# Commission Regulation (EU) 2019/1783 of 1 October 2019 amending Regulation (EU) No 548/2014 on implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to small, medium and large power transformers (Text with EEA relevance)

## COMMISSION REGULATION (EU) 2019/1783

## of 1 October 2019

## amending Regulation (EU) No 548/2014 on implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to small, medium and large power transformers

## (Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 setting out a framework for the setting of ecodesign requirements for energy-related products[(1)] and in particular Article 15(1) thereof,

Whereas:

(1) Article 7 of Commission Regulation (EU) No 548/2014[(2)] requires the Commission to review that Regulation in the light of technological progress and present the results of this review to the Consultation Forum in 2017.

(2) The Commission has carried out a review study that analysed the specific aspects set out in Article 7 of Regulation (EU) No 548/2014. The study was undertaken together with stakeholders and interested parties from the Union and the results have been made publicly available.

(3) The study confirmed that the impact of energy consumption during the use phase on the Global Warming Potential remains dominant. The analysis made did not provide sufficient evidence to support proposing environmental requirements other than a minimum energy performance.

(4) The study confirmed that Regulation (EU) No 548/2014 has had a positive effect on the efficiency of power transformers being placed on the market, and found that available transformer models can fulfil minimum requirements set in Tier 1 (July 2015) without difficulties.

(5) It is generally recognised that the most appropriate method to optimise transformer designs in order to minimise electricity losses continues to be the valuation and capitalisation of future losses using proper capitalisation factors for load and no load losses in the tendering process. However, for the purposes of product regulation only the use of prescribed values for minimum efficiency or maximum losses is feasible.

(6) The study also confirmed that for manufacturers there are no major technical barriers to manufacturing transformers compliant with the minimum requirements set out in Tier 2 for entry into force in July 2021.

(7) The study analysed the economic viability of transformers compliant with minimum requirements set out in Tier 2 applicable as of July 2021 and found that lifecycle costs for compliant medium and large power transformers are always lower than Tier 1 compliant models, when these are being put into service in new installation sites. However, in specific situations where medium power transformers are being installed in existing urban substation locations, there can be space and weight constraints that affect the maximum size and weight of the replacement transformer to be used. Therefore, when the replacement of an existing transformer is technically infeasible or entails disproportionate costs, a regulatory relief should be justified.

(8) An existing regulatory exemption for the replacement of large power transformers related to disproportionate costs associated with their transportation and/or installation should be complemented by an exemption for new installations, where such cost constraints are also applicable.

(9) Experience shows that transformers may be held in stock by utilities and other economic actors for long periods of time before they are installed at their final sites. It should however remain clear that compliance with applicable requirements should be have been demonstrated either when the transformer is placed on the market or when it was put into service, but not both.

(10) The existence of a market for the repair of transformers makes it necessary to provide guidance on the circumstances under which a transformer that has undergone certain repair operations should be considered equivalent to a new product and therefore it should comply with the requirements set out in Annex I of this Regulation.

(11) To improve the effectiveness of this Regulation and to protect consumers, products that automatically alter their performance in test conditions to improve the declared parameters should be prohibited from being placed on the market or put into service.

(12) To facilitate verification testing market surveillance authorities should be allowed to test, or witness the testing of, larger transformers at premises such as those of the manufacturer.

(13) Experience gained in implementing Regulation (EU) No 548/2014 has revealed the existence of national deviations in standard voltages in electricity distribution grids in certain Member States. These deviations justify different threshold voltage levels in the categorisation of transformers, and they inform what minimum energy performance requirements should be applicable. Therefore, the inclusion of a notification mechanism to provide publicity for specific situations in Member States is justified.

(14) The measures provided for in this Regulation are in accordance with the opinion of the Committee established by Article 19(1) of Directive 2009/125/EC,

HAS ADOPTED THIS REGULATION:

*Article 1*

Regulation (EU) No 548/2014 is amended as follows:

(1) Article 1 is replaced by the following:

*Article 1*

**Subject matter and scope**

1 This Regulation sets out ecodesign requirements for placing on the market or putting into service power transformers with a minimum power rating of 1 kVA used in 50 Hz electricity transmission and distribution networks or for industrial applications.

