Deliverable 4.2: Final Methodology on market surveillance of Transformers

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TRANSFORMERS FANS

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About the INTAS project

The aim of the INTAS project is to provide technical and cooperative support, as well as capacity building activities, to Market Surveillance Authorities (MSAs). The need for the INTAS project arises from the difficulty that MSAs and market actors face in establishing and verifying compliance with energy performance requirements for large industrial products subject to requirements of the Ecodesign Directive, specifically transformers and industrial fans. Therefore, the project aims to:

- Support European Member State MSAs deliver compliance for large products (specifically for transformers and large fans);
- Support industry to be sure of what their obligations are under the Ecodesign Directive and to deliver compliance in a manner that will be broadly accepted by MSAs;
- Foster a common European approach to the delivery and verification of compliance for these products.

List of project partners:

WIP Renewable Energies	Europe
European Environmental Citizens' Organisation for Standardisation	Europe
European Copper Institute	Europe
Engineering Consulting and Design	Europe
Waide Strategic Efficiency	Europe
Austrian Energy Agency	Austria
Federal Public Service Health, Foodchain, Safety and Environment	Belgium
SEVEn Energy Efficiency Center	Czech Republic
Danish Technological Institute	Denmark
Finnish Safety and Chemicals Agency	Finland
The Polish Foundation for Energy	Poland
Directorate General of Energy and Geology	Portugal
Romanian Regulatory Authority for Energy	Romania
Foundation for the Promotion of Industrial Innovation	Spain
Italian National Agency for New Technologies, Energy and Sustainable Economic Development	Italy
Food and Economic Safety Authority	Portugal

Executive summary

This document contains a step-by-step guide about the market surveillance process for transformers aimed mainly at market surveillance authorities.

The methodology described in this guide has been designed by the partners of the INTAS project with information obtained in WP2, WP3 and WP4, altogether with the inputs of the main stakeholders, both at national and European level, that will be reflected in deliverable 6.3, and has been implemented satisfactorily by the MSAs that are part of INTAS consortium in a pilot exercise.

The INTAS WP 4 included a pilot exercise for the validation of that methodology proposed. This validation stage used the draft methodology and guide applying it at least in one test case. The respective outcome has been reported back to the project, including a description and evaluation of each case, stressing in particular the usability and validity of the methodology developed in WP3.

Partners involved in this practical pilot were: ASAE (Portugal) with the support of DGEG (Portugal), ENEA (Italy), ANRE (Romania), BHTC (Belgium) and TUKES (Finland). This evaluation phase was not expected to include – though if feasible would include - the physical testing of transformers. The main focus was the documentation inspection, including when applicable - according to the MSA formal status - a theoretical selection of a model and the most appropriate test method. The feedback from the pilot exercise enables to highlight the actual usability and validity of the whole methodology and has been taken into account in the preparation of this deliverable.

The guide describes the different steps for the compliance assessment methodology by MSAs adapted to the particular case of power transformers:

- General information
- Product screening / sample selection
- Documentation inspection
- Testing

It also introduces a new concept: “the mandatory notification” that will make possible for the MSAs to know if a transformer has been installed (or produced) in their region/country. This new concept is considered very necessary and useful for market surveillance purposes, as it will be described in section 4.1.1 of this document.

1. Introduction

1.1 Objectives

WP3 outlined the individual tools for verifying the compliance of transformers under the Eco-design Directive.

Task 4.2 allows for the methodology to be assembled, tested, and validated by MSAs and industry stakeholders. This system of review has enabled adjustments and corrections to be made where necessary, and has also validated the defined methodology for transformers. The various inputs that will make this possible are as follows:

Collection of relevant data and outcomes from work packages 2, 3, and 6:

• Comments and input from stakeholders through the national focal point meetings. These have included contributions from national energy agencies or other interested departments/agencies, manufacturers from NGOs and other associated stakeholders.

• European-level stakeholders have been given the opportunity to comment on the draft methodology as appropriate via the EU-level focal point consultation.

Real-world application and piloting phase:

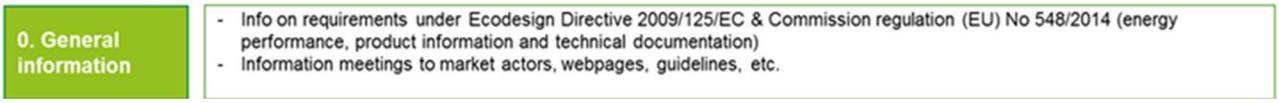
• There has been be a 'validation phase' by partners in the project consortium who have been able to secure the time and resources to carry out this pilot action. This phase has taken the draft of the methodology and guide, and applied at in at least one test case within their region. After that the partners participating in the pilot phase have then made comments and report back on the usability and validity of the methodology. The validation phase has not included physical testing of transformers (this action was undertaken under WP3), but has focused more on the documentation inspection and other stages of the verification process as preliminarily proposed in WP3, including the theoretical selection of a product and the most appropriate test method.

Feedback from the pilot and outcomes of other work packages has been used to complete the final deliverable of this task. The outcome of this task, has taken the form of a step-by-step guide aimed mainly at market surveillance authorities and has included a graphical flowchart. This task culminates in the deliverable 4.2.

2. Step by step guide

This section includes the full explanation of each of the different steps included within the INTAS methodology for the compliance assessment of power transformers (see section *3: Final flowchart*).

