PPC INSULATORS

ELECTRIFYING THE WORLD

PPC Hybrid Insulators

Advanced Insulator Technology

Hybrid Station Post Insulators

Performance for environmentally challenging applications

Extreme environmental or high pollution conditions like those encountered in industrial, desert or coastal regions can lead to electrical activity on insulators such as leakage currents. The surface condition of an insulator in such areas can subsequently lead to pollution flashovers power system outages. The need for reliable power networks, avoidance of blackouts and substation shutdowns from frequent maintenance activities like substation washing, led the insulation industry to react. Satisfying our customers is our ultimate goal. Unique know how, constant innovation, and flexibility are key success factors in this fast moving world. PPC Insulators' long-term expertise in porcelain and composite technology allows us to provide alternative solutions to customers for high- to ultra-high voltage AC/DC and high pollution applications. Hybrid Insulators combine the advantages of porcelain cores (undisputed mechanical strength, stability & longevity) with the excellent performance of silicone housings in order to provide the ideal solution for highly contaminated service conditions.

Manufacturing Tecnology

High pressure, high temperature injection molding is required due to the high viscocity of HTV silicone rubber. Injection molding technology used by PPC is set at temperatures above 160°C and a pressure of several hundred bars.
The silicone housing is fully bonded onto the porcelain solid core, by perfectly managing the "triple-point", where the fittings, porcelain core, and silicone housing meet. The high pressure injection involved allows the silicone housing to adhere directly on to the core and fittings, without the need for an artificial sealing.

Hybrid Insulators

Porcelain strength meets hydrophobicity

Porcelain Core

The porcelain core is manufactured with the PPC Isostatic process that allows for flexible designs, tight tolerances and short lead times. Ceramic granulates are pressed into a cylindrical blank at very high pressure. After turning, glazing and firing, the solid core porcelain (without sheds) is cut to the required length.
Hot-dip galvanized fittings made of spheroidal cast iron are then cemented onto the porcelain core.

