



Technical Specification 43-125

Issue 2 2017

Design guide and technical specification for
overhead lines above 45 kV

Part 4 Lattice steel tower foundations and site
requirements

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**Operations Directorate
Energy Networks Association
6th Floor, Dean Bradley House
52 Horseferry Rd
London
SW1P 2AF**

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Issue 1 of TS 43-125 published, 2005.

Revised, 2017.

Amendments since publication

Issue	Date	Amendment
Issue 2	February 2017	<p>Issue 1 major revision:</p> <ul style="list-style-type: none">(i) reflects major technical amendments made to two main Standards referenced namely BS EN 50341-1 and BS EN 50341-2-9(ii) split the document into multi-parts reflecting standalone design requisites and the requirements for individual components and parts of lattice tower design(iii) remove wood poles and steel poles from the scope of TS 43-125. <p>TS 43-125 has been divided into 4 separate documents:</p> <ul style="list-style-type: none">• Part 1 Design basis and electrical requirements• Part 2 Conductor systems, insulators and fittings• Part 3 Vibration dampers and spacers• Part 4 Foundations and site requirements <p>Clause numbering of this Specification has changed significantly due to the document becoming 4 Parts. The cross referencing within the document has been updated accordingly.</p> <p>To ensure consistency to the normative reference BS EN 50341 throughout the document, the following key changes have been completed.</p> <ul style="list-style-type: none">• Where BS EN 50341-1 Part 1 and Part 2-9 are referenced in square brackets as part of the clause title, these references have been amended to ensure all are correct and accurate.

