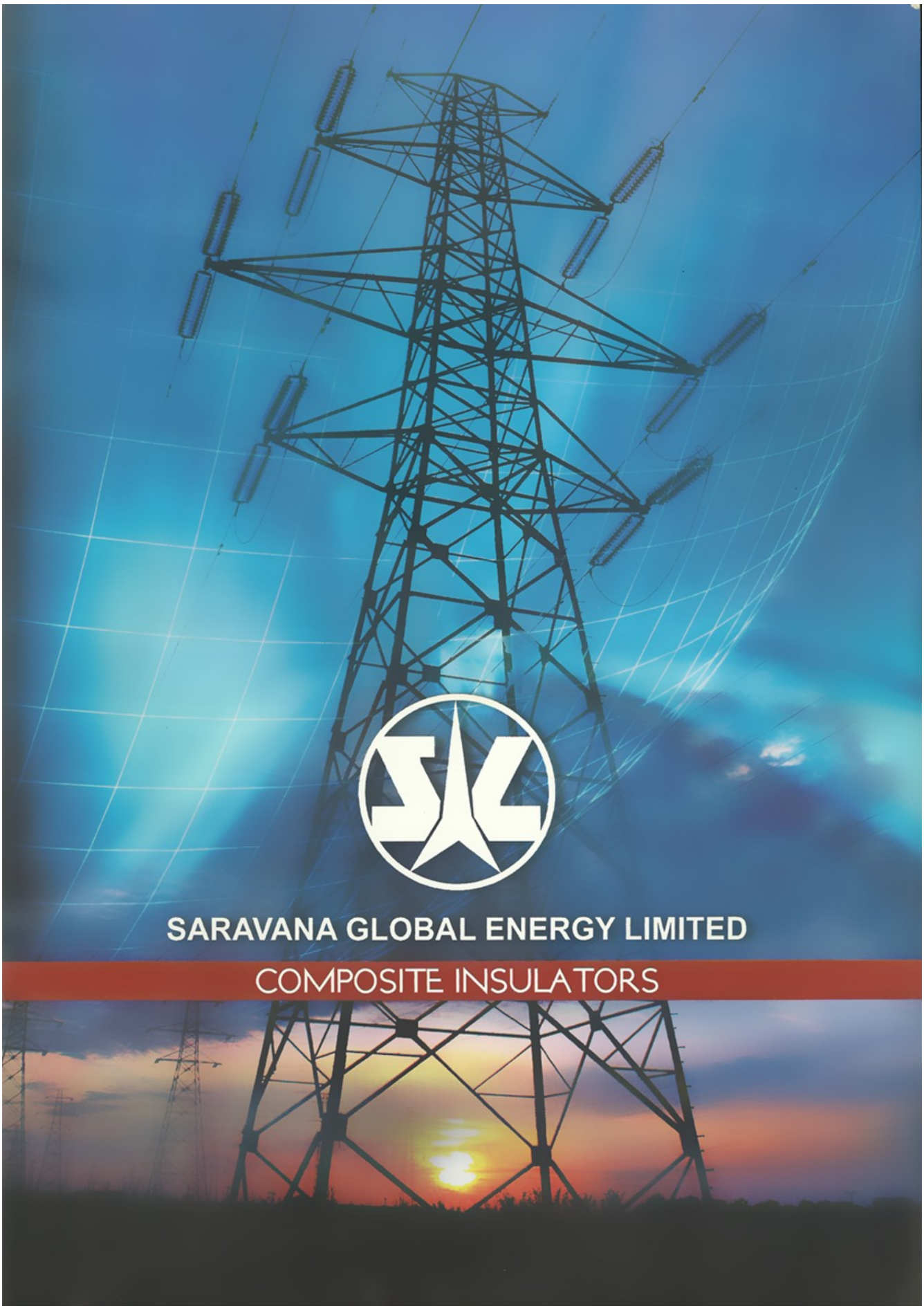

SARAVANA GLOBAL ENERGY LIMITED
COMPOSITE INSULATORS

Saravana Global Energy Limited (SGEL) is a Public Limited Company promoted by leading entrepreneurs with over three decades experience in finance, hire purchase and jewellery sectors.