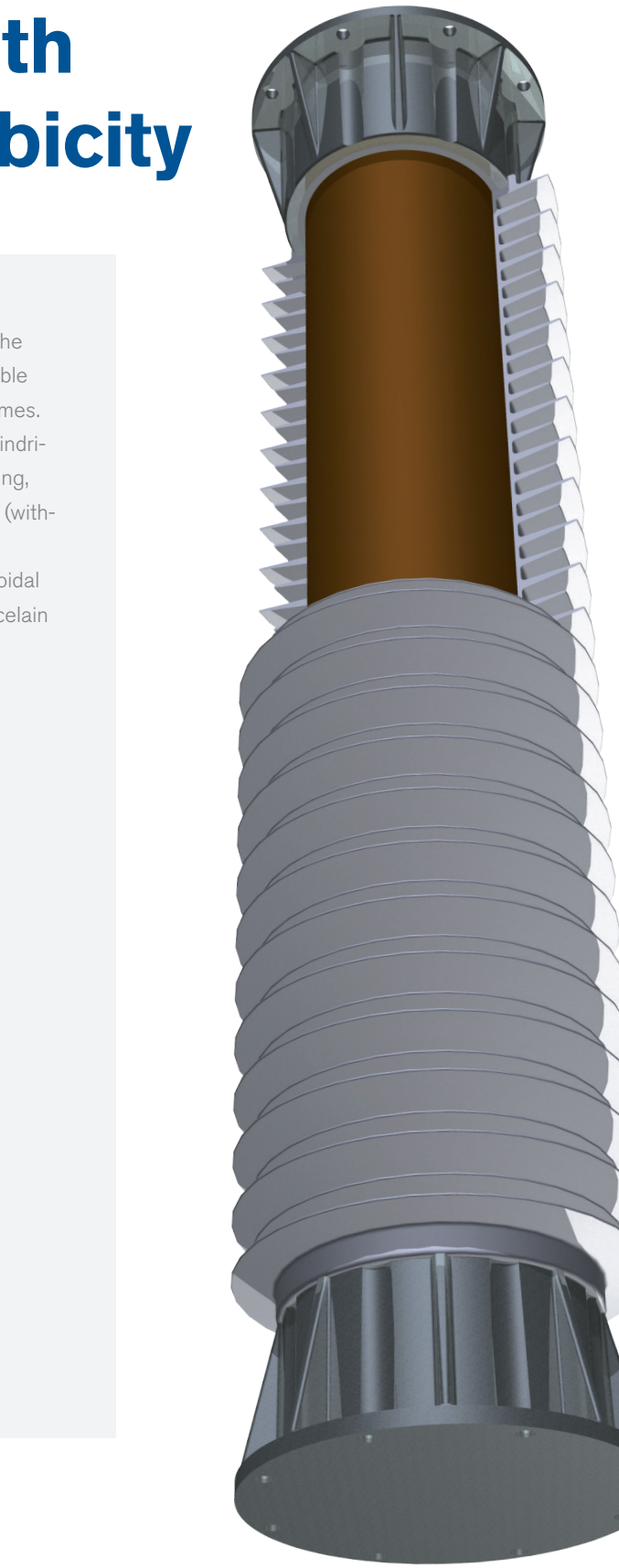
Process

- Material Preparation
- Blank Pressing & Turning
- Glazing & Firing
- Cutting & Grinding
- Assembling with metal fittings

Silicone Rubber Housing

Process

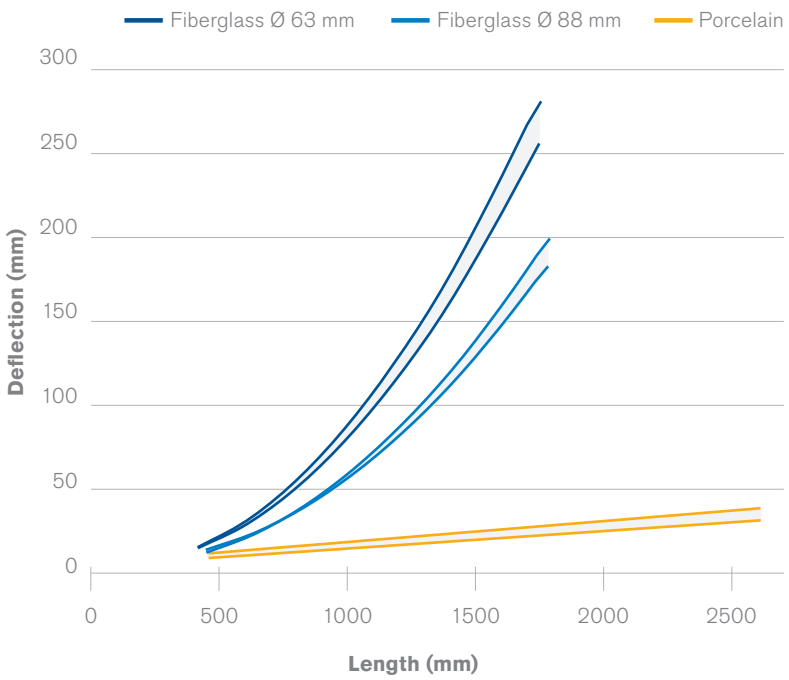
- Surface preparation
- Silicone injection molding
- Insulator testing



Porcelain Core Rigidity

PPC Hybrid Insulators takes advantage of the high mechanical strength porcelain core, thereby offering unique stability along with long time performance. The porcelain core is made of high-strength alumina oxide, C130 according to IEC 60672, thereby avoiding the aging of material and electro corrosion problems of the insulator.

