SEDIVER

TOUGHENED GLASS INSULATORS FOR HVAC APPLICATIONS

Experts & Pioneers

CANADA - 2025

Sediver,
Experts and Pioneers in insulation technology

Sediver was established in 1898 in Saint-Yorre, France. Its history has been shaped by a series of innovations – and successes – that ultimately made Sediver what it is today: the partner of choice for utilities around the world.

We bring deep knowledge and on-the-ground experience in designing power lines and equipping them with high-quality toughened glass insulators suitable for all environments.

Our significant recurring investments in R&D have resulted in a level of technical know- how that is unique on the market. Today, we are proud of the relationships we have built with our customers around the world. Our mission is to give all people access to electricity while keeping environmental impacts as low as possible.

Supported by a worldwide network of Business Partners, we maintain the closest partnership with all our customers in more than 150 countries.

This catalog presents a selection of the Sediver® toughened glass insulator range of products answering the needs of Canadian customers in term of technical standards (CSA), best practices and environmental conditions. CSA standard C411.1 sets the basic and minimum requirements for wet-process porcelain and toughened glass transmission suspension insulators. Sediver® toughened glass insulators meet and exceed the performance requirements of CSA standard.

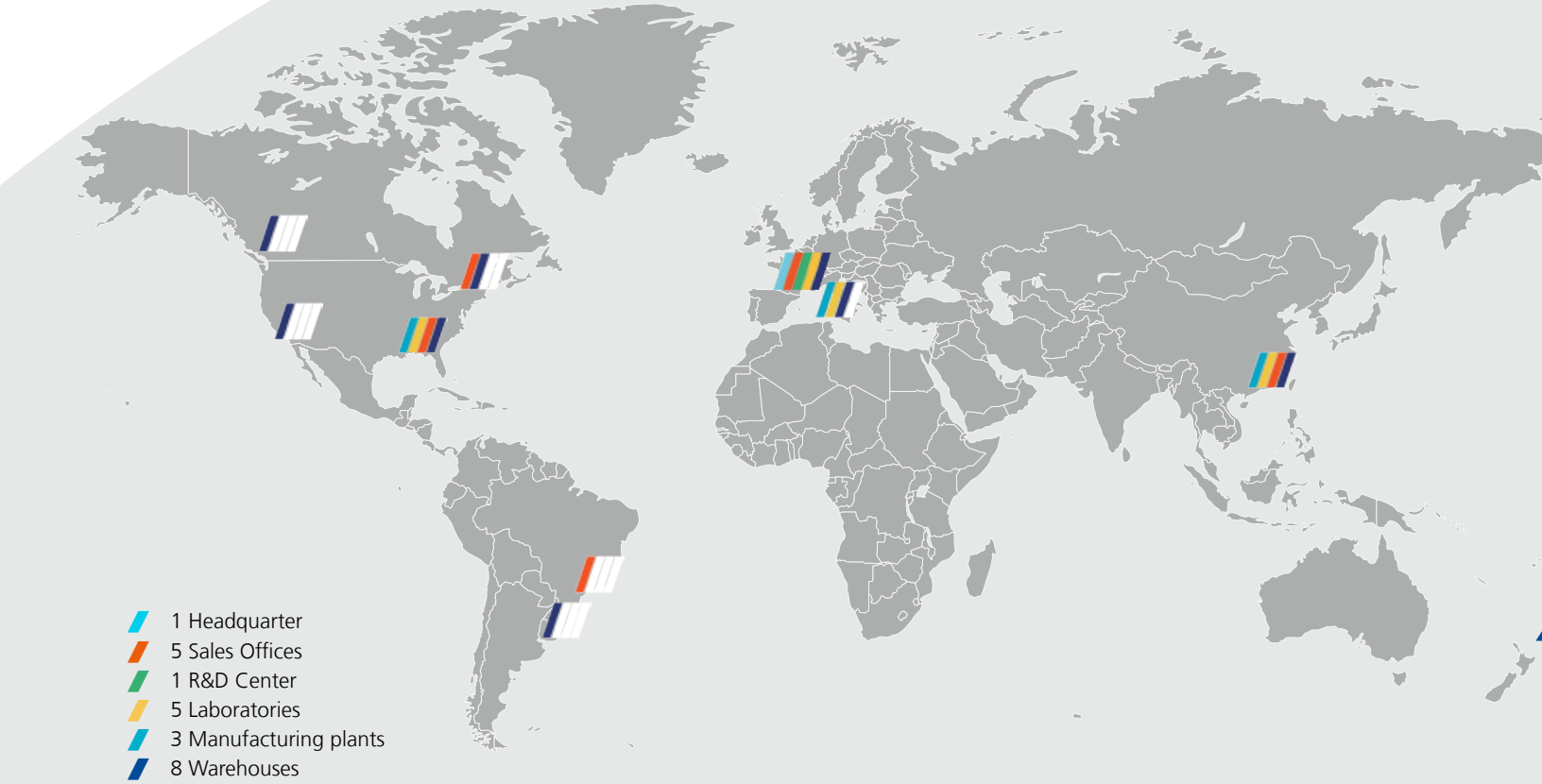
600+ million toughened glass insulators installed in more than 150 countries on lines up to **1,100 kV AC**,

11+ million toughened glass **DC** insulators installed on line up to 800 kV,

15 million insulators installed on lines **≥735 kV AC&DC UHV**,

5+ million Sedicoat insulators, silicone coated toughened glass insulators for both AC and DC applications.

Worldwide presence



1 Headquarter
5 Sales Offices
1 R&D Center
5 Laboratories
3 Manufacturing plants
8 Warehouses

We support the energy transition
by enabling a reliable and sustainable electricity supply

Our decades of experience have given us ample opportunities to experiment with and test different insulator technologies. Since 1947 we have maintained a sharp focus on the one technology capable of giving our customers the confidence and assurance they demand: toughened glass.

Since then, we have never stopped innovating to improve our products for:

- Greater efficiency in all operating conditions
- Longer lifespans in all environments
- Easier installation
- Simpler line maintenance
- Lower total cost of ownership

And, with one of the most extensive product lines on the market, we are positioned to support all types of projects, anywhere in the world.

We manufacture

High quality toughened glass insulators

Why glass?

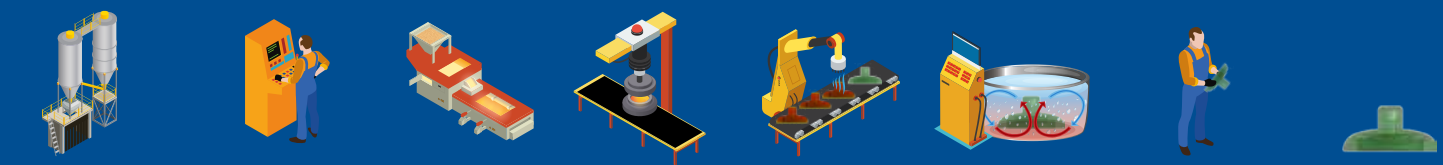
Glass is fully amorphous, it is a frozen liquid. Therefore, it has no crystallographic structure responsible for aging. Through our unique manufacturing process the glass becomes even more reliable, stable, and strong. We have decades of knowledge around this material enabling us to provide unique benefits to our customers throughout the lifecycle of their transmission line.

Our own distinctive manufacturing process

- Ensures an **outstanding homogeneity in the chemical composition of the glass** and provides **high purity** glass.
- Our unique know-how enables us to create **complex glass shapes** and products up to 16½" (420 mm) in diameter and weighing more than 22 lbs. (10 kg).
- The toughening process developed by Sediver generates a compressive pre-stress on the surface of the glass shells which confers to the glass: a high mechanical strength & high resistance to thermal shocks and mechanical impacts as well as an immunity to the effects of aging.
- A highly automated manufacturing process, perfected along the years by Sediver, guarantees consistent high levels of quality in the materials and the final product assembly.
- The assembly is done by a **specific hot curing process**, using a chemically inert cement (high strength aluminous cement) immune to the cement growth phenomena, providing outstanding mechanical stability over time & a very high mechanical strength.

