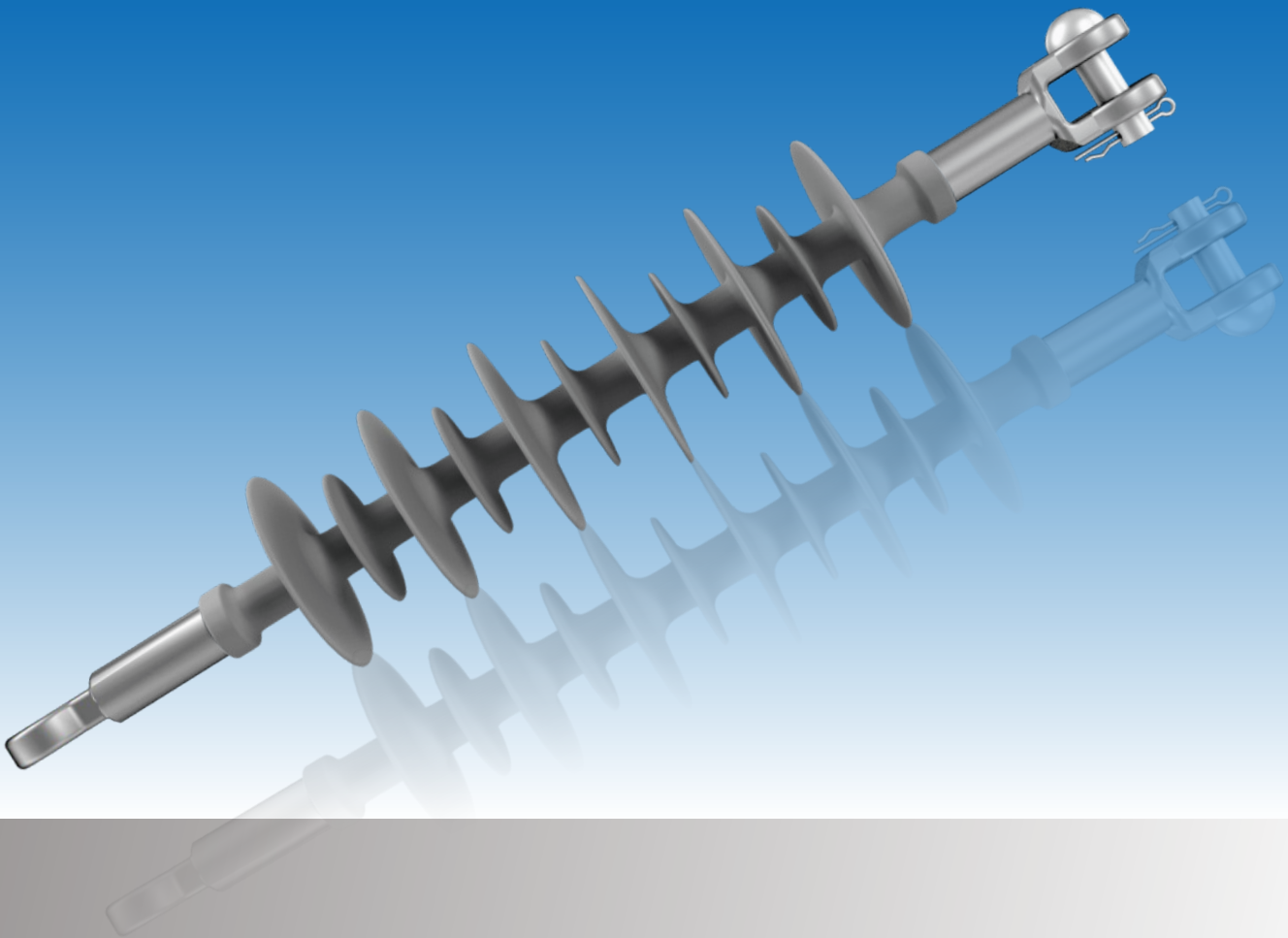


SHEMAR

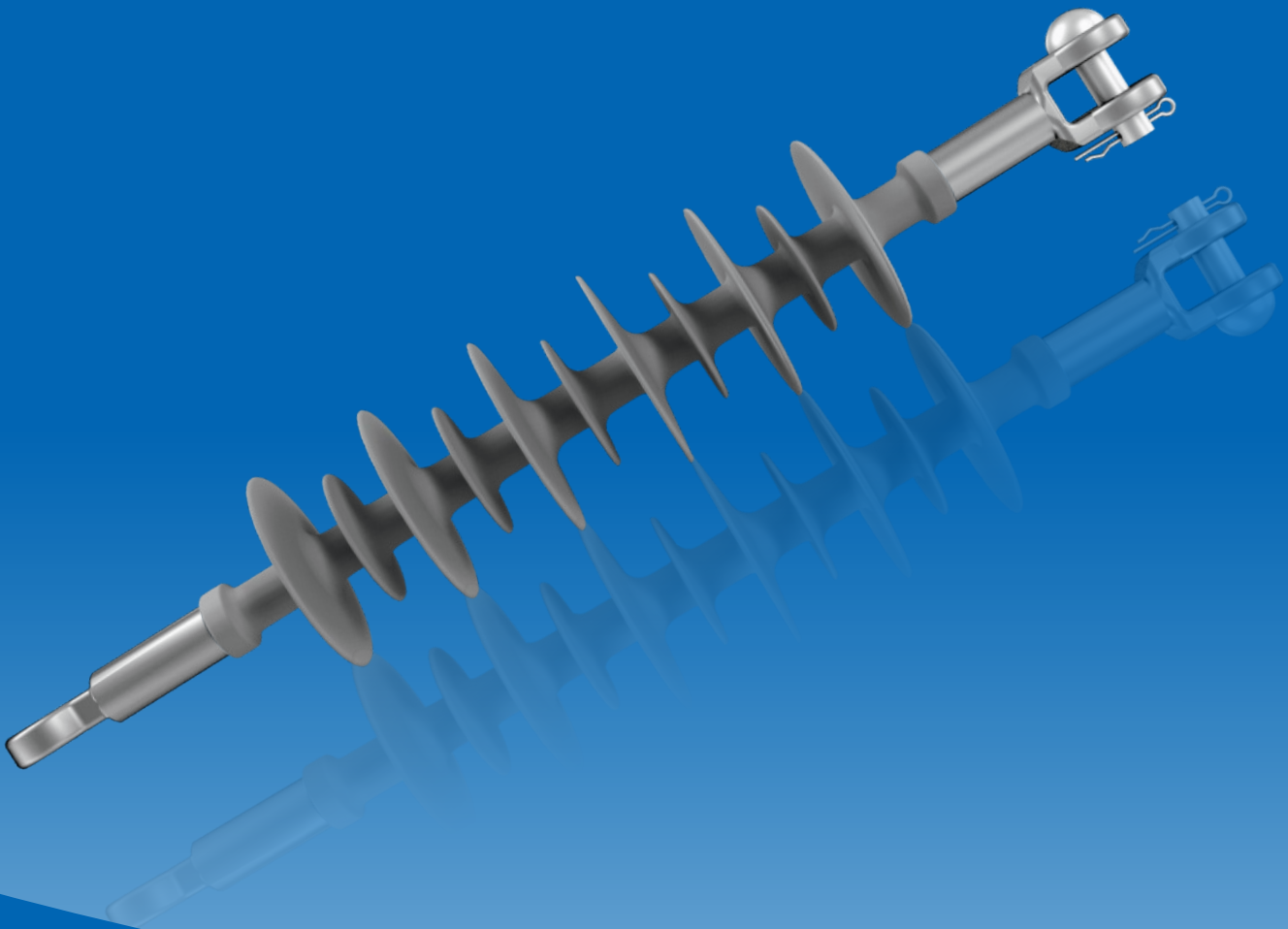
Distribution Line Insulators Catalogue

15kV to 69kV



Leading Innovation in Composite Insulation Technology

SHEMAR



Distribution Line Insulators Catalogue
15kV to 69kV

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SHEMAR Composite Insulators

Delivering Superior Ageing Resistance and Longevity in Reliability Performance

SHEMAR distribution line insulators embody the latest innovations in composite insulation technology combining world leading material science development, cutting edge design technology, state-of-the-art manufacturing and rigorously monitored quality control.

