

The very Best.



That's what we deliver.

Only a company that develops, produces and delivers products worldwide can provide the optimal solution for your requirements. The specialists of **PPC** Insulators are dedicated to supplying you with superior advice and global support. **PPC** Insulators quality products and service provide time-tested value to fulfill your needs! Please visit us on the web at www.ppcinsulators.com



The very Best.











Insulators for High Speed Train Safe traveling

> IEC > DIN > ÖNORM

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Safe traveling at more than 300 km/h (190 mph)

From the 1930's into the third millennium, we're reducing weight while offering the highest performance. Since the 1930's, we have manufactured insulators for overhead lines supplying railway networks. Originally, system electrification voltage was 1.5 to 3 kV D.C.

The need for speed from town to town required improvements in the electrification system, thus 15 & 25kV AC voltages were chosen to replace DC. Railway porcelain insulators are subjected to the most severe service conditions, electrical and mechanical stresses, due to parameters of the service site and their performance specifications as required by worldwide railway companies.



PPC Insulators, after more than 70 years of experience in designing and manufacturing railway porcelain insulators, has developed a new concept to improve safety and performance while optimizing cost considerations for our customers.

Our research, in conjunction with national and transnational railway companies, yielded a high-grade design for C130 porcelain material with the optimum cement for assembly and fittings.

Metallic hardware connections can easily be designed using high-grade material for fittings according to customer specifications.

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Mechanical Design

In-service stresses for catenary insulators are mainly due to tension or bending loads (e.g., tension and vibration in wires, feeder, wind pressure, ice, short circuit loads). Few applications induce compression strength (depending on catenary mounting arrangement) or torsion strength when using as rotating air disconnects.

Designing for H.S.T. (High Speed Train) needs to take into account high security for railway lines. PPC experience in this field (more than 25 years), has led us to use special high-grade material for the porcelain body with an appropriate shed design.

PPC Insulators manufacturing plants mainly use C130 body for this range of insulators (catenary or post insulators) because of its high-grade high-quality properties. This allows a smaller core diameter, smaller sized fittings and makes insulators lighter.

Material data according to IEC 60672

Indicative mean values on test samples

Material	Flexural Strength Unglazed	Flexural Strength Glazed	Modulus of Elasticity	Linear thermal Expansion Coefficient [®]	Specific Weight
	Mpa psi	Mpa psi	x 10 ³ Mpa psi	× 10 ⁻⁶ K ⁻¹	
C12O body	100 14500	140 20300	70 10150	4.5 to 5.5	2.4
C13O body	165-180 23925-26100	190-200 27550-29000	100 14500	4 to 6	2.7

* Temperature range from 20°C to 300°C

Fittings

Design

Material for Fittings is usually malleable cast or ductile iron. Protection against corrosion is made by hot dip galvanizing according to IEC 60383-60168. For galvanization, we recommend a minimum nominal thickness of $\geq 85\mu m$ (or 3.3 mil).

PPC Insulators can design and provide High Grade aluminium for fittings as an alternative for our customers. Standard sizes for fittings for busbars or air disconnect switches are used.

We can design fittings for Catenary Insulators of any kind according to the standard live parts connection for clamping based on customer usage.

Mechanical Data for Fittings Standard indicative values on test samples

Material	Tensile Strength	Modulus of Elasticity	Linear Thermal Expansion Coefficient	Specific Weight
	Mpa	x 10 ³ Mpa	x 10 ⁻⁶ K ⁻¹	
	psi	psi	psi	
Malleable	350	230	11	7.35
cast iron	50750	33350		7.00
Ductile	400	250	11	כ ד
cast iron	58000	36250		/.⊏
Aluminium alloy casting AI-Si-Mg	250-290 36250-42050	210 30450	21	2.7

Railway Insulators Design

Glazing

Brown Glaze

is according to RAL 8017 & RAL 8016



Semi-conductive glaze (SCG) can be provided for special polluted environments. We also have developed state-of-the-art shed design to optimize performance.

Electrical Performance



Creepage distance calculations and performance have been improved through our relationships with our customers the world over.

For each application, PPC Insulators offers the best choice for the design by using "K-Value" method and for the quality surface (e.g. SCG).