- **Galvanization & zinc sleeves prevent corrosion of metal fittings**. These features help extend the service life of our insulators.
- **Very stringent quality system** comprises systematic controls and inspection of the insulators during manufacturing. The entire process is **constantly automaticaly monitored** and supervised by qualified inspectors.
- **Our process is standardized across all our production facilities, with a guaranteed consistency of our product performance worldwide.**
- Our **Quality Assurance system** and individually marked units grant the full traceability of our insulators.
- **Low shattering rate:** Guaranteed < 1/10,000 per year due to the high purity of Sediver® glass and outstanding process.

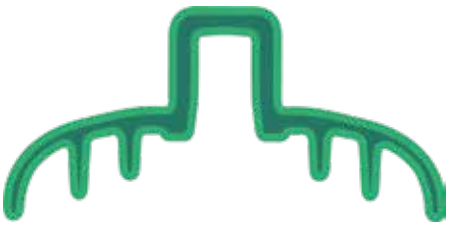
GLASS LINE



ASSEMBLY LINE

Focus on toughening process

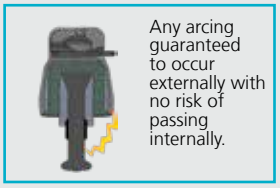
The toughening process consists of **inducing pre-stresses to the glass shell** by a rapid and precisely controlled cooling of the glass shell. The pre-stresses result in **compressive forces** on the outer surface layer balanced by **extension forces** inside the body of the glass shell.



Toughening provides our insulators:

- **High mechanical** strength.
- **High resistance to thermal shocks.**
- **No aging** thanks to the toughening treatment.
- **High resistance to the most extreme surges** such as switching surges, steep front lightning strikes and power arcs.
- Unique property of **breaking in a predictable pattern** when overstressed mechanically or electrically. Crumbling of the glass shell always results in fragments of safety glass with no razor–sharp shards.
- **Binary Nature.** Only exists in 2 well-defined states: fully intact or as a mechanically & electrically safe stub. Visual inspection provides 100% infallible data at glance: no possible hidden cracks, ease of inspection, with no instruments needed.

With glass, the line will not drop



Intact shell	Damaged shell
• Guaranteed absence of internal cracks or electrical punctures. • 100% of the mechanical rating guaranteed over prolonged periods of time even in very harsh condition • 100% electrical strength	• Residual mechanical strength: 80% of the mechanical rating guaranteed over prolonged periods of time even in very harsh conditions • Residual electrical strength: Avoiding internal puncture and forcing overvoltage induced discharges externally
Therefore	
• Ease of inspection: No need to climb structures or to use sophisticated instrumentation. • Enhanced workers' safety in live line operations. • Very low cost of inspection for the entire service life of the line.	• No risk of separation or line drops. • No urgency in replacing a unit with a broken shell. • Long-term savings in maintenance operations.

Global user benefits

- Superior mechanical, electrical and safety performance
- Very **resistant** to rough handling.
- **Easy transportation** and installation at site.
- **No risk of installing a damaged unit.**
- Residual mechanical strength: **no urgency in replacing an insulator with a broken glass shell.**
- **The lifetime of Sediver® glass insulators equals or exceeds the lifetime of the conductors, hardware and structures.**
- Sediver® toughened glass insulators offer **the lowest life cycle cost of all insulating solutions.**

Our worldwide network of experts
at your service

Innovating to bring our customers greater added value every day

At Sediver, we invest heavily in R&D. The drive to innovate is one of our people's biggest motivators. For a mission-critical product like high-voltage transmission line insulators, innovation is not onlypossible, it is vital!

Our R&D department brings a high level of engagement and commitment to improving the performance, sustainability, and reliability of our products and services.

- By **working closely with our customers** to help them design the most efficient lines possible and by developing custom solutions for their projects.
- By **developing products** for the environments in which they will be used. We deliver solutions whose implementation, operation, maintenance, and resistance to harsh environments have been researched and tested.
- By **offering training classes** to help our customers keep their knowledge up to date with the latest regulatory and technical information.
- By **sharing our results** with the international technical community and with grid operators around the world through regular technical publications.

Technical support even from the beginning of your project

Our team performs:

- Research and testing through our global network of laboratories, including electric field simulations and analysis
- Development of string designs and custom solutions with dedicated quality and testing programs
- In-field assessments of in-service insulators and on-site pollution measurements
- Technical consultation on selection of insulation solution and specification
- Solving technical issues relating to the operating conditions of the lines
- Evaluating end-of-life timeline for in-service insulators

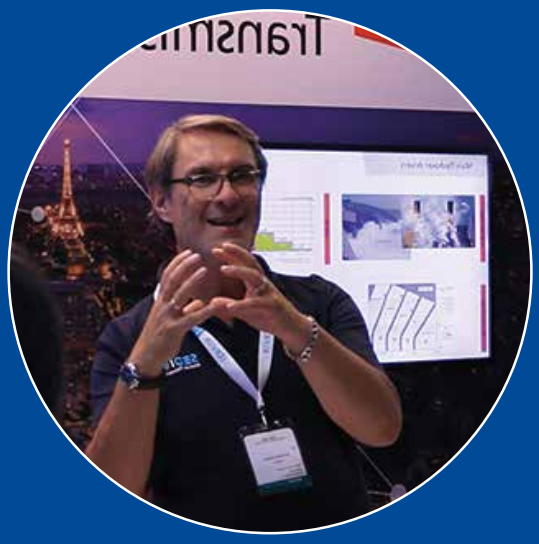
Our laboratory network

The equipment and facilities of our 5 research and testing centers ensure the development of insulators with excellent long-term behavior and performance. Sediver laboratories are all **ISO 9001 or ISO 17025** certified. **We can perform dielectric tests on single units and complete strings of insulators for glass, porcelain and composites according to relevant standards in IEC, ANSI and CSA.**

- Investigation and research in **material science**: Vital to ensure a high level of performance and reliability of our insulators
- **Mechanical** endurance testing: Essential to designing insulators with excellent long-term behavior under extreme service conditions
- Evaluation of the insulators' **electrical** performance: Fundamental to assess the performance of any type of insulator string configuration
- Evaluation of the **pollution** performance of insulators and complete strings: Critical for the choice of the right insulator adapted to each specific environmental condition

Main testing equipment per country	China	France	Italy	USA
Dielectric tests on insulator units	✔	✔	✔	✔
Dielectric tests on complete strings		up to 800 kV*		
AC Salt-fog Pollution tests		250 kV		
AC Solid layer Pollution tests		250 kV		
DC Pollution tests (salt fog/solid layer)		350 kV		
DC Sample tests according to IEC 61325	✔	✔	✔	✔
DC Type tests according to IEC 61325		✔		
Mechanical tests on insulator units	✔	✔	✔	✔
Thermal-mechanical tests	✔	✔	✔	✔
Long duration vibration tests on complete strings		2 Hz to 30 Hz *1		
Standard sample tests according to national and international standards	✔	✔	✔	✔
Fatigue test station		✔		

* line equipment
*1 2 Hz to 30 Hz, 60 kN per conductor, 6 conductors - 40 m span



Toughened glass insulators technology
The basics

Definitions

Figure 1

Selecting the appropriate profile of insulators for your line's environment is essential to obtain the necessary arcing and leakage distances necessary to avoid flashovers.

- **Arcing distance**: the shortest air distance between metal parts which can be used by an external arc as shown in red in Figure 1.
- **Leakage distance**: distance along the glass shell surface of the insulator as shown in yellow in Figure 2.

Figure 2

Unlike the arcing distance, which is the distance an electric arc will have to bridge during lightning or other events, the **leakage distance is THE parameter to be considered in polluted environments**.

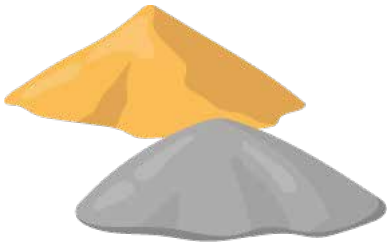
- **USCD**: the **U**nified **S**pecified **C**reepage **D**istance for a given application given in mm/kV where the leakage distance of a string of insulators divided by the line's maximum phase-to-ground voltage.