This Regulation shall apply to transformers purchased after 11 June 2014.

2 This Regulation shall not apply to transformers specifically designed for the following applications:

a instrument transformers, specifically designed to transmit an information signal to measuring instruments, meters and protective or control devices or similar apparatus;

b transformers specifically designed and intended to provide a DC power supply to electronic or rectifier loads. This exemption does not include transformers that are intended to provide an AC supply from DC sources such as transformers for wind turbine and photovoltaic applications or transformers designed for DC transmission and distribution applications;

c transformers specifically designed to be directly connected to a furnace;

d transformers specifically designed to be installed on fixed or floating offshore platforms, offshore wind turbines or on board ships and all kinds of vessels;

e transformers specifically designed to provide for a situation limited in time when the normal power supply is interrupted due to either an unplanned occurrence (such as a power failure) or a station refurbishment, but not to permanently upgrade an existing substation;

f transformers (with separate or auto-connected windings) connected to an AC or DC contact line, directly or through a converter, used in fixed installations for railway applications;

g earthing or grounding transformers specifically designed to be connected in a power system to provide a neutral connection for earthing either directly or via an impedance;

h traction transformers specifically designed to be mounted on rolling stock, connected to an AC or DC contact line, directly or through a converter, for specific use in fixed installations for railway applications;

i starting transformers, specifically designed for starting three-phase induction motors so as to eliminate supply voltage dips and that remain de-energised during normal operation;

j testing transformers, specifically designed to be used in a circuit to produce a specific voltage or current for the purpose of testing electrical equipment;

k welding transformers, specifically designed for use in arc-welding equipment or resistance-welding equipment;

l transformers specifically designed for explosion-proof applications in accordance with Directive 94/9/EC of the European Parliament and of the Council[(3)] and underground mining applications;

m transformers specifically designed for deep water (submerged) applications;

n medium Voltage (MV) to Medium Voltage (MV) interface transformers up to 5 MVA used as interface transformers used in a network voltage conversion programme and placed at the junction between two voltage levels of two medium voltage networks and that need to be able to cope with emergency overloads;

o medium and large power transformers specifically designed to contribute to the safety of nuclear installations, as defined in Article 3 of Council Directive 2009/71/Euratom[(4)];

p three-phase medium power transformers with a power rating below 5 kVA;

except as regards the requirements set out in point 4(a), (b) and (d).of Annex I to this Regulation.

3 Medium and large power transformers, regardless of when they were first placed on the market or put into service, shall be reassessed for conformity and comply with this Regulation, if they are subject to all of the following operations:

a replacement of the core or part thereof;

b replacement of one or more of the complete windings.

This is without prejudice to the legal obligations under other Union's harmonisation legislation that these products could be subject to.;

(2) Article 2 is amended as follows:

(a) points (3) and (4) are replaced by the following:

(3) "medium power transformer" means a power transformer with all windings having rated power lower than or equal to 3 150 kVA, and highest voltage for equipment greater than 1,1 kV and lower than or equal to 36 kV;

4 "large power transformer" means a power transformer with at least one winding having either rated power greater than 3 150 kVA or highest voltage for equipment greater than 36 kV;;

(b) point (7) is replaced by the following:

(7) "medium power pole-mounted transformer" means a power transformer with a rated power of up to 400 kVA suitable for outdoor service and specifically designed to be mounted on the support structures of overhead power lines.;

(c) the following points (17) to (22) are added in Article 2:

(17) "declared value(s)" mean the values given in the technical documentation pursuant to point 2 of Annex IV to Directive 2009/125/EC, and where applicable, the values used to calculate these values;

18 "dual voltage transformer" means a transformer with one or more windings with two voltages available in order to be able to operate and supply rated power at either of two different voltage values;