Grev Glaze

is according to RAL 7038 or ANSI Z55.1. (MUNSELL 5BG7.0/0.4) Grey glazed insulators provide an enhanced visual aesthetic advantage and compliment the tone of the metallic poles. These neutral colors blend well with most environments in which it is situated.

Mechanical performance, too, has been enhanced through the rigors of speeding along at more than 300 km/hour (~190 mph.), requiring excellent knowledge concerning the electrical behavior of railway insulators and their mounting arrangment on-site.

Pollution performance is one of the most important points to consider when designing a railway insulator. Furthermore, we must take into account the kind of pollution and its severity according with pollution class levels from IEC 60815.

Railway Insulators

Level	Pollution	Specific Cr	eepage Distance
3	Heavy	25 mm/kV	0.984 inch/kV

expsed to strong winds carrying sand and salt, and subjected to regular condensation.

K-value Design

K-value design is traditional creepage distance.

Form factor used as a design method is referred to as K-value and can be used for different improvements.

Creepage distance considers a leakage current as traveling along the exterior contour of the insulator, identifying only the linear distance.

K-value considers a leakage current as traveling along the insulator over its surface. K-value identifies an insulator's total shape, i.e., geometric (ohmic) resistance against leakage currents. It is necessary to calculate the shape of the surface of the insulator for reaching optimum pollution performance.

Traditional calculation of creepage distance is still used, but to achieve best performance in relation to material and space used, K-value design is essential.

PPC Insulators offer complete computer design of K-value, integrated with traditional requirements.



Plain Shed





ALE!



Increased Pollution Performance Equalized Field Distribution

In its full extent, K-value design is a method to reduce

- a method to improve > weight > volume and > space
 - while improving properties in service by increasing
 - pollution performance and equalizing electrical field.

International standard IEC 60507 defines form factor as:

 $\label{eq:F} F = \int dl \big/ p[l] \, {}^{I}_{p[l]} \, {}^{is \, the \, creepage \, distance}_{is \, the \, circumference \, of \, the insulator \, as \, a \, function \, of \, l.}$

- MMM Distance Distance and Diameter

Shed design

We recommend the plain or alternating sheds for general uses because of their best self-cleaning properties. According to our research, choosing an appropiate shape for sheds is also important for the optimum behavior against impact .

Railway Insulators Product Features

Assembling

PPC Insulators uses three kinds of assemblies for fittings mated to the porcelain:

>	Lead antimony alloy
>	Sulfur cement
>	Portland Cement base

from -50°C to 150°C from -50°C to 80°C from -30°C to 105°C

The environmental conditions and the use of insulators dictates the choice of assembly. Temperature, specific mechanical strength, and other parameters must be considered to make the right choice for the best performance of the insulators.

Hardware (when applicable)

PPC Insulators can deliver metallic hardware after agreement with the railway utility.

Tolerances

> General tolerances	± (0.04 d + 1.5) mm when d< 300
	± (0.025 d + 6) mm when d> 300
> Specific tolerances (When applicable)	
Angular deviation of fixing holes	According to IEC 60273
Parallelism of end faces	According to IEC 60273
Eccentricity	According to IEC 60273
Axial, Radial, Angular displacements	According to IEC 60383

Railway Insulators Pantograph Post

PPC Insulators can provide a large range of insulators according to each use for locomotive and rail line builders.

Our design department can assist with custom solutions, e.g., posts with special end fixing, bushings fixed on the roof of the train.



ypical System voltage	25 kV A.C.				
уре	А	в			
PC Catalog N°	114713	115821			
ilaze Color	Brown Brown				
lain dimensions (mm)					
eight "H"	360	300			
hed Diameter "D"	205	220			
ottom Fixing "DB"	4 Ø16/184	4 Ø16/184			
p Fixing "MT" (*)	M18 x20	M18 x25			
eakage distance	720	720			
lechanical Values					
ensile (kN)	45	30			
antilever (kN)	18	10			
lectrical Values (kV)					
Vet Power Frequency -1min.	70	70			
ightning impulse (+) & (-)	170	170			
pproximative Weight (Kg)					
	15	12			
"M" when mothin threaded hale					



