ANNEX

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

(1) Annex I is amended as follows:

(a) point 1 is amended as follows:

(i) the following paragraphs are added:

"As of the date of application of Tier 2 requirements (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, it can be considered that installation costs are disproportionate if these costs (e.g. 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 normal expected service life. This net present value should be calculated based on capitalised loss values using widely accepted social discount rates.

In those cases where the replacement transformer is only capable of meeting Tier 1 requirements instead of Tier 2, the manufacturer or importer must state in the technical documentation of the transformer the following information obtained from the commissioner of the unit:

* Address and contact details of the commissioner of the unit
* The station where the replacement unit is to be installed. This can be either a specific location or an specific installation type (e.g., station or cabin model)
* The justification to install a unit that is only Tier 1 compliant. If the unit(s) were commissioned by a tendering process, this shall include all the necessary information regarding the analysis of bids and the award decision, but not information that may be commercially sensitive for bidders.",

(ii) 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 ≤ 3150 kVA)

|  |  |  |
| --- | --- | --- |
| Special combination of voltages in one winding | Load losses (Pk) | No load losses (Po) |
| For both liquid immersed (Table I.1) and dry type (Table I.2) | No correction | No correction |
| Primary highest voltage for equipment Um ≤ 24kV | Secondary highest voltage for equipment Um > 3.6kV |
| For liquid immersed (Table I.1)  | 10% | 15% |
| Primary highest voltage for equipment Um = 36kV | Secondary highest voltage for equipment Um ≤ 3.6kV |
| Primary highest voltage for equipment Um = 36kV | Secondary highest voltage for equipment Um > 3.6kV | 10% | 15% |
| For dry type (Table I.2) | 10% | 15% |
| Primary highest voltage for equipment Um = 36kV | Secondary highest voltage for equipment Um ≤ 3.6kV |
| Primary highest voltage for equipment Um = 36kV | Secondary highest voltage for equipment Um > 3.6kV | 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 ≤ 3150 kVA.

|  |  |  |  |
| --- | --- | --- | --- |
| Type of dual voltage  | Reference voltage for the application of correction factors | Load losses (Pk)(\*) | No load losses (Po)(\*) |
| Dual voltage on one winding with reduced power output on the lower low-voltage winding ANDmaximum 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  ANDmaximum 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 ANDfull rated power available on both windings, i.e., the full nominal power is available regardless of the combination of voltages.  | The losses shall be calculated based on the higher voltage of the dual voltage winding  | 10% | 15% |
| Dual voltage on both windings ANDrated 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% |

(\*) 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, 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. The correction factors for special combinations of winding voltages indicated in Tables I.3a and I.3b are also applicable." ,

(c) point 2 is replaced by the following:

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

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

As of the date of application of Tier 2 requirements (July 2021), when the one-to-one replacement of an existing large power transformers or the installation of a new large power transformer 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 meet Tier 1 requirements for the given rated power.

Furthermore, if the cost involved in meeting Tier 1 requirements also proves to be disproportionate, or where it is demonstrated in the technical documentation that no technically feasible solutions exist, no minimum requirements would be applicable for the one-to-one replacement of a large power transformer in an existing site.

As of the date of application of Tier 2 requirements (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.

Furthermore, if the cost involved in meeting Tier 1 requirements also proves to be disproportionate, or where it is demonstrated in the technical documentation that no technically feasible solutions exist, no minimum requirements would be applicable for new large power transformers installed in new sites.

In those cases where a replacement or a new large power transformer is not capable of meeting Tier 2 requirements, or not even Tier 1 ones, the manufacturer or importer responsible for placing on the market or putting into service the transformer must state in the technical documentation the following information obtained from the commissioner of the unit:

* Address and contact details of the commissioner of the unit
* The station where the replacement unit is to be installed. This can be either a specific location or an specific installation type (e.g., station or cabin model)
* The technical and/or economic justification to install a unit that is only Tier 1 compliant (or not even able to meet Tier 1 requirements for new transformers). If the unit(s) were commissioned by a tendering process, this shall include all the necessary information regarding the analysis of bids and the award decision, but not information that may be commercially sensitive for bidders.

In all the above cases, the complete technical documentation must systematically be submitted to the competent national market surveillance authorities every time that a non-compliant transformer is placed on the market or put into service.

**Table I.7 Minimum Peak Efficiency Index requirements for liquid immersed large power transformers**

|  |  |  |
| --- | --- | --- |
| **Rated Power (MVA)** | Tier 1 (01.07.2015) | Tier 2 (01.07.2021) |
| 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 | 99.32 |
| 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 | 99.51 | 99.571 |
| 8 | 99.535 | 99.593 |
| 10 | 99.56 | 99.615 |
| 12.5 | 99.588 | 99.64 |
| 16 | 99.615 | 99.663 |
| 20 | 99.639 | 99.684 |
| 25 | 99.657 | 99.7 |
| 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 | 99.77 |
| 125 | 99.737 | 99.78 |
| 160 | 99.737 | 99.79 |
| 200 | 99.737 | 99.797 |

Minimum PEI values for kVA 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 (01.07.2015) | Tier 2 (01.07.2021) |
| 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 kVA 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 (01.07.2015) | Tier 2 (01.07.2021) |
| Minimum Peak Efficiency Index (%) |
| ≤ 0.05 | 96.174 | 96.59 |
| 0.1 | 97.514 | 97.79 |
| 0.16 | 97.792 | 98.016 |
| 0.25 | 98.155 | 98.345 |
| 0.4 | 98.334 | 98,57 |
| 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 | 98.96 |
| 2 | 98.942 | 98.996 |
| 2.5 | 98.933 | 99.045 |
| 3.15 | 99.048 | 99.097 |
| 4 | 99.158 | 99.225 |
| 5 | 99.2 | 99.265 |
| 6.3 | 99.242 | 99.303 |
| 8 | 99.298 | 99.356 |
| 10 | 99.33 | 99.385 |
| 12.5 | 99.37 | 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 | 99.59 | 99.626 |

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

(d) in point 3, a new point (f) is added as follows:

"(f) the noise levels of medium and large power transformers, measured at least as a type test

and 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) point 5 is added as follows:

"5. Repair operations

Existing medium and large power transformers shall be considered as new products if they are subject to upgrade or retrofit activities, regardless of when they were first placed on the market. This is without prejudice to the legal obligations under other Union's harmonisation legislation that these products could be subject to.

Existing medium and large power transformers on which only routine repair or refurbishment operations are performed shall not be considered as new products. Therefore, obligations set out in this Annex are not applicable to repaired or refurbished transformers, which were first placed on the market before 11 June 2014."

(2) Annex II is replaced by the following:

**"Annex II**

Measurement methods

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."

(3) In Annex III the following paragraph is added:

"If Factory Acceptance Tests (FATs) are planned, which test minimum requirements set out in Annex I of this Regulation, the competent authorities in may decide to use witnessed testing during these FATs to assess compliance of the transformer under investigation or have an independent test house carry out such assessment on their behalf. The authorities may request a manufacturer to disclose information on any planned FATs relevant for witnessed testing."

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

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