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Ceramic Insulator Datasheet & Specifications: Complete Technical Reference

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A **ceramic insulator datasheet** is a standardized technical document that defines the electrical withstand capability, mechanical rated load, dimensional envelope, and test compliance of a porcelain or vitrified-clay insulator unit. Unlike catalog listings, a proper datasheet is traceable to a specific type test report conducted under IEC 60305 (disc suspension), IEC 60383 (pin and post), or ANSI C29 series standards, and forms the contractual basis for material acceptance at incoming inspection. Engineers evaluating ceramic insulators for overhead line, substation, or apparatus applications use datasheets to verify three core suitability criteria: voltage level, mechanical duty, and pollution environment compatibility.

Standards Governing Ceramic Insulator Datasheets

Three standards families define what must appear on a ceramic insulator datasheet. Understanding which standard applies to your project determines which parameters to demand from the supplier.

Standard	Scope	Key Parameters Defined	Typical Markets
IEC 60305	Disc suspension insulators	SML, coupling dimensions (ball–socket), creepage, electrical tests	International, MENA, Asia–Pacific, Africa
IEC 60383	Pin and post insulators	Voltage class, cantilever load, puncture resistance	International, IEC–adopting utilities
IEC 62155	Hollow porcelain (apparatus)	Failing load, internal pressure, cantilever, torsion	Substation, transformer, switchgear OEMs
ANSI C29.1	General test methods	Test procedures for all ANSI insulator types	North America, Philippines, some Latin America
ANSI C29.2	Suspension disc insulators	Mechanical class, coupling (clevis–tongue)	North America

Standard	Scope	Key Parameters Defined	Typical Markets
ANSI C29.5 / C29.6	Pin insulators	Voltage class, cantilever strength, thread dimensions	North America, ANSI–infrastructure countries

When a datasheet references "IEC" without specifying the sub–standard number, request clarification. IEC 60305 disc and IEC 60383 pin insulators share overlapping test procedures but differ significantly in how mechanical load is expressed and what dimensional checkpoints are mandatory.

Electrical Parameters on a Ceramic Insulator Datasheet

Electrical parameters define the insulator's ability to withstand operating and transient overvoltages. A complete datasheet must include all of the following:

Parameter	Symbol	IEC Definition	Typical Value (C70 disc)
Rated voltage	U_r	Maximum system voltage the insulator is designed for	≤ 420 kV system
Power frequency withstand (dry)	U_{pfd}	1–minute 50 Hz test, no flashover or puncture	100 kV (single disc)
Power frequency withstand (wet)	U_{pfw}	Same test with artificial rain per IEC 60507	50 kV (single disc)
Lightning impulse withstand	U_{imp}	1.2/50 μ s wave, 15 positive + 15 negative	125 kV (single disc)
Puncture withstand voltage	—	Voltage at which current passes through ceramic body	$> 2\times$ flashover voltage
Creepage distance	L_c	Total leakage path along insulator surface	295 mm (standard C70)

Critical distinction: Dry flashover voltage and dry withstand voltage are not the same parameter. Flashover voltage is determined during type tests (the average value at which flashover occurs 50% of the time). Withstand voltage is the value at which no flashover occurs — typically 75–80% of the flashover value. Datasheets must specify withstand voltage for procurement purposes.

Mechanical Parameters: SML, MFL, and Load Classification

Mechanical parameters are where ceramic insulator datasheets most frequently cause procurement errors. The three key values are defined differently across standards, and mixing them leads to systematic under–specification.

IEC 60305 Disc Insulators: SML System

IEC 60305 uses **Specified Mechanical Load (SML)** as the primary rating. Standard SML classes and their key values:

IEC Class	SML (kN)	Routine Test Load (50% SML)	Min. Failing Load ($\geq 167\%$ SML)	Typical Application
C40	40 kN	20 kN	≥ 66.8 kN	Light distribution lines
C70	70 kN	35 kN	≥ 116.9 kN	Standard transmission (most common)
C100	100 kN	50 kN	≥ 167 kN	Heavy transmission, river crossings
C120	120 kN	60 kN	≥ 200.4 kN	Extra-heavy, double circuit, EHV
C160	160 kN	80 kN	≥ 267.2 kN	UHV, long-span, ice zone
C210	210 kN	105 kN	≥ 350.7 kN	Angle towers, dead-end, special

Design practice: String design applies a safety factor of 2.5–3 $\times$ over everyday conductor tension (EDT) when selecting SML. For a 400 kV line with 3.5 kN EDT per conductor, the minimum string mechanical rating is 8.75–10.5 kN — well within C70 capacity. However, broken wire and construction loads can exceed 3 $\times$ EDT, making C100 or C120 the conservative choice for EHV lines.