We understand the crucial impact that insulators can have on the long-term performance of distribution lines, which is why at SHEMAR we have prioritized creating composite insulator products and solutions that offer unparalleled, reliability, ageing resistance and exceptional performance

Design Features and Manufacturing

One Piece Insulator without Joints

SHEMAR's distribution line insulators are designed with advanced one-piece housing technology that eliminates internal interfaces, providing superior bonding performance and protection against erosion damage. The housing is directly vulcanized to the core, resulting in a single, seamless HTV silicone rubber housing (sheath and sheds) that is impenetrable to moisture ingress and provides ultimate defense against environmental factors.

During manufacturing a single-shot injection molding process is used, which applies high pressure and temperature to ensure a robust, one-piece housing that is chemically bonded to the core rod. This one-piece housing design features only one internal interface, i.e. the boundary interface between the housing and the FRP core rod, which significantly reduces sensitivity to tangential electrical field stress that can cause erosion damage.



1500T Injection machine



500T Injection machine

Excellent Bonding between Core and Housing

SHEMAR's injection molding manufacturing process also creates an unmatched quality of chemically bonded interface between the rod and housing, as well as the end fitting and housing, which eliminates the risk of internal tracking along the longitudinal interface of the composite insulator. The bond between the silicone rubber housing and fiberglass rod is also mechanically stronger than the intrinsic tear strength of the silicone rubber, ensuring an incredibly durable and reliable insulator.



Excellent Bonding Performance



Bonding Pull-off Test

Impenetrable Triple Point

SHEMAR's distribution line insulators feature an innovative and unique impenetrable sealing system to prevent water and contamination from entering the insulator at its triple point. This is achieved by directly molding HTV silicone onto the triple point and overlapping part of the metal end fittings to ensure total enclosure and protection of the sensitive triple junction zone (where metal end fitting/core rod/silicone housing meet).

The highest bonding and adherence of HTV silicone housing on to the end fittings safely protects the fiberglass rod against water or contamination attack and eliminates the needs for inherently weak traditional sealing devices.



Crimping machine and acoustic emission detection device

Maximized Mechanical Integrity

To ensure uniform stress distribution and maximum mechanical integrity of the finished insulator a circumferential, multi-step crimping system is used for the attachment of metal end fittings to the FRP core. Each crimping process is monitored for acoustic emission, crimp pressure and travel distance of compression dies as control parameters.

Large variability in the ultimate tensile strength of insulators can occur due to various failure modes at the interface between the core rod and end fitting. To deliver the most consistent reproducibility in tensile strength, SHEMAR's insulator designs are based on uniform failure mode and a safety buffer of approximately 20% is maintained between the ultimate tensile failure load and the specified mechanical load (SML).

In addition, SHEMAR insulators come with built-in redundancies that contribute to their higher torsional strength rating, which can make the installation and in-service operation of the insulators safer.