The company was established by purchasing the total assets of erstwhile Seshasayee Industries Limited who were prominent suppliers of high voltage porcelain insulators to electric power utilities and power projects for more than 25 years.

After acquisition the total setup was revamped and modernized to achieve a production capacity of about 500 tonnes per month and now enhanced to 1000 tonnes per month to manufacture the following range of sophisticated products required by the power industry.

* Solid Core Post Insulators up to 800 kV
* Solid Core Long Rod Insulators up to 800 kV
* Hollow Insulators for SF6 Circuit Breakers/CTs/CVTs/Lightning Arrestors
* 25 kV Solid Core Insulators for Railway Electrification

Composite Silicone Rubber Insulators

SGEL has now focussed on the development of Composite Silicone Rubber Insulators

Advantages at a glance

- ☆ Suitable for polluted and harsh environments
- ☆ Resistance to breakage and vandalism
- ☆ Superior tracking and erosion resistance
- ☆ Resistance to earthquake
- ☆ Low leakage current
- ☆ Environment friendly process of manufacture
- ☆ Good mechanical and electrical characteristics
- ☆ Light in weight – handling and transportation advantage
- ☆ Easy to install and maintenance free
- ☆ Excellent hydrophobicity, hence no need to clean
- ☆ No Pollution flashover, hence reliable in polluted environment
- ☆ Resistance to weathering, UV and ozone
- ☆ Easy interchangeability with porcelain insulators

Injection Moulding Machines

Pultrusion Machines

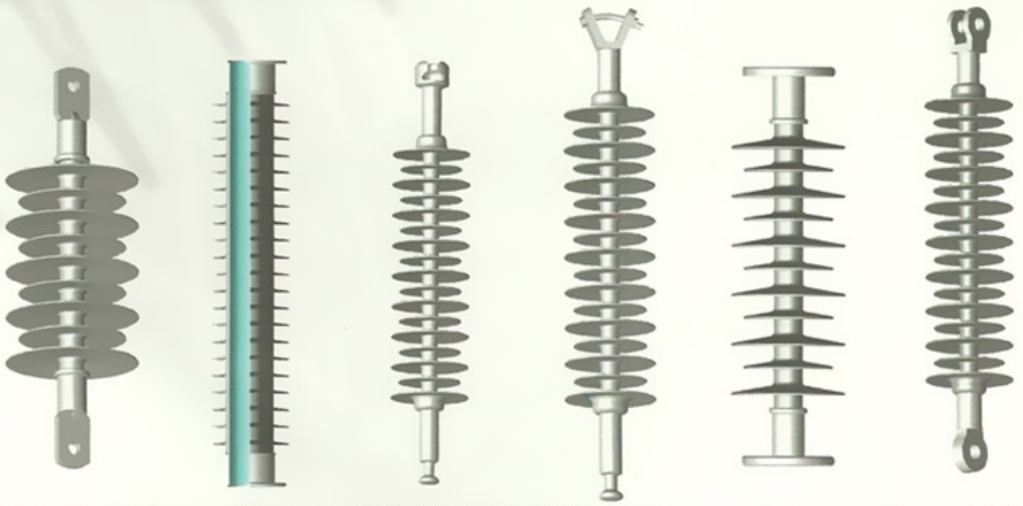
Crimping Machines

Salient Features

* SGEL insulators have qualified in 5000 hours Accelerated Ageing test as per IEC: 62217 at STRI, Sweden.
* SGEL insulators have qualified in 1000 hours Tracking and Erosion test as per IEC: 62217 at CPRI, Bangalore.
* Use of both HTV and LSR grades of silicone rubber depending upon the requirement of the product.
* Use of Silicone Rubber Compound from Global suppliers like Wacker, Momentive, Dow Corning etc.
* FRP rods are manufactured in-house using ECR grade Glass Fiber and Hydrolysis Resistant Epoxy Resin System.
* The SGEL make composite silicone rubber insulators meet the requirements of IEC: 61109, IEC: 62217, IEC: 60815, IEC: 62231, IEC: 61462, ANSI C29.13 and any relevant international standards.
* Robust packing for easy handling, transportation and site storage.