ANSI C29.2 Disc Insulators: Mechanical Class System

ANSI uses a number-based class system where the number represents mechanical load in thousands of pounds-force. Class 15 = 15,000 lbf = 66.7 kN, approximately equivalent to IEC C70.

ANSI Class Mechanical Load kN Equivalent			IEC Approx.
Class 15	15,000 lbf	66.7 kN	C70
Class 25	25,000 lbf	111.2 kN	Between C100–C120
Class 36	36,000 lbf	160.1 kN	C160

Coupling incompatibility warning: IEC 60305 uses ball-and-socket coupling (16 mm or 20 mm ball). ANSI C29.2 uses clevis-and-tongue coupling. These are not interchangeable in the field. When a project specifies "IEC equivalent" ANSI insulators, verify the coupling type explicitly on the datasheet drawing.

Dimensional Parameters and Coupling Specifications

Dimensional data determines hardware compatibility. For disc insulators, the critical dimensions are:

Dimension	Description	Standard C70 Value	Tolerance
Disc spacing (H)	Center-to-center distance in string	146 mm	±2 mm
Overall diameter (D)	Maximum diameter including sheds	280 mm	±5 mm
Ball diameter (IEC)	16 mm standard, 20 mm for C100+	16 mm	±0.2 mm
Socket depth	Ball engagement depth; affects locking clip fit	Per IEC 60305 Annex A	Checked at type test
Length overall (L)	Pin-to-socket loaded distance	Manufacturer-specific	±3 mm

For pin insulators (IEC 60383), the datasheet must additionally include the pin thread specification: metric thread size (M16/M20/M24), thread pitch, and minimum engagement length. These must match the crossarm pin hardware installed on the line.

How to Read a Ceramic Insulator Certificate of Analysis (COA)

A COA is the production-batch document proving each manufactured unit meets the datasheet parameters. IEC 60305 mandates routine tests on every disc before shipping. A compliant COA includes:

1. **Batch/lot number** — traceable to kiln firing records and raw material certificates
2. **Quantity** — number of pieces subject to this COA
3. **Mechanical-electrical (M&E) test result** — simultaneous 50% SML mechanical load and power frequency voltage; all pieces pass or the lot fails
4. **Galvanizing certificate reference** — for steel cap and pin, confirming hot-dip galvanizing per ISO 1461
5. **Dimensional inspection record** — spot-check of key dimensions against approved drawing
6. **Visual inspection pass** — no cracks, chips, glaze defects, or cap misalignment
7. **Inspector signature + date** with QC stamp
8. **Reference to type test report number** — linking batch to approved design

Red flags in COA documents:

- M&E test load stated as "100% SML" — exceeds IEC routine requirements, may indicate fabricated data
- No lot number or lot number not traceable to packing list
- Test date predates manufacturing date on packing list
- No reference to accredited lab for third-party witness testing (if specified in PO)
- Galvanizing certificate missing for cap and pin components

Creepage Distance Calculation and Pollution Class Selection

Creepage distance is the most project-specific parameter on a ceramic insulator datasheet. The required value depends on site pollution level per IEC 60815.

IEC 60815 Level	Environment	Min. Specific Creepage (mm/kV)	Example Sites
Level a (light)	Low pollution, no salt	16 mm/kV	Inland, low industry, low traffic
Level b (medium)	Moderate pollution	20 mm/kV	Light industry, moderate traffic, some agriculture
Level c (heavy)	High pollution or salt	25 mm/kV	Heavy industry, coastal (5–50 km), desert dust
Level d (very heavy)	Extreme pollution	31 mm/kV	Direct sea coast (<1 km), chemical plants, salt lakes

Worked example — 132 kV line, Level c site:

1. Phase-to-earth voltage: $132\text{ kV} \div \sqrt{3} = 76.2\text{ kV}$
2. Required total creepage: $76.2\text{ kV} \times 25\text{ mm/kV} = 1,905\text{ mm}$
3. Standard C70 disc creepage: 295 mm per disc
4. Discs required: $1,905 \div 295 = 6.46 \rightarrow$ **7 discs minimum**
5. Check disc spacing: $7 \times 146\text{ mm} = 1,022\text{ mm}$ string length (insulation coordination check required)

For Level d environments, fog-type or extended-shed disc profiles (creepage 320–370 mm per disc at same 146 mm spacing) reduce the number of discs required. Verify the disc profile type is explicitly stated on the datasheet — "standard" and "fog type" are not interchangeable in pollution class selection.

