

T&D Europe Implementation Guide for Commission Regulation 2019/1783, amending Commission Regulation N°548/2014

Scope of the paper

This Implementation Guide describes the main changes to Commission Regulation (EU) No 548/2014 of 21 May 2014 on implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to small, medium and large power transformers¹, following the adoption of Commission Regulation 2019/1783². differences between the original implementing Eco-design regulation voted in 2014 and the changes introduced by the amendment voted on January 15th, 2019 and published in official journal L272 on 25/10/2019.

***Disclaimer:** This T&D Europe Implementation Guide reflects the best knowledge of industry experts from all over Europe and the state of the art at the moment of its publication. This document aims at providing a descriptive overview of the relevant legal provisions, interpretation notes and reference documents that technology manufacturers need to be aware of when identifying the precise compliance measures to be taken for their specific products. A binding interpretation of EU legislation is of the exclusive competence of the European Court of Justice. Subject to new information, this document may be modified to accommodate new developments. Such information will be made available on T&D Europe's website.*

¹ <https://op.europa.eu/en/publication-detail/-/publication/9124a197-e17f-11e3-8cd4-01aa75ed71a1/language-en>

² <https://eur-lex.europa.eu/legal-content/GA/TXT/?uri=CELEX:32019R1783>

Introduction

In 2007, the European Commission started working on the performance of power transformers to help the EU to reach by 2020 the 20/20/20 targets agreed by Member States.

The 20/20/20 targets are:

- 20 % cut in greenhouse gas emissions (from 1990 levels);
- 20 % of EU energy should come from renewables;
- 20 % improvement in energy efficiency;

In 2007 the Commission agreed to begin developing the transformer regulations. Following extensive studies by VITO (a consultant contracted by the Commission) with stakeholders, including transformer manufacturers and utilities, the European Commission adopted Regulation No 548/2014 in 2014. This Regulation fixed the minimum energy performance of transformers from 1st July 2015. The Regulation contained a provision that required that it should be evaluated and, if necessary, modified after 3 years. In compliance with this requirement, the current revision was conducted in 2019, resulting in the development and publication of an amending regulation. This paper sets out the changes that are immediately applicable (after 14/11/2019) as well as the new and improved minimum energy performance requirements, effective from 1st July 2021. The implementation of the new provisions are estimated to result in energy savings of 16 TWh per year from 2020 onwards, which corresponds to 3.7 Mt of avoided CO₂ emissions. This is equivalent to saving half of the annual electricity consumption of Denmark (32 TWh) per year³.

The main conclusion of the evaluation was that transformer technology can reach TIER1 [I4]⁴ efficiency levels in 2015 without difficulty. In all case where there are no other constraints for the transformers' specification, there are no technical barriers foreseen by manufacturers in producing TIER2 transformers[I6].

³ Press release European Commission : https://europa.eu/rapid/press-release_IP-14-591_en.htm

⁴ References in square brackets refer to the page of the relevant text of the amended regulation and annex

The amendments to the Regulations comprise two parts, the first contains revisions to the scope, definitions, global requirements of eco-design, conformity, benchmark, market surveillance aspects and the content of the review. The second part concerns the annex which contains detailed eco-design requirements with tables and values.

The content of the amendment

As explained above, the amendment deals with more general administrative requirements and not the specific data for an individual transformer.

Most transformers are produced in large quantities for common applications, making the definition of energy performance relatively easy, but in a few cases with special transformers and those intended for special applications and meeting specific constraints, it is not so easy to define the performance because this depends on several parameters that are not always known. For this reason, the Commission has decided to exclude some types of transformers from the energy efficiency requirements of the Regulations [A1.2]. In the previous Regulation some of the definitions for the excluded transformers were not clear and this has been reviewed. In the case of transformers for onshore wind turbine and solar applications [A1.2b], it is now made clear that these are not excluded from the regulation and must apply the energy performance criteria. Special transformers for railway applications [A1.2f, A.1.2h], and starting transformers [A.1.2i] have clearer definitions. Transformers for offshore platform [A.1.2d] (wind turbine) have been excluded along with some nuclear power plant [20] applications and all transformers rated less than 5kVA [A.1.2p]. Nevertheless, the obligation to fulfil the official technical documentation for all transformers was highlighted even when the transformers are excluded [Annex4d] from the energy performance requirements of the regulation.

