

GUIDE

GUIDE

Securing credible environmentally relevant performance assessment methods in standards

Assurer des méthodes d'évaluation crédibles et pertinentes de la performance pour l'environnement dans les normes



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**SECURING CREDIBLE ENVIRONMENTALLY RELEVANT
PERFORMANCE ASSESSMENT METHODS IN STANDARDS**

FOREWORD

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IEC Guide 121 has been prepared by the Advisory Committee on Environmental Aspects (ACEA).

The text of this IEC Guide is based on the following documents:

Draft	Report on voting
SMBNC/43/DV	SMBNC/52/RV

Full information on the voting for the approval of this Guide can be found in the report on voting indicated in the above table.

The language used for the development of this Guide is English.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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INTRODUCTION

The IEC has been developing and publishing standards to support industry and other stakeholders for over 100 years, and the last few decades have seen an increase in the importance of standards that address environmental matters. The protection of people from the potential safety hazards of products has always been an important aspect in the portfolio of standards developed by the IEC, and today society at large is also demanding that products do not damage the world in which we live.

Therefore, there is a growing demand for publications that include assessment methods to determine whether a product can cause harm to the Earth's ecosystem. For instance, the quantification of hazardous emissions to the environment (for example, fluorinated or other greenhouse gases) helps to counteract climate change.

The possible harm to the Earth's environment can be caused either directly by a product, for example, through the emission of harmful substances such as greenhouse gases or other toxic pollutants directly to land, water, or air during manufacture, use, or end-of-life phase, or indirectly by the consumption of resources such as energy or water (called "inputs") by a product. These can affect the environment through, for example, emissions coming from the production of such inputs and the depletion of the Earth's resources.

IEC and other international standards are expected to provide commonly agreed, objective and unbiased assessment methods to determine, amongst other things, quantitative properties of a product or system, such as CO₂ emission or energy consumption. The measurement result can then be used to prepare an associated declaration to demonstrate the conformity of the product to specified requirements. Even if IEC standards do not include assessment methods to assess the direct impact of products on the environment, it is possible that they include methods relating to a means to assess (or consider) the indirect impact of that product on the environment, for example, energy consumed to deliver one or more product functions. In this Guide, assessment methods of either the direct or the indirect environmental impact of products are referred to as "environmentally relevant assessment".

Testing for environmental impacts, whether beneficial or detrimental, is not always easy. For instance, such impacts cannot always be readily measured in a consistent and uniform manner. This can lead to ambiguity and debate as to the usefulness of such a test.

When developing an assessment method, it is already general practice to consider classical aspects such as measurement repeatability, reproducibility, and accuracy, as well as the costs of testing. However, these considerations alone do not guarantee that such assessment method is credible (from the environmental performance point of view). For an IEC standard to be credible, it needs to ensure that its environmentally relevant performance assessments are representative of how the product is used, maintained, and disposed of in real-life and to prevent, as far as practicable, circumvention. Representativeness and (anti-)circumvention will be extensively addressed in this Guide.

This Guide is complementary to IEC Guide 109. While IEC Guide 109 describes the general principles of specifying environmental aspects in IEC publications, this Guide provides principles and requirements to ensure that standards writers are made aware of and consider the aspects of credibility described in this Guide.

In this Guide the term "committees" includes "technical committees, TCs", "project committees, PCs", "subcommittees, SCs" and "systems committees, SyCs".

Since environmentally relevant performance assessment methods are present in standards applicable to many committees, this Guide was prepared by ACEA and was circulated to all IEC technical committees, some advisory committees, IEC Conformity Assessment Board and CEN-CLC ECO-CG/TF2 for comments.

The following IEC committees are thanked for their active contribution to the preparation of this Guide: NL NC, KR NC, JP NC, TC 59, TC 100, and TC 111.

SECURING CREDIBLE ENVIRONMENTALLY RELEVANT PERFORMANCE ASSESSMENT METHODS IN STANDARDS

1 Scope

This Guide specifies principles, requirements, and guidance for standards writers to identify whether an assessment method in their standard can be used to obtain an indication of the environmental performance of a product and to ensure that such assessment is credible.