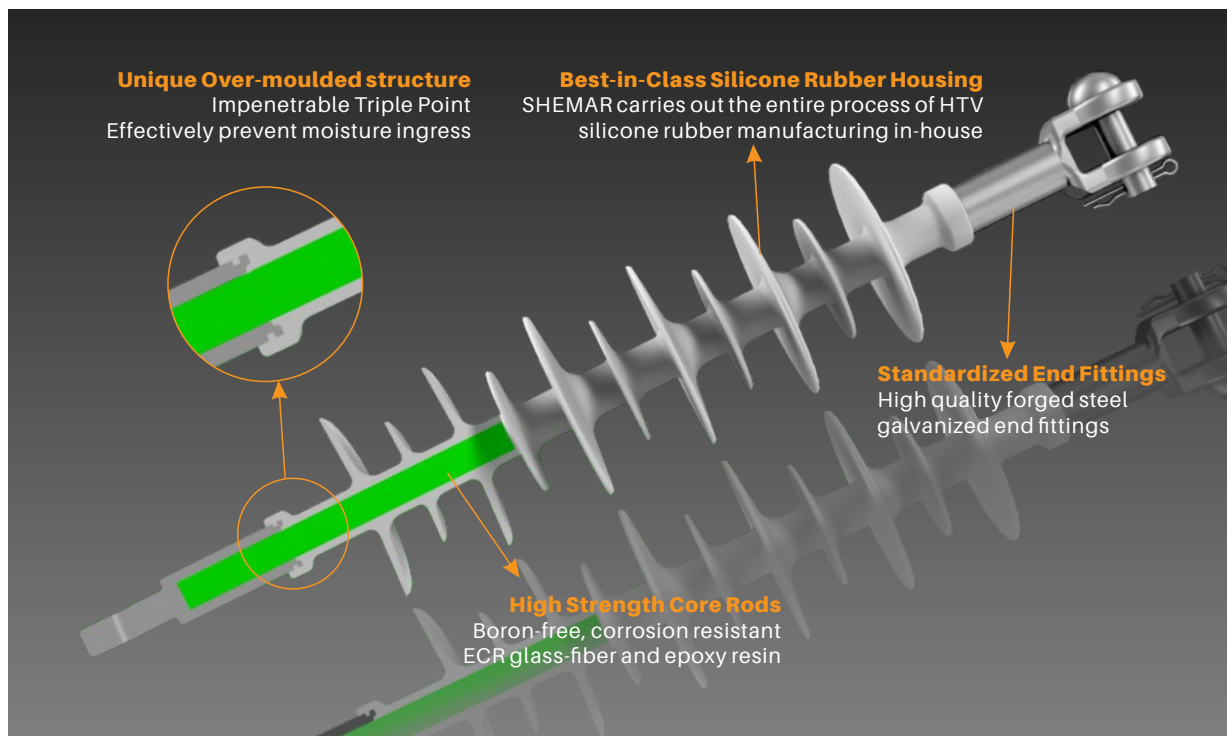
Designed to Endure Severe Environments

SHEMAR's distribution line insulators are created to endure even the most severe service conditions, such as coastal salt fog, dust and industrial contamination without impairment in performance.

Superior hydrophobicity retention and short hydrophobicity transfer and recovery times prevents the formation of conductive layer and the excellent tracking and erosion performance of the housing provides an additional defense mechanism.

The insulator housing features alternating weathershed profiles with both standard and high leakage distance designs, along with optimized shed spacing (S), overhang (P) and creepage factor (CF) parameters, to ensure maximum effectiveness, self-cleaning performance and resistance to contamination, ice and leakage currents in various environmental applications. All of our housing shed profile designs adhere to the recommendations given in IEC 60815-3 and have a minimum 3mm sheath thickness.

Materials and Components



Best-in-Class Silicone Rubber Housing

The special HTV silicone rubber formulation used in SHEMAR's composite insulator housings has been scientifically engineered as a result of extensive R&D in order to overcome the various environmental, electrical and physical degradation mechanisms and deliver the best-in-class ageing resistance and long-term reliable performance.

SHEMAR carries out the entire process of HTV silicone rubber manufacturing in-house from raw material sourcing to mixing with special additives and fillers which achieves the best UV, tracking and erosion, weatherability and contamination resistance performance. SHEMAR HTV silicone rubber formulation has a long-term track record of successfully performing in some of the most extreme and demanding service conditions without degradation.

Fracture-Proof Core Rods

The fiberglass core rods for SHEMAR's distribution line insulators are manufactured with boron-free, corrosion resistant ECR glass-fiber and epoxy resin. By using this E-CR boron-free formulation of fiberglass, the core rods have exceptional electrical integrity, and they are extremely resistant to hydrolysis and stress corrosion attack, which eliminates the risk of brittle fracture. Additionally, the core rods can withstand a 96-hour nitric acid resistance test as specified in IEC 62039. SHEMAR manufactures all of its fiberglass core rods in-house using a high-quality pultrusion process.

Standardized End Fittings

SHEMAR uses industry standard forged steel or ductile iron galvanized end fittings. All end fittings are subjected to rigorous incoming quality control inspections.

Testing and Quality

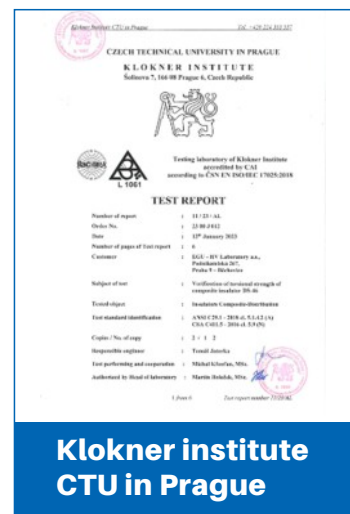
Compliant with National and International Standards

SHEMAR takes pride in being a truly global composite insulator enterprise. We have customized quality control plans for each type of distribution line insulator and work instructions for each production line. Every distribution line insulator goes through rigorous process verification, internal testing and third party testing. All of our distribution line insulators meet ANSI C29.13, CSA C411.5 and IEC 61109, and we carry out routine and sample tests on each batch of insulators to ensure a reliable manufacturing process.