19 "witnessed testing" means actively observing the physical testing of the product under investigation by another party, to draw conclusions on the validity of the test and the test results. This may include conclusions

on the compliance of testing and calculations methods used with applicable standards and legislation;

20 "factory acceptance test" means a test on an ordered product where the customer uses witnessed testing to verify the product's full accordance with contractual requirements, before they are accepted or put into service;

21 "equivalent model" means a model which has the same technical characteristics relevant for the technical information to be provided, but which is placed on the market or put into service by the same manufacturer or importer as another model with a different model identifier;

22 "model identifier" means the code, usually alphanumeric, which distinguishes a specific product model from other models with the same trade mark or the same manufacturer's or importer's name.;

(3) Article 3 is replaced as follows:

The ecodesign requirements set out in Annex I shall apply from the dates indicated therein.

If threshold voltages in electricity distribution networks deviate from the standard ones across the Union[(5)], Member States shall notify the Commission accordingly, so that a public notification can be made for the correct interpretation of Tables I.1, I.2, I.3a, I.3b, I.4, I.5, I.6, I.7, I.8 and I.9 in Annex I.;

(4) Article 4 is replaced as follows:

*Article 4*

**Conformity assessment**

1 The conformity assessment procedure referred to in Article 8 of Directive 2009/125/EC shall be the internal design control system set out in Annex IV to that Directive or the management system set out in Annex V to that Directive.

2 For the purposes of the conformity assessment pursuant to Article 8 of Directive 2009/125/EC, the technical documentation shall contain a copy of the product information provided in accordance with point 4 of Annex I, and the details and the results of the calculations set out in Annex II to this Regulation.

3 Where the information included in the technical documentation for a particular model has been obtained:

a from a model that has the same technical characteristics relevant for the technical information to be provided but is produced by a different manufacturer; or

b by calculation on the basis of design or extrapolation from another model of the same or a different manufacturer, or both;

the technical documentation shall include the details of such calculation, the assessment undertaken by the manufacturer to verify the accuracy of the calculation and, where appropriate, the declaration of identity between the models of different manufacturers.

4 The technical documentation shall include a list of all equivalent models, including model identifiers.;

(5) Article 7 is replaced by the following:

*Article 7*

**Review**

The Commission shall review this Regulation in the light of technological progress and shall present the results of the assessment, including, if appropriate, a draft revision proposal, to the Consultation Forum no later than 1 July 2023. The review shall in particular address the following issues:

— the extent to which requirements set out for Tier 2 have been cost-effective and the appropriateness to introduce stricter Tier 3 requirements,

— the appropriateness of the concessions introduced for medium and large power transformers in cases where installation costs would have been disproportionate,

— the possibility of utilising the PEI calculation for losses alongside the losses in absolute values for medium power transformers,

— the possibility to adopt a technology-neutral approach to the minimum requirements set out for liquid-immersed, dry-type and, possibly, electronic transformers,

— the appropriateness of setting minimum performance requirements for small power transformers,

— the appropriateness of the exemptions for transformers in offshore applications,

— the appropriateness of the concessions for pole-mounted transformers and for special combinations of winding voltages for medium power transformers,

— the possibility and appropriateness of covering environmental impacts other than energy in the use phase, such as noise and material efficiency.;

(6) Article 8 is renumbered into Article 9 and a new Article 8 is added as follows:

*Article 8*

**Circumvention**

The manufacturer, importer or authorised representative shall not place on the market products designed to be able to detect they are being tested (e.g. by recognising the test conditions or test cycle), and to react specifically by automatically altering their performance during the test with the aim of reaching a more favourable level for any of the parameters declared by the manufacturer, importer or authorised representative in the technical documentation or included in any documentation provided.;

(7) the Annexes are amended as set out in the Annex to this Regulation.

*Article 2*

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels, 1 October 2019.