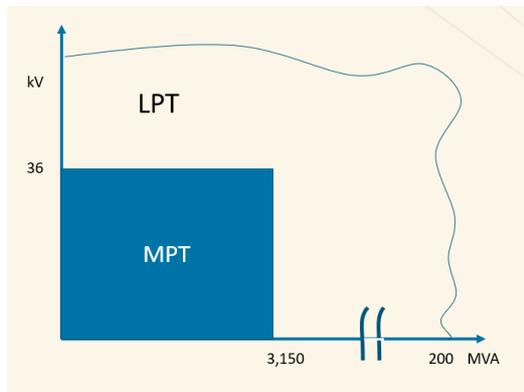
The definition of transformers for emergency conditions [A.1.2d] is now more clearly defined and corresponds to transformers especially designed to replace normal power supply for a limited period due to unplanned events or maintenance operation. These kinds of transformers are excluded from the energy performance related requirements of the Regulation.

The amendment now clarifies the performance requirements of the transformers that are subject to after sales operations [A1.3] considering the kind of operations to be done. If all or a part of the magnetic core is replaced and also one or more windings replaced (IEC60076-1 Chapter 3.3), then the transformers must meet the new efficiency requirements in force when it is made available again.

Note:

The regulation is applied only in the case of a change of 3 medium voltage or 3 low voltage phase coils along with the partial (e. g. upper yoke) or complete change of core

The definition of Large power transformers and Medium power transformers has changed [A2.3, A2.4], and it has been decided that all non-standard transformers will be set peak index efficiency (PEI) requirements which are immediately applicable. This changes the limits of Maximum Rated Power for standard transformers (called MPT) which is now 3150kVA instead of 40MVA. MPT are referred to as standard transformers because they are manufactured in large quantities with common components.



To meet the needs of some Member States, the rating of pole mounted transformers has been increased from 315kVA up to 400 kVA. [A2.7]

The definition of declared values [A2.17] has been clarified to be the values measured on the transformer during routine factory tests [A2.20] that shall be included in the technical documentation before compliance checks by Market Surveillance Authorities (MSA). The declared value of losses or PEI have to meet the requirement of the Regulation without applying any tolerances [Annex III].

Definitions for dual voltage [A2.18], equivalent model [A2.21], model identifier [A2.22], witness testing [A2.19] and factory acceptance test [A2.20] have now been given.

A concession has now been given for electricity distribution networks in the Czech Republic where the insulation level led to uncertainties in the definition of losses[A3].

It is important to note that manufacturers, importers or authorized representatives are responsible for the conformity of the product with the Regulation[A8].

The Regulations will be reviewed to see if technological progress creates the need for further amendment, any such changes will be presented to the Consultation Forum by 1st July 2023.[A7] The review will address several points, most notably whether the TIER 2 has been cost effective and if some other measures might be appropriate. Among these measures the European Commission can:

- introduce a definition of TIER 3 performance levels
- set minimum performance requirements for small transformers
- evaluate
 - some exemptions such as offshore applications
 - concessions related to pole-mounted transformers
 - special combinations of windings
 - new concession on MPT and LPT brought in by the 2019 amendments
- consider introducing environmental impacts other than energy in the use phase, such as noise and material efficiency
- consider the possibility of applying PEI calculations for losses instead of absolute loss values for MPT
- whether or not to adopt a technology neutral approach for liquid immersed, dry-type and electronic transformers.

Modification of the Annex

The Amendment Annex deals with more specific data for dedicated transformers and presents most of the value for the design of the transformers.

In the original Regulation No 548/2014 there were no energy performance requirements for

- All transformers with voltage >36kV and rated power less than 3150 kVA
- Dry type transformers above 40MVA.