Defining solid pollution

Any contaminants deposited over the surface of the insulator impacting the performance of the string

Types/sources of solid pollution

INDUSTRIAL



SAND/DUST

COASTAL

ROAD SALT/SNOW & ICE

WILDLIFE

AGRICULTURAL

Measuring pollution levels

Evaluating pollution levels requires the washing of an insulator's surface with deionized water and measuring both ESDD & NSDD.

Quantifies the accumulation of conductive contaminants on an insulator.

Represents the amount of contamination on an insulator undissolved by water

Pollution accumulation/ what are the risks? How does flashover occur?

1- Pollution deposits, day after day, over the time, time driven process depending on environmental conditions, until it reaches a critical level

2- Wetting of the solid layer pollution by rain, dew, fog etc.

3- Development of surface leakage current in the conductive layer (pollution+water). This surface leakage current along the polluted surface generates dry bands.

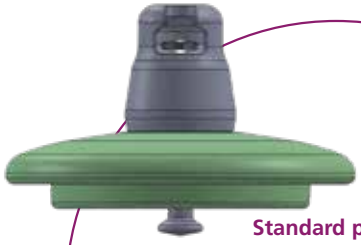
4- Localised drying causes partial flashover of dry bands.

5- If the resistance of the remaining layer is low enough, arcs can extend along the insulator.

6- Flashover.

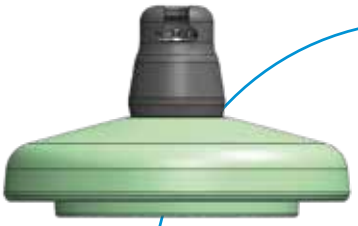
High voltage transmission lines
selecting the proper profile

Throughout decades, Sediver engineers have developed and designed different types of insulators adapted to all climates and environments, such as described in technical standard IEC 60815-1



Standard profile

The standard profile is characterized by a leakage distance* higher than the values indicated in CSA C411.1 and by well-spaced under-ribs that allow an effective self-cleaning action by wind or rain. It is particularly effective in suspension and tension applications in very light to medium polluted areas (Examples: areas E1 to E4). It is the most commonly used profile for inland projects.



Fog type profile

The fog type profile is characterized by long and widely-spaced under-ribs, which prevent arc bridging between adjacent ribs. It is particularly effective in coastal areas (Salt fog environment) as well as in locally polluted areas where a higher specific leakage distance* is required.(Examples: areas E5 to E7).

Open profile

The open type profile features no under-ribs to avoid the accumulation of solid pollution deposits (dust, sand) on its lower surface. It is particularly adapted to suspension and tension applications in dry desertic areas where wind is predominant and rain infrequent. (Example: areas E1 to E4).

* or creepage distance

Made for your operating conditions

Corrosion prevention sleeve

In severely corrosive marine and industrial atmospheres, the galvanized coating on suspension insulator pins may deteriorate over time and be followed by corrosion of the pin itself. To prevent this form of pin damage, Sediver can supply insulators equipped with a corrosion retardation sleeve made of high-purity zinc.

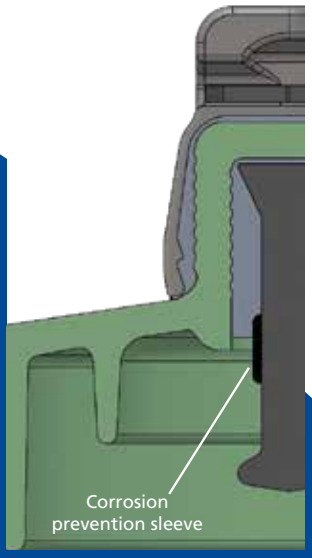
Metallurgy

Our insulators meet the CSA C411.1's metallurgical requirements and are well-suited and proven to perform in Canada's varying operating conditions.

Heavy galvanization

All Sediver® ferrous metal fittings are hot-dip galvanized. IEC 60383-1 and ASTM A153-82 require a zinc coating mass of 600/610 g/m² corresponding to a thickness of 85/86 µm. In severe conditions, where this standard protection is known to be insufficient, Sediver offers enhanced protection of the cap and the pin by increasing the thickness of zinc to 120 µm, or up to 130 µm.

For specific insulators not presented in this catalogue, or for specific applications such as extreme pollution areas or direct current, please contact us.

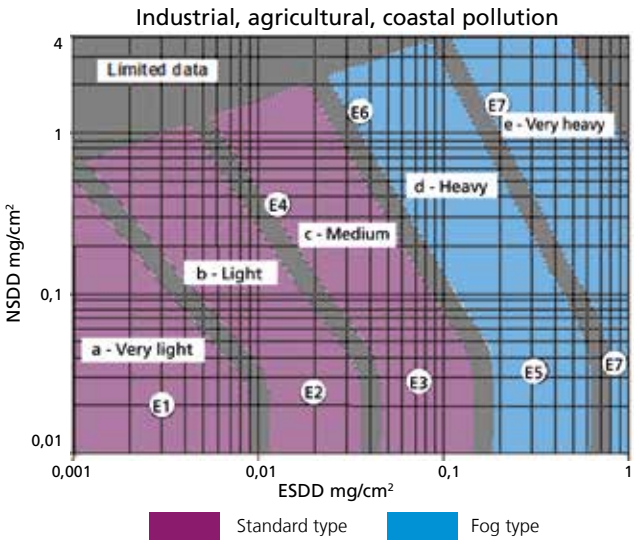


Selection criteria for pollution management

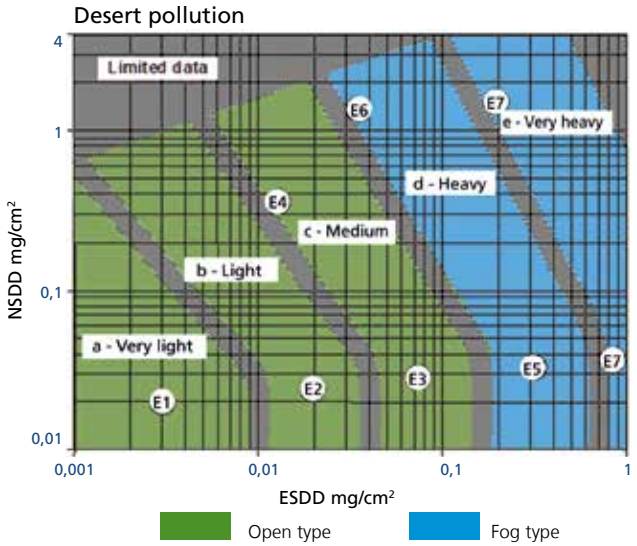
Insulator profile selection

Technical standard IEC 60815-1 defines 5 levels of pollution according to the pollution severity: very light, light, medium, heavy and very heavy.

The levels of pollution are defined according to the Equivalent Salt Deposit Density (ESDD) and the Non-Soluble Deposit Density (NSDD) on the surface of the insulator.



In the case of industrial, agricultural and coastal pollution, Sediver recommends the use of the standard profile in very light, light and medium polluted areas and the fog type profile in heavy and very heavy polluted areas.

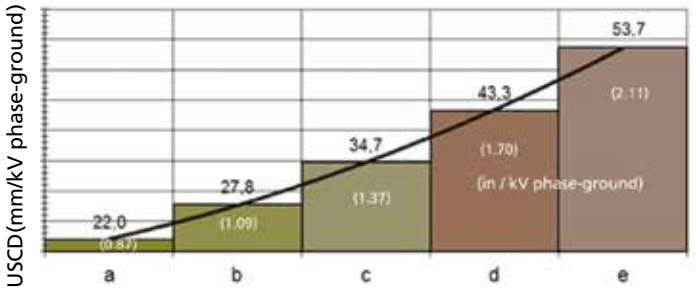


In the case of desert pollution Sediver recommends the use of the open profile in very light, light and medium polluted areas and the fog type profile in heavy and very heavy polluted areas.