*For the Commission*

*The President*

Jean-Claude JUNCKER

# ANNEX

The Annexes to Regulation (EU) No 548/2014 are amended as follows:

(1) Annex I is amended as follows:

(a) point 1 is amended as follows:

(i) the title of Table I.1 is replaced as follows:

> Maximum load and no-load losses (in W) for three-phase **liquid-immersed** medium power transformers with one winding with $U_m \leq 24$kV and the other with $U_m \leq 3{,}6$ kV;

(ii) the title of Table I.2 is replaced as follows:

> Maximum load and no-load losses (in W) for three-phase **dry-type** medium power transformers with one winding with Um ≤ 24kV and the other with Um ≤ 3,6 kV;

(iii) the following paragraphs are added after the first paragraph:

> As of the date of application of Tier 2 requirements (1 July 2021), when the one-to-one replacement of an existing medium power transformer entails disproportionate costs associated with their installation, the replacement transformer is, exceptionally, only required to meet Tier 1 requirements for the given rated power.
>
> In this respect, installation costs are disproportionate if the costs of the replacement of the complete substation housing the transformer and/or the acquisition or rental of additional floor space are higher than the net present value of the additional avoided electricity losses (tariffs, taxes and levies excluded) of a Tier 2 compliant replacement transformer over its normally expected service life. The net present value shall be calculated based on capitalised loss values using widely accepted social discount rates[(6)].
>
> In this case, the manufacturer, importer, or authorised representative shall include in the technical documentation of the replacement transformer the following information:
>
> — Address and contact details of the commissioner of the replacement transformer
>
> — The station where the replacement transformer is to be installed. This shall be unequivocally identified by either a specific location or a specific installation type (e.g., station or cabin model)
>
> — The technical and/or economic justification of the disproportionate cost to install a transformer that is only Tier 1 compliant instead of a Tier 2 compliant one. If the transformers(s) were commissioned by a tendering process, all the necessary information regarding the analysis of bids and the award decision shall be provided.
>
> In the above cases, the manufacturer, importer or authorised representative shall notify the competent national market surveillance authorities.;

(iv) Table I.3 is replaced by Tables I.3a and I.3b as follows:

*TABLE I.3A*

**Correction factors to be applied to the load and no load losses indicated in Tables I.1, I.2 and I.6 for medium power transformers with special combinations of winding voltages (for rated power ≤ 3 150 kVA)**

| **Special combination of voltages in one winding** | | **Load losses ($P_k$)** | **No load losses ($P_o$)** |
|---|---|---|---|
| For both liquid immersed (Table I.1) and dry type (Table I.2) | | No correction | No correction |
| Primary highest voltage for equipment $U_m \leq$ 24kV | Secondary highest voltage for equipment $U_m >$ 3,6 kV | | |
| For liquid immersed (Table I.1) | | 10 % | 15 % |
| Primary highest voltage for equipment Um = 36kV | Secondary highest voltage for equipment Um ≤ 3,6 kV | | |
| Primary highest voltage for equipment Um = 36kV | Secondary highest voltage for equipment Um > 3,6 kV | 10 % | 15 % |
| For dry type (Table I.2) | | 10 % | 15 % |
| Primary highest voltage for equipment Um = 36kV | Secondary highest voltage for equipment Um ≤ 3,6 kV | | |
| Primary highest voltage for equipment Um = 36kV | Secondary highest voltage for equipment Um > 3,6 kV | 15 % | 20 % |

*TABLE I.3B*

**Correction factors to be applied to the load and no load losses indicated in Tables I.1, I.2 and I.6 for medium power transformers with dual voltage in one or both windings differing more than 10 % and rated power ≤ 3 150 kVA.**

| **Type of dual voltage** | **Reference voltage for the application of correction factors** | **Load losses (Pk)[a]** | **No load losses (Po)[a]** |
|---|---|---|---|

**a** The losses shall be calculated on the base of the voltage of the winding specified in the second column and can be increased with the correction factors given in the last 2 columns. In any case, whatever the combinations of winding voltages, the losses cannot exceed the values given in Tables I.1, I.2 and I.6 corrected by the factors in this table.