In the 2019 Amendment Annex, PEI has been established for these cases where the limit is now $\geq 200\text{MVA}$ and has been changed above 100MVA for liquid immersed [Annex I Table I.7] and $\geq 63\text{MVA}$ for dry type transformers [Annex I Table I.9].

The table of losses has also been reviewed for three-phase **liquid-immersed** medium power transformers with one winding with $U_m \leq 24\text{kV}$ and the other with minimum voltage $U_m \leq 3,6\text{kV}$ rather than 1,1kV [Annex I Table I.1, Annex I Table I.2]. This has been done to avoid manufacturers over sizing the insulation of their transformers to take benefit of correction factors for losses.

For $U_m \leq 24\text{kV}$ the correction factor has been eliminated and these transformers now have to fulfil the same energy performance requirements as basic transformers [Annex I Table I.3a] independently of the secondary highest voltage. However, for $U_m = 36\text{kV}$ the correction factor remains valid with a small change for no-load losses for liquid immersed which changes from 20% to 15% [Annex I Table I.3a]. The table covering dual voltages has been fully reviewed as this table was liable to misunderstanding in the original Regulation [Annex I Table I.3b].

To ensure that pole mounted transformers were not too heavy for the existing poles in certain countries, pole mounted transformers have been allowed to have higher levels of losses. To avoid having to replace existing poles to withstand the higher weight of more efficient transformers, the Commission allows for 'one to one' replacement of pole mounted transformers, in which case a special table of higher losses applies [Annex I 1.4]. In this case the manufacturers, importers or the authorized representatives must specify that this is a 'one to one' replacement in the technical documentation along with all other mandatory information, such as the address, either the local destination or the specific installation type. This means that for other cases new pole mounted transformer installations must comply with the standard table of MPT.

Experience with implementing the Regulations has shown some difficulties in some cases in installing compliant transformers, for example, the weight or size could create issues for transportation to the location where the transformers were installed. For this reason, it has been decided to give some concessions. The following concessions may be applied but shall be notified to the competent national market surveillance authority and justified in the Technical documentation (to be done by the manufacturer, importer or authorized representative).

When disproportionate costs appear with TIER 2 (Installation, surface, ...) that are not compensated by electricity losses saved for the expected service life the following rules can be applied:

- For Medium Power transformers $\leq 3150\text{kVA}$ $\leq 36\text{kV}$, the replacement of one to one can be done with TIER 1 transformers. It is the responsibility of the manufacturer to obtain evidence that the customer is buying the transformer for one to one operation; [Annex I 1]. There is no concession in the case of a new installation.
- For Large Power transformers, the replacement of one to one can be done with transformers TIER 1 or no minimal requirements. It is also allowed for new installations to implement TIER 1 transformers [Annex I 2].

The text of the Regulation has been improved by clarifying what information must be given on the rating plate [Annex I 3] and also when the transformer has been exempted from the regulation [Annex I 4]. This exemption must now be written in the technical documentation with the specific reasons leading to this exemption [Annex I 4].

When calculating efficiency, the electrical power required for the cooling system is now well defined and includes all the losses caused by the operation of the transformer [Annex II].

Market surveillance, which was a weak point in the Regulation, has been improved by making it possible for the market surveillance authorities to attend the FATs to verify compliance with the Regulations [Annex III 1].

Rules of application for the amendment 2019/1783

The amended Regulations was published on the 25 October 2019 and the modifications described in paragraph 2 and 3 of this document must be applied as of 14th November 2019.

All new contracts signed after 14th November 2019 shall be fully compliant with the regulation 2014/548 and 2019/1783.

The rules regarding the manufacturing and delivery of TIER 2 are subject to guidance set out in the Blue Guide⁵ which covers European Union product regulation from 2016.

⁵ The 'Blue Guide' on the implementation of EU product rules 2016,
<http://ec.europa.eu/DocsRoom/documents/18027/>

In the Blue Guide, two stages are defined:

1) Placing on the market

A product is placed on the market when it is made available for the first time on the union market.

This phase is only relevant to for **manufacturers or importers**.