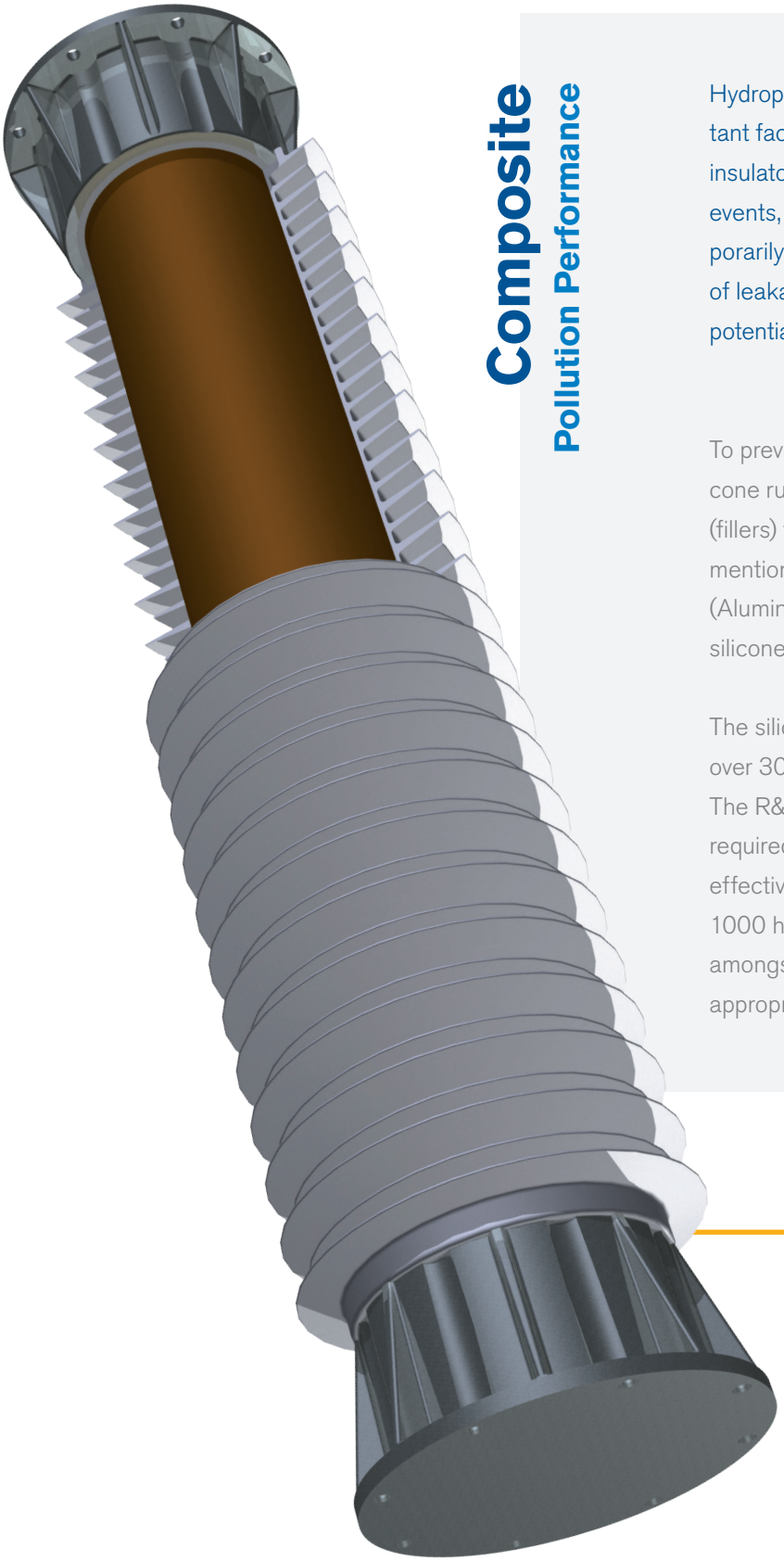
Deflection Performance vs. Insulator Length



Comparison: Fiberglass Rods at MDCL* & Solid Core Porcelain at MFL*

Polymer station posts are limited in their application to voltage classes around 170 kV due to excessive deflection at increased lengths. The graph shows deflection values for typical fiberglass rod diameters used for polymer station post insulators at their MDCL value, above which there exists a risk of permanent damage to the core. In comparison, the low deflection of porcelain cores at MFL values (largely above the MDCL equivalent load) clearly explains why solid core porcelain is ideal for such applications.

*MDCL = Max. Design Cantilever Load;
*MFL = Minimum Failing Load (Bending)



Composite
Pollution Performance

Hydrophobicity is widely considered to be the most important factor regarding the insulation behavior of composite insulators. It is well known that under specific pollution events, the hydrophobicity of silicone rubber can be temporarily inhibited. Such conditions can lead to development of leakage current on the surface housing resulting in potential erosion of the silicone housing material.

To prevent permanent degradation, high performance silicone rubbers have been designed with specific additives (fillers) to protect the silicone from erosion under the above mentioned circumstances. These fillers – typically ATH (Alumina Tri Hydrate) – have to be incorporated in the HTV silicone in specific quantities in order to be effective.

The silicone compounds used by PPC are the result of over 30 years of expertise in composites at SEDIVER. The R&D facility based in St Yorre, France has all of the required resources and equipment to achieve the most effective product. Tracking wheel test, inclined plain test, 1000 hour salt fog test, 5000 hour multistress test, are amongst the necessary steps in the selection of the most appropriate solution.