This Guide applies to standards covering environmental performance of new products and as appropriate to standards covering environmental performance of second life products (for example, refurbished or remanufactured).

This Guide is therefore intended to ensure that assessment methods developed by standards writers are credible. The credibility of an environmentally relevant performance assessment method is determined by taking into account all the related principles, namely representativeness, measurement repeatability, measurement reproducibility, measurement accuracy, cost of testing, anti-circumvention, as well as review of standards.

Environmentally relevant performance assessment methods can be present in many IEC standards (for example, standards covering performance aspects of products), and not only those focused on the environment. This Guide will be applicable to those as well.

This Guide is not applicable to standards containing environmentally relevant performance assessment methods that are not assessed by test (for example, assessment by inspection or simulation), nor is it applicable to other aspects not linked to environment, such as electromagnetic compatibility (EMC) and electromagnetic fields (EMF).

This Guide does not include guidance on whether all environmentally relevant aspects are covered by an IEC standard. This Guide also does not give guidance on whether a performance assessment method was successfully identified as environmentally relevant.

NOTE The IEC Standardization Management Board (SMB) has decided that Guides such as this one can have mandatory requirements which shall be followed by all IEC committees developing technical work that falls within the scope of the Guide, as well as guidance which may or may not be followed. The mandatory requirements in this Guide are identified by the use of "shall". Statements that are only for guidance are identified by using the verb "should" (see IEC Directives Supplement Part 1, A1.1).

2 Normative references

There are no normative references in this Guide.

3 Terms, definitions and abbreviated terms

For the purposes of this Guide, the terms and definitions given in the ISO/IEC Directives, Part 2, and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org>

3.1 Terms and definitions related to standards

3.1.1

standard

document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context

Note 1 to entry: Standards should be based on the consolidated results of science, technology and experience, and aimed at the promotion of optimum community benefits.

Note 2 to entry: The term "standard" in this document refers to IEC publications, for example, "International Standard, IS", "Technical Specification, TS", "Publicly Available Specification, PAS", and "Technical Report, TR".

[SOURCE: ISO/IEC Guide 2:2004, 3.2, modified – Note 2 to entry was added to provide the additional information contained in ISO/IEC Directives, Part 2:2021, 3.1.1, excluding the reference to "Guides".]

3.1.2

Guide

document published by ISO or IEC giving rules, orientation, advice or recommendations relating to international standardization

Note 1 to entry: Guides can address issues of interest to all users of documents published by ISO and IEC.

[SOURCE: ISO/IEC Directives, Part 2:2021, 3.1.7]

3.1.3

assessment

undertaking of an investigation in order to arrive at a judgement, based on evidence, of the suitability of a product

[SOURCE: IEC 60050-821:2017, 821-12-04]

3.2 Terms and definitions related to the environment

3.2.1

environment

surroundings in which a product or system exists, including air, water, land, natural resources, flora, fauna, humans and their interrelation

[SOURCE: IEC 60050-904:2014, 904-01-01]

3.2.2

environmental aspect

element of an organization's activities or products that can interact with the environment

[SOURCE: IEC 60050-904:2014, 904-01-02, modified – Note 1 to entry has been omitted.]

3.2.3

environmental impact

change to the environment, whether adverse or beneficial, wholly or partly resulting from environmental aspects

EXAMPLE Typical environmental impacts are resource depletion, ozone depletion, smog formation, eutrophication, climate change, alteration of habitats, reduction of biological diversity and human exposure.

[SOURCE: IEC 60050-904:2014, 904-01-03, modified – The example has been added.]

3.2.4

performance

<of a product> characteristics defining the ability of a product to achieve the intended functions

[SOURCE: IEC 60050-311:2001, 311-06-11, modified – The domain "<of a product>" has been added and, in the definition, "measuring instrument" has been replaced by "product".]

3.2.5

environmental performance

performance related to environmental impacts and environmental aspects

Note 1 to entry: The environmental performance is influenced by all processes related to the life cycle of the object of consideration.