2.1 General information



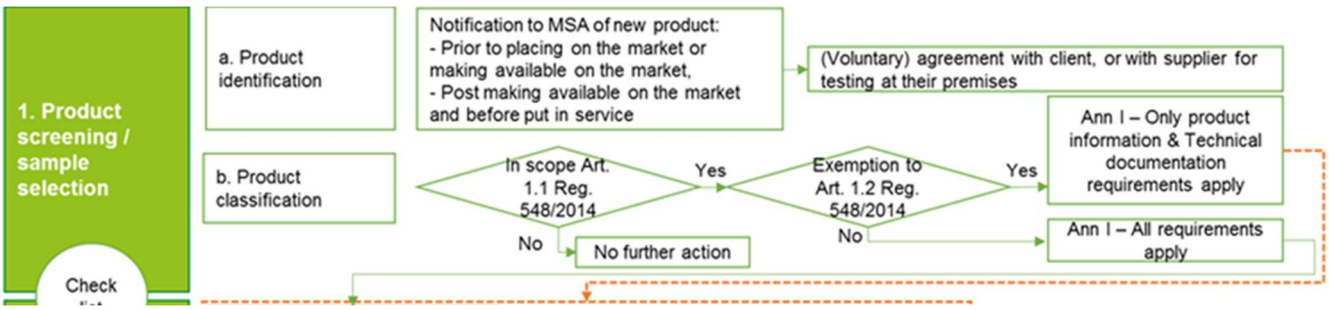
MSAs can play a key role fostering knowledge among the different market actors (manufacturers, importers utilities, end users, etc.) about Commission Regulation (EU) No 548/2014 and the Directive 2009/125/EC requirements, namely:

- Conformity assessment procedures
- Product information and rating plate requirements
- Technical documentation requirements

Market Surveillance Authorities may also encourage compliance by providing information on applicable legislation (e.g. via press releases, dedicated websites or information campaigns).

Another effective tool to reach the main stakeholders is to contact professional associations (transformer manufacturers, installers, etc.) and to set up discussion forums, and organize meetings or workshops in close collaboration with them.

2.2 Product screening/sample selection



Large industrial products such as power transformers are poorly suited to the product selection techniques that MSAs established and deployed for Ecodesign conformity verification targeted for smaller mass-produced products.

Given the very specific nature of the power transformer sector MSAs are likely to need to apply a bespoke screening methodology for the selection of such transformers for conformity verification.

Before the product is placed on the market this could entail selecting products for the tests at manufacturer's premises (see section 2.4.2).

After the product has been placed on the market this could entail:

a) a broader selection for technical documentation checks (see section 2.3)

b) a potentially slightly narrower selection for visual inspection checks (mainly checking the rating plate information)

c) a smaller sample for laboratory verification testing. (see section 2.4.1)

2.2.1 Mandatory notification

One of the major problems detected during the development of the INTAS project is that, in general, the MSAs do not have a procedure that allows them to know if a transformer has been imported, manufactured or installed in their country / region. This situation greatly hinders market surveillance.

INTAS project proposes a mandatory ([1]) notification from the manufacturer/importer to MSA (either that which has a mandate where the product is first placed on the market, and/or that which has the mandate where the product is put into service) to know that the transformer has been placed on the market. Every transformer placed on the market would be notified to the MSA, but this does not imply an inspection of every transformer, the notification only would consist of the date of putting into service and place of installation of the transformer.

If the notification is not made by the manufacturer or importer, this notification could be done by the end user or installer.

This notification could be done:

-before placing the transformer on the market or

-after placing the transformer on the market and before the putting into service.

[1] *INTAS is exploring the possibility of a mandatory notification for the MSAs to know if a transformer has been placed on the market (either by importing or producing) and installed in their territory, but currently there is no obligation for manufacturers, importers or their authorised representatives to inform MSAs that they have placed products on the market.*

Under the provisions of annex III of the Commission Regulation (EU) No 548/2014, the MSAs may decide to undertake the verification procedure at the premises of manufacturers, before they are put into service in their final destination. Therefore, it is recommended that the notification to be made before the transformer leaves the manufacturer's premises.

This notification can be combined with the existing legal requirements of the different Member States.

In the following cases it will be necessary to explore the possibility of collaboration between different MSAs:

1) When the MSAs of the place where the transformer is produced and where it is put into service are different.

   In this case, the MSA of the place where the transformer will be installed can contact the MSA of the place where the manufacturer is located to manage the possibility of undertaking the verification procedure at the premises of the manufacturer.

2) When the transformer is manufactured outside the EU.

   In this case, the customs authorities can contact the MSA of the place where the transformer will be installed to check if the notification has been made.

2.2.1.1 Advantages of the mandatory notification

As it will be discussed later in this report (section 2.4.3), the physical tests on an already installed transformer are problematic; therefore, knowing the existence of a transformer prior to its installation will facilitate market surveillance.

Annex III of Regulation 548/2014 states: “Given the weight and size limitations in the transportation of medium and large power transformers, Member States authorities may decide to undertake the verification procedure at the premises of manufacturers, before they are put into service in their final destination.” Thus, MSAs have the authority to demand such a verification procedure. Furthermore, the only way this could be conducted is if the manufacturer notifies the MSA prior to the product’s factory acceptance test (FAT).

The manufacturer has an incentive to inform the MSA in any case, because if the MSA were to conduct conformity verification testing after the product was placed on the market, it would be very costly for the transformer client in terms of lost operational time or delays. Thus, in general producers would not wish to develop a reputation of putting their clients at risk due to failings in cooperating with MSAs responsible for Ecodesign conformity verification.

2.2.2 Market intelligence

Before the selection of the sample, we propose to make a “Market Intelligence” exercise to gather knowledge of the market and begin to use this to establish profiles of the market actors and their importance. This can be done by contacting national manufacturer’s associations and conducting web-searches to find suppliers to the local market including local and international manufacturers of large power transformers. As this is a

relatively concentrated sector it is not difficult to establish a complete list of producers; however, it is also recommended that the MSA liaise with the local end-users of large transformers to establish a complete list of who is supplying what to the local market.

The initial profiling process should aim to identify the following:

- any local manufacturers, the main characteristics of their product offer, revenues and market shares (on the local market)
- ditto for the other manufacturers supplying the local market
- importers/traders
- the contractors that install transformers, the sectors they work with, their size and importance
- the end-use sectors with some approximate data on their likely levels of use of power transformers by type.

Once this has been done it should be possible to liaise with the economic operators (especially the principal ones) and take steps to better understand their business, competences and practices with regard to transformers.

2.2.3 Establishing non-conformity risk profiles of economic operators

Once sufficient details regarding economic operators have been established MSAs can begin to simultaneously take steps which will establish risk of non-conformity profiles and help to increase compliance among economic operatives.

As any local producers are likely to be most accessible and also to have an important position in the local market this process is likely to begin with site visits to the local producers (see 2.2.3.1). In addition, it will entail measures to address imported products from either within the EEA or from outside.