| | | | |
|---|---|---|---|
| Dual voltage on one winding with reduced power output on the lower low-voltage winding AND maximum available power on the lower voltage of the low-voltage winding limited to 0,85 of the rated power assigned to the low-voltage winding at its higher voltage. | losses shall be calculated based on the higher voltage of the low-voltage winding | No correction | No correction |
| Dual voltage on one winding with reduced power output on the lower high-voltage winding AND maximum available power on the lower voltage of the high-voltage winding limited to 0,85 of the rated power assigned to the high-voltage winding at its higher voltage. | losses shall be calculated based on the higher voltage of the high-voltage winding | No correction | No correction |
| Dual voltage on one winding AND full rated power available on both windings, i.e., the full nominal power is available regardless of the | The losses shall be calculated based on the higher voltage of the dual voltage winding | 10 % | 15 % |

**a** The losses shall be calculated on the base of the voltage of the winding specified in the second column and can be increased with the correction factors given in the last 2 columns. In any case, whatever the combinations of winding voltages, the losses cannot exceed the values given in Tables I.1, I.2 and I.6 corrected by the factors in this table.

| | | | |
|---|---|---|---|
| combination of voltages. | | | |
| Dual voltage on both windings AND rated power available on all combinations of windings, i.e., both voltages on one winding are fully rated in combination with one of the voltages on the other winding | the losses shall be calculated based on the higher voltages of both dual voltage windings | 20 % | 20 %; |

**a** The losses shall be calculated on the base of the voltage of the winding specified in the second column and can be increased with the correction factors given in the last 2 columns. In any case, whatever the combinations of winding voltages, the losses cannot exceed the values given in Tables I.1, I.2 and I.6 corrected by the factors in this table.

(b) in point 1.4, the first paragraph is replaced as follows:

1.4. For the one-to-one replacement of existing medium power pole-mounted transformers with power ratings between 25 kVA and 400 kVA, the applicable maximum levels of load and no-load losses are not the ones in Tables I.1 and I.2, but those in Table I.6 below. Maximum allowable losses for kVA ratings other than those explicitly mentioned in Table I.6 shall be obtained by linear interpolation or extrapolation. The correction factors for special combinations of winding voltages indicated in Tables I.3a and I.3b are also applicable.

For the one-to-one replacement of existing medium power pole-mounted transformers, the manufacturer, importer or authorised representative shall include in the technical documentation of the transformer the following information:

— the address and contact details of the commissioner of the replacement transformer;

— the station where the replacement transformer is to be installed. This shall be unequivocally identified either by a specific location or an specific installation type (e.g. technical description of the pole).

In the above cases, the manufacturer, importer or authorised representative shall notify the competent national market surveillance authorities.

With regard to the installation of new pole-mounted transformers, it is the requirements in Tables I.1 and I.2, in conjunction with Tables I.3a and I.3b where justified, which are applicable.;

(c) point 2 is replaced by the following:

2. **Minimum energy efficiency requirements for large power transformers**

Minimum efficiency requirements for large power transformers are set out in Tables I.7, I.8 and I.9.

There may be specific instances where the replacement of an existing transformer, or the installation of a new one, meeting the applicable minimum requirements set out in Tables I.7, I.8 and I.9 would result in disproportionate costs. As general rule, costs can be considered to be disproportionate when the extra transportation and/or installation costs of a Tier 2 or Tier 1, as applicable, compliant transformer would be higher than the net present value of the additional avoided electricity losses (tariffs, taxes and levies excluded) over its normally expected service life. This net present value shall be calculated based on capitalised loss values using widely accepted social discount rates[7].

In those cases, the following fall-back provisions apply:

As of the date of application of Tier 2 requirements (1 July 2021), when the one-to-one replacement of a large power transformers in an existing site entails disproportionate costs associated to its transportation and/or installation, or is technically infeasible, the replacement transformer is, exceptionally, only required to comply with Tier 1 requirements for the given rated power.

