



## Technical Specification 35-7

Issue 1 2014

Tap-changers for system voltages up to and including 132 kV

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## Foreword

This Technical Specification (TS) is published by the Energy Networks Association (ENA) and comes into effect from 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 35-7”.

This is the first issue, which replaces the legacy specification BEBS T2 – Specification for Transformers and Reactors, Section 26 (1991) – Tap-Changing Equipment.

This Technical Specification has been prepared by the Energy Networks Association with direction from the ENA Transformer Panel.

Tap-changers covered by this Technical Specification conform with the International and National Standards listed. This Technical Specification amplifies and/or clarifies the requirements of IEC 60214-1 where alternative arrangements are permitted and where additional information is required. The Technical Specification should be read, therefore, in conjunction with IEC 60214-1.

The clause numbering of this Technical Specification follows that of IEC 60214-1 as far as the second level headings but deviates thereafter. Where appropriate, the relevant clause number of IEC 60214-1 is given for reference.

All references relate to IEC 60214-1 Edition 2, 2014.

Assistance on the correct selection of a tap-changer can be found in IEC 60214-2 Tap-changers – Part 2: Application guide.

NOTE: At the date of publication of this Technical Specification, IEC 60214-2 was under review.

Annex B of this Technical Specification includes ‘Self Certification Conformance Declaration’ sheets to enable manufacturers to declare conformance or otherwise, clause by clause, with the relevant clauses of the document. Manufacturers are also requested to provide supporting information by completing the additional schedules detailed in Annexes C and D of this document.

Where the term “shall” or “must” is used in this document it means the requirement is mandatory. 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 requirement.

## Introduction

Tap-changers are present on virtually all power transformers used by ENA Member Companies.

Tap-changers fitted to transformers operating on the lower voltage distribution systems (typically those with the higher voltage winding operating at 6.6 kV, 11 kV and 20 kV) are predominantly of the de-energised tap-changer type and operated manually. For the higher voltages (33 kV, 66 kV and 132 kV), on-load tap-changers with motor-operated mechanisms are usually specified.

NOTE: De-energised tap-changers were called “off-circuit tapping selectors” in BEBS T2-26. The term “off-load tap-changer” is commonly used when referring to an off-circuit tapping selector. All off-circuit tapping selectors are operated with the transformer de-energised. Hence the terms are synonymous. The term “de-energised tap-changer” is a defined term in IEC 60214-1 and is used in this Technical Specification.

Current specification of tap-changers by ENA Member Companies predominantly follows the requirements set out in IEC 60214-1. The purpose of this document is to cover the technical requirements and features that are specific to ENA Member Companies in the UK but not addressed by IEC 60214-1.

With the increasing penetration of embedded generation into the network, it is likely that on-load tap-changers for distribution transformers will become increasingly common. The requirements of this Technical Specification are intended to cover these situations along with the more traditional applications.

It is also intended that this Technical Specification covers the requirements for on-load tap-changers intended as replacement units for time-expired or failed units on existing transformers. Opportunities exist to encourage innovative solutions when replacing such units.

## 1 Scope

This Specification covers both de-energised and on-load tap-changers for use on any power transformer up to and including 132 kV intended for use on the UK electricity distribution and transmission networks. It predominantly covers conventional methods of tap-changing but does not preclude the use of emerging technologies such as power electronics.

This Specification covers the technical requirements for on-load and de-energised tap-changers and, where appropriate, their motor-drive mechanisms fitted, or intended to be fitted, to transformers at all voltage levels up to and including 132 kV.

The requirements apply to traditional designs of tap-changers immersed in mineral insulating oil but are also applicable for tap-changers with air or gas insulation or immersed in other insulating liquids in so far as conditions are applicable.

This Specification applies to tap-changers with arcing contacts but may also be used for arcing free on-load tap-changers incorporating electronic switching in so far as conditions are applicable.

Remote control schemes and automatic voltage control relays are subject to separate specifications and are, therefore, excluded from this Specification.

NOTE: The terms “power electronics” and “electronic switching” are intended to refer to innovative technologies such as solid-state semiconductor devices. The terms are interchangeable for the purposes of this Technical Specification.

## 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

IEC 60214-1:2014, *Tap-changers – Part 1: Performance requirements and test methods*

IEC 60214-2:2004, *Tap-changers – Part 2: Application guide*

IEC 60529:1989, *Specification for degrees of protection provided by enclosures (IP code)*

BS IEC 60076-7:2005, *Power transformers. Loading guide for oil-immersed transformers*

BS EN 50216-5:2005, *Power transformer and reactor fittings. Liquid level, pressure and flow indicators, pressure relief devices and dehydrating breathers*

### Other publications

[N1] The Health and Safety (Safety Signs and Signals) Regulations 1996]

[N2] ENA Technical Specification 98-1, *Environmental classification and corrosion protection of structures, plant and equipment*

[N3] ENA TS 50-18, *Application of auxiliary electrical equipment*

[N4] ENA TS 50-19, *Standard numbering for small wiring (for switchgear and transformers together with their associated relay panels)*

[N5] ENA TS 35-2, *Emergency rated system transformers 66/20.5 kV, 66/11.5 kV and 33/11.5 kV delta/star and star/star connected*

[N6] ENA TS 35-3, *Continuous Maximum Rated (CMR) system transformers (for use on systems up to and including 132 kV)*

## 3 Terms and definitions

For the purposes of this document, Clause 3 of IEC 60214-1 shall apply as supplemented with the following terms and definitions.

### 3.1 unattached tap-changer

on-load tap-changer complete with motor-drive mechanism supplied for on-site installation onto an existing power transformer

NOTE: An “unattached tap-changer” may sometimes be referred to as a retro-fit tap-changer as most of these units will probably be used as a replacement item for an existing time-expired on-load tap-changer. “Retro-fit” or “replacement” can sometimes infer a like for like unit and might discourage innovative solutions.

### 3.2 barrier board

insulation barrier completely separating the insulating medium of a transformer main tank and the insulating medium of an attached compartment type tap-changer, and which is arranged to permit the connections between the transformer tappings and the tap-changer