Note 2 to entry: Environmental performance can be expressed either quantitatively or qualitatively with reference to performance requirements or possibly relative to a scale of values or a benchmark.

[SOURCE: ISO 21931-1:2022, 3.2.10]

Note 3 to entry: Environmental impacts can be either direct or indirect.

[SOURCE: ISO 15392:2019, 3.16, modified – Notes 2 and 3 to entry have been added.]

3.3 Terms and definitions related to credibility and metrology

3.3.1

circumvention

act that results in an invalid outcome to an assessment of a product that is advantageous for the provider of that product

Note 1 to entry: The act of circumvention can be an intentional or an unintentional evasion of the provisions of a standard, policy or legislation.

Note 2 to entry: The assessment is presumed to be carried out on a product or system. Consequently, if the assessment is deemed to be advantageous, it benefits the provider of the product or system.

3.3.2

anti-circumvention

act aimed at preventing circumvention

3.3.3

defeat mechanism

mechanism that changes a product's performance, in particular under test conditions

Note 1 to entry: The mechanism can be hardware, software or firmware or a combination thereof.

3.3.4

representativeness

degree to which a quantitative property reflects the population of interest

Note 1 to entry: A "population of interest" refers to the group from which a conclusion is drawn.

3.3.5

measurement repeatability

closeness of agreement between the results of successive measurements of the same measurand, carried out under the same conditions of measurement, i.e.:

- by the same measurement procedure,
- by the same observer,
- with the same measuring instruments, used under the same conditions,
- in the same laboratory,

- at relatively short intervals of time.

Note 1 to entry: The concept of "measurement procedure" is defined in VIM (ISO/IEC Guide 99:2007) 2.6.

[SOURCE: IEC 60050-311:2001, 311-06-06, modified – The term "repeatability (of results of measurements)" has been replaced by "measurement repeatability".]

3.3.6

measurement reproducibility

closeness of agreement between the results of measurements of the same value of a quantity, when the individual measurements are made under different conditions of measurement:

- measurement principle,
- measurement method,
- observer,
- measuring instruments,
- reference standards,
- laboratory,
- under conditions of use of the instruments, different from those customarily used,
- after intervals of time relatively long compared with the duration of a single measurement.

Note 1 to entry: The concepts of "measurement principle" and "measurement method" are respectively defined in VIM (ISO/IEC Guide 99:2007) 2.4 and 2.5.

Note 2 to entry: The term "reproducibility" also applies to the instance where only certain of the above conditions are taken into account, provided that these are stated.

[SOURCE: IEC 60050-311:2001, 311-06-07, modified – The term "reproducibility (of measurements)" has been replaced by "measurement reproducibility" and, in the definition and note, "principle of measurement" and "method of measurement" have been replaced with "measurement principle" and "measurement method", respectively.]

3.3.7

measurement accuracy

closeness of agreement between a measured quantity value and a true quantity value of a measurand

Note 1 to entry: The concept "measurement accuracy" is not a quantity and is not given a numerical quantity value. A measurement is said to be more accurate when it offers a smaller measurement error.

Note 2 to entry: The term "measurement accuracy" should not be used for measurement trueness and the term measurement precision should not be used for 'measurement accuracy', which, however, is related to both these concepts.

Note 3 to entry: "Measurement accuracy" is sometimes understood as closeness of agreement between measured quantity values that are being attributed to the measurand.

[SOURCE: ISO/IEC Guide 99:2007, 2.13, modified – Admitted terms "accuracy of measurement" and "accuracy" have been omitted.]

3.3.8

cost of testing

cost of equipment and routine calibration, and cost of material and non-material resources needed for determining conformity with a standard

Note 1 to entry: Examples of material resources can be test medium and consumables.

Note 2 to entry: Examples of non-material resources can be energy, time, and human resources.

3.3.9 review

activity of checking a normative document to determine whether it is to be reaffirmed, changed or withdrawn

[SOURCE: ISO/IEC Guide 2:2004, 9.4]

3.4 Other terms and definitions

3.4.1 product

goods or service

Note 1 to entry: This includes interconnected, interrelated goods or services.