Composite Insulator Product Range

Product	Range	Specification
Distribution Insulators	11kV, 15kV, 22kV, 33kV	REC'S Specification 76/2006
Railway Insulators	All 9 Types of 25kV ac 50Hz Electric Traction	RDSO's Specification TI/SPC/OHE/ INSCOM/1070
Transmission Line Insulators (Long Rod Insulator)	66kV, 110kV, 132kV, 220kV, 400kV, 765kV	IEC: 61109, IEC: 62217, IEC: 60815 and any other Specification of Customer
Post Insulators	11kV, 33kV, 66kV, 110kV, 132kV, 220kV	IEC: 62231
Hollow Insulators	33kV, 66kV, 110kV, 132kV, 220kV	IEC: 61462



Railway Traction Insulator | Hollow Insulator | Ball & Socket Insulator | Y-Clevis & Ball Insulator | Post Insulator | Tongue & Clevis Insulator

Design

SGEL make composite insulators for high and extra high voltages are of superior quality and comply to IEC: 61109-2008, IEC: 62217-2005, IEC: 60815-3-2008.

The technology adopted is direct injection moulding of silicone rubber over FRP rod to reduce number of interfaces and the creepage distance meets the requirement of 25mm/kV and 31mm/kV

Composite insulators consist of the following components:

FRP core rod - This is the load bearing member and electrically insulating member also. The core is made of Boron free ECR grade glass fibre impregnated in the hydrolysis resistant epoxy resin system thus resistant to electrochemical corrosion normally known as brittle fracture.

End fittings - SGCI castings and En8 steel, both hot dip galvanized are used. The precise process of crimping metal fittings followed by ultrasonic crack detection onto the FRP core rod ensures high mechanical strength for both static and dynamic load.

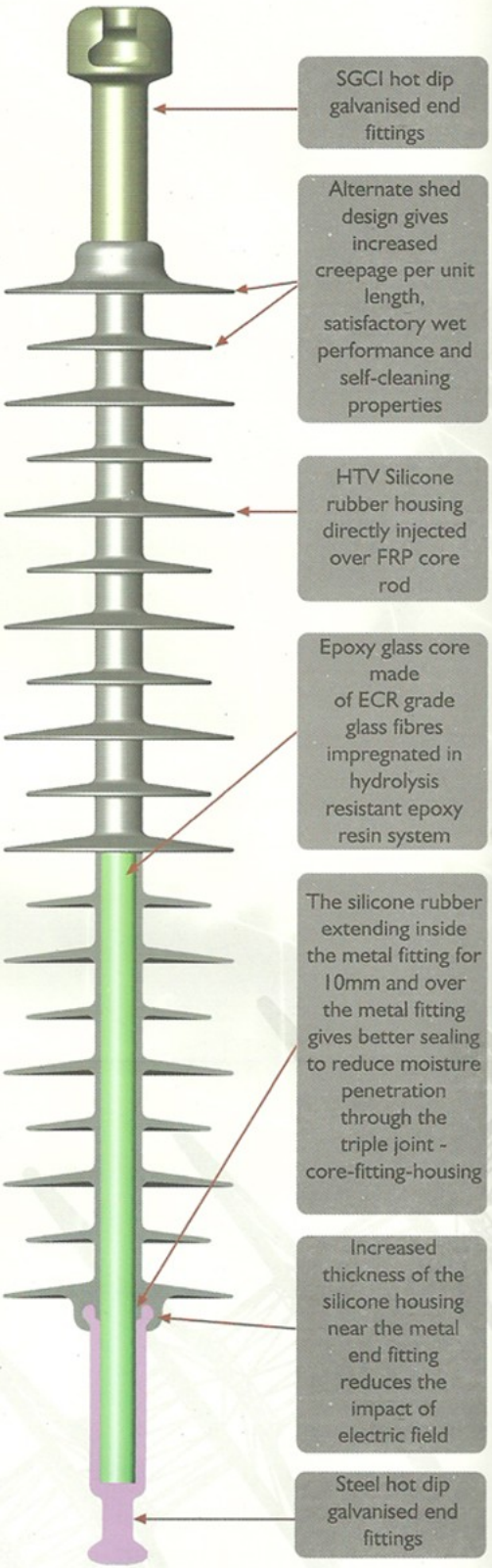
Silicone rubber housing - It is made of high temperature vulcanized (HTV) silicone rubber. It protects the FRP core rod against moisture and impurities. The silicone housing is thicker near the metal end fitting to resist the impact of electric field.

