



Technical Specification 43-93

Issue 5 2018

Line insulators

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Amendments since publication

Issue	Date	Amendment
Issue 5	March, 2018	<p>Major amendment to Issue 4 to align document with the latest normative Standards, and to enhance and clarify the requirements for composite insulators.</p> <p>This issue includes the following principal technical changes.</p> <p>Foreword: Majority of previous content re-written.</p> <p>Clause 1, Scope: Upper voltage for LV insulators changed from '650 V' to '1 000 V'.</p> <p>Clause 2, Normative references: reference titles updated and new references inserted as appropriate.</p> <p>Clause 3, Terms and definitions: majority of definitions subject to editorial amendment. Definitions aligned with BS EN 62217 and BS EN 60383-1, in particular 'creepage distance', 'line post insulator' and 'pin insulator'. New definitions added for 'thermoplastic insulator' and 'unified specific creepage distance'.</p> <p>Clause 4.4, Composite insulator materials: additional requirements inserted covering conformance to BS EN 61109, material bonding, insulator shed formation, electric field stress avoidance and interface sealing.</p> <p>New Clause 4.5 (Thermoplastic insulators) inserted.</p> <p>Clause 5, HV line insulator—standard applications: all sub-clauses have been subject to a major amendment. All figures have been inserted in the relevant sub-clause. New figures have been added depicting typical composite tension and line post insulators. The wording in each sub-clause has been amended to improve consistency of terminology.</p>

	<p>Clause 5.6, String insulator units: reference to HD 474 has been replaced with BS 3288-3. Commentary has been extended to explain ball and socket couplings in accordance with IEC 60120.</p> <p>Clause 5.7, Composite string insulator: Commentary amended to reflect current practice regarding corona rings and arcing horns.</p> <p>Clause 6.2, Design and type test: Commentary inserted to explain design tests for composite insulators.</p> <p>Clause 6.5, Tracking and erosion tests: Reference to IEC 61109 replaced with BS EN 62217 and PD IEC/TR 62730.</p> <p>Clause 6.6.2, Corona extinction test: Reference to BS EN 61284 added. Option for use of daylight corona camera added.</p> <p>Clause 6.6.3, Single unit RIV test 132 kV: Test voltage of 18 kV now stipulated.</p> <p>Clause 6.6.5, Insulator sets RIV and corona test arrangement: New clause added to capture requirements for RIV and corona testing.</p> <p>Clause 7, Pollution performance: Major amendment to clause to align with IEC/TS 60815. New creepage distance criteria inserted reflecting UK experience (25 mm/kV and 31 mm/kV). Option to design insulator creepage distance using Approach 2, 'measure and test' or Approach 3, 'measure and design', are now included. Table 4 and Table 5 have been amended to remove reference to 'light' pollution level as this level is generally not applicable for UK overhead lines.</p> <p>Clause 8, Mechanical performance: Major amendment to clause which now stipulates mechanical loading for insulators regardless of design material. New requirement for pilot post insulators to meet an SCL of 8 kN. Commentary re-written to reflect the 'damage limit' concept described in BS EN 61109 Annex A. New commentary added describing mechanical loading terminology and also describing torsional capability of composite insulators.</p> <p>Annex A, Summary of type and sample tests: New column added for 'Composite line insulators'.</p> <p>Annex B, Self-Certification Conformance Declarations: Declaration sheets updated to reflect latest clauses in TS 43-93.</p> <p>Details of all other technical, general and editorial amendments are included in the associated Document Amendment Summary for this Issue (available on request from the Operations Directorate of ENA).</p>
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Foreword

This Technical Specification (TS) is published by the Energy Networks Association (ENA) and comes into effect from the date of publication. It has been prepared under the authority of the ENA Engineering Policy and Standards Manager and has been approved for publication by the ENA Electricity Networks and Futures Group (ENFG). The approved abbreviated title of this engineering document is “ENA TS 43-93”.

This ENA TS replaces and supersedes ENA TS 43-93 Issue 4 2004.

The main normative Standards for insulators are referenced by this ENA TS, namely:

- BS EN 60383 Part 1 and Part 2, covering porcelain and glass insulators;
- BS EN 61109, covering composite string insulators (specific test procedures now described in BS EN 62217);
- BS EN 61952, covering composite line post insulators (specific test procedures now described in BS EN 62217);
- IEC/TS 60815 Parts 1-3, covering pollution requirements for insulators.