Insulation level

The number of insulators per string depends on the maximum voltage of the transmission line and the pollution severity of the region. It should be calculated in accordance with the specific creepage distance (USCD*) as defined by the IEC 60815-2 standard.

Reference USCD depending on the pollution level



(*) USCD = Leakage distance of the string of insulators divided by the RMS value of the highest power frequency voltage seen by the string (phase - ground).

String dimensioning example:

For a 500 kV line, located on the coast in a heavy pollution level
(max. phase-ground voltage: 525 / √ 3=303 kV)

Selected insulator: N180P/160DC
(fog type profile with 21 1/2 in leakage distance)

Total leakage distance needed: 1.7 x303 = 515.1 inch.

Number of insulators in the string:
515.1 / 21.5 = 24 insulators.

Sedicoat - RTV coated insulators
solution for pollution mitigation

A proven solution with 5 million insulators in service & 25+ years of satisfactory service

Sedicoat RTV Coated glass insulators

Based on extensive testing and large field experience with 5 million RTV coated glass insulators (Sedicoat) supplied over a period of 25+ years worldwide, Sediver offers high-quality factory coated glass insulators as part of our standard product range.

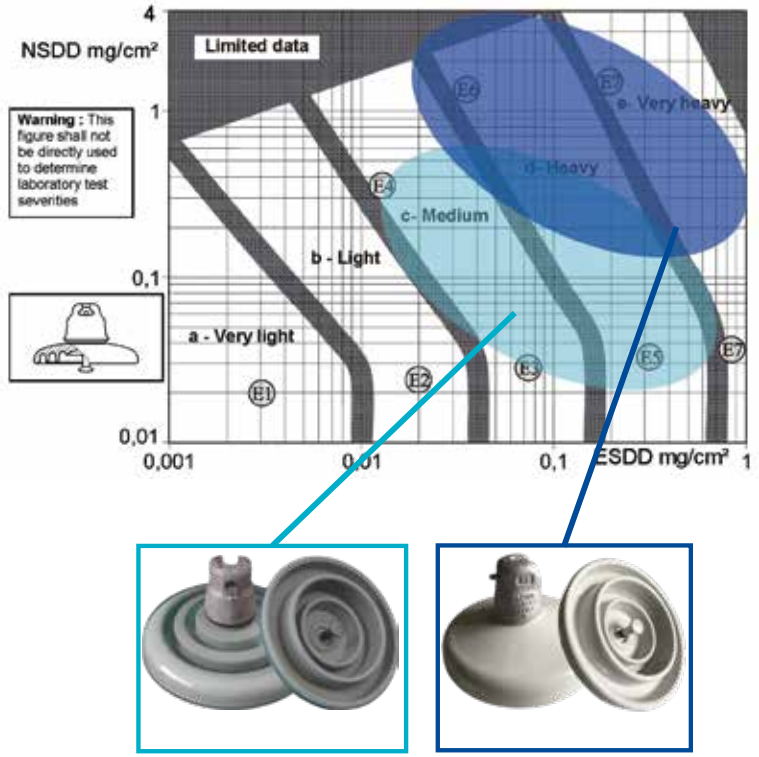
Sedicoat is a combination of a high-performance material with a fully-controlled, industrial application process.

Sedicoat was developed to eliminate or dramatically reduce the need for washing insulator strings in areas of heavy and very heavy contamination. It also helps to improve the performance of insulators in areas of medium contamination, while retaining the inherent self-detecting features and longevity of toughened glass.

While fully coated insulators were the initial approach to pollution mitigation, Sediver introduced under coated insulators for the first time in 2010 as an optional feature.

All Sediver toughened glass insulator models can be coated.

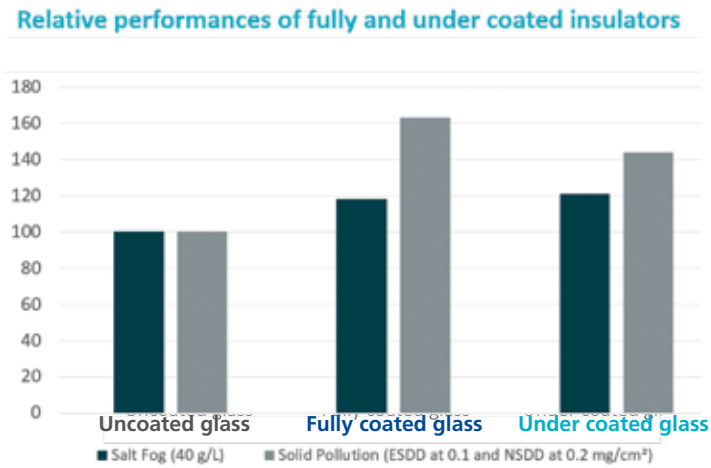
Insulator strings in very heavy (IEC) pollution classes will generally require fully coated insulators, while undercoated insulators are suitable for medium and heavy pollution areas (IEC) as shown below. For specific cases, where high NSDD levels are registered, Sediver technical support can assist engineers to evaluate the best fit on a case by case situation.



Sediver's Sedicoat maintains the unique properties of our toughened glass insulators while eliminating the risk of flashovers

Undercoated insulators

Under coating, in many cases, offers an optimal solution since it provides a performance close to a fully coated insulator, with the benefit of packing and handling conditions similar to non-coated insulators. A comparison between fully and under coated insulators is shown below



Application of Sedicoat insulators to enhance pollution performance

RTV coated insulators can be used to either optimize a string length at design stage or improve the performance of insulators in highly polluted environments for existing lines by increasing the effectiveness of the leakage distance compared to non-coated insulators.

For short line sections where the pollution deposit is homogeneous the use of coated glass can be justified for the entire line.

For longer lines with multiple pollution levels along the route, a flexible approach can be used by coating some sections only, increasing the effectiveness of the USCD (Unified Specific Creepage distance) wherever needed. In many cases this will help achieving a line design where similar string and tower designs can be used while adapting the string performance to each specific environment.

Long term performance of coated glass insulators

The performance and lifetime of silicone coatings depend on the silicone type, the adherence of the silicone layer to the glass shell, the thickness and the homogeneity of the coating.

To obtain optimal performance, Sediver® has set in place a stringent R&D program. The silicones qualified by Sediver® have been specifically selected to resist the severe electrical conditions cap and pin insulators face on overhead lines in polluted environments.

The application of the coating is done at the factory according to a specific industrial process qualified by Sediver.

Sediver has performed extensive testing before offering this solution while monitoring closely from the very beginning how these insulators perform and age. Assisting end users in their selection, SEDIVER also recommends a selection method which includes a 2000h long-term aging, multi-stress testas shown below:

Left: test setup.

Middle & right: at the end of the test, the strong hydrophobicity and overall condition demonstrates the strong performance and lack of erosion on Sedicoat coated insulators after 2000 h multi-stress test

Safety, reliability, and peace of mind
with Sediver® toughened glass insulators

Safety in handling and construction

Due to Sediver® glass insulators' high resistance to mechanical impact, the stringing and line construction is much easier, while the number of accidentally damaged insulators is significantly lower than with porcelain insulators.

The small fragments from an unlikely damaged shell will not harm personnel or equipment.

Lastly, as the detection of any damage during installation is evident and immediate, the risk of installing a damaged unit is non-existent.