2.2.3.1 Site visits of local producers

At this stage an MSA could choose to make site visits of local producers which could be used to serve any of the following purposes:

- clarify information on the producer's products and markets
- ensure that the producer is familiar with the Ecodesign requirements
- gain understanding of and appraise the conformity management systems and procedures that the producer is using for conformity assessment of its products.

Additionally, such site visits could be used as a first form of informal conformity verification via:

- provisional screening of conformity assessment records for products previously placed on the market, including review of their technical documentation

- assessment of the quality of the testing facilities and calibration procedures being used

- conduct of visual inspections of available finished products for plausibility and rating plate requirements

- assessment of the design software used and checking whether the technical data from randomly selected finished products is likely to be in line with the Ecodesign requirements.

Most probably, it would be important for the MSA to assure the economic operator that these checks are not going to be used, at least in the first instance, for formal conformity verification checks, but rather are intended to understand the likelihood that the economic operator's products do conform to the requirements. If issues and non-conformity risks are identified via these checks then the MSA could alert the economic operator to these deficiencies and agree a process wherein they would remedy them prior to a future site visit and check.

Note, in many countries MSAs are likely to have the authority they need to oblige economic operators within their territory to cooperate with them; however, in some jurisdictions this may not be the case. If an economic operator does not wish to cooperate with an MSA, especially if the offer of a non-disclosure agreement is in place, then it could be indicative of bad-faith and imply that there is an elevated risk of non-conformity. This could be explained to the economic operator and if they still wish not to cooperate the MSA could set their risk profile at high and consider taking more proactive measures to sample their products for conformity verification purposes.

2.2.3.2 Addressing products from elsewhere within the EEA

In this case, the MSA should still be granted access to undertake the verification procedure at producer's premises due to the clause specified within Annex III of the regulation providing the producer is known to supply products to the MSA's market. However, it is also an option for the MSA to contact the MSA(s) with direct jurisdiction over the site(s) where these products are produced and ask them to either conduct the same type of checks they would have done and/or to supply them with information on what they know about the operations and likely conformity of the producer in question. If this information is not forthcoming the requesting MSA may consider requesting the same access to that producer as they would for a locally based one or raising the risk profile of the producer in question.

If the product is not placed on the market, MSAs can invite manufacturers to sign a voluntary agreement (see section 2.2.5.2) to allow market surveillance tests at their premises.

2.2.3.3 Addressing products made outside the EEA

Customs can identify manufacturers of power transformers based outside the EEA and MSAs could still seek to contact these and propose them, as in the case of manufacturers based in the EEA, to sign a voluntary agreement to allow market surveillance tests at their premises. This agreement will avoid problems that could occur if the transformer is found non-compliant after being placed on the market.

Furthermore, products imported from outside the EEA will all be passed through a hard trade border at customs and thus MSAs should have the opportunity to be informed by customs that they have been placed

on the market and to deploy conformity verification actions prior to them being put into service. The risk profiling of these products could be informed by market intelligence but also by plausibility checks based on documentation and visual inspection.

Regarding the relationship between MSAs and customs, the 'Blue Guide' on the implementation of EU products rules 2016 states the following:

"*Regulation (EC) No 765/2008 on checks for conformity with Union harmonisation legislation in the case of products imported from third countries requires the customs authorities to be closely involved in the market surveillance activities and information systems provided for under EU and national rules. Article 27(2) of Regulation (EC) No 765/2008 foresees the obligation for cooperation between customs officers and market surveillance officers. Obligations for cooperation are also included in Article 13 of the Community Customs Code which establishes that controls performed with customs and other authorities are undertaken in close cooperation between each other. In addition, the principles of cooperation between the Member States and the Commission established in Article 24 of the Regulation are extended to authorities in charge of external controls, when relevant (Article 27(5)).*"

2.2.4 Selecting products for conformity verification checks

Based on the risk profiling activities set out above it should be possible for MSAs to progressively establish risk profiles for the economic actors serving the local market. In a simple risk profiling system there could be 4 classes of non-conformity risk per economic operator:

- low
- medium
- high
- unknown.

As more information on the economic operators becomes available the share of unknowns would decrease. Also, as higher risk economic operators are seen to take measures to improve their conformity their risk status could be amended downwards. Risk profile status of economic operators would also be adjusted in the light of outcomes from any conformity verification processes undertaken on their products.

When the MSA becomes aware that a product has been placed on the market and the manufacturer/importer is known they can match it to their risk profile database to ascribe a risk status (with unknown being the default when the supplier is unknown or has no risk profile).

Based on this simple set of risk profiles the MSA can then apply a sampling algorithm to decide which products to select from a sample of potential candidates, and/or to decide whether to conduct conformity verification on a product which has just come to their attention. The weightings applied in the algorithm could take into account:

- the relative risk

• the desire to ensure there is a possibility that any product could be selected, not just the highest risk ones

• any pre-set intention to do conformity verification on a minimum or maximum number of the product type in question within a given period or given conformity verification budget envelope.

More information about how to apply the sampling algorithm and the screening process can be found in the INTAS deliverable 3.8 “Report about the screening techniques available for product/supplier targeting”

2.2.5 Product identification

When selecting a product, the following situations can be found:

- the product is already placed on the market or

- the product is not placed on the market.

This is the analysis of both situations:

2.2.5.1 The product is already placed on the market

2.2.5.1.1 The product is not put into service

In this case, the market surveillance will consist in document inspection (see chapter 5) plus the following options for physical testing:

- Testing at independent lab (see clause 2.4.1)

- Testing at manufacturer premises (see clause 2.4.2)

2.2.5.1.2 The product is already put into service.

In this case, the market surveillance will consist in document inspection (see clause 2.3) plus testing in situ (see clause 2.4.3)

2.2.5.2 The product is not placed on the market

In this case, the manufacturer has not performed the conformity assessment yet, and these tests can be used for market surveillance purposes if there is an agreement ([2]) between the manufacturer and the MSA. Please see clause 2.4.2.2 (witness testing with 3rd party assessment).

The documentation inspection can be done only after the tests have been performed.