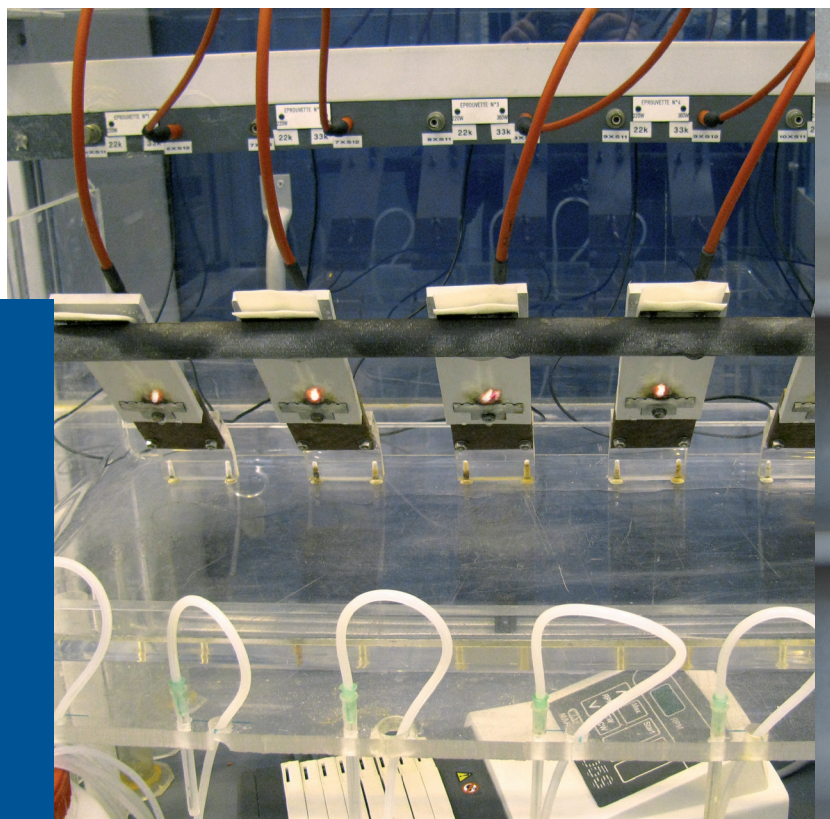
The Hybrid design offered by PPC uses a superior silicone compound containing at least 45% ATH by weight. The sheds of PPC Hybrid Insulators are characterized by an aerodynamic profile, in accordance with IEC 60815.

Hybrid Insulators
Made for extreme environments

Technology Benchmark

	Porcelain	RTV Coated Porcelain	Composite	Hybrid
Deflection under Bending Load Performance	++	++	-	++
Torsion Strength	++	++	-	++
Compression Strength	++	++	-	++
Product Lifetime	+	-	-	+
Pollution Performance	-	++	++	++
Weight	-	-	++	+
Vandalism	-	-	+	+
Maintenance	-	-	+	+
Reliability	+	+	-	+

Insulator Aging



Erosion

Experience and laboratory tests have shown that silicone polymer can suffer severe erosion damage under electrical activity that results from partial loss of hydrophobicity. In this respect, it is well-documented that silicone rubber with 45% of ATH-fillers out performs Liquid Silicone Rubber (LSR) with 50% of ATH-fillers.

Hybrid Insulators with solid porcelain cores and silicone housings are the right technical solution for highly contaminated and polluted areas. Further, deflection under bending load can prove critical in the case of composite posts, but the deflection in the case of Hybrid Insulators is extremely limited due to the high mechanical strength of the ceramic cores.

The resistance of Hybrid Insulators to adverse external conditions is simply outstanding. The nature of the silicone housing prevents the breakage of shed(s) induced by mechanical shocks. On the other hand, if for any reason the silicone housing is damaged, the porcelain core does not suffer any of the risks associated with exposed fiberglass rods as used in traditional composite insulators.