Product Features

for trains and locomotives



Railway Insulators

Overhead Line Catenary

Top Guy & Bracket Insulators/Feeder Insulators

25 kV A.C. Overhead Line Catenary Insulators

Typical System voltage 25 kV A.C.								
				-				
Туре	A	А	A*	В	в	B*	С	D*
PPC Catalog N°	113601	113602	114666	113603	113604	114665	113088	115666
Glaze Color	Brown	Brown	Sky blue	Brown	Brown	Sky blue	Brown	Sky blue
Main dimensions (mm)								
Height "H"	500	625	625	490	615	615	500	560
Shed Diameter "D"	188	198	198	188	198	198	125	160
Tube Diameter "D Tube"	49	49	49	- 28	58	58	N/A	N/A
Bottom Fixing "DB"	18	18	18	N/A	N/A	N/A	20.5	N 16
Top Fixing "DT"	N/A	N/A	N/A	18	18	18	20.5	20
Bottom Thickness "EB"	16	16	16	N/A	N/A	N/A	19	N/A
lop Thickness "ET"	N/A	N/A	N/A	16	16	16	19	N/A
Leakage distance	800	1200	1200	800	1200	1200	530	1200
Mechanical Values								
Tensile (kN)	80	80	80	50	50	50	130	30
Cantilever (kNm)	2.45	2.45	2.45	1	1	N/A	4	N/A
Electrical Values (kV)								
Wet Power Frequency -1min.	70	95	95	70	95	95	80	95
Lightning impulse (+) & (-)	170	250	250	170	250	250	170	250
Approximative Weight (Kg)							
	15	18	20	14	17	19	13	14

* Insulators used for High Speed Trains

15 kV A.C., 1.5 - 3.3 kV D.C. Overhead Line Catenary Insulators

Typical System voltage		15 kV A.C.					3.3 k	3.3 kV D.C. 1.5 kV D		V D.C.
Туре	A**	B**special	C**	C**	A***	C***	А	в	С	С
PPC Catalog N°	4Ebs 13 02 21	4 Ebs 13 02 22	Ebs 4 13 02 11	Ebs 2130103	ED 6519	ED 6513	115493	115492	116038	116040
Glaze Color	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Main dimensions (mm)										
Height "H"	550	570	485	440	632	505	380	363	400	455
Shed Diameter "D"	175	184	162	180	140	120	158	158	125	150
Tube Diameter "D Tube"	42/55/ 60/70	42/55/ 60/70	N/A	N/A	49	N/A	57	38	N/A	N/A
Bottom Fixing "DB"	21	N/A	21	21	N/A	N 16	18	N/A	24	26
Top Fixing "DT"	N/A	N/A	21	21	N/A	N 17	N/A	18	24	26
Bottom Thickness "EB"	19	N/A	19	19	N/A	N/A	16	N/A	18	18
Top Thickness "ET"	N/A	N/A	19	19	N/A	N/A	N/A	16	18	18
Leakage distance	760	760	760	565	690	690	360	360	250	250
Mechanical Values										
Iensile (kN)	120	120	100	100	72	/0	64	64	/5	150
Cantilever (kNm)	2.6	3.5	N/A	N/A	N/A	N/A	1.7	1./	N/A	N/A
Electrical Values (kV)	Electrical Values (kV)									
Wet Power Frequency -1min.	65	65	65	75	100	100	38	38	28	28
Lightning impulse (+) & (-)	195	190	145	200	220	220	95	95	60	60
Approximative Weight (Kg))									
	15	16	14	11	12	8	10	10	9	16
D** second E. End Colors of Consulations of			and 1 1 1	1.6			In a data a second	and Comp Annatation	0 0 · D	

The single-piece core design for 3 kV DC or 25 kV AC with special design provides maximum protection after flashovers and against mechanical impact.

PPC Insulators designed for working in the horizontal position or angle mounted on a crossarm provides maximum safety for the electrical line connection with the train.

We supply the entire range of insulators for each voltage level: 1.5 – 3 kV DC 15 – 25 kV AC



Type A









Type C

Type B

Railway Insulators Post Catenary

In some applications (e.g., tunnels, bridge crossings), **PPC** Insulators can design insulators with reduced dimensions.

Rigid Post or Post-with-Anchoring-Hole types are available for situations of reduced clearance.