The requirements for composite insulators in this ENA TS have been extended and aligned with the relevant normative Standards. These additions and clarifications cover both design and testing requirements.

The requirements for insulators intended for use in polluted environments i.e. creepage distance, have been aligned with the latest IEC/TS 60815 Standards. As well as creepage distances based on historical practice, the application of ‘measure and test/design’ approaches is captured in this ENA TS.

The terms ‘porcelain’ and ‘ceramic’ are considered the same for the purposes this ENA TS.

Annex A of this ENA TS summarises type and sample tests for insulators.

Annex B of this ENA TS includes ‘Self Certification Conformance Declaration’ sheets to enable manufacturers/suppliers to declare conformance or otherwise, clause by clause, with the relevant parts of the document.

Where the term “shall” or “must” is used in this document it means the requirement is mandatory. The term “should” is used to express a recommendation. The term “may” is used to express permission.

NOTE: Commentary, explanation and general informative material is presented in smaller type, and does not constitute a normative element. ‘COMMENTARY ON’ text has also been written in *italics*.

1 Scope

This ENA TS describes requirements for HV line insulators, and LV line and service insulators, to be used on pole overhead systems.

HV line insulators covered are those intended for operation up to and including 132 kV, and that conform to the requirements of BS EN 60383 Parts 1 and 2, BS EN 61109, and BS EN 61952.

A range of LV line and service insulators for voltages up to and including 1 000 V are covered.

As LV line and service insulators are not covered by an equivalent specification, this ENA TS determines their design, materials, dimensions and tolerances, quality of manufacture, finished condition, marking and test requirements.

2 Normative references

The following referenced documents, in whole or part, are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

BS 3288-2, *Insulator and conductor fittings for overhead power lines: Specification for a range of insulator fittings*

BS 3288-3, *Insulator and conductor fittings for overhead power lines. Dimensions of ball and socket couplings of string insulator units*

BS EN ISO 1461, *Hot dipped galvanised coatings on fabricated iron and steel articles. Specifications and test method*

BS EN 60060-1, *High-voltage test techniques. General definitions and test requirements*

BS EN 60071-1, *Insulation co-ordination. Definitions, principles and rules*

BS EN 60305, *Insulators for overhead lines with a nominal voltage above 1 kV. Ceramic or glass insulator units for a.c. systems. Characteristics of string insulator units of the cap and pin type*

BS EN 60383-1, *Insulators for lines with a nominal voltage above 1000 V: Ceramic or glass insulator units for a.c. systems. Definitions, test methods and acceptance criteria*

BS EN 60383-2, *Insulators for overhead lines with a nominal voltage above 1000 V: Insulator strings and insulator sets for a.c. systems. Definitions, test methods and acceptance criteria*

BS EN 60372, *Locking devices for ball and socket couplings of string insulator units. Dimensions and tests*

BS EN 60437, *Radio interference test on high-voltage insulators*

BS EN 60507, *Artificial pollution tests on high-voltage ceramic and glass insulators to be used on a.c. systems*

BS EN 60672 Series, *Ceramic and glass insulating materials*

BS EN 61109, *Insulators for overhead lines. Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1000 V. Definitions, test methods and acceptance criteria*

BS EN 61284, *Overhead lines. Requirements and tests for fittings*

BS EN 61466-1, *Composite string insulator units for overhead lines with a nominal voltage greater than 1000 V. Standard strength classes and end fittings*

BS EN 61466-2, *Composite string insulator units for overhead lines with a nominal voltage greater than 1000 V. Dimensional and electrical characteristics*

BS EN 61952, *Insulators for overhead lines. Composite line post insulators for A.C. systems with a nominal voltage greater than 1000 V. Definitions, test methods and acceptance criteria*

BS EN 62217, *Polymeric HV insulators for indoor and outdoor use. General definitions, test methods and acceptance criteria*

IEC 60120, *Dimensions of ball and socket couplings of string insulator units*

IEC/TS 60815-1, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles*

IEC/TS 60815-2, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for a.c. systems*

IEC/TS 60815-3, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 3: Polymer insulators for a.c. systems*

PD IEC/TR 62730, *HV polymeric insulators for indoor and outdoor use tracking and erosion testing by wheel test and 5 000h test*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

class A insulator

insulator or insulator unit in which the length of the shortest puncture path through solid insulating material is at least equal to half the arcing distance

NOTE: An example of class A insulator is a long rod insulator with external fittings.