- ❑ In normal situation (when there is no concession), this means that after 1st July 2021 manufacturers and importers will not have the right to **transfer of ownership** of transformers TIER 1. Then only Transformers TIER 2 can be supplied, even if contract has been signed before 1st July 2021. The meaning of **transfer of ownership** depends of Incoterms applied with the contract.

2) Making available

Products made available on the market must comply with the applicable Union harmonisation legislation at the moment of placing on the market.

In the case of a distributor that had received transformers from a manufacturer or importer, then the transformers have been placed on the market and made available.

- The Blue Guide demands "to place on the market" or to "put in service" transformers compliant with TIER 2 after the 1st July 2021 but not necessarily both of these steps.
- ❑ That means that from 1st July 2021, a distributor can transfer to the user or another distributor and put in service transformers TIER 1 if these transformers have been placed on the market before 1st July 2021. Stockpiling of Tier-1-only compliant transformers by distributors is certainly in conflict with the aim and spirit of the regulation.

Impact on the CENELEC standards

It is normal for the Commission to list Harmonized Standards which, if manufacturers comply with them, provide an assumption of conformity with the Regulations. This link was established when EN50588 and EN50629 were listed in the Official Journal (2016/C 416/04) published in 11.11.2016 for the original Regulations adopted in 2014. With the amendment of the regulation adopted on October 1st, 2019, the previous ENs are now obsolete.

The two standards (EN50588 MPT $\leq 3150\text{KVA}$ and $\leq 36\text{KV}$ and EN50629LPT $> 3150\text{KVA}$ and $> 36\text{KV}$) will be superseded by the new series of prEN50708 which it is expected to be adopted following the amendment.

CENELEC has decided to review all transformer standards related to the Directive to improve their visibility by adopting an appropriate numbering EN50708.

The new standard EN50708 will be split in 3 mains parts and subparts:

1. EN50708-1-1 Power transformers - Additional European requirements: Part 1-1 Common part

- EN50708-1-2 Power transformers - Additional European requirements: Part 1-2 Assessment of power transformer energy performance
- EN50708-2-1 Power transformers - Additional European requirements: Part 2-1 Medium power transformer
- EN50708-2-2 Power transformers - Additional European requirements - Medium power transformer: Part 2-2 Accessories
- EN50708-2-3 Power transformers - Additional European requirements - Medium power transformer: Part 2-3 Special tests
- EN50708-2-4 Power transformers - Additional European requirements - Medium power transformer: Part 2-4 Single phase transformers
- EN50708-2-5 Power transformers - Additional European requirements - Medium power transformer: Part 2-5 Non-conventional technology power transformers

2. EN50708-3-1 Power transformers - Additional European requirements: Part 3-1 Large power transformer

3. EN50708-3-2 Power transformers - Additional European requirements - Large power transformer: Part 3-2 Special tests for corrugated tank and radiators

These standards will be published starting in early 2020 for the main part and up to 2022 for the sub parts 1.2, 2.2 and further parts.

Conclusions

The revision of the regulation is a step forward in energy efficiency and sustainability.

This revision has clarified:

- the scope of excluded transformers
- set out the rules for the repair
- clearly defined the declared values
- improved by around 10% the efficiency of the transformers by the implementation of the TIER2.

To help the users in case of highly constrained situations, concessions have been defined for MPT, LPT, pole mounted with compulsory declarations in the technical documentation and to the market surveillance authorities.

CENELEC standards will soon be ready to support this amendment.

The target of the next revision of the regulation that will start in 2023 is also defined.

ABOUT T&D EUROPE

T&D Europe is the European Association of the Electricity Transmission & Distribution Equipment and Services Industry, which members are the European National Associations representing the interests of the electricity transmission and distribution equipment manufacturing and derived solutions. The companies represented by T&D Europe account for a production worth over € 25 billion EUR, and employ over 200,000 people in Europe. Further information on T&D Europe can be found here: <http://www.tdeurope.org>

CONTACTS

Diederik Peereboom
Secretary General, T&D Europe
secretarygeneral@tdeurope.eu
+32 2 206 6888

Laure Dulière
Policy Adviser
policyadviser@tdeurope.eu
+32 2 206 6863