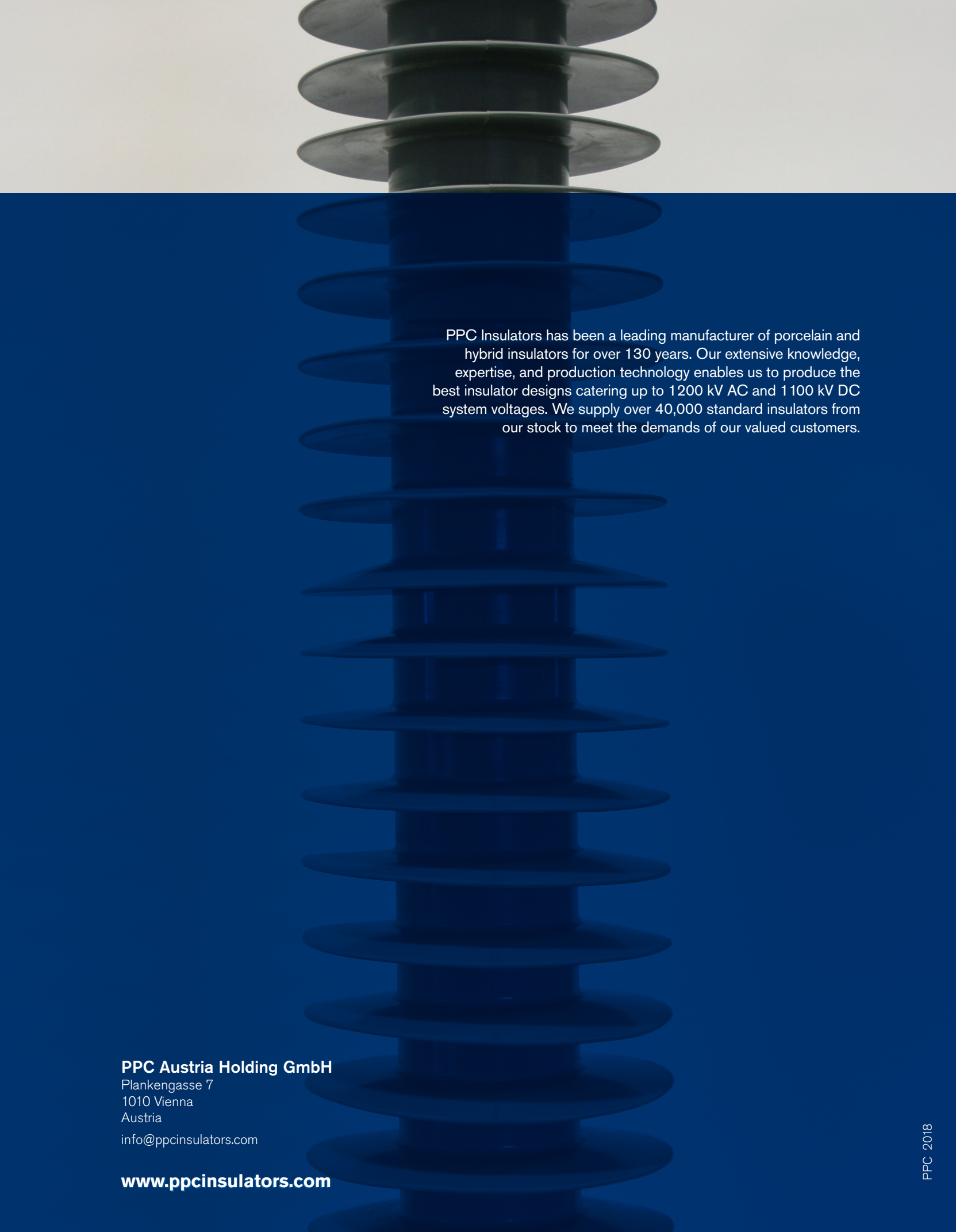
Maintenance costs of Hybrid Insulators are reduced to a minimum, thanks to the reduced washing required by the HTV silicone given its excellent hydrophobicity. Flexibility in designing core dimensions and creepage distances of PPC Hybrid Insulators guarantee full substitution of installed porcelain insulators for all substation applications.

PPC Hybrid Insulators are fully compliant with the requirements of IEC 62217, 60587, 62231, 60168 and 60273.

Employing PPC´s Hybrid Insulators goes beyond “buying hydrophobicity”. Our unique design combines the best of both worlds: high-strength mechanical cores for superior deflection performance and silicone housings for excellent pollution performance. The HTV silicone rubber employed by PPC provides excellent tracking and erosion performance, for long-term applications.

Tracking

To avoid internal tracking, the silicone housing needs to be fully bonded to the core. Managing the interface of fitting, porcelain core and silicone housing is critical. Benefiting from unique know-how and field experience, hybrid technology has inherited the unique attribute of PPC's impenetrable design. The silicone housing adheres directly to the hardware assembly and the cemented section without the need for additional artificial sealing.



PPC Insulators has been a leading manufacturer of porcelain and hybrid insulators for over 130 years. Our extensive knowledge, expertise, and production technology enables us to produce the best insulator designs catering up to 1200 kV AC and 1100 kV DC system voltages. We supply over 40,000 standard insulators from our stock to meet the demands of our valued customers.

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