Note 2 to entry: The goods or service can comprise processes, and combinations of processes, goods and services, commonly known as "systems".

[SOURCE: IEC 62430:2019, 3.1.2, modified – in the definition the term "any" was deleted and Note 2 to entry was added.]

3.4.2 test testing

determination of one or more characteristics of an object of conformity assessment according to a procedure

[SOURCE: ISO/IEC 17000:2020, 6.2, modified – added term "test" and notes to entry omitted.]

3.4.3 user user of the product

one or more individuals or organizations that install, use, maintain, or finally dispose of the product

3.5 Abbreviated terms

EMC Electromagnetic compatibility

EMF Electromagnetic field

4 Principles for ensuring credible environmentally relevant performance assessments

4.1 General

When verifying whether an assessment method can be used to obtain information about the environmental performance of a product, it is necessary to understand whether the quantitative property assessed by such a test can have an impact on the environment.

The environmental impacts of products (including systems) are caused by inputs consumed and outputs generated at all stages of a product's life cycle. Examples of inputs and outputs are:

- inputs: substances, materials (virgin or recycled), parts (new, reused or remanufactured), subassemblies, consumables, water, and energy, etc.;
- outputs: products, substances, parts, subassemblies, semi-finished products, rejects during production, emissions to air, water and soil, and waste, etc.

NOTE For further information on environmental impacts, see IEC Guide 109.

The environmental impacts can be direct or indirect. More details are provided in 5.2.

When developing an assessment method, it is already general practice to consider traditional aspects related to the outcome of the test such as measurement repeatability, reproducibility, and accuracy, as well as the costs of testing. However, these considerations alone do not guarantee that such an assessment method is credible from the environmental performance point of view. To ensure credibility, it is important that the assessment method is representative of the use conditions as applied by the users in practice and that it takes into consideration the associated state of the art and potential advances in technology.

Furthermore, in order to ensure that environmentally relevant performance assessment methods are credible, it is necessary to consider and to limit the possibilities for circumvention of such methods and the use of defeat mechanisms in particular. A review of the ways in which tests can be circumvented should be integral to drafting and revising IEC standards. Product-specific elements and ways to avoid circumvention can be extensively explored based on, for example, previous experience and technical insights of committees.

These principles are explained in more detail in 4.2 to 4.8.

4.2 Representativeness

The assessment of representativeness, as defined in 3.3.4, is likely to result in an unbiased estimate of the quantitative properties obtained in practice by users of that product, reflecting use conditions and user behaviour. Thus, it is necessary to take into consideration, for example, the geographical region of use, time interval, state of the art of the technology, and technological coverage in different regions.

Deviations in manufacturing processes (compared to specification) could result in differences in the manufactured products and so have an impact on the representativeness of the samples under test. Understanding the manufacturing processes is, therefore, important when accounting for representativeness (of products).

IEC standards may also cover (analytical) assessment methods of substances and materials that have an environmental impact (for example, hazardous to the environment) and when designing analytical assessment methods, the representativeness of such methods is normally taken into account. To guarantee the representativeness of analytical testing of substances or materials, reference substances or materials are necessary. The use of certified reference materials will enhance the representativeness and reliability of the test.

NOTE Certified reference materials are 'controls' used to confirm the quality and metrological traceability of products, to validate analytical measurement methods, or for the calibration of instruments. A certified reference material is a particular form of measurement control.

Both sample selection and manufacturing variations are impacted by quality assurance procedures in manufacturing and in the laboratory. Variations in manufacturing and sample selection also have an impact on measurement repeatability and measurement reproducibility of the measurement results.

Last, in order for IEC standards to remain representative, aspects such as the evolution of product technologies, measurement equipment, measurement techniques and user behaviour is regularly reviewed. Hence, it is necessary that standards writers periodically monitor all relevant factors and review the assessment methods as described in 4.8.

