BS ISO 17534-1:2015

BSI Standards Publication

Acoustics — Software for the calculation of sound outdoors

Part 1: Quality requirements and quality assurance

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National foreword

This British Standard is the UK implementation of ISO 17534-1:2015.

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Acoustics — Software for the calculation of sound outdoors —

Part 1: Quality requirements and quality assurance

Acoustique — Logiciels de prévision de bruit dans l'environnement — Partie 1: Exigences de qualité et assurance qualité

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

ISO 17534 consists of the following parts, under the general title *Acoustics — Software for the calculation of sound outdoors*:

— *Part 1: Quality requirements and quality assurance*

— *Part 2: General recommendations for test cases and quality assurance interface* [Technical Report]

— *Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1* [Technical Report]

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Introduction

Noise calculation methods are a mathematical description on how to determine noise levels at receivers from the emission data of sources and from data describing the acoustically relevant environment along the propagation paths. In some cases, they include the determination of the sound emission from the technical parameters of the sources. Even if knowledge about the physics of sound propagation grows continuously driven by research and experience, the standardized calculation methods are adapted to this increasing state of the art stepwise and remain constant some years for reasons of planning stability. If obviously relevant influences on sound emission and sound propagation cannot, with sufficient accuracy, be derived from physical models with existing knowledge, empirically constructed mathematical formulations are often applied as a time-limited agreement. Such a compromise between experts needs careful consideration of pros and cons and is generally derived and periodically reconsidered by standardization or similar groups.

In some cases, software programs are designed and developed to apply a certain documented method. Software products with more than one alternatively selectable calculation method implemented are software platforms, often organizing many other important jobs and operations like the user interfacing, the data input and output facilities, the tools to inspect and modify the input data, and last but not least, the tools to present and analyse the result data.

The illustration in Figure 1 shows the structure of the ISO 17534 series. Such a subdivision generated by the introduction of a row of Technical Reports is necessary because in many cases, existing standards or alternative documentations of calculation method are not complete in the sense that certain situations occurring in real scenarios are not or not sufficiently covered. Existing specifications are often unclear and allow different interpretations — in such cases, it is necessary to reduce the degrees of freedom and varying interpretations by writing down the best possible compromise as an “interim solution” as long as the responsible standardization committee or another responsible body will not fill the gap.

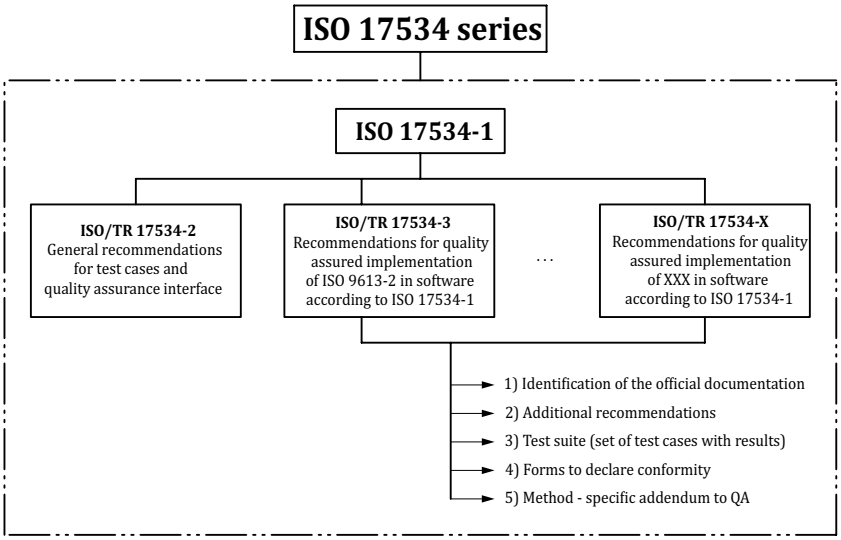

Figure 1 — Structure of the ISO 17534 series consisting of the main Part 1 and subordinated Technical Reports

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Acoustics — Software for the calculation of sound outdoors —

Part 1: Quality requirements and quality assurance

1 Scope

ISO 17534-1 describes quality requirements and measures to ensure, to indicate, and to verify the degree of conformity of a software program with a consistently implementable calculation method/procedure.