[2] *voluntary agreement between manufacturer/supplier and MSA, or between MSA and client, to allow market surveillance tests at manufacturer/supplier premises. This agreement can be a general agreement for a fixed period of time (for example, a year) or agreement only for a sample and could be similar to existing agreements between transformers manufacturers and clients (large utilities) for witnessing FATs*

2.2.6 Product classification[3]

Once the sample is selected, it necessary to check if it is in the scope of the Commission Regulation (EU) No 548/2014

This Regulation establishes 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. The Regulation is only applicable to transformers purchased after the entry into force of the Regulation (11/06/2015)

2.2.6.1 Categorization

The Regulation classifies the power transformers in 3 types:

2.2.6.1.1 Small power transformers

Power transformer with a highest voltage for equipment not exceeding 1,1 kV.

2.2.6.1.2 Medium power transformers

Power transformer with a highest voltage for equipment higher than 1,1 kV, but not exceeding 36 kV and a rated power equal to or higher than 5 kVA but lower than 40 MVA.

2.2.6.1.3 Large power transformers

Power transformer with a highest voltage for equipment exceeding 36 kV and a rated power equal or higher than 5 kVA, or a rated power equal to or higher than 40 MVA regardless of the highest voltage for equipment

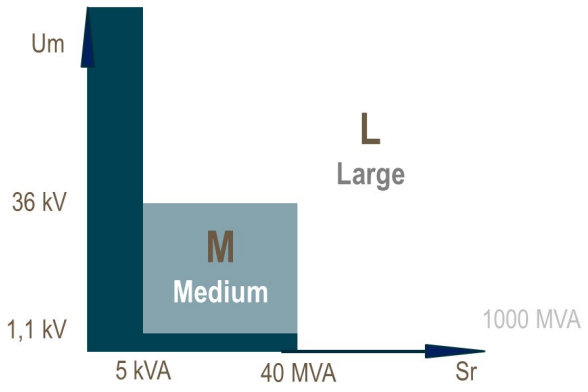


Figure 1-1: Classification of transformers

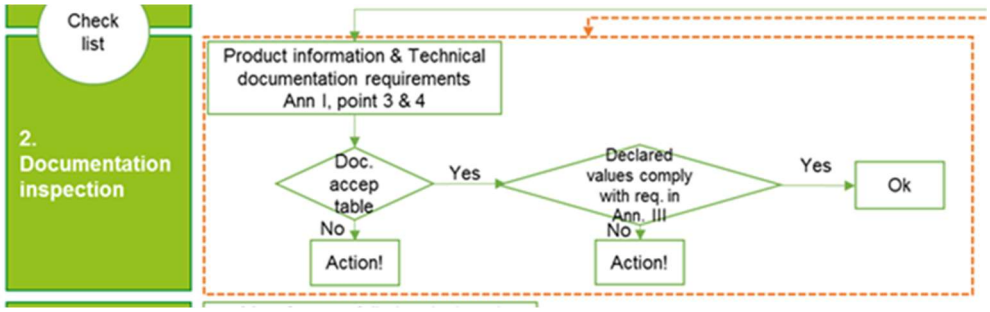
[3] *Commission Regulation (EU) No 548/2014 is under revision , the information of this section can change in the new regulation*

The exemptions to this Regulation do not apply to information and technical documentation requirements set out in Annex I, point 3 and 4. For the rest of the Regulation, these are the exemptions:

Transformers specifically designed and used for the following applications:

- instrument transformers, specifically designed to supply measuring instruments, meters, relays and other similar apparatus,
- transformers with low-voltage windings specifically designed for use with rectifiers to provide a DC supply,
- transformers specifically designed to be directly connected to a furnace,
- transformers specifically designed for offshore applications and floating offshore applications,
- transformers specially designed for emergency installations
- transformers and auto-transformers specifically designed for railway feeding systems,
- earthing or grounding transformers, this is, three-phase transformers intended to provide a neutral point for system grounding purposes,
- traction transformers mounted on rolling stock, this is, transformers connected to an AC or DC contact line, directly or through a converter, used in fixed installations of railway applications,
- starting transformers, specifically designed for starting three-phase induction motors so as to eliminate supply voltage dips,
- testing transformers, specifically designed to be used in a circuit to produce a specific voltage or current for the purpose of testing electrical equipment,
- welding transformers, specifically designed for use in arc welding equipment or resistance welding equipment,
- transformers specifically designed for explosion-proof and underground mining applications
- transformers specifically designed for deep water (submerged) applications,
- medium Voltage (MV) to Medium Voltage (MV) interface transformers up to 5 MVA,
- large power transformers where it is demonstrated that for a particular application, technically feasible alternatives are not available to meet the minimum efficiency requirements set out by this Regulation,
- large power transformers which are like for like replacements in the same physical location /installation for existing large power transformers, where this replacement cannot be achieved without entailing disproportionate costs associated to their transportation and/or installation

2.3 Documentation inspection



The documentation inspection is only possible when the product has been placed on the market or it is ready to be placed (conformity assessment by the manufacturer has been completed).

2.3.1 Ecodesign Directive (2009/125/EC) requirements

The Annex IV to the directive states the following:

1. This Annex describes the procedure whereby the manufacturer or its authorised representative who carries out the obligations laid down in point 2 ensures and declares that the product satisfies the relevant requirements of the applicable implementing measure. The EC declaration of conformity may cover one or more products and must be kept by the manufacturer.

2. A technical documentation file making possible an assessment of the conformity of the product with the requirements of the applicable implementing measure must be compiled by the manufacturer.

The documentation must contain, in particular:

(a) a general description of the product and of its intended use;

(b) the results of relevant environmental assessment studies carried out by the manufacturer, and/or references to environmental assessment literature or case studies, which are used by the manufacturer in evaluating, documenting and determining product design solutions;

(c) the ecological profile, where required by the implementing measure;

(d) elements of the product design specification relating to environmental design aspects of the product;

(e) a list of the appropriate standards referred to in Article 10, applied in full or in part, and a description of the solutions adopted to meet the requirements of the applicable implementing measure where the

standards referred to in Article 10 have not been applied or where those standards do not cover entirely the requirements of the applicable implementing measure;

(f) a copy of the information concerning the environmental design aspects of the product provided in accordance with the requirements specified in Annex I, Part 2; and

(g) the results of measurements on the ecodesign requirements carried out, including details of the conformity of these measurements as compared with the ecodesign requirements set out in the applicable implementing measure.

3. The manufacturer must take all measures necessary to ensure that the product is manufactured in compliance with the design specifications referred to in point 2 and with the requirements of the measure which apply to it.