Furthermore, if the cost of installing a replacement transformer complying with Tier 1 requirements are also disproportionate, or where no technically feasible solutions exist, no minimum requirements shall apply to the replacement transformer.

As of the date of application of Tier 2 requirements (1 July 2021), when the installation of a new large power transformer in a new site entails disproportionate costs associated to their transportation and/or installation, or is technically infeasible, the new transformer is, exceptionally, only required to meet Tier 1 requirements for the given rated power.

In these cases, the manufacturer, importer or authorised representative responsible for placing on the market or putting into service the transformer shall:

include in the technical documentation of the new or replacement transformer the following information:

— address and contact details of the commissioner of the transformer,
— the specific location where the transformer is to be installed,
— the technical and/or economic justification to install a new or replacement transformer that does not comply with Tier 2 or Tier 1 requirements. If the transformer(s) were commissioned by a tendering process, all the necessary information regarding the analysis of bids and the award decision, shall also be provided,
— notify the competent national market surveillance authorities.

*TABLE I.7*

**Minimum Peak Efficiency Index requirements for liquid immersed large power transformers**

| Rated Power (MVA) | **Tier 1 (1.7.2015)** | **Tier 2 (1.7.2021)** |
|---|---|---|
| | **Minimum Peak Efficiency Index (%)** | |
| ≤ 0,025 | 97,742 | 98,251 |
| 0,05 | 98,584 | 98,891 |
| 0,1 | 98,867 | 99,093 |

| | | |
|---|---|---|
| 0,16 | 99,012 | 99,191 |
| 0,25 | 99,112 | 99,283 |
| 0,315 | 99,154 | 99,320 |
| 0,4 | 99,209 | 99,369 |
| 0,5 | 99,247 | 99,398 |
| 0,63 | 99,295 | 99,437 |
| 0,8 | 99,343 | 99,473 |
| 1 | 99,360 | 99,484 |
| 1,25 | 99,418 | 99,487 |
| 1,6 | 99,424 | 99,494 |
| 2 | 99,426 | 99,502 |
| 2,5 | 99,441 | 99,514 |
| 3,15 | 99,444 | 99,518 |
| 4 | 99,465 | 99,532 |
| 5 | 99,483 | 99,548 |
| 6,3 | 99,510 | 99,571 |
| 8 | 99,535 | 99,593 |
| 10 | 99,560 | 99,615 |
| 12,5 | 99,588 | 99,640 |
| 16 | 99,615 | 99,663 |
| 20 | 99,639 | 99,684 |
| 25 | 99,657 | 99,700 |
| 31,5 | 99,671 | 99,712 |
| 40 | 99,684 | 99,724 |
| 50 | 99,696 | 99,734 |
| 63 | 99,709 | 99,745 |
| 80 | 99,723 | 99,758 |
| 100 | 99,737 | 99,770 |
| 125 | 99,737 | 99,780 |
| 160 | 99,737 | 99,790 |
| ≥ 200 | 99,737 | 99,797 |

Minimum PEI values for MVA ratings that fall in between the ratings given in Table I.7 shall be calculated by linear interpolation

*TABLE I.8*

**Minimum Peak Efficiency Index requirements for dry-type large power transformers with Um ≤ 36kV**

| Rated Power (MVA) | **Tier 1 (1.7.2015)** | **Tier 2 (1.7.2021)** |
|---|---|---|
| | **Minimum Peak Efficiency Index (%)** | |
| 3,15 < Sr ≤ 4 | 99,348 | 99,382 |
| 5 | 99,354 | 99,387 |
| 6,3 | 99,356 | 99,389 |
| 8 | 99,357 | 99,390 |
| ≥ 10 | 99,357 | 99,390 |

Minimum PEI values for MVA ratings that fall in between the ratings given in Table I.8 shall be calculated by linear interpolation

