltage applications or the PLUG connector system for low voltages.

In-depth knowledge of the mechanical and electrical properties of all materials and how they change during the lifetime of our products formed the basis for these products. In the development process we use modern computer based simulation models to evaluate the behavior of new designs. Thus we make sure that we produce the best possible prototypes before they undergo complex developmental testing. Our test labs carry out all kinds of mechanical and electrical tests, as well as lifetime testing.

We do not simply focus on individual products, but rather develop comprehensive solutions to real problems. That is why we offer a comprehensive range of accessories for installation, testing and operation, together with installation training.

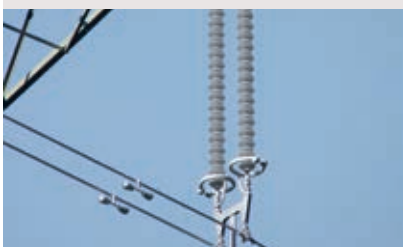
And every time we think up a new solution, we think long-term, because in the safety-conscious energy industry, new ideas often take years to establish themselves. So we are really pleased when our ideas constantly generate industry standards and shape international specifications.



1975

Silicone composite insulators

SILCOSIL insulators on power lines prevent flashover between the mast and the power line. PFISTERER makes them out of silicone, a far less sensitive material than the porcelain or glass used previously.



2000

PLUG

PFISTERER extends their range of activities to include transport engineering, new forms of energy and industrial applications. The PLUG low voltage system for transmitting high currents in harsh conditions was first used in railway engineering. Today, almost every modern high-speed train in Europe is equipped with this system.



2005

SICON

Easy assembly and optimal contact forces for all wire types: PFISTERER reinvents the shear bolt for the SICON bolted connector.



Core competence

Production

Anyone who wants to win the trust of the customer in the energy sector must make sure they have the right quality and with good reason. Security of supply is the top priority in the energy supply industry, so energy equipment and components must function reliably for decades. PFISTERER means quality – in word and deed.

Anyone who wants to handle high currents and voltages must pay attention to all the details. That is why we manufacture the core components of our products ourselves. Thanks to our high level of vertical integration, we have one hundred percent control over all the processes and can implement changes quickly and flexibly. Many of our techniques have been developed in-house, such as the ACIM method (Automatic Continuous Injection Molding), with which we can produce silicone composite insulators over 6 m long or post insulators with rod diameters of up to 120 mm in a single pass.

All manufacturing facilities and processes are perfectly matched to the applications in which our products are used. We use three different methods for manufacturing silicone insulating components. Depending on the product we assemble using fully automated equipment or manually.



2007

ISICOMPACT

Incredibly easy and safer than ever. The new branch terminals for low voltage cables makes eight contacts with just one screw.



2010

Offshore approval for CONNEX

CONNEX is the first and so far only cable system to receive an offshore approval from Germanischer Lloyd.



2011

ESF/EST

The oil-free and gas-free cable terminations for high voltage cables are environmentally friendly and reduce installation times.



To ensure consistent quality we use quality management and technical methods. A sophisticated quality management system permeates all levels of staff and production processes – from operator self-monitoring and running controls to planning and carrying out routine tests.

Our testing facilities enable us to carry out a variety of mechanical and electrical tests internally, together with life testing. We have developed a special high voltage test for our CONNEX sockets, which we use for all our HV components: Each is individually tested prior to delivery, and the test report is sent with the goods. Testing is always to the relevant standards. Frequently we put even stricter controls in place that comply with our internal standards, because you cannot be too safe.



2011

HV-CONNEX surge arresters

Our solid-state surge arresters make power transformers and gas-insulated switchgear completely touch-proof.



2014

EHV

A full portfolio for all extra high voltage cables up to 550 kV



2015

CrossPower

The hybrid power generation system for micro grids saves up to 50 % of fossil fuel.



Facts and Figures

Executive Board

Stephan Götschel
Member of the Executive Board

Dr. Konstantin Kurfiss
Member of the Executive Board

Supervisory Board

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Chairman of the Supervisory Board

Karl-Heinz Pfisterer
Vice Chairman of the Supervisory Board

Prof. Dr. Petra Denk
Erich Schefold
Matthias Benz
Prof. Dr. Siegfried Wendel

1921

year of foundation

1,100 kV

maximum operation range of our
products and solutions

2,100

employees worldwide

18

own subsidiaries on 4 continents

70

countries in the worldwide
distribution network

Concentrated Know-how



The PFISTERER Group is amongst the world's leading specialist equipment and system suppliers in the energy infrastructure industry. Around 2,100 employees develop, produce and distribute components and complete solutions for the particularly sensitive interfaces in modern energy networks. With a complete range of products and services, the PFISTERER Group provides customised solutions for the complete transmission chain from low and medium to high and ultra-high voltage. Everything from a single source. Worldwide.

PFISTERER



IXOSIL

SEFAG

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