2.3.2 Commission Regulation (EU) No 548/2014 requirements

The points 3 and 4 of Annex I to the regulation state the following:

2.3.2.1 Product information requirements (Point 3, Annex I)

"From 1 July 2015, the following product information requirements for transformers included in the scope of this Regulation (Article 1) shall be included in any related product documentation, including free access websites of manufacturers:

(a) information on rated power, load loss and no-load loss and the electrical power of any cooling system required at no load;

(b) for medium power (where applicable) and large power transformers, the value of the Peak Efficiency Index and the power at which it occurs;

(c) for dual voltage transformers, the maximum rated power at the lower voltage, according to Table I.3;

(d) information on the weight of all the main components of a power transformer (including at least the conductor, the nature of the conductor and the core material);

(e) For medium power pole mounted transformers, a visible display 'For pole-mounted operation only'.

The information under a); c) and d) shall also be included on the rating plate of the power transformers."

2.3.2.2 Technical documentation (Point 4, Annex I)

"The following information shall be included in the technical documentation of power transformers:

(a) manufacturer's name and address;

(b) model identifier, the alphanumeric code to distinguish one model from other models of the same manufacturer;

(c) the information required under point 3.

If (parts of) the technical documentation is based upon (parts of) the technical documentation of another model, the model identifier of that model shall be provided and the technical documentation shall provide the details of how the information is derived from the technical documentation of the other model, e.g. on calculations or extrapolations, including the tests undertaken by the manufacturer to verify the calculations or extrapolations undertaken."

2.3.3 Minimum content of the documentation

The manufacturer, or the representative office at EU level or in each country as intermediary, could be requested to send the MSAs responsible for Commission Regulation (EU) No 548/2014 the following documentation:

2.3.3.1 Technical file

According point 2 of Annex IV to Ecodesign Directive (see section 2.3.1 of this report) the manufacturer must compile a technical documentation file. In general, the technical file includes the following documents:

2.3.3.2 EC conformity declaration

EC declaration of conformity of the manufacturer or his authorised representative established within the EU according Annex VI to Directive 2009/125/EC

2.3.3.3 Test report

The test report should contain the measured values used for the determination of the rated values, according to point 2.g of Annex IV to Directive 2009/125/EC (see section 2.3.1 of this report)

2.3.3.4 Calculations

A document with if they are not included in the test report. These calculations must comply with point 4 of Annex I to Commission Regulation (EU) No 548/2014 that states:" *If (parts of) the technical documentation is based upon (parts of) the technical documentation of another model, the model identifier of that model shall be provided and the technical documentation shall provide the details of how the information is derived from the technical documentation of the other model, e.g. on calculations or extrapolations, including the tests undertaken by the manufacturer to verify the calculations or extrapolations undertaken"*

2.3.3.5 Rating plate

According to point 3 of Annex I to Commission Regulation (EU) No 548/2014, some product information shall be included in the rating plate.

2.3.3.6 Free access website address

According to point 3 of Annex I of Commission Regulation (EU) No 548/2014, some product information shall be included in free access websites of manufacturers.

2.3.4 Checklist for documentation inspection according Commission Regulation (EU) No 548/2014

Taking into account all the above, a checklist has been developed and is included in Appendix B .It contains the following sections:

2.3.4.1 Identification and classification

This first part of this section must be filled out with the product identification data from EC declaration and other product information.

Once this step is completed, it is necessary to check if the inspected transformer is within the scope of the Regulation and which type of transformer (small, medium or large) is.

2.3.4.2 Product information requirements

This section is divided in two parts that correspond to point 3 and 4 of Annex I to Commission Regulation (EU) No 548/2014 respectively.

According point 3 of annex I to this Regulation all the product information requirements shall be included in the product documentation and free access websites of the manufacturers but only some of them shall also be included on the rating plate of the transformers. The column “Shall be included in” indicates where every requirement has to be included.

2.3.4.3 Do the documentation values comply with energy efficiency requirements?

The previous section is designed to check if the product documentation and the technical file contain all the requested information but this section is intended to check if those values are valid according to the Regulation energy efficiency requirements.

While exemptions to the regulation do not affect the previous section (product information requirements and technical file), they apply to this section, so it is necessary to check that the inspected transformer is not included in these exemptions.

The columns “Declared values” must be filled out with the values the manufacturer declares in the product documentation and the columns “Measured values” must contain the values of the manufacturer test report.

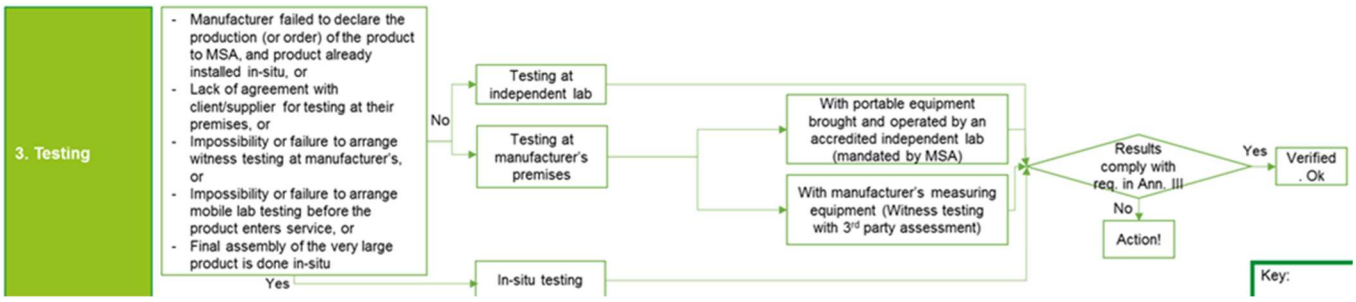
Annex III to Commission Regulation (EU) No 548/2014 is amended in accordance with Annex XIX to Commission Regulation (EU) No 2016/2282 that states:

“The model shall be considered to comply with the applicable requirements if:

(a) the values given in the technical documentation pursuant to point 2 of Annex IV to Directive 2009/125/EC (declared values), and, where applicable, the values used to calculate these values, are not more favourable for the manufacturer or importer than the results of the corresponding measurements carried out pursuant to paragraph (g) thereof; and

(b) the declared values meet any requirements laid down in this Regulation, and any required product information published by the manufacturer or importer does not contain values that are more favourable for the manufacturer or importer than the declared values;"

2.4 Testing



The different options for physical testing are described below. The best option for testing a transformer in each case will depend on many factors that include size, transportation, price, availability of independent labs, agreement with the manufacturer, etc.