Type A

Type B

Typical System voltage		15 kV A.C.	1.5 kV D.C.						
Туре	А	в	в	в	А				
PPC Catalog N°	377 00 07	ED 6507	ED 6518	116039	116041				
Glaze Color	Brown	Brown	Brown	Brown	Brown				
Main dimensions (mm)									
Height "H"	598	574	574	406	388				
Shed Diameter "D"	185	140	140	162	162				
Tube Diameter "D Tube"	70	43	49	89	89				
Bottom Fixing "DB"	4 Ø18/140 *	Ø19-L103 ^(A)	Ø19-L103 ^(A)	Ø22-L120 ^(A)	4 M 16/127				
Leakage distance	700	690	690	250	250				
Mechanical Values									
Tensile (kN)	N/A	72	72	12.5	12.5				
Cantilever (kNm)	2.5	N/A	N/A	10	10				
Electrical Values (kV)									
Wet Power Frequency -1min.	70	100	100	28	28				
Lightning impulse (+) & (-)	170	220	220	60	60				
Approximative Weight (Kg)									
	27	12	12	17	17				
* Pitch square 1/0x1/0mm		A) For Anabon halo dimonsion of the nin is given							

Railway Insulators Posts and Rods

Transmitting power to the railway line requires busbars and air disconnect switches. Typical post and rod insulators are used for insulating live components.

Considering each on-site installation, our **PPC** Insulators are available to work upright, underhung or even in the horizontal position.



Posts & Rods Insulators used for Air Disconnect Switch and as post for feeder wire

Typical System voltage	25 kV A.C.			3.3 k\	1.5 kV D.C.	
Гуре	А	А	в	А	А	А
PPC Catalog N°	114012	114013	115662	113608	113607	116042
Glaze Color	Brown	Brown Brown Brown		Brown Brown		Brown
Vlain dimensions(mm)						
Height "H"	420	560	885	245	343	295
Shed Diameter "D"	195	200	120	155	155	162
Bottom Fixing "DB"	4 M16/127	4 M16/127	N/A	2 Ø15/130	4 Ø12/50 *	4 M16/127
op Fixing "DT" ⁾	4 M16/127	4 M16/127	N/A	2 Ø15/130	4 Ø12/50 *	4 M16/127
eakage distance	840	1200	1200	360	360	250
Mechanical Values						
ensile (kN)	60	60	27	50	50	4
Cantilever (kNm)	5	5	N/A	2.7	1	4
Torsion (kNm)	5.5	5.5	N/A	0.7	0.7	N/A
Electrical Values (kV)						
Net Power Frequency -1min.	70	95	95	38	38	28
ightning impulse (+) & (-)	170	250	250	95	95	60
Approximative Weight (Kg)						
	19	26	12	7	8	15

Typical System voltage	25 kV A.C.		3.3 kV D.C.		1.5 kV D.C.		
Туре	А	А	В	А	А	А	
PPC Catalog N°	114012	114013	115662	113608	113607	116042	
Glaze Color	Brown	Brown	Brown	Brown	Brown	Brown	
Main dimensions(mm)							
Height "H"	420	560	885	245	343	295	
Shed Diameter "D"	195	200	120	155	155	162	
Bottom Fixing "DB"	4 M16/127	4 M16/127	N/A	2 Ø15/130	4 Ø12/50 *	4 M16/127	
Top Fixing "DT"	4 M16/127	4 M16/127	N/A	2 Ø15/130	4 Ø12/50 *	4 M16/127	
Leakage distance	840	1200	1200	360	360	250	
Mechanical Values							
Tensile (kN)	60	60	27	50	50	4	
Cantilever (kNm)	5	5	N/A	2.7	1	4	
Torsion (kNm)	5.5	5.5	N/A	0.7	0.7	N/A	
Electrical Values (kV)							
Wet Power Frequency -1min.	70	95	95	38	38	28	
Lightning impulse (+) & (-)	170	250	250	95	95	60	
Approximative Weight (Kg)							
	19	26	12	7	8	15	

ypical System voltage	25 kV A.C.		3.3 kV D.C.		1.5 kV D.C.		
ype	А	А	В	А	А	А	
PC Catalog N°	114012	114013	115662	113608	113607	116042	
laze Color	Brown	Brown	Brown	Brown	Brown	Brown	
lain dimensions(mm)							
eight "H"	420	560	885	245	343	295	
hed Diameter "D"	195	200	120	155	155	162	
ottom Fixing "DB"	4 M16/127	4 M16/127	N/A	2 Ø15/130	4 Ø12/50 *	4 M16/127	
p Fixing "DT")	4 M16/127	4 M16/127	N/A	2 Ø15/130	4 Ø12/50 *	4 M16/127	
eakage distance	840	1200	1200	360	360	250	
lechanical Values							
ensile (kN)	60	60	27	50	50	4	
antilever (kNm)	5	5	N/A	2.7	1	4	
orsion (kNm)	5.5	5.5	N/A	0.7	0.7	N/A	
lectrical Values (kV)							
Vet Power Frequency -1min.	70	95	95	38	38	28	
ghtning impulse (+) & (-)	170	250	250	95	95	60	
approximative Weight (Kg)							
	19	26	12	7	8	15	