Ease of inspection

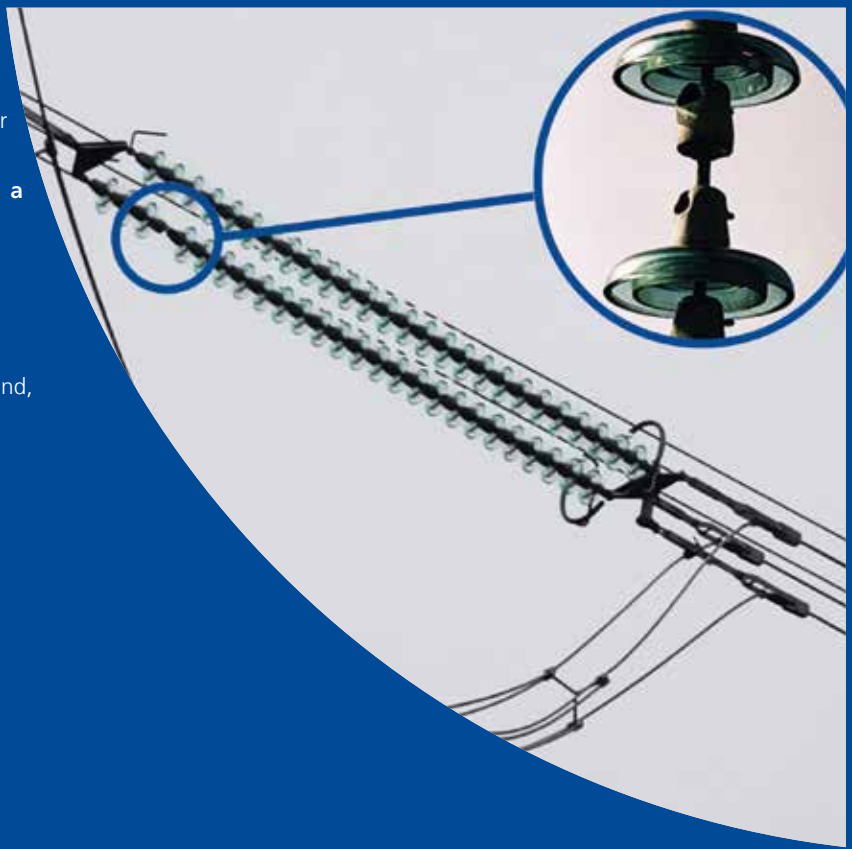
A visual inspection at a glance provides 100% infallible data regarding the condition of Sediver Toughened Glass Insulators.

The inspection costs are thus reduced to a minimum throughout the life cycle of the line.

- No climbing, no bucket truck, no training needed
- No instruments required
- Maximum safety for live-line working
- Can be done by helicopter, drone or from the ground, covering many miles of line per day.

No hidden cracks or punctures

- Binary behavior (intact or stub)
- Stub mechanically and electrically safe



Safe for live-line work

Sediver® toughened glass insulators are, above any other technology, highly suitable for safe live-line maintenance operations.

Thanks to the unique properties of toughened glass, which cannot have hidden punctures nor become conductive due to tracking, maintenance crews can do live-line work in full confidence since there are no hidden risks due to internally damaged insulators.

Unlike other materials, such as porcelain or composites, a quick and easy visual inspection is enough to identify the state of the toughened glass insulators without any possible mistake. The inspection costs are thus reduced to a minimum throughout the life cycle of the line.

Even with a missing shell, the remaining stub is mechanically & electrically safe with a guaranteed 80% residual strength.

The small fragments from an unlikely damaged shell will not harm personnel or equipment as well as the remaining stub

Peace of mind

Insulators must survive both extreme environmental conditions as well as in-service stresses for 50+ years without any failures or service interruptions.

For example the reliability of insulators during or after a fire is a key consideration for T&D line design or refurbishment.

Transmission Line Operators must evaluate the risk of a line drop in the proximity of a fire as well as the possibility for a catastrophic failure afterwards resulting from a degraded insulator.

Toughened Glass insulators do not lose their performance after a fire*

- Non-combustible glass insulators
- Toughened glass: no crack propagation or puncture
- Easy visual inspection after the fire
- Mechanically safe at high temperatures and even with a damaged shell

* Based on «Overhead lines under extreme heat resulting» by Jean-Marie GEORGE (Scientific Director) & Sandrine PRAT (PhD Research Manager) - T&D World library - wildfire risk mitigation for electric utilities.

Specific applications
use the right toughened glass insulator

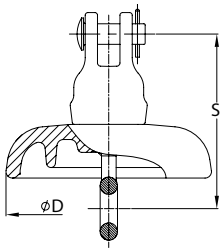
Distribution lines

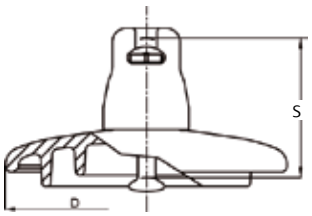
Designed for distribution applications, Sediver toughened glass insulators are strong, durable and easy to inspect.

The toughened glass dielectric shell provides superior resistance to damage in shipment, storage, installation and service.

They are ideal for hotline work and pose no risk of line drops.

Damaged units can be easily detected by visual inspection. The small fragments from an unlikely damaged shell will not harm personnel or equipment.





Bird issue mitigation

By including an open profile insulator at the top of the string you will, without any new hardware required:

- Protect the insulator string below
- Maintain the existing string length
- Maintain safe live-line working conditions
- Reduce or eliminate the need for washing
- Reduce or eliminate flashovers due to bird mute

Ice bridging solutions in contaminated areas

The large diameter of the open profile glass shell can be used advantageously to alleviate ice bridging problems.

Flashovers due to ice bridging can occur under specific climatic conditions with ambient temperature close to the melting point of ice. Urban areas with the presence of atmospheric particles and contaminants are most prone to ice bridging problems.

The use of alternate shed profile insulators reduces the risk of flashovers due to ice bridging since it effectively doubles the length of icicles required to bridge in between insulators.

Other applications on demand

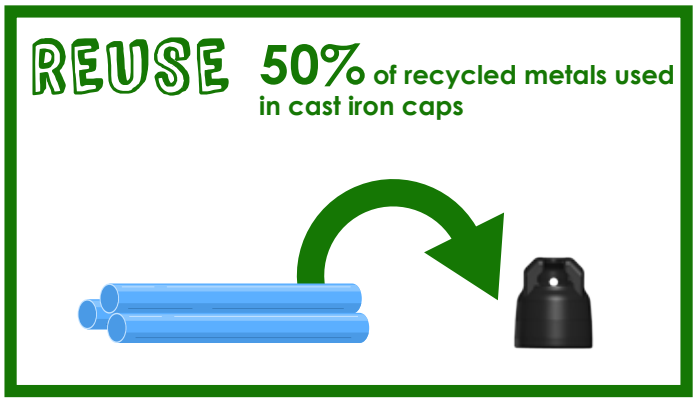
Our products are inherently
more resilient and sustainable

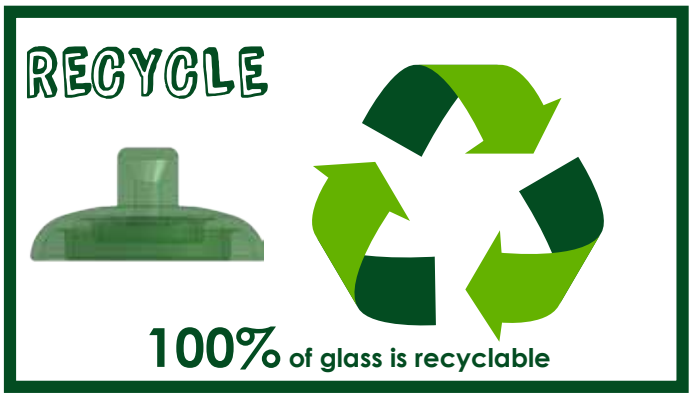
Sediver® toughened glass insulators are suitable for renewable applications

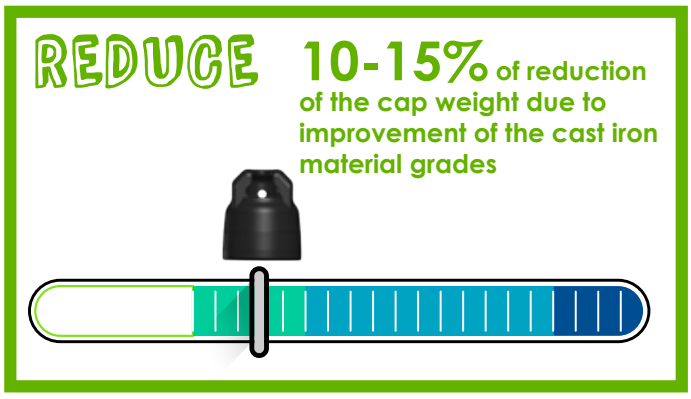
By essence, our core activity contributes to better access to energy, easier integration of renewable energy and accelerated electrification by supporting grid infrastructure expansion & decarbonization