4.3 Measurement repeatability

Measurement repeatability (3.3.5) is necessary to achieve a credible environmentally relevant performance assessment.

Put in simple words, every person who conducts an experiment and gets a particular result will ask the question: "Can I do that again?". Repeatability is a measure of the likelihood that the answer is yes. To calculate repeatability, a person conducts the same experiment multiple times and performs a statistical analysis of the results. Repeatability is, therefore, related to standard deviation.

4.4 Measurement reproducibility

Measurement reproducibility (3.3.6) is necessary to achieve a credible environmentally relevant performance assessment.

Reproducibility is a characteristic of a measurement method, related to the question: "If the same measurement is done by different persons in different laboratories, will it yield a similar result, considering measurement uncertainty?".

NOTE Measurement uncertainty is understood as a parameter that characterizes the dispersion of the values that can reasonably be attributed to the measured value.

Reproducibility is, among other things, important for quality control. In addition, reproducibility is relevant to demonstrate that a laboratory is able to replicate measurement results.

Products that show high deviations in their properties during manufacturing compared to their specification could impact measurement reproducibility.

4.5 Measurement accuracy

Measurement accuracy (3.3.7) is necessary to achieve a credible environmentally relevant performance assessment.

Accuracy refers to how close a measured value is to the actual ("true") value. For example, if a standard 100 g weight were to be weighed on a scale, an accurate reading for that weight would be as close as possible to 100 g.

The true quantity value is the value attributed to a particular quantity value and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose.

4.6 Cost of testing

Cost of testing is defined in 3.3.8. It is important that the cost of equipment and operation remains at a reasonable level with respect to the unit under test to allow multiple and different groups of interested parties to conduct the test.

4.7 Anti-circumvention

To ensure that a credible environmentally relevant performance assessment method is developed, it is necessary to minimize the risk of circumvention, which is an act known as anti-circumvention.

Anti-circumvention, as defined in 3.3.2, can be achieved by proactively minimizing risks of misusing environmentally relevant test procedures. Anti-circumvention is relevant to all considerations when designing an assessment method, including foreseeing and avoiding the possibility of circumvention.

Circumvention can, in theory, be intentional or unintentional:

- intentional circumvention is the act of avoiding a difficulty to conform with an obligation or rule;
- unintentional circumvention is the accidental bypassing of conformance with an obligation or rule.

It is often not possible to distinguish between intentional and unintentional circumvention. Therefore, they are not differentiated in this Guide.

NOTE 1 Intentional circumvention is oftentimes achieved by using defeat mechanisms.

NOTE 2 Intentional circumvention is also achieved by allowing products to be designed to be able to detect if they are being tested and that can automatically alter their performance to a more favourable result, or by allowing for manually altering the product under test, for example, by providing instructions in the manufacturer instructions for using the product under test conditions.

4.8 Review of standards

Technological advancements or changes, and functional integrations on the one hand and changes in the user expectations and practical use on the other hand, can require modifications or updates of the use case scenario and the assessment method to keep the standard and its contents representative. A review (3.3.9) of the standard by the responsible committee and timely maintenance are essential for the continuous credibility of the assessment method. Review cycles depend on:

- speed of change in technology;
- usage of new technologies by users of the product;
- change of user habits and use conditions; and
- change of regulatory and market requirements.

To monitor changes in user expectations, committees should review studies conducted worldwide on the actual use and performance of products. Also, aspects such as maintenance, repair and end-of-life for the product/service should be considered.

5 Requirements for ensuring credible environmentally relevant performance assessment methods

5.1 General

The requirements presented in Clause 5 of this Guide shall be applied when developing IEC publications to ensure that environmentally relevant performance assessment methods are able to deliver credible results. Credibility of environmentally relevant performance assessment methods should be an integral part of developing those assessment methods.

5.2 Identifying environmentally relevant assessment methods

Standards writers shall determine whether properties assessed by an assessment method or part of it provide an indication of the environmental performance of the tested product by considering whether it results in direct or indirect environmental impacts (see Figure 1).

NOTE See IEC Guide 109 for more details about environmental aspects and impacts.