Typical System voltage	25 kV A.C.		3.3 kV D.C.		1.5 kV D.C.		
Туре	А	А	в	А	А	А	
PPC Catalog N°	114012	114013	115662	113608	113607	116042	
Glaze Color	Brown	Brown	Brown	Brown	Brown	Brown	
Main dimensions(mm)							
Height "H"	420	560	885	245	343	295	
Shed Diameter "D"	195	200	120	155	155	162	
Bottom Fixing "DB"	4 M16/127	4 M16/127	N/A	2Ø15/130	4 Ø12/50 *	4 M16/127	
Top Fixing "DT"	4 M16/127	4 M16/127	N/A	2Ø15/130	4 Ø12/50 *	4 M16/127	
Leakage distance	840	1200	1200	360	360	250	
Mechanical Values							
Tensile (kN)	60	60	27	50	50	4	
Cantilever (kNm)	5	5	N/A	2.7	1	4	
Torsion (kNm)	5.5	5.5	N/A	0.7	0.7	N/A	
Electrical Values (kV)							
Wet Power Frequency -1min.	70	95	95	38	38	28	
Lightning impulse (+) & (-)	170	250	250	95	95	60	
Approximative Weight (Kg)							
	19	26	12	7	8	15	

(*) "M" when metric threaded hole

* Pitch square 50x50mm







for Air Disconnect Switches

Choosing the best design for several possibilities of site use provides flexibility for our customers to consider the optimum arrangement for each mounting.

For instance, fast trains crossing under bridges require posts hanging the feeder cable as stable as possible to prevent power disruption.



Railway Insulators Control

Conversion table

1 inch	25.4	n
1 pound	4.448	Ν
1 inch-pound	0.113	Ν
1 mm	39.374	n

> ISO 9000 Quality Procedures

- are applied throughout the production process.
- > Type tests are performed on New Design insulators.
- > Sample and Routine tests are performed during
- production according to the following tables.

Overhead Railway Insulators

IEC 60383-1/2	Design Test	Sample Test	Routine Test
	§6.1	§ 6.2	§ 6.3
Dry lightning impulse withstand voltage test § 13	1		
Wet power-frequency withstand voltage test § 14	1		
Puncture withstand test (only on insulators class B) § 15		1	
Routine electrical test (only on insulators class B) § 16			✓
Mechanical failing load:			
Tensile strength § 19.2 - 19.4 - 33	1	1	
Bending strength (where applicable) § 19.1	1	1	
Thermal-mechanical performance test § 20 -33	1		
Verification of dimensions § 17-21		1	
Temperature cycle test § 23.1		1	
Verification of locking system (where applicable) § 22		1	
Visual inspection § 27			✓
Porosity test § 25		1	
Galvanizing Test (where applicable) § 26		1	
Routine mechanical test § 28			1

Posts and Rods

IEC 60168	Design Test	Sample Test	Routine Test				
	§6.1	§ 6.2	§6.3				
Dry lightning impulse withstand voltage test § 13	1						
Wet power-frequency withstand voltage test § 14	1						
Puncture test (only on insulators class B) § 4.9		1					
Routine electrical test (only on insulators class B) § 4.10			1				
Mechanical failing load:							
Bending strength § 5.2.4	1	1					
Torsion test (when applicable) § 5.2.5	1	1					
Tensile test (when applicable)	1						
Verification of dimensions § 5.1		1					
Temperature cycle test § 5.4		1					
Visual inspection § 5.8			1				
Porosity test § 5.6		1					
Galvanizing Test § 5.7		1					
Routine mechanical test § 5.9			1				









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Design Test	Sample Test	Routine Test		
§ 6.1	\$ 6.2	\$ 6.3		
1				
✓				