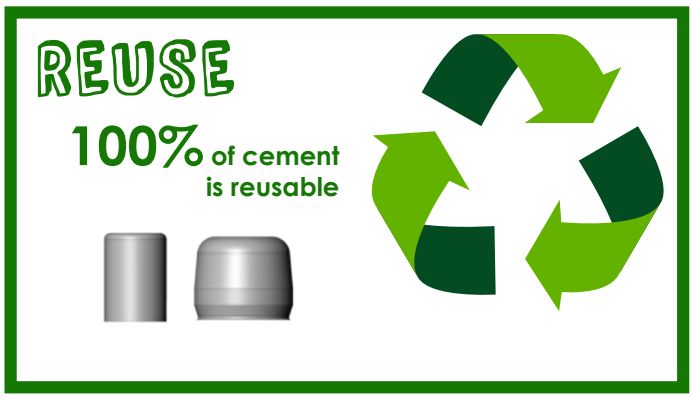
- Our products' quality ensures a service life which meets or exceeds that of all other components on the line: high quality insulators translating into higher line reliability and lower replacement needs.
- Our insulators have the unique ability to withstand mechanical, thermal and electrical stresses with no aging or degradation of the dielectric performance.
- Glass insulators are 100% recyclable.

Sustainability: our commitment is to improve our environmental performance









Packaging Quality Matters

Packaging Units

The packaging and palletizing methods used by SEDIVER® are the result of a precise analysis of needs, the optimization of transport methods, and the latest packaging technologies. This ensures the design of highly reliable, well-adapted packaging.

All packaging units have been specifically developed to offer effective protection for our products during transport.

1. Primary Packaging: The Wooden Crate

Factory-assembled **SEDIVER®** insulators are short-chain packed in clear wooden crates, which constitute the primary packaging. They are primarily designed to support the weight of the products and ensure their protection. External metal ties make it easy to open and close the crate, while locking it firmly in place to maintain the integrity of the primary packaging during transport.

Additional protection can be added for specific products requiring a higher level of protection.

2. The logistical unit: Pallets for Crate Transport

The logistics unit consists of a wooden pallet holding a predefined number of crates, structured to meet logistical and safety constraints. Strapping is added on both sides of the pallet to hold the load in place during handling and transport. Finally, a plastic cover protects the products from external pollution, notably dust, ensuring that shipments arrive clean at our customers' locations.

3. Traceability Systems

Each case is specifically marked to identify the products it contains.

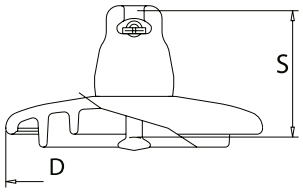
In addition, a traceability label is affixed to each logistics unit, listing product information, quality controls, and weight and size indications.

4. Customized packaging

SEDIVER® can design and propose customized packaging solutions to meet specific customer requirements, in line with our production standards.

® toughened glass suspension insulators
Socket type

ANSI



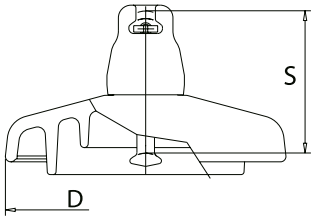
		Standard Profile					
Insulator type		**N70/146**	**N12/146**	**N160/146**	**N16/171**	**N21/156**	**N21/171**
CSA type		CS-3	CS-5	CS-8	CS-8A	CS-11	CS-11A
Equivalent ANSI class or IEC		52-3-L	52-5-L	52-8-L		52-11	
Coupling according to ANSI C29.2B or IEC 60120		Type B	Type J	Type K	Type K	Type K	Type K
MECHANICAL CHARACTERISTICS							
Mechanical failing load	kN	70	120	160	160	222	222
	lbs	15,000	25,000	36,000	36,000	50,000	50,000
Impact strength	*N-m*	45	45	45	45	45	45
	in-lbs	400	400	400	400	400	400
Tension proof	*kN*	35	60	80	80	111	111
	lbs	7,500	12,500	18,000	18,000	25,000	25,000
DIMENSIONS							
Diameter (D)	*mm*	255	255	280	280	280	280
	in	10	10	11	11	11	11
Spacing (S)	*mm*	146	146	146	171	156	171
	in	5 3/4	5 3/4	5 3/4	6 3/4	6 1/8	6 3/4
Creepage distance	*mm*	320	320	380	380	380	380
	in	12 5/8	12 5/8	15	15	15	15
ELECTRICAL CHARACTERISTICS							
Low frequency dry flashover	kV	80	80	80	80	80	80
Low frequency wet flashover	kV	50	50	50	50	50	50
Positive critical impulse flashover	kV	125	125	125	125	140	140
Negative critical impulse flashover	kV	130	130	130	130	140	140
Low frequency puncture voltage	kV	130	130	130	130	130	130
R.I.V low frequency test voltage	kV	10	10	10	10	10	10
Max. RIV at 1 MHz	µV	50	50	50	50	50	50
PACKING AND SHIPPING DATA							
Approx. net weight per unit	kg	3.8	4	6.2	6.6	7.2	7.2
No. of insulators per crate		6	6	6	6	6	6
Volume per crate	m^3	0.06	0.06	0.09	0.09	0.08	0.09
Gross weight per crate	kg	27	28	43	46	50	50
No. of insulators per pallet		96	96	54	54	54	54
Volume per pallet	m^3	1.40	1.40	1.20	1.20	1.20	1.20
Gross weight per pallet	kg	463	482	415	442	471	474

Custom products are also available

Sediver® toughened glass suspension insulators
Ball & Socket type

ANSI

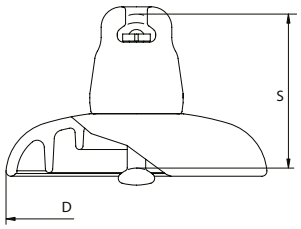
IEC



		Fog profile			
Insulator type		**N12P/146DC**	**N16P/171DC**	**N21P/171DC**	**F300P/195DC**
Coupling according to ANSI C29.2B		Type J	Type K	Type K	IEC 24
MECHANICAL CHARACTERISTICS					
Mechanical failing load	kN	120	160	222	300
	lbs	*25,000*	*36,000*	*50,000*	*66,000*
Impact strength	N-m	45	45	45	45
	in-lbs	*400*	*400*	*400*	*400*
Tension proof	kN	60	80	111	150
	lbs	*12,500*	*18,000*	*25,000*	*33,000*
DIMENSIONS					
Diameter (D)	mm	280	330	330	360
	in	*11*	*13*	*13*	14 1/8
Spacing (S)	mm	146	171	171	195
	in	*5 3/4*	*6 3/4*	*6 3/4*	7 5/8
Creepage distance	mm	445	545	545	635
	in	*17 1/2*	*21 1/2*	*21 1/2*	*25*
ELECTRICAL CHARACTERISTICS					
Low frequency dry flashover	kV	100	105	105	105
Low frequency wet flashover	kV	60	65	65	65
Positive critical impulse flashover	kV	140	170	170	170
Negative critical impulse flashover	kV	140	160	160	160
Low frequency puncture voltage	kV	130	130	130	130
R.I.V low frequency test voltage	kV	10	10	10	10
Max. RIV at 1 MHz	µV	50	50	50	50
PACKING AND SHIPPING DATA					
Approx. net weight per unit	kg	5.6	9.1	9.9	13,6
No. of insulators per crate		6	6	6	2
Volume per crate	m^3	0.08	0.12	0.12	0,06
Gross weight per crate	kg	40	61	66	34,7
No. of insulators per pallet		54	54	54	24
Volume per pallet	m^3	1.20	1.38	1.38	1,13
Gross weight per pallet	kg	383	577	620	413

