

This document is for internal and contract specific use only.

Disclaimer

NGG and NGET or their agents, servants or contractors do not accept any liability for any losses arising under or in connection with this information. This limit on liability applies to all and any claims in contract, tort (including negligence), misrepresentation (excluding fraudulent misrepresentation), breach of statutory duty or otherwise. This limit on liability does not exclude or restrict liability where prohibited by the law nor does it supersede the express terms of any related agreements."

Copyright © National Grid plc 2011, all rights reserved

All copyright and other intellectual property rights arising in any information contained within this document are, unless otherwise stated, owned by National Grid plc or other companies in the National Grid group of companies. No part of this publication may be reproduced in any material form (including photocopying and restoring in any medium or electronic means and whether or not transiently or incidentally) without the written permission of National Grid plc

This information should not be forwarded to third parties.

ADDENDUM

Date Effective From	July 2011
----------------------------	-----------

	Originated by	Approved by
Name	Hayley Tripp	
Job Title	EMF Scientist	
Department	Electricity Network Investment	
Date	July 2011	

ORIGINAL DOCUMENT DETAILS

DOCUMENT TITLE	Generic design principles for a new overhead line
DOCUMENT NUMBER	TS 2.27
ISSUE NUMBER	1
ISSUE DATE	April 2004

ADDENDUM DETAILS

The above document shall be read in conjunction with the following amendments:

Check appropriate boxes below

Addition		Replacement	X	Deletion	
This addendum replaces the 5th bullet point in section 1.2 and replaces it with: 1.2 Conductor type, size and bundle configuration - Electric and magnetic field: The overhead line design will comply with National Grid's EMF policy defined in PS(T) 103.					

GENERIC DESIGN PRINCIPLES FOR A NEW OVERHEAD LINE

TABLE OF CONTENTS

PURPOSE AND SCOPE	1
PART 1 – PROCEDURAL	1
1 GENERAL REQUIREMENTS	1
2 TEST REQUIREMENTS	10
3 FORMS AND RECORDS	10
PART 2 - DEFINITIONS AND DOCUMENT HISTORY	10
4 DEFINITIONS	10
5 REFERENCES	10
6 AMENDMENTS RECORD	11
PART 3 – GUIDANCE NOTES AND APPENDICES.....	12
APPENDIX A - EXAMPLE OF A CONTRACT SPECIFIC SPECIFICATION FOR A NEW OVERHEAD LINE.....	12

PURPOSE AND SCOPE

This document forms part of a suite of documents which define the National Grid Transco plc's (NGT) functional and performance requirements for new plant and equipment.

This Specification covers the requirements applicable to **new designs** of overhead lines to be operated by NGT at 132, 275 or 400 kV, with highest system voltages for overhead line design purposes of 145, 300 and 420 kV respectively. **It shall not be used for the refurbishment or re-utilisation of existing overhead lines.** For refurbishment/re-utilisation of existing lines refer to TS 2.4

PART 1 – PROCEDURAL

1 GENERAL REQUIREMENTS

The design of a new overhead line for use on the NGT System shall meet the general parameters in CI 101 and TS 1. It shall also take into consideration the requirements of EN 50341 Part 1 and the UK National Normative Aspects EN 50341-3-9. This Standard permits line design to meet local, rather than United Kingdom worst weather conditions, both from the mechanical reliability and conductor current ratings points of view, using semi-probabilistic design methods (General Approach).

The hierarchy of functional design specifications shall be:

- EN 50341, as modified by:
- EN 50341-3-9, as modified by:
- TS 2.27, TS 2.10 and TS 3 series, as modified by
- The Contract Specification

TS 2.27 and the level 3 National Grid Transco Technical Specifications (TS's) shall be considered as the Project Specification for compliance with EN 50341. A procurement tender document will specify the requirements for the proposed line design using the Contract Specification defined herein.

An overhead line is an assembly of sub components or sub systems. The requirements for these are covered by Level 3 TS's and only equipment registered by NGT to these specifications and in line with the Type Registration process, described in TGN (E) 185, shall be used on an overhead line.

An overhead line is part of the NGT transmission system and all reliability, security and safety considerations shall take account of the system requirements for the location on the system. It shall be possible for designs of overhead line for NGT to be safely maintained with one circuit live using the current NGT dead-line procedures. Maintenance of the proposed overhead line by live-line techniques may be required and will be specified in the Contract. The design should also allow replacement of the earthwire with either circuit live.