The design of both the metal fittings is such that the silicone rubber sheath extends inside the metal fitting for 10mm and covers the outer surface also for about 18mm. This design reduces the electric field intensity and ensures tightness to resist moisture entry at the triple joint - core-fitting-housing. Silicone rubber is characterized by its good recovery of hydrophobicity, high flexibility, very high mechanical strength and resistance to tracking and erosion.

Hydrophobicity - is the water repellant behaviour and avoids moistening of the insulator's surface since the water drops do not make clusters. Due to the characteristics of transfer of hydrophobicity in silicone rubber, a hydrophobic coat is formed on a layer of pollutants over the insulator surface and thus ensures very high resistance to pollution flashover.

Sheds - The aerodynamic profile of the sheds comply with the requirements of IEC:60815 and the inclination of the sheds facilitate for good self cleaning property.

SGEL make composite insulators have been designed well to meet the requirements of IEC: 61109 and IEC: 62217 design and are type tested as per international standards. The results of FEM analysis for electric field and fatigue testing reveal the superiority of SGEL make insulators.



Test Facilities

Silicone Rubber

- Tensile Strength
- Percentage Elongation
- Tear Strength
- Volume Resistivity
- Specific Gravity
- Die-electric Strength
- Hardness (Shore A)
- Weathering & UV test as per ASTM G-53
- Inclined Plane Tracking & Erosion test as per IEC: 60587
- Recovery of Hydrophobicity
- Corona Generator for destroying hydrophobicity
- Moulding machine for making rubber sheets

Accelerated Weathering Testing Machine

Insulators

- Non-destructive testing for bonding in the insulator
- Ultrasonic crack detection during crimping
- UTM for tensile load including routine testing
- Horizontal tensile test machine for test on long rod insulator including routine testing
- Bending test machine for Post and Railway Insulators
- High voltage test up to 150kV
- Water immersion test set up for distribution and railway insulators
- Water immersion test set up for long rod insulators
- Assembled core load-time test on all types of insulators

Universal Tensile Testing Machine

FRP

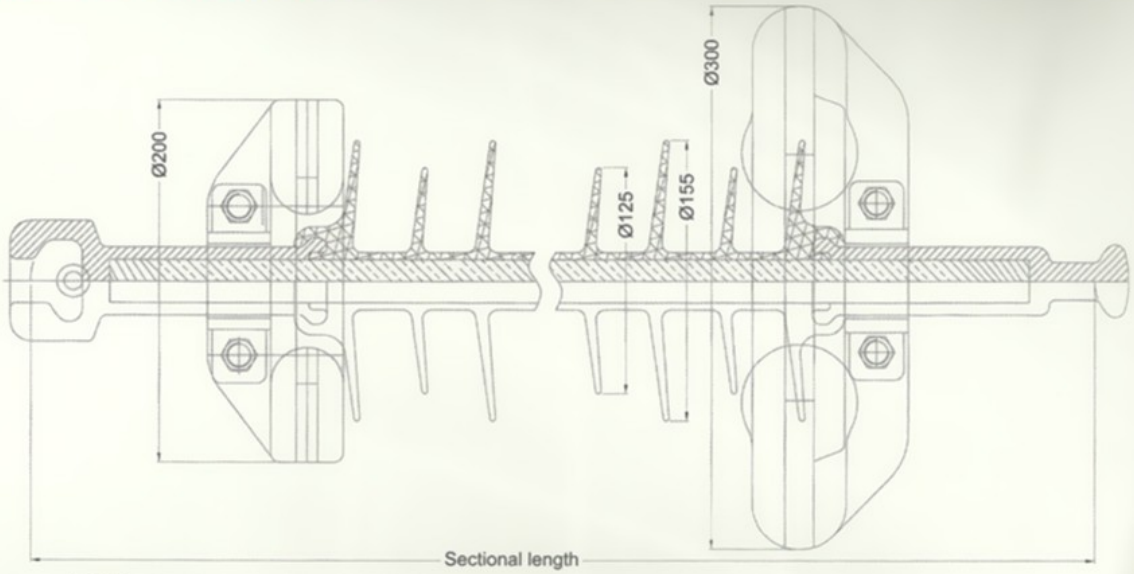
- Dye penetration
- Water diffusion
- Percentage of glass content
- Water absorption
- Brittle fracture resistance
- Bending moment
- Specific gravity
- Viscometer for resin