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		<ul style="list-style-type: none"> • All references to ‘Part 3’ have been changed to the correct ‘Part 2-9’ reference as appropriate. • The terminology to describe the design approaches has been amended throughout i.e. <ol style="list-style-type: none"> i. ‘General Approach’ is now written as ‘Approach 1’ ii. ‘Empirical Approach’ is now written as ‘Approach 3’ <p>NOTE: To avoid confusion due to the extensive re-numbering of existing Clauses and addition of new Clauses, the Clause numbering below refers to this revised version, Issue 2. The Clause numbers of Issue 1 are given in brackets, where relevant.</p> <p>The following technical changes are relevant to this document.</p> <p>Foreword: Clause added to introduce Part 4 describing importance of BS EN 50341, splitting of TS 43-125 into 4 Parts and explanation of the structure of Part 4.</p> <p>Clause 1: Introductory Clause to provide context for the overall role of TS 43-125 and relationship with BS EN 50341 Parts 1 and 2-9.</p> <p>Clause 2.1 (Issue 1, 11.2): Scope limited to lattice towers and references to steel and timber poles removed.</p> <p>Clause 2.3 (Issue 1, 11.3): References updated, added or deleted as necessary.</p> <p>Clauses 2.4.2.1 to 2.4.2.4 (Issue 1, 11.4.2.1 to 11.4.2.4): Requirements for steel and timber poles deleted.</p> <p>Clause 2.4.3.3, Table 2.1 (Issue 1, 11.4.3.3): Minimum shielding angle for 66 kV added.</p> <p><i>Issue 1 clauses 11.4.5.2 to 11.4.6.3 deleted to remove requirements for steel and timber poles and guy terminations.</i></p> <p><i>Issue 1 clauses 11.4.7.2 to 11.4.7.4 deleted to remove requirements for steel and timber poles.</i></p> <p>Clause 2.4.8.1 (Issue 1, 11.4.9.1): Attention drawn to the UK NNA amendments relating to partial factors.</p> <p><i>Issue 1 clauses 11.4.9.2, 11.4.9.3, 11.4.10.3 & 11.4.10.4 deleted to remove requirements for steel and timber poles.</i></p> <p>Clause 2.4.9.6 (Issue 1, 11.4.10.8): Requirements for steel poles deleted.</p> <p><i>Issue 1 clauses 11.4.10.10 deleted to remove requirements for timber poles.</i></p> <p>Clause 2.4.11 (Issue 1, 11.4.12): Requirements for steel and timber poles deleted.</p> <p><i>Issue 1 clauses 11.5.4 & 11.5.5 deleted to remove requirements for timber poles and guy materials.</i></p> <p>Clause 2.6.1.6 (Issue 1, 11.6.1.6): Requirements for timber poles deleted.</p> <p><i>Issue 1 Clause 11.6.1.7 deleted to remove requirements for timber poles.</i></p> <p>Clause 2.7.1 (Issue 1, 11.7.1): Requirements for guy wires deleted.</p> <p><i>Issue 1 Clause 11.7.4 deleted to remove requirements for timber poles.</i></p> <p>Clause 2.8.2 (Issue 1, 11.8.2): Requirements for timber poles deleted.</p> <p><i>Issue 1 Clause 11.8.5 deleted to remove requirements for timber poles.</i></p> <p>Clause 2.9 (Issue 1, 11.9): Requirements for steel and timber poles and guys deleted.</p> <p><i>Issue 1 clauses 11.9.5.2 & 11.9.5.3 deleted to remove requirements for timber poles.</i></p> <p>Clause 2.9.6 (Issue 1, 11.9.6): Requirements for steel and timber poles deleted.</p> <p>Clause 2.9.8 (Issue 1, 11.9.8): Requirements for steel poles deleted.</p>
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		<p><i>Issue 1 clauses 11.9.9 to 11.9.11.2 deleted to remove requirements for steel and timber poles and guy terminations.</i></p> <p><i>Issue 1 Clause 11.9.13 deleted to remove requirements for timber poles.</i></p> <p>Clause 3.3 (Issue 1, 12.3): References updated, added or deleted as necessary.</p> <p>Clause 3.4.3 (Issue 1, 12.4.3): Requirements for steel and timber poles deleted.</p> <p>Clause 3.4.5 (Issue 1, 12.4.5): Major revision to recommend that the calculations for foundation design to be based on the design methodology in BS EN 50341-1:2012 Clause 8.2 (design methodology was not in the BS EN 50341-1:2001 version). Requirements for steel poles deleted.</p> <p><i>Issue 1 Clause 12.4.6 deleted because design by prescriptive measures does not apply to lattice towers.</i></p> <p><i>Issue 1 Clause 12.4.7 deleted and text incorporated into Clause 3.4.5.</i></p> <p>Clause 3.4.6 (Issue 1, 12.4.8): Requirement added that the design principles for foundation uplift and ground resistance to be based on the models in BS EN 50341-1:2012 Annex M (design methodology was not in the BS EN 50341-1:2001 version).</p> <p>Clause 3.4.6.2 (Issue 1, 12.4.8.2): Requirements for steel poles deleted.</p> <p><i>Issue 1 Clause 12.4.8.3 deleted to remove requirements for guy terminations.</i></p> <p>Clause 3.4.7 (Issue 1, 12.4.9): Requirement added that the concrete design of foundations to be to take account of the guidance in BS EN 50341-1:2012 Annex M.3.2 (concrete foundation design methodology was not in the BS EN 50341-1:2001 version).</p> <p>Table 3.2 (Issue 1, Table 12.3): Permitted cement types updated to align with BS EN 8500-1 Table A.6.</p> <p><i>Issue 1 clauses 12.5.5 to 12.5.7 deleted to remove requirements for guy terminations.</i></p> <p><i>Issue 1 Clause 12.8 deleted because not used.</i></p> <p>Clause 4.3 (Issue 1, 13.2): References updated, added or deleted as necessary.</p> <p>Clause 5.3 (Issue 1, 14.3): References updated, added or deleted as necessary.</p> <p>Clause 5.4.1 (Issue 1, 14.4.1): Requirements for a desk study of timber poles deleted.</p> <p><i>Issue 1 Clause 14.4.4 deleted because design by prescriptive measures does not apply to lattice towers.</i></p> <p>Clause 5.6 (Issue 1, 14.6): 3rd list item b): Requirement added that the study to be carried out in accordance with established procedures e.g. BS 10175.</p> <p>Clause 6.3 (Issue 1, 15.3): References updated, added or deleted as necessary.</p> <p>Clause 6.4 (Issue 1, 15.4): Habitat conservation added to list of public concerns.</p> <p>Clause 6.5.2 (Issue 1, 15.5.2): Text added of background to the 'Holford rules' and the value of continuing to make use of them.</p> <p>Clause 6.5.5.1 (Issue 1, 15.5.5.1): Text added regarding the National Grid T-pylon', which has the potential to reduce the impact of a line in some landscapes.</p>
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		<p>Clause 6.6.1 (Issue 1, 15.6.1):</p> <p>(i) Para 1: Wording revised to reference the latest regulations for environmental impact assessment.</p> <p>(ii) After last para: Additional requirements that reference to be made to The Conservation of Habitats and Species Regulations and The Town and Country Planning (Environmental Impact Assessment) Regulations.</p> <p>Clause 6.6.2 (Issue 1, 15.6.2): List item d) ii: Additional requirement that environmental statement to include natural habitats subject to the conservation regulations.</p> <p>Bibliography added. Non-normative references contained in the Specification included.</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 43-125”.

Energy Networks Association Technical Specifications (ENA TS) 43 series for Overhead Lines were originally issued as Electricity Supply Industry (ESI) Specifications, and reflected current practice within the industry in the 1970-80s. Design methodology was based on the deterministic approach in accordance with the requirements of the Electricity (Overhead Lines) Regulations 1970. Complementary design requirements were based on the CEGB Transmission Plant Standards, subsequently reissued as ENA Technical Specifications.