1.1 Statutory Requirements

1.1.1 Electricity Supply Regulations

All new overhead line construction must comply with the requirements of the 2002 Electricity Safety, Quality and Continuity Regulations with particular reference to ground clearances, earthing, safety signs and precautions against unauthorised access and to EN 50341, including EN 50341-3-9, the National Normative aspects for the United Kingdom

1.1.2 Clearances for Overhead Line Conductors

The line design shall ensure that the external clearances specified in ENA TS 43-8 are provided under the conditions specified therein except where a greater clearance is defined in the Contract specification.

For clearances of phase conductors at any point which is not over a road, it should be noted that the minimum clearance allows for safe passage of vehicles up to 4.5 m in height. For a new overhead line NGT will assume a vehicle height of 5.0 m. If higher vehicles are known to operate under a span then the minimum clearances shall be increased by 3.1 m for 400 kV, 2.4 m for 275 kV and 1.4 m for 132 kV above the maximum height of such vehicles.

A minimum clearance of 10 m or as required by the relevant authority shall be obtained over areas used for Sport and Recreation. These areas shall include sports pitches, golf courses, horse jumping sites, fishing lakes, rivers and canals. Line towers with earthwires shall not normally be within 30 m of a swimming pool, if earthwires are not used this shall be extended to 50 m. Clearances to permanently installed sports facilities including rugby posts, starting posts etc., shall be such as to ensure that an approach of any person closer than 3.1 m is avoided.

1.1.3 Earthing

The requirement for earthing in the 2002 Electricity Safety, Quality and Continuity Regulations shall be met by ensuring that each tower has a footing resistance not exceeding 10 Ohms for an unstrung tower. Where foundations are made from reinforced concrete the reinforcing bars shall where practicable be connected to the tower leg. For tubular steel encased foundations a direct electrical connection from the tower leg to the casing shall be made. At sub-stations connection shall be made from at least two legs of the terminal tower to the sub-station earthing mat.

The values to be used for acceptable levels of step and touch potential shall be in accordance with those in EN50341.

1.1.4 Safety Signs

The requirement for safety signs shall be met by complying with TS 3.4.9.

1.1.5 Precautions Against Unauthorised Access

The requirement to prevent unauthorised access to a position at which an overhead line would be a source of danger shall be met. For a line supported by lattice towers this shall be met by fitting anti-climbing devices to TS 3.4.9. Special anti-climbing devices shall be used where owing to the ground slope or for other reasons the standard type is not adequate.

In the case of pole towers having a base diameter exceeding 1 m, unauthorised access shall be prevented by not providing permanent climbing aids until at least 4 m above ground level. Poles having a base diameter equal to, or less than, 1m will have anti-climbing devices fitted, as defined in the Contract.

1.2 Conductor Type, Size and Bundle Configuration

The selection of a conductor system for a new line design must take into account the following constraints:

- Conductor thermal rating for the circuits
- Mechanical load withstand capability for the location
- Electrical impedance characteristics for the circuits
- Radio and audible noise acceptability for the line location.
- Electric and magnetic field levels at 1m above the ground must comply with the guidelines recommended by the NRPB and advice on their implementation issued by UK Government.
- Acceptable levels of thermal losses for the circuits
- Short circuit current withstand capability

The required conductor system will be specified in the Contract placed by NGT. Conductor systems currently used by NGT are specified in TS 3.4.20.

a) Conductor Thermal Rating

The rated conductor temperature for clearance purposes will be specified in the Contract. Thermal ratings shall be specified by NGT.

b) Conductor Bundle Configuration

The acceptability of the conductor bundle configuration is determined by constraints on the surface electrical stress and by the aerodynamic behaviour of the bundle under a wide range of weather loads. The dimensions and orientation of the conductor bundle to be maintained on the line will be specified in the Contract.

c) Conductor System Mechanical Characteristics

The individual sub-conductors and earthwire shall be designed to withstand the 50 year return loads with partial factor on load of $\gamma_v = 1.1$ and a partial factor on strength γ_m of at least 1.3. Methods to control wind-induced conductor movement in the form of aeolian vibration and sub-conductor oscillation shall be provided with evidence of functional capability unless the control systems in clause 1.10 are used with NGT type-registered equipment.