Sediver® toughened glass suspension insulators
Ball & Socket type

IEC

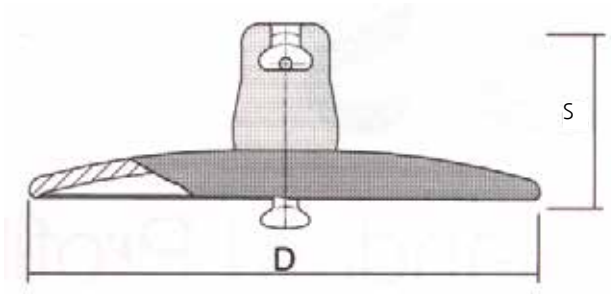


		Standard Profile		
Insulator type		**F300/195**	**F400/205**	**F530/240DC**
CSA type		CS-13	CS-14	
Equivalent ANSI class or IEC		U300B	U400B	
Coupling according to ANSI C29.2B or IEC 60120		IEC 24	IEC 28	IEC 32
MECHANICAL CHARACTERISTICS				
Mechanical failing load	kN	300	400	530
	lbs	*66,000*	*90,000*	*120,000*
Impact strength	*N-m*	45	45	45
	in-lbs	*400*	*400*	*400*
Tension proof	*kN*	150	200	265
	lbs	*33,000*	*45,000*	*60,000*
DIMENSIONS				
Diameter (D)	*mm*	320	360	360
	in	*12 5/8*	*14 1/8*	*14 1/8*
Spacing (S)	*mm*	195	205	240
	in	*7 11/16*	*8 1/16*	9 1/2
Creepage distance	*mm*	480	550	635
	in	*19*	*21 5/8*	*25*
ELECTRICAL CHARACTERISTICS				
Low frequency dry flashover	kV	95	100	100
Low frequency wet flashover	kV	55	60	60
Positive critical impulse flashover	kV	145	150	170
Negative critical impulse flashover	kV	145	150	170
Low frequency puncture voltage	kV	140	140	130
R.I.V low frequency test voltage	kV	10	10	10
Max. RIV at 1 MHz	µV	50	50	50
PACKING AND SHIPPING DATA				
Approx. net weight per unit	kg	10.4	13.8	18
No. of insulators per crate		5	4	2
Volume per crate	m^3	0.11	0.11	0.05
Gross weight per crate	kg	59	62	41.7
No. of insulators per pallet		45	36	24
Volume per pallet	m^3	1.35	1.28	1.2
Gross weight per pallet	kg	554	577	494

Custom products are also available

Sediver® toughened glass suspension insulators
Ball & Socket type

ANSI

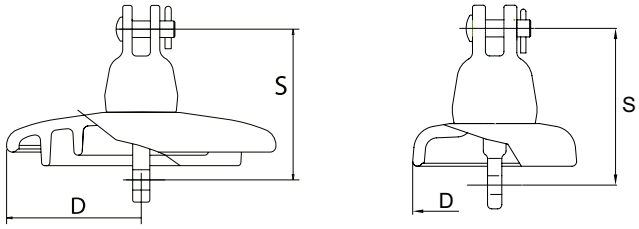


		Open Profile		
Insulator type		**N12D/146**	**N160D/146**	**N21D/156**
Coupling according to ANSI C29.2B		Type J	Type K	Type K
MECHANICAL CHARACTERISTICS				
Mechanical failing load	kN	120	160	222
	lbs	*25,000*	*36,000*	*50,000*
Impact strength	N-m	45	45	45
	in-lbs	*400*	*400*	*400*
Tension proof	kN	60	80	111
	lbs	*12,500*	*18,000*	*25,000*
DIMENSIONS				
Diameter (D)	mm	380	420	420
	in	*15*	*16 1/2*	*16 1/2*
Spacing (S)	mm	146	146	156
	in	*5 3/4*	*5 3/4*	*6 1/8*
Creepage distance	mm	365	375	375
	in	*14 3/8*	*14 3/4*	*14 3/4*
ELECTRICAL CHARACTERISTICS				
Low frequency dry flashover	kV	65	75	75
Low frequency wet flashover	kV	50	50	50
Positive critical impulse flashover	kV	100	105	105
Negative critical impulse flashover	kV	100	105	105
Low frequency puncture voltage	kV	130	130	130
R.I.V low frequency test voltage	kV	10	10	10
Max. RIV at 1 MHz	µV	50	50	50
PACKING AND SHIPPING DATA				
Approx. net weight per unit	kg	5.9	7.5	8.7
No. of insulators per crate		6	6	6
Volume per crate	m^3	0.14	0.17	0.18
Gross weight per crate	kg	43	54	61
No. of insulators per pallet		72	72	72
Volume per pallet	m^3	1.91	2.40	2.50
Gross weight per pallet	kg	538	674	737

Custom products are also available

Sediver® toughened glass suspension insulators
Clevis coupling CT

ANSI



		Standard Profile				Ground wire insulator
CATALOG N°		**CT12/146**	**CT50/159**	**CT4/140**	**CT160/165**	**CT14-6/146DC**
CSA/ANSI class		CS-6	52-9	52-1	CS-10	
MECHANICAL CHARACTERISTICS						
Combined M&E strength	*kN*	120	*45*	*50*	*160*	136
	lbs	*25,000*	10,000	10,000	36,000	*30,000*
Impact strength	*N-m*	45	*45*	*45*	*45*	45
	in-lbs	*400*	400	400	400	*400*
Tension proof	*kN*	60	*22.5*	*25*	*80*	68
	lbs	*12,500*	5,000	5,000	18,000	*15,000*
DIMENSIONS						
Diameter (D)	*mm*	255	*160*	*160*	280	155
	In	*10*	6 5/16	6 5/16	*11*	*6*
Spacing (S)	*mm*	146	*159*	*140*	165	146
	In	*5 3/4*	6 1/4	5 1/2	*6 1/2*	*5 3/4*
Leakage distance	*mm*	320	*190*	*190*	400	135
	In	*12 5/8*	7 1/2	7 1/2	*15 3/4*	*5 1/3*
ELECTRICAL CHARACTERISTICS						
Low frequency dry flashover	kV	80	60	60	80	40
Low frequency wet flashover	kV	50	30	30	50	20
Critical impulse flashover pos.	kV	125	90	90	125	70
Critical impulse flashover neg.	kV	130	95	95	130	70
Low frequency puncture voltage	kV	130	110	110	130	90
R.I.V low frequency test voltage	kV	10	7.5	7.5	10	7.5
Max. RIV at 1 MHz	µV	50	50	50	50	50
PACKING AND SHIPPING DATA						
Approx. net weight per unit	kg	4	1,84	1,84	7,56	2.5
N° of insulators per crate		6	6	6	6	6
Volume per crate	m^3	0.06	0,03	0,03	0,08	0.02
Gross weight per crate	kg	29	12,23	12,23	52	17
No. of insulators per pallet		96	144/216	144/216	54	150
Volume per pallet	m^3	1.36	0,8/1,13	0,8/1,13	1,06	0.81
Gross weight per pallet	kg	482	300/445	300/445	490	446

Sediver® model **CT14-6/146DC** is an ideal solution for supporting and insulating ground (shield) wires.

It can be installed in either suspension or dead-end configurations.

Custom products are also available

Sediver® toughened glass suspension insulators
ANSI string electrical ratings - Standard profile

Standard profile suspension insulator string flashover voltages based on the test procedure of the American Standard ANSI C29.1 & C29.2B.