*TABLE I.9*

**Minimum Peak Efficiency Index requirements for dry-type large power transformers with Um > 36kV**

| Rated Power (MVA) | **Tier 1 (1.7.2015)** | **Tier 2 (1.7.2021)** |
|---|---|---|
| | **Minimum Peak Efficiency Index (%)** | |
| ≤ 0,05 | 96,174 | 96,590 |
| 0,1 | 97,514 | 97,790 |
| 0,16 | 97,792 | 98,016 |
| 0,25 | 98,155 | 98,345 |
| 0,4 | 98,334 | 98,570 |
| 0,63 | 98,494 | 98,619 |
| 0,8 | 98,677 | 98,745 |
| 1 | 98,775 | 98,837 |
| 1,25 | 98,832 | 98,892 |
| 1,6 | 98,903 | 98,960 |
| 2 | 98,942 | 98,996 |
| 2,5 | 98,933 | 99,045 |
| 3,15 | 99,048 | 99,097 |
| 4 | 99,158 | 99,225 |
| 5 | 99,200 | 99,265 |
| 6,3 | 99,242 | 99,303 |
| 8 | 99,298 | 99,356 |
| 10 | 99,330 | 99,385 |

| | | |
|---|---|---|
| 12,5 | 99,370 | 99,422 |
| 16 | 99,416 | 99,464 |
| 20 | 99,468 | 99,513 |
| 25 | 99,521 | 99,564 |
| 31,5 | 99,551 | 99,592 |
| 40 | 99,567 | 99,607 |
| 50 | 99,585 | 99,623 |
| ≥ 63 | 99,590 | 99,626 |

Minimum PEI values for MVA ratings that fall in between the ratings given in Table I.9 shall be calculated by linear interpolation.;

(d) in point 3, the last subparagraph is replaced by:

For medium and large power transformers only, the information under (a); (c) and (d) shall also be included on the rating plate of the transformer.;

(e) in point 4, the last paragraph is deleted,

and a new point (d) is added as follows:

(d) the specific reason(s) why transformers are considered to be exempted from the Regulation in accordance with Article 1.2;

(2) Annex II is replaced by the following:

‘ANNEXMeasurement methods
II

For the purpose of compliance with the requirements of this Regulation, measurements shall be made using a reliable, accurate and reproducible measurement procedure, which takes into account the generally recognised state of the art measurement methods, including methods set out in documents the reference numbers of which have been published for that purpose in the *Official Journal of the European Union*.

**Calculation methods**

The methodology for calculating the Peak Efficiency Index (PEI) for medium and large power transformers referred to in Tables I.4, I.5, I.7, I.8 and I.9 of Annex I is based on the ratio of the transmitted apparent power of a transformer minus the electrical losses to the transmitted apparent power of the transformer. The calculation of PEI shall use state-of-the-art methodology available in the latest version of the relevant harmonised standards for medium and large power transformers.

The formula to be used for the Peak Efficiency Index calculation is:

$$\mathrm{PEI} = 1 - \frac{2\left(\mathrm{P_0} + \mathrm{P_{c0}} + \mathrm{P_{ck}}(k_{PEI})\right)}{\mathrm{S_r}\sqrt{\frac{\mathrm{P_0} + \mathrm{P_{c0}} + \mathrm{P_{ck}}(k_{PEI})}{\mathrm{P_k}}}} = 1 - \frac{2}{\mathrm{S_r}}\sqrt{\left(\mathrm{P_0} + \mathrm{P_{c0}} + \mathrm{P_{ck}}(k_{PEI})\right)\mathrm{P_k}}\ (\%)$$

Where:

| | |
|---|---|
| $P_0$ | is the no load losses measured at rated voltage and rated frequency on the rated tap |
| $P_{c0}$ | is the electrical power required by the cooling system for no load operation, derived from the type test measurements of the power taken by the fan and liquid pump motors (for ONAN and ONAN/ONAF cooling systems $P_{c0}$ is always zero) |
| $P_{ck}$ ($k_{PEI}$) | is the electrical power required by the cooling system in addition to $P_{c0}$ to operate at $k_{PEI}$ times the rated load. $P_{ck}$ is a function of the load. $P_{ck}$ ($k_{PEI}$) is derived from the type test measurements of the power taken by the fan and liquid pump motors (for ONAN cooling systems $P_{ck}$ is always zero). |
| $P_k$ | is the measured load loss at rated current and rated frequency on the rated tap corrected to the reference temperature |
| $S_r$ | is the rated power of the transformer or autotransformer on which $P_k$ is based |
| $k_{PEI}$ | is the load factor at which Peak Efficiency Index occurs’; |