Additionally, SHEMAR's composite insulators also comply with the following tests:

- 5000 Hour Multi Stress Test as specified in IEC 62730
- Accelerated Weathering Test (1000 h UV test) as specified in IEC 61109
- Tracking and Erosion Test (Class 1A 4,5) as specified in IEC 60587
- Resistance to Weathering and UV (5000 h UV test) as per ISO 4892-3
- Resistance to Hydrolysis and Acid Attack on FRP Core as specified in IEC 62039
- Tracking Wheel Test as specified in CSA C411.4
- Resistance to Corona Cutting as per SHEMAR propriety test method
- Resistance to Acid Rain as per SHEMAR propriety test method
- Corona Ring Power Arc Withstand Test (20kA-0.25s, 5 shots) as per IEC 61467

Our in-lab test results are backed-up by SHEMAR insulators proven 25+ years of successful field experience in diverse and severe service conditions.



Continuous R&D and Improvement

SHEMAR is dedicated to advancing key technologies, enhancing technical support, and ensuring the success of key projects. We are also focused on improving our independent innovation capabilities and core competitiveness in the rapidly evolving energy industry. This commitment has resulted in significant advancements in technical innovation, exceptional performance, and influential demonstration initiatives. These achievements have also earned recognition from the National Energy Administration. As evidence of our success, the National Energy Administration granted SHEMAR approval to establish the "National Energy Power Insulation Composite Material Key Laboratory" on August 24, 2014.

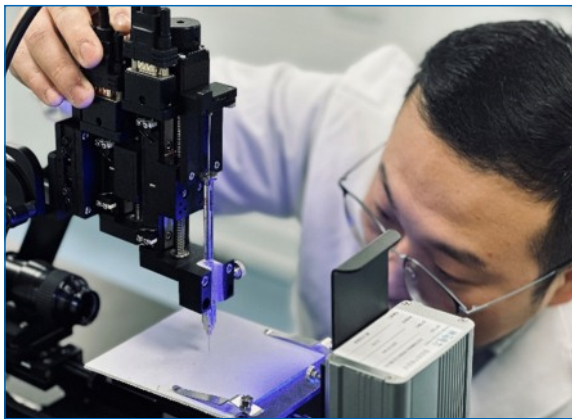


- (A) High low temperature humid-heat test box.
- (B) Optical Contact Angle Measuring Device.
- (C) Tensile Tester.
- (D) Thermal Gravimetric Analyzer.
- (E) Ultraviolet aging test chamber.

Currently, SHEMAR possesses robust and extensive in-house self-testing facilities that continually undergo refinement and enhancement. The company has established a comprehensive collection of material testing laboratories, structural mechanics testing laboratories, and electrical performance testing laboratories. These facilities are fully equipped to conduct physical and chemical property experiments on raw materials and samples, as well as structural mechanics and high-voltage electrical experiments on semi-finished and finished products. These resources enable SHEMAR to meet the research and development demands of high-quality external insulation products.



- (A) Static contact angle
- (B) Tearing strength test
- (C) Tensile strength test
- (D) Tracking and erosion resistance test



Static contact angle test

Our R&D team currently comprises 155 members, including 7 senior experts with doctorate degrees, 12 foreign technical experts, and 49 individuals with master's degrees. The team's research and development center is fortified by an interdisciplinary and cross-functional approach. With our team's continual expansion, more researchers from both domestic and international backgrounds are choosing to join SHEMAR's R&D efforts, contributing to the advancement of the green energy industry.

As of December 31, 2022, SHEMAR holds a total of **481** patents internationally.



Advantages and Reasons for Choosing SHEMAR Distribution Line Insulators

- Innovative and reliable design methods and advanced manufacturing technology
- Best-in-class composite materials and high quality components
- Rigorous production quality control plan and strict testing of products
- Fast delivery cycle and rapid after-sales service
- Eliminates or reduces maintenance, more economical life cycle cost

How to Select the Right Distribution Line Insulators

Customized solutions

At SHEMAR, we can offer customized solutions tailored to our customers' specific requirements. We take into consideration the actual working conditions, such as the required mechanical load, the connection method, coupling size of the end fittings, the pollution level and other unique applications, as well as any unique applications that need to be addressed. By doing so, we guarantee that our products will meet 100% of our customers' needs.