CATALOG N°	Diameter / Spacing Ø 10 / 5 3/4 - Ø 11 / 5 3/4 N100/146DC - N12/146 - N180/146DC CT100/146DC - CT12/146				Diameter / Spacing Ø 11 / 6 1/8 N21/156DC			
Number of units	Low frequency flashover voltage (kV)		Critical impulse flashover voltage (kV)		Low frequency flashover voltage (kV)		Critical impulse flashover voltage (kV)	
	DRY	WET	+	-	DRY	WET	+	-
2	145	90	220	225	145	90	230	230
3	205	130	315	320	210	130	325	330
4	270	170	410	420	275	170	425	440
5	325	215	500	510	330	215	515	540
6	380	255	595	605	385	255	610	630
7	435	295	670	695	435	295	700	720
8	485	335	760	780	490	335	790	810
9	540	375	845	860	540	375	880	900
10	590	415	930	945	595	415	970	990
11	640	455	1015	1025	645	455	1060	1075
12	690	490	1105	1115	695	490	1150	1160
13	735	525	1185	1195	745	525	1240	1245
14	785	565	1265	1275	790	565	1330	1330
15	830	600	1345	1360	840	600	1415	1420
16	875	635	1425	1440	890	635	1500	1510
17	920	670	1505	1530	935	670	1585	1605
18	965	705	1585	1615	980	705	1670	1700
19	1010	740	1665	1700	1025	740	1755	1795
20	1050	775	1745	1785	1070	775	1840	1890
21	1100	810	1825	1870	1115	810	1925	1985
22	1135	845	1905	1955	1160	845	2010	2080
23	1180	880	1985	2040	1205	880	2095	2175
24	1220	915	2065	2125	1250	915	2180	2270
25	1260	950	2145	2210	1290	950	2260	2365
26	1300	985	2220	2295	1330	958	2390	2465
27	1340	1015	2300	2380	1370	1015	2470	2555
28	1380	1045	2375	2465	1410	1045	2570	2650
29	1425	1080	2455	2550	1455	1080	2650	2740
30	1460	1110	2530	2635	1490	1110	2740	2830

For other values, please contact the Sediver technical department.
These electrical ratings are applicable to Sediver® suspension insulator strings not equipped with arcing devices or grading rings.
According to the American Standard the average value of three tested strings shall equal or exceed:
95% of the guaranteed values as given in the data sheet, for low frequency dry flashover,
90% of the guaranteed values as given in the data sheet, for low frequency wet flashover,
92% of the guaranteed values as given in the data sheet, for critical impulse flashover.

These electrical ratings are applicable to Sediver® suspension insulator strings not equipped with arcing devices or grading rings

Sediver® toughened glass suspension insulators
ANSI string electrical ratings - Fog profile

Fog type profile suspension insulator string flashover voltages based on the test procedure of the American Standard ANSI C29.1 & C29.2B.

	Diameter / Spacing Ø 11 / 5 3/4				Diameter / Spacing Ø 13 / 6 3/4			
Catalog N°	N100P/146DC - N14P/146DC				N21P/171DC			
Number of units	Low frequency flashover voltage (kV)		Critical impulse flashover voltage (kV)		Low frequency flashover voltage (kV)		Critical impulse flashover voltage (kV)	
	DRY	WET	+	-	DRY	WET	+	-
2	155	95	270	260	160	110	315	300
3	215	130	380	355	230	145	440	410
4	270	165	475	435	290	155	550	505
5	325	200	570	520	350	225	660	605
6	380	240	665	605	405	265	775	705
7	435	275	750	690	460	310	870	800
8	485	315	835	775	515	355	970	900
9	540	350	920	860	570	390	1070	1000
10	590	375	1005	950	625	430	1170	1105
11	640	410	1090	1040	680	460	1270	1210
12	690	440	1175	1130	735	495	1370	1315
13	735	470	1260	1220	790	530	1465	1420
14	785	500	1345	1310	840	565	1565	1525
15	830	525	1430	1400	885	595	1665	1630
16	875	555	1515	1490	935	630	1765	1735
17	920	580	1600	1595	980	660	1860	1845
18	965	615	1685	1670	1030	690	1960	1945
19	1010	640	1770	1755	1075	725	2060	2040
20	1055	670	1850	1840	1120	755	2155	2140
21	1100	695	1930	1925	1165	785	2245	2240
22	1145	725	2010	2010	1210	820	2340	2340
23	1190	750	2090	2095	1255	850	2430	2440
24	1235	780	2170	2180	1300	885	2525	2540
25	1280	810	2250	2265	1345	910	2620	2635
26	1325	835	2330	2350	1385	945	2710	2735
27	1370	860	2410	2435	1430	975	2805	2835
28	1410	890	2490	2520	1470	1005	2900	2935
29	1455	915	2560	2600	1515	1035	2980	3025
30	1495	940	2630	2680	1555	1065	3060	3120

For other values, please contact the Sediver technical department.
These electrical ratings are applicable to Sediver® suspension insulator strings not equipped with arcing devices or grading rings.
According to the American Standard the average value of three tested strings shall equal or exceed:
95% of the guaranteed values as given in the data sheet, for low frequency dry flashover,
90% of the guaranteed values as given in the data sheet, for low frequency wet flashover,
92% of the guaranteed values as given in the data sheet, for critical impulse flashover.

These electrical ratings are applicable to Sediver® suspension insulator strings not equipped with arcing devices or grading rings.

Active contributions to international committees

Since the very beginning of international technical cooperation, Sediver has always been an active member in fields of research and standardization in international committees and working groups dealing with all aspects of high voltage insulation; for example Sediver experts are involved in IEC working groups TC36B, CIGRE: B2, D1, C4 and contribute to the activities of NEMA-ANSI C29, IEEE OHL SC and CSA 411 standard Committees.

Extract of Sediver articles in IEEE and international publications on glass:

- MATTE A / GEORGE JM "AGING INFRASTRUCTURE EVALUATION : THE EVALUATION OF AGED HIGH VOLTAGE CERAMIC SUSPENSION INSULATORS - A SYNTHESIZED ANALYSIS OF IN-SERVICE INSULATOR AGING ASSESSMENTS", 2024 CIGRE Canada Conference & Exhibition, 28 - 31 Oct 2024, Winnipeg, Canada
- GEORGE JM "POLLUTION OF OVERHEAD LINE INSULATORS: UPDATE ON STANDARDS AND INSULATORS PERFORMANCE UNDER SEVERE CONTAMINATION FOR AC AND DC LINES", 2024 EDM, International Conference on Overhead Lines, April 15-18, 2024, Fort Collins, U.S.A
- GEORGE JM / LEPLEY D. "AC AND DC POLLUTION TESTING METHODS: ACCURACY AND LIMITATIONS", 2022 INMR World Congress, Oct 16 - 19 2022, Berlin, Germany
- DELHUMEAU F / DUMAS C / GEORGE JM. "SIMULATION OF ELECTRIC FIELD: WHAT AND WHAT NOT TO EXPECT", 2022 INMR World Congress, Oct 16 - 19 2022, Berlin, Germany
- ESPINOSA C / VO D / GEORGE JM . "OVERHEAD LINE INSULATORS IN OPERATING CONSTRAINTS UNDER SEVERELY POLLUTED CONDITIONS : THE BENEFITS OF SILICONE COATED GLASS INSULATORS AND THEIR APPLICATION AT THE PG&E DIABLO CANYON NUCLEAR POWER PLANT", 2022 CIGRE PARIS, 28 aug. - 02 sept 2022, Paris
- GEORGE JM / PONS C / VOSLOO WL. "ASSESSMENT OF PERFORMANCE OF INSULATORS THROUGH LEAKAGE CURRENT MONITORING UNDER CONTAMINATED CONDITIONS", CIGRE 2020 PARIS - cigre e-session 48 - Aug 24 - Sep 3 2020
- GEORGE JM / PRAT S. "INSULATORS UNDER FIRE", EDM 2019, International conference on overhead lines, Design, Construction, Inspection & Maintenance, Mar. 25-28, 2019, Frt Collins, Colorado, USA
- VIRLOGEUX F / PRAT S / GEORGE JM. "REVIEW OF 20 YEARS OF SILICONE COATED INSULATORS IN THE FIELD", INMR 2017 World Congress, nov 5 - 8 2017, Barcelona, Spain
- GEORGE JM. / BROCARD E. / PRAT S. / VIRLOGEUX F. / LEPLEY D. "NECESSARY CHECK POINTS & TESTING FOR SCREENING THE QUALITY OF INSULATORS", INMR 2017 World Congress, nov 5 - 8 2017, Barcelona, Spain
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