(3) Annex III[8] is amended as follows:

the following paragraph is added after the first paragraph:

> Where a model has been designed to be able to detect it being tested (e.g. by recognizing the test conditions or test cycle), and to react specifically by automatically altering its performance during the test with the objective of reaching a more favourable level for any of the parameters specified in this Regulation or included in the technical documentation, or included in any of the documentation provided, the model and all equivalent models shall be considered not compliant.

At the end of point (1) the following is added:

> The Member State authority can do this verification using its own testing equipment.
>
> If Factory Acceptance Tests (FATs) are planned for such transformers, which will test parameters laid down in Annex I of this Regulation, the Member State authorities may decide to use witnessed testing during these FATs to gather test results which can be used to verify compliance of the transformer under investigation. The authorities may request a manufacturer to disclose information on any planned FATs relevant for witnessed testing.
>
> If the result referred to in point 2(c) is not achieved, the model and all equivalent models shall be considered not to comply with this Regulation. The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision is taken on the non-compliance of the model.

And point (3) is replaced as follows:

> (3) If the results referred to in point 2(a), (b) or (c) are not achieved, the model and all equivalent models shall be considered not to comply with this Regulation.;

(4) in Annex IV, point (c) is amended as follows:

(c) Medium power transformers with amorphous steel core: Ao-50 %, Ak..

(**1**) OJ L 285, 31.10.2009, p. 10.

(**2**) 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 transformers (OJ L 152, 22.5.2014, p. 1).

(**3**) Directive 94/9/EC of the European Parliament and the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres (OJ L 100, 19.4.1994, p. 1).

(**4**) Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations. (OJ L 172, 2.7.2009, p. 18).';

(**5**) Cenelec EN 60038 includes in Annex 2B a national deviation in the Czech Republic according to which the standard voltage for the highest voltage for equipment in AC three-phase systems are 38,5 kV instead of 36 kV and 25 kV instead of 24 kV.';

(**6**) The European Commission Better Regulation Toolbox suggest using a value of 4 % for the social discount rate
https://ec.europa.eu/info/sites/info/files/file_import/better-regulation-toolbox-61_en_0.pdf ';

(**7**) The European Commission Better Regulation Toolbox suggest using a value of 4 % for the social discount rate
https://ec.europa.eu/info/sites/info/files/file_import/better-regulation-toolbox-61_en_0.pdf';

(**8**) Annex III to Regulation (EU) No 548/2014 as amended by Commission Regulation (EU) 2016/2282 of 30 November 2016 amending Regulations (EC) No 1275/2008, (EC) No 107/2009, (EC) No 278/2009, (EC) No 640/2009, (EC) No 641/2009, (EC) No 642/2009, (EC) No 643/2009, (EU) No 1015/2010, (EU) No 1016/2010, (EU) No 327/2011, (EU) No 206/2012, (EU) No 547/2012, (EU) No 932/2012, (EU) No 617/2013, (EU) No 666/2013, (EU) No 813/2013, (EU) No 814/2013, (EU) No 66/2014, (EU) No 548/2014, (EU) No 1253/2014, (EU) 2015/1095, (EU) 2015/1185, (EU) 2015/1188, (EU) 2015/1189 and (EU) 2016/2281 with regard to the use of tolerances in verification procedures (OJ L 346, 20.12.2016, p. 51).

**Status:**
Point in time view as at 01/10/2019.

**Changes to legislation:**
There are outstanding changes not yet made to Commission Regulation (EU) 2019/1783. Any changes that have already been made to the legislation appear in the content and are referenced with annotations.