The "pros" and "cons" of every option are included in the corresponding clause.

2.4.1 Testing at independent lab

The inspected transformer is transported from the manufacturer premises, end user installation or warehouse to the independent lab premises. There, the transformed is tested by the lab staff using its own measuring equipment.

Pros

- Using accredited laboratories provides more accurate and according to the harmonised standards measurements. These measurements could be used to prove non-conformity within a court of law.
- Using independent laboratories guarantees the independence of the market surveillance process.
- The testing costs are lower than in the rest of the options because they do not include any travel costs of the lab staff or transportation cost of the measuring equipment.

Cons

- The testing capability of the independent laboratories is limited. Most of the laboratories can have limitations in the size, power or voltage of the transformer to be tested

- Costs of purchasing the transformer, although a specific agreement can be done with the manufacturer in order to have the sample product for free for the time needed for the testing, although in some cases, national legislation may not allow this
- Costs of transportation of the transformer to the laboratory facilities
- Costs of installation of the transformer at the laboratory to be ready for the tests.
- Respecting installation dates can be very critical for the scheduled operation of power networks and delays in this risk incurring unacceptable inconvenience and costs for third parties
- Lack of laboratories in the national territory. In some cases, national legislation may not allow testing in laboratories outside national territory.
- Large power transformers are extremely heavy and particularly difficult and costly to transport to and test in independent labs.

A brief guide about how select an independent lab can be found in Appendix B

2.4.2 Testing at manufacturer's premises

Testing could occur before the product is placed on the market in those cases in which there is an agreement between the manufacturer and the MSA to allow testing at the manufacturer's premises.

Commission Regulation (EU) No 548/201 4has a clause in it that empowers MSAs to undertake the verification process at the premises of manufacturer:

Annex III to Commission Regulation (EU) No 548/2014 states: "*Given the weight and size limitations in the transportation of medium and large power transformers, Member States authorities may decide to undertake the verification procedure at the premises of manufacturers, before they are put into service in their final destination.*"

2.4.2.1 With portable equipment brought and operated by an accredited independent lab (mandated by a MSA)

The MSA hires and appoints an accredited independent lab that moves its staff and measuring equipment to manufacturer's premises where the test is performed.

Pros

- The market surveillance tests at manufacturer premises could be conducted in sequence with the conformity assessment test of the manufacturer. In this case, the transformer is ready to be tested and with very little effort, the measurement equipment of the manufacturer can be substituted by the measuring equipment of the independent lab for the market surveillance tests.

- Using accredited laboratories provides more accurate and according to the harmonised standards measurements. These measurements could be used to prove non-conformity within a court of law.
- Using independent laboratories guarantees the independence of the market surveillance process.
- Using the manufacturer's premises guarantees higher testing capability in power and size
- Performing market surveillance tests in sequence with the conformity assessment test of the manufacturer minimizes the risk of delays in the delivery of the transformer to the costumer

Cons

- Moderate cost of testing (the testing costs will include the travel costs of the lab staff and the transportation cost of the measuring equipment)
- It is necessary the coordination between the independent lab and the manufacturer for fixing the dates of the tests

2.4.2.2 With manufacturer's measuring equipment (Witness testing with 3rd party assessment)

The transformer is tested at manufacturer's premises with manufacturer's staff and measuring equipment. The test will be witnessed by the staff of an independent lab hired by the MSA to ensure the procedure and tests are correct

A modification of this testing procedure could entail not only the assessment of the manufacturer measurement equipment and the testing procedures but also the physical calibration of the manufacturer's measuring equipment by the 3rd party experts with their own calibration instruments

A variation of this method could be a random visit to manufacturer premises (i.e. without the coordination between the staff of the independent lab and the manufacturer for fixing the dates of the tests). The staff of the independent lab visits the manufacturer lab asking for the on-going tests:

- if there are units into the scope of the Regulation being tested: a traditional witness test using the instrumentation of the manufacturer is performed
- if no test of units into the scope of the Regulation is on-going: a documentation inspection is performed randomly accessing to the existing reports

Pros

- Market surveillance tests at manufacturer premises could be conducted in parallel with the conformity assessment tests of the manufacturer

- All large power transformers are subject to factory acceptance tests (FATs) arranged between the commercial parties prior to the product being granted approval for shipping, these tests can be witnessed by the staff of an independent lab hired by the MSA for market surveillance purposes
- Using the manufacturer's premises guarantees higher testing capability in power and size
- Performing market surveillance tests in parallel with the conformity assessment test of the manufacturer minimizes the risk of delays in the delivery of the transformer to the costumer
- Lowest cost of testing

Cons

- It is necessary the coordination between the staff of the independent lab and the manufacturer for fixing the dates of the tests (except for randomly visiting manufacturer premises)
- Use of non-independent and/or non-accredited premises requires a previous assessment of the measurement equipment and the testing procedures.

  This assessment will contain at least:

  - Checking of the climatic conditions
  - Checking of the accredited calibration of the measurement equipment of the manufacturer
  - Checking of the installation conditions (load and supply)
  - Costs of the calibration of the manufacturer's instruments (if done)
  - Due to the risk of performing the test not completely in line with the standard methodology (if the manufacturer's instrumentation is not correctly calibrated and test conditions differ from the harmonized standard) may produce a measurement that could be legally questioned for use to prove non-conformity

2.4.3 In-situ testing

This is the most complicated option. It is recommended using it only in the cases where none of the options described previously are feasible (i.e manufacturer failed to declare the production (or order) of the product to MSA, product already installed, lack of agreement with the manufacturer or end user for testing at manufacturer premises, impossibility or failure to arrange witness testing at manufacturer premises, , impossibility or failure to arrange mobile lab testing before the product enters into service, final assembly of the product at transformer installation place, etc).