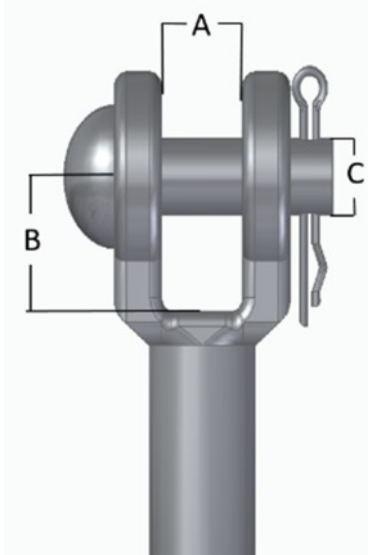
Standard catalogue products

To simplify the promotion of distribution grid projects and to facilitate quick selection by our customers, we have developed a range of standardized catalogue products to choose from. These products offer shorter delivery cycles and increased flexibility for future replacements. For ease of reference, our detailed standardized selection library is provided below.

SHEMAR Catalog Number Definition					
S	70	1	11	C	T
S=SHEMAR	SML 70=15,750lbs. [70kN] 90=20,230lbs. [90kN]	Core Dia. 1:0.625"[16mm]	Number of sheds	Tower EF E: Eye Y:Y-Clevis C: Clevis T: Tongue S: Socket J:Ball [ANSI J] K:Ball [ANSI K]	Line EF E: Eye Y:Y-Clevis C: Clevis T: Tongue S: Socket J:Ball [ANSI J] K:Ball [ANSI K]

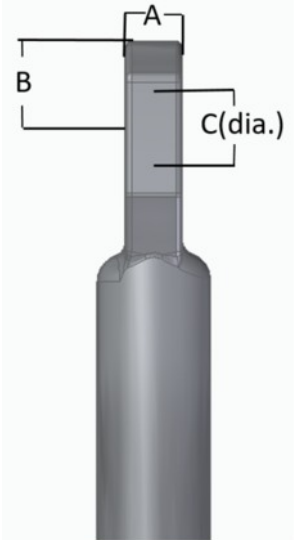
End fitting selection

SML LBS [kN]	Clevis		
	A	B	C
15,750 [70]	0.73 [18.5]	1.10 [28]	0.63 [16]
20,230 [90]	0.83 [21]	1.10 [28]	0.63 [16]



End fitting selection

SML LBS [kN]	Tongue		
	A	B	C
15,750 [70]	0.51 [13]	0.87 [22]	0.71 [18]
20,230 [90]	0.63 [16]	0.87 [22]	0.71 [18]



Dimensions are in inches [mm]

TECHNICAL DATA

Categories		Unit	Shemar Catalogue Number			
			S70104CT	S70107CT	S70109CT	S90111CT
			22SM510823	22SM510824	22SM510825	22SM510826
Voltage Class		kV	15	28	35	46
ANSI & CSA Class		-	DS-15	DS-28	DS-35	DS-46
Section Length "L"		Inch[mm]	13.4[340]	17.3[440]	19.3[490]	22.8[580]
Dry Arcing Distance		Inch[mm]	8.3[210]	12.2[310]	14.4[365]	16.9[430]
Leakage Distance		Inch[mm]	16.1[410]	27.2[692]	33.5[851]	40.2[1021]
Shed Number		-	4	7	9	11
Low-Frequency Flashover	Dry	kV	90	130	145	180
	Wet	kV	65	100	130	145
Positive Critical Impulse Flashover		kV	140	190	250	280
RIV at 1MHZ	Test	kV	15	20	30	30
	Value	μV	10	10	10	10
SML		kN	70	70	70	90
		[lbs]	[15,750]	[15,750]	[15,750]	[20,230]
RTL		kN	35	35	35	45
		[lbs]	[7,875]	[7,875]	[7,875]	[10,115]
Torsional Load		N.m	50	50	50	50
		[Ft-lb]	[36.9]	[36.9]	[36.9]	[36.9]
Weight (about)		kg	0.9	1.1	1.2	1.3
		[lb]	[1.98]	[2.42]	[2.64]	[2.87]

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