Metal Fittings

- Brinell hardness
- Uniformity of Zinc coating
- Mass of Zinc coating

Brinell Hardness Testing Machine

Transmission Line Insulators



NOTE: Ø 300 Grading Ring for 220kV system. Ø 300 & Ø 200 Grading Ring for 400kV system.

Sl No	System Voltage (kV)	Highest System Voltage (kV)	Dry Lightning Impulse withstand voltage (kVp)	Wet power Frequency withstand voltage kV(rms)	Mech Rating (kN)	Sectional Length (mm)	25mm/kV Creepage Distance (Min) (mm)	31mm/kV Creepage Distance (Min) (mm)
1	66	72.5	325	140	70/90	725 ± 25	1900	2245
					70/90	870 ± 25	2320	2720
					120	870 ± 25	2170	2575
					160	1020 ± 30	2600	2980
2	110	123	550	230	70/90	1015 ± 30	2895	3375
					70/90	1160 ± 35	3420	3870
					120	1160 ± 35	3270	3870
3	132	145	650	275	70/90	1305 ± 36	3970	4535
					120	1450 ± 45	4240	5050
					160	1700 ± 45	5060	5830
4	220	245	1050	460	70/90	1885 ± 50	6160	7150
					70/90	2030 ± 50	6710	7645
					120	2030 ± 50	6430	7645
					160	2380 ± 50	7530	8940
					120	2175 ± 50	6980	8160
					160	2550 ± 50	8080	9720
					160	2720 ± 50	8900	10235
5	400	420	1550	680	120	3335 ± 50	11370	13345
					120	3480 ± 50	11720	13860
					160	3910 ± 50	13290	15420
					160	4080 ± 50	13840	16190

Distribution Line Insulators

Sl No	System Voltage (kV)	Highest System Voltage (kV)	Dry Lightning Impulse withstand voltage (kVp)	Wet power Frequency withstand voltage kV(rms)	Mech Rating (kN)	Sectional Length (mm)	Creepage Distance (Min) (mm)	Type of Metal Fitting
1	11	12	75	35	45	255	320	Tongue & Clevis
					70/90	300		
2	15	17	90	45	45	299	430	
					70/90	344		
3	22	24	125	55	45	387	600	
					70/90	432		
4	33	36	170	75	45	475	900	
					70/90	520		
5	11	12	75	35	70/90	286	320	Ball & Socket
6	15	17	90	45	70/90	330	430	
7	22	24	125	55	70/90	418	600	
8	33	36	170	75	70/90	506	900	

Sl No	System Voltage (kV)	Highest System Voltage (kV)	Dry Lightning Impulse withstand voltage (kVp)	Wet power Frequency withstand voltage kV(rms)	Sectional Length (mm)	Creepage Distance (Min) (mm)	Type of Insulator
9	11	12	75	35	210	320	Post
10	33	36	200	75	508	900	
11	11	12	75	35	252	320	Pin
12	33	36	200	75	530	900	