The transformer is tested at its installation place by an independent lab accredited for in-situ testing. The lab will provide its own staff, measuring equipment and power supply

Pros

- In-situ testing is the most feasible option for transformers already put into service

Cons

- In-situ tests are not according to harmonised standards and the regulation (i.e. climatic conditions are hard to reach, the measurement of the losses is done with reduced power/voltage, etc.)
- The use of independent laboratory mobile testing system has limitations in terms of power, voltage, etc.
- Highest costs (the testing cost will include the travel costs of the lab staff and the transportation cost of the measuring equipment and the power supply)
- If the transformer is already in service, the stop of the installation for performing the tests could be complicated and could result in costs for the end user
- Due to the risk of performing the test not completely in line with the standard methodology, in-situ tests may produce a measurement that could be legally questioned for use to prove non-conformity.

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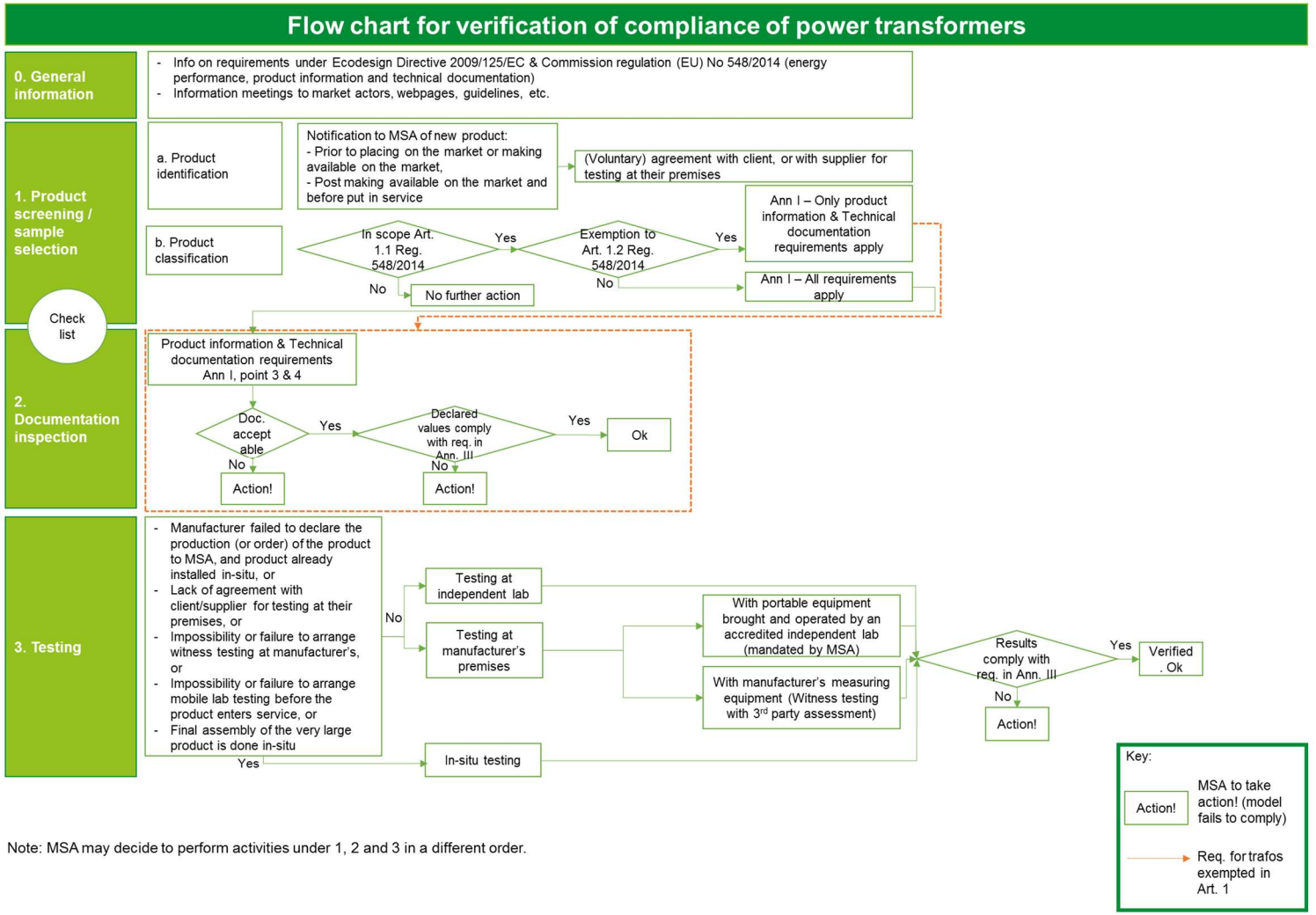
3. Final Flowchart



Note: MSA may decide to perform activities under 1, 2 and 3 in a different order.

The flowchart of deliverable 3.9 has been basically maintained and validated by the piloting phase except for the “boxes” corresponding to:

1) Complementary non-conformity risk assessment.

   It has been considered included in “Screening”

2) Plausibility check.

   Plausibility check is based in documentation and visual inspection. Bearing in mind that, in the case of transformers, the visual inspection consists mainly in checking the rating plate, it has been considered that “plausibility check” is included in “Documentation inspection”

Appendix A: Check list for documentation inspection

CHECK LIST FOR DOCUMENTATION INSPECTION ACCORDING REGULATION Nº 548/2014

1. IDENTIFICATION AND CLASSIFICATION

Trademark:	
Model number:	
Serial number:	
Manufacturer:	
Date of purchase:	
Rated power (S_r):	
Highest voltage for equipment (Um):	
Dry-type transformer (Y/N):	
Liquid immersed transformer (Y/N):	
Dual voltage on one or both windings (Y/N):	
Pole-mounted transformer (Y/N):	
Final destination (only for tailor-made products):	

Scope		
Power transformers with a power rating ≥1 kVA used in 50 Hz electricity transmission and distribution networks or for industrial applications.		
Classification		
Small power transformer	$U_m \leq 1{,}1kV$	
Medium power transformer	$1{,}1kV \leq U_m \leq 36kV$ and $5kVA \leq S_r < 40$ MA	
Large power transformer	$U_m > 36kV$ and $S_r \geq 5kVA$ or $S_r \geq 40MVA$	