European Normalised Standard, EN 50341, for the general design requirements of overhead electrical lines, initially for lines with voltages exceeding 45 kV (a.c.) was published in 2001. To complement the main body of the Standard, National Normative Aspects (NNAs) were prepared to reflect existing national laws or regulations relating to the design and/or construction of overhead lines, climatic conditions and current national practices in their own country. BS EN 50341 and its associated NNA Standard became the main normative reference for overhead line design in the United Kingdom (UK) as reflected in ENA TS 43-125 Issue 1.

In 2012, BS EN 50341-1 (subsequently referred to as Part 1) was subject to a technical revision. Technical content was updated and the scope was widened to cover overhead lines exceeding 1 kV a.c. The technical changes in the document impacted a number of topics including overhead line loadings. For example, the move away from using hourly-mean wind speeds for calculating applied forces on overhead line structures to 10-minute mean wind speeds. The ENA conducted specialist analysis of impacts of the revised BS EN 50341-1 and, as such, calculation factors have been incorporated into the NNA, where appropriate, to mitigate onerous overhead line designs.

Following the revision of BS EN 50341-1, the UK NNA was revised and published in 2015 as BS EN 50341-2-9 (subsequently referred to as Part 2-9). The intent of the United Kingdom NNA remains the same in that minimum design loading conditions and corresponding ‘boxed’ values have been specified and reference made to the Project Specification for the actual conditions or values.

Previously, two distinct design approaches were described in BS EN 50341-1 for both the mechanical and electrical design: the ‘General Approach’ based on the application of probabilistic reliability theory and an ‘Empirical Approach’ based on long term European experience, i.e. a deterministic-based design. The revised Standard now describes Approaches 1-3. However, it is Approach 1 (previously ‘General Approach’) and Approach 3 (previously ‘Empirical Approach’) that are followed in the UK as declared in Part 2-9. Indicative values for partial loading or material factors (‘boxed’ values) are contained within the main body of the Standard, with the actual value specified in the NNA or alternatively in the Project Specification.

To ensure consistency in the application of both Part 1 and Part 2-9 and to provide guidance in the determination of the actual loading cases, boxed values etc., the Energy Networks Association has prepared this Specification for overhead lines above 45 kV, specifically, lattice tower overhead lines. ENA TS 43-125 Issue 1 contained requirements for wood pole and steel pole overhead lines but this has been removed as such construction is covered by other Engineering Documents, namely: ENA TS 43-30 [1], ENA TS 43-40 [2], ENA TS 43-50 [3] and ENA TS 43-97 [4].

Since neither Part 1 nor Part 2-9 encompass the installation aspects of overhead line construction, standard Clauses covering these requirements have been included at appropriate points. To further assist in the use of these technical guidance documents cross-references have been included in the Clause headings.

To provide guidance on the application of Part 1 and Part 2-9, where appropriate, a '*commentary*' has been provided in the text, especially as regards the determination of specific design loading conditions and the corresponding partial loading and material factors.

ENA TS 43-125 has been restructured as a multi-part document with the objective that any future amendments can be completed in an efficient and timely manner. ENA TS 43-125 comprises of the following parts.

ENA TS 43-125 Part 1 – Design basis and electrical requirements.

ENA TS 43-125 Part 2 – Conductor systems, insulators and fittings.

ENA TS 43-125 Part 3 – Vibration dampers and spacers.

ENA TS 43-125 Part 4 – Foundations and site requirements.

Within each Part of TS 43-125, the main Clause heading is used to bound the requirements for a particular topic, e.g. Clause 2 in ENA TS 43-125 Part 3 captures all requirements for vibration dampers. Under each main Clause, the scope, terms and definitions and normative references are provided, relevant to that topic.

Previous requirements in ENA TS 43-125 Issue 1 covering optical fibre cables have been removed as this topic is covered by ENA TS 43-126 suite of documents.

Project information to be provided by the ENA Member Company (ENAMC) Engineer, quality assurance requirements and the need for Contractors' and/or Suppliers' design submissions have been identified throughout this Specification. For consistency, informative annexes are included at the end of each main Clause heading and include the following details.

- Annex A: Project Information to be provided by the ENAMC Engineer.
- Annex B: Contractors' and/or Suppliers' Q.A. Hold and Notification Points.
- Annex C: Contractors' and/or Suppliers' Design Submissions.

Overhead lines by their very nature constitute a hazardous environment during their construction, maintenance and dismantling. Consequentially, to fulfil the requirements of the CDM Regulations [5] health and safety considerations and in particular 'risk assessments' should be undertaken as part of the overall design process.