Supplier Evaluation: What the Datasheet Reveals

A ceramic insulator datasheet is also a supplier qualification document. The following elements distinguish a heritage production base with documented quality systems from a catalog-only trader:

Datasheet Element	What It Signals	Minimum Acceptable Standard
Type test report reference	Product has been independently validated	Accredited lab (CESI, KEMA, CPRI, NGC), within last 10 years
Traceable drawing number	Production controlled against approved design	Drawing number matching type test specimen
COA lot-level traceability	Manufacturer has kiln and QC records	Lot number on COA must match packing list
Galvanizing standard cited	Metal hardware controlled to spec	ISO 1461 or ASTM A153 with zinc thickness stated

Datasheet Element	What It Signals	Minimum Acceptable Standard
Third-party witness option	Manufacturer is open to verification	PO should include right-to-witness routine tests
Pollution class declared	Supplier understands end-use environments	IEC 60815 level stated or creepage per disc stated

Common Datasheet Errors and How to Catch Them

- 1. SML stated as failing load:** Some suppliers list the type-test MFL under the "mechanical load" column without labeling it as MFL. A 70 kN disc with a 120 kN type-test MFL may appear as a "120 kN insulator" in the catalog. Always confirm whether the stated load is SML (rated working load) or MFL (breaking load).
- 2. Creepage distance at disc level only:** A datasheet may state "creepage 295 mm" for a single disc. String-level creepage must be calculated and verified against IEC 60815 requirements for the project voltage and pollution class. Coupling hardware does not contribute to creepage.
- 3. Electrical test voltages without test conditions:** Withstand voltage values are only valid under stated test conditions (temperature, humidity, water conductivity for wet tests). A datasheet stating "withstand voltage: 80 kV" without specifying dry or wet conditions is incomplete for procurement purposes.
- 4. Missing impulse voltage data:** Some simplified datasheets omit lightning impulse withstand voltage. This is required for insulation coordination above 66 kV. If absent, request the full type test report.
- 5. Outdated type test reports:** IEC 60305 does not specify a mandatory re-test interval, but utility procurement standards typically require reports less than 10–15 years old with no design changes since the test date. Confirm that current production matches the test specimen drawing.

Frequently Asked Questions

What parameters are on a ceramic insulator datasheet?

A complete ceramic insulator datasheet includes: rated voltage, power frequency withstand voltage (dry and wet), impulse withstand voltage, creepage distance, mechanical failing load (disc) or cantilever strength (pin/post), weight, coupling dimensions (ball-socket or clevis-tongue), and material classification. IEC datasheets also reference pollution class per IEC 60815.

How do I read a ceramic disc insulator COA?

A COA for ceramic disc insulators covers routine test results per IEC 60305: mechanical-electrical combined load test at 50% of SML, dimensional check against drawing, and visual

inspection. Each lot has a unique number traceable to kiln batch. Key fields: SML rating, test load applied, pass/fail, inspector signature, and accreditation body reference.

What is the difference between SML and failing load in ceramic insulator specs?

SML (Specified Mechanical Load) is the rated working load per IEC 60305. Failing load (MFL) is the actual breaking load from type test — IEC requires MFL to be at least 67% greater than SML. Routine tests apply 50% of SML. Always compare SML to SML when evaluating datasheets from different suppliers.

Can ceramic insulators be used in heavily polluted environments?

Yes, with the correct pollution class specified. IEC 60815 Level c (heavy, coastal/industrial) requires 25 mm/kV specific creepage; Level d (very heavy) requires 31 mm/kV. Fog-type disc profiles with extended sheds (320–370 mm creepage per disc) are used for Level c–d applications. The disc profile type must be explicitly stated on the datasheet.

What certifications should a ceramic insulator supplier provide?

Minimum for international project procurement: IEC 60305 or IEC 60383 type test reports from accredited labs (CESI, KEMA, CPRI, or equivalent), batch COA for each shipment, and dimensional drawings traceable to the type test specimen. For EPC or utility projects: CRCC or equivalent factory audit certification. For North American projects: ANSI C29 type test reports.

What is the creepage distance for a standard 70 kN disc insulator?

A standard IEC C70 disc (70 kN SML, 146 mm spacing, 280 mm diameter) has approximately 295 mm creepage per disc. For 132 kV at IEC 60815 Level c (25 mm/kV), 7 discs minimum are required. For Level d (31 mm/kV), fog-type discs with extended creepage reduce string length while meeting the threshold.

Related Resources

- [Pin Insulator Types: IEC vs ANSI vs AS Standards Guide](#)
- [ANSI C29.7 vs IEC 60383: Standard Comparison](#)
- [IEC 60815 Pollution Severity and Creepage Distance Guide](#)
- [Porcelain vs Composite Insulators: Material Comparison](#)
- [Different Types of Transmission Line Insulators](#)

Need Certified Ceramic Insulator Datasheets for Your Project?

Vuulcan Insulators provides complete technical documentation packages — type test reports, COA, dimensional drawings, and application engineering support — for ceramic disc, pin, and post insulators sourced from heritage production bases operating under Tyco-era quality

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