2. PRODUCT INFORMATION REQUIREMENTS

Annex I. Point 3. Product information requirements		
Requeriment	**Shall be included in**	**Verdict**
(a) Rated power; S_r	product documentation, free access websites of manufacturers and rating plate	
Load loss; P_k	product documentation, free access websites of manufacturers and rating plate	
No load loss; P_0	product documentation, free access websites of manufacturers and rating plate	
Electrical power of any cooling system required at no load; P_{c0}	product documentation, free access websites of manufacturers and rating plate	
(b) For medium power transformers with S_r>3150kV, the value of the Peak Efficiency Index (PEI) and the power at which it occurs;	product documentation and free access websites of manufacturers	
For large power transformers, the value of the Peak Efficiency Index (PEI) and the power at which it occurs;	product documentation and free access websites of manufacturers	
(c) for dual voltage transformers, the maximum rated power at the lower voltage, according to Table I.3;	product documentation, free access websites of manufacturers and rating plate	
d) information on the weight of all the main components of a power transformer (including at least the conductor, the nature of the conductor and the core material)	product documentation, free access websites of manufacturers and rating plate	
e) For medium power pole mounted transformers, a visible display ‘For pole-mounted operation only’	product documentation and free access websites of manufacturers	

Annex I. Point 4. Technical documentation		
Requeriment		**Verdict**
(a) manufacturer's name and address;		
(b) model identifier, the alphanumeric code to distinguish one model from other models of the same manufacturer;		
(c) the information required under point 3.		
If (parts of) the technical documentation is based upon (parts of) the technical documentation of another model, the model identifier of that model shall be provided and the technical documentation shall provide the details of how the information is derived from the technical documentation of the other model, e.g. on calculations or extrapolations, including the tests undertaken by the manufacturer to verify the calculations or extrapolations undertaken.		

3. DO THE DOCUMENTATION VALUES COMPLY WITH THE ENERGY EFFICIENCY REQUIREMENTS?

(Exemptions to the Regulation apply to this section)

3.1. Minimum energy performance or efficiency requirements for medium power transformers

Annex I. Point 1. 1. Requirements for three-phase medium power transformer with rated power ≤ 3150 kVA				
Requeriment	**Rated value**	**Measured value**	**Limit**	**Verdict**
Load loss; P_k				
No load loss; P_0				

Annex I. Point 1. 2. Requirements for medium power transformer with rated power > 3150 kVA				
Requeriment	**Rated value**	**Measured value (*)**	**Limit**	**Verdict**
Peak Efficiency Index (PEI)				
(*) PEI calculated with the measured values (values included in the test report)				

Annex I. Point 1. 3. for medium power transformers with rated power ≤ 3 150 kVA equipped with tapping connections suitable for operation while being energised or on-load for voltage adaptation purposes. Voltage Regulation Distribution Transformers are included in this category				
Requeriment	**Rated value**	**Measured value**	**Limit**	**Verdict**
Load loss; P_k				
No load loss; P_0				

Annex I. Point 1. 4. Requirements for medium power pole-mounted transformers				
Requeriment	**Rated value**	**Measured value**	**Limit**	**Verdict**
Load loss; P_k				
No load loss; P_0				

3.2. Minimum energy efficiency requirements for large power transformers

Annex I. Point 2. Requirements for large power transformers				
Requeriment	**Rated value**	**Measured value (*)**	**Limit**	**Verdict**
Peak Efficiency Index (PEI)				
(*) PEI calculated with the measured values (values included in the test report)				

NOTE: Information about how to fill in this check list can be found in clause 2.3.4 of this report.

Appendix B: Brief guide for selecting independent laboratories

For the tests described in section 6 of this report, a laboratory must be selected which has the capability to make the required tests on the transformer. It is important that the laboratory can demonstrate an acceptable level of quality and competence.

As one of the conclusions of the practical exercise carried out in WP3 of INTAS project, we can stablish the following aspects to be considered when selecting a laboratory for market surveillance purposes:

1. Independence

The laboratory shall not be, or be influenced by, a body which manufactures or trades in the type of equipment being tested. Furthermore, the qualified laboratory shall be impartial and objective in its testing activities and decisions.

2. Competence

The most convenient way to demonstrate the competence of the laboratory is the accreditation by a recognised national accreditation body for the specific tests (at laboratory premises and with portable laboratory at manufacturer's premises) to be carried out according the EN ISO/IEC 17025., but considerations needs to be done on the fact that in some countries it could be required a specific legal recognition and laboratory official registration when have to be used as a laboratory for MS activities. This of course shall be considered for the selection.

3. Capability

It is based in the equipment and installation available in the laboratory to perform the tests required. The equipment additionally needs to be calibrated, maintained and adapted to the modifications and interpretations adopted in the Regulation 548/2014 and the harmonised standards.

For testing transformers, the capability is limited by the size, possibility of installation, or the power/voltage required by the equipment under test.

In addition to checking the capability of the laboratory to perform tests on its facilities, it will also be necessary to check its capability to carry out tests at the manufacturer's premises using a portable measuring equipment

4. Experience

This is a basic aspect to consider in the laboratory selection, especially for market surveillance testing. The quality of the testing results directly relies on the laboratory experience. The possibility of applying

the Regulation requirements in a different way depending on the laboratory involved is not acceptable from the legal point of view.

The ways to operate the appliances under test, or the control of the parameters of the supply installation, or the appropriate settings of the measuring instrument features, or records, are examples of this “good practise” or “knowledge” that are only accessible to those laboratories which frequently perform these tests.

By other hand, the interchange of views and experiences with other laboratories, including manufacturer laboratories, provides the necessary intercomparison to achieve the quality of the test.

The involvement in standardisation activities (i.e. participation in European or national standardisation technical committees) also contributes to the tests results quality

Abbreviation list

EU – European Union
MSA – Market Surveillance Authority
FAT - Factory Acceptance Test

References

Directive 2009/125/EC

Commission Regulation (EU) No 548/2014

Commission Regulation (EU) No 2016/2282

“Blue Guide” on the implementation of EU products rules 2016

INTAS Deliverable 3.8: “Best practice and experiences of both MSAs and industry regarding testing of transformers”

INTAS Deliverable 3.9: “Graphical flow chart of the methodological process, taking into account all tasks within WP3”

List of Figures

More information
about the INTAS project activities
and all of its results
are published on:

www.INTAS-testing.eu

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