



## Engineering Technical Report 140

August 2017

Statutory Voltage Limits at customers' terminals  
in the UK and options for future application of  
wider limits at low voltage

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First Published August 2017

**Amendments since publication**

<b>Issue</b>	<b>Date</b>	<b>Amendment</b>

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## **Foreword**

This Engineering Technical Report is published by the Energy Networks Association (ENA) and comes into effect from July 2017. 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 "ETR 140". This is a first issue and does not cancel or replace any other document.

This document has been developed in conjunction with the ENA Task Group on Statutory Voltage Limits and includes all relevant findings from work carried out by the Task Group. The Task Group would like to acknowledge the contributions of its membership and the support of BEIS (formerly DECC) and BEAMA/GAMBICA in its work.

The intention is for this document to be used by ENA member companies, Ofgem and the Department for Business, Energy and Industrial Strategy (BEIS) to promote stakeholder engagement on the use of the full range of statutory voltage limits currently available. It is also prepared to provide an evidence base for consideration by BEIS when assessing proposals to change statutory voltage limits.

The Task Group has also developed an Engineering Recommendation on the measurement of voltage at customer terminals at low voltage level. That document assists with the investigation and categorisation of voltage events.

## Introduction

At a meeting of the Energy Networks Futures Group (ENFG) held in January 2015 it was agreed that an ENA Task Group would be established to consider the findings of various Low Carbon Network Fund (LCNF) projects in relation to voltage control on the low voltage (LV) network. The projects have highlighted benefits that could be gained by utilising a wider range and new lower voltage bound.

The Task Group used LCNF findings to review the current lower bound of the statutory voltage limits on the low voltage network and, specifically at LV customers' terminals. Additionally the Task Group reviewed the option for changing the current lower bound from 6 per cent below nominal voltage to 10 per cent below nominal so as to align with the current BS EN 50160 and BS EN 60038 standards [3], [4].

The Task Group quantified the positive and negative aspects of such a policy and practice change on network operators, customers, generators and other stakeholders in terms of planning and operations.

An ENA Task Group was convened under the chairmanship of Paul Jewell of Western Power Distribution. A list of Task Group members is provided at Annex A.

The terms of reference for the Task Group included five main areas of consideration which were:

- Working within the existing UK limits of 230V +10/-6%
- Working within wider limits of 230V +10/-10%
- Distributed Generation (DG) headroom<sup>1</sup> and Low Carbon Technology (LCT) footroom<sup>2</sup>
- Specific engineering challenges
- Impact on the National Electricity Transmission System

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<sup>1</sup> A measure of the maximum capacity of additional DG that can be connected for the voltage on the supply terminals not to exceed the upper statutory voltage limit

<sup>2</sup> A measure of the maximum additional LCT load that can be connected for the voltage on the supply terminals not to fall below the lower statutory voltage limit

## 1 Scope

This report details the potential benefits to stakeholders gained through Distribution Network Operators (DNOs) revising their operations within the current statutory voltage limit bands. In part this change is driven by the changing requirements placed on their networks by customers but also by opportunities identified by a number of LCNF projects. This report summarises the potential benefits and impacts on stakeholders, including the effect on LV networks, of changing the lower bound of the current LV statutory voltage limit from 6 per cent to 10 per cent as referenced in BS EN 50160 and BS EN 60038 [3], [4]. The report also compares the UK position with a number of other European countries who already utilise a wider band and investigates the voltage flexibility available within the current Regulations.

## 2 Normative references

The following referenced documents, in whole or part, are pertinent to this document.

### Statutory Instruments:

- [1] Electricity Safety Quality and Continuity Regulations 2002, as amended (ESQCR)
- [2] Electricity Safety Quality and Continuity Regulations (Northern Ireland) 2012, as amended (ESQCR [NI])

### Standards Publications:

- [3] BS EN 50160:2010 - Voltage characteristics of electricity supplied by public electricity networks
- [4] BS EN 60038:2011 - CENELEC standard voltages
- [5] BS 7671:2008+A3:2015 – Requirements for Electrical Installations. IET Wiring Regulations

## 3 Terms and definitions

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

### 3.1 AVC

Automatic Voltage Control

### 3.2 DUOS

Distribution Use Of System (charges)

### 3.3 Low Carbon Network Fund (LCNF)

The LCN Fund, established by Ofgem as part of the electricity distribution price control that ran until 31 March 2015. It supported projects sponsored by the DNOs to try out new technology, operating and commercial arrangements.

### 3.4 Low Voltage (LV)

In relation to alternating current, a voltage exceeding 50V measured between phase conductors (or between phase conductors and earth), but not exceeding 1,000V measured between phase conductors (or 600V if measured between phase conductors and earth), calculated by taking the square root of the mean of the squares (RMS) of the instantaneous values of a voltage during a complete cycle.