The main objective of ISO 17534-1 is to ensure that applying a consistent implementable calculation method with different quality assured software products on an identical set of input data will produce the same results within a defined range of acceptable deviations.

ISO 17534-1 enables the producer of this type of software to declare and to proof the correct implementation of a calculation method and the software user to verify it without the necessity of a third-party certification. It takes into account that software developers and software users are members of the same scientific-technical community and offers means and measures for a transparent and open communication between them.

ISO 17534-1 does not cover the aspect of correctness of the calculation method itself, i.e. especially the agreement of calculated results with results obtained with measurements will not be touched.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
accuracy
agreement of results calculated with a software with those obtained by strict obedience of the method according to its official documentation

2.2
beta version
version of the software not yet ready for release but sent to a selected group of users for testing and comment

2.3
calculation method
complete set of algorithms, simulations, and other routines necessary to determine a result in accordance with the scope of the method on the basis of a complete set of input data

Note 1 to entry: A set of input data that quantifies and describes the noise sources output and position, the geometric and acoustic properties of the environment that influence sound propagation, and the positions of the receivers.

Note 2 to entry: For the purpose of ISO 17534-1, “calculation”, “prediction”, or “computation” has the same meaning.

2.4
calculation ray
polygon line representing a propagation path from a point source to a receiver taken into account to calculate the corresponding sound contribution

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2.5
correct results
results calculated with *reference configuration* (2.12) that are in agreement with the published results or intervals

Note 1 to entry: In this sense, a result is correct if it is obtained by exactly applying the calculation method according to its official documentation.

Note 2 to entry: Other aspects of correctness are beyond the limits of the normative definitions of ISO 17534-1. This includes the error propagation with uncertain input data, uncertainties caused by simplifications in the calculation model or other influences caused by shortcomings in the physical understanding, or mathematical formulation.

2.6
declaration of conformity
Test Case Results Comparison Form (TRC-form) stating that the results calculated for the test cases obtained by means of the software are within the tolerances specified and a Grade of Implementation Form (GoI-form) stating the grade of agreement of the implementation with the official documentation

2.7
modified configuration
configuration of the software where one or more steps according to the *official documentation of a consistently implementable calculation method* (2.9) necessary to obtain a result in the frame of its scope are approximated, neglected, or otherwise simplified

Note 1 to entry: The reason to select such configurations is often to accelerate the calculation and to perform it in less computational capacity.

2.8
new release
version of software made available to end-users having a version or release number or date different from the previously available version

Note 1 to entry: Beta versions of new releases are not included.

2.9
official documentation of a consistently implementable calculation method
clear and unambiguous documentation sufficient to perform a calculation covered by the scope of the *calculation method* (2.3)

2.10
point to point calculation
P2P
calculation of the sound contribution or attenuation based on one calculation ray either in case of a direct ray from the source to the receiver or a reflected ray with direction changes

2.11
quality assurance
securing of an agreed acceptable quality of a software implemented *calculation method* (2.3) by following the requirements and recommendations

2.12
reference configuration
configuration of the software where all steps according to the *official documentation of a consistently implementable calculation method* (2.9) necessary to obtain a result in the frame of its scope are performed and none of these steps is approximated, neglected, or otherwise simplified

2.13
software
programs, procedures, rules performed by an information processing system based on a set of routines operated by computers to determine a result from a set of input data by performing a consistently implemented *calculation method* (2.3)

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2.14
test case
unambiguous description of a scenario with one or more sources and one or more receivers by a complete set of input data with intermediate and final results and intervals of acceptable deviations calculated in the *reference configuration* (2.12)

Note 1 to entry: According to this definition, a test case is always related to a well-defined calculation method.

Note 2 to entry: See 4.5 about requirements for such test cases.

2.15
test scenario
complete description of a complex scenario to check the precision of a method implemented in different software products operated in a specified configuration or to evaluate the uncertainty caused by applying a *modified configuration* (2.7) instead of the *reference configuration* (2.12)

2.16
test suite
set of test cases to check the correct implementation of a *calculation method* (2.3) in software

2.17
uncertainty
statistical description of potential deviations of calculated results from those obtainable with best possible *accuracy* (2.1) due to ambiguous or unclear descriptions in the *calculation method* (2.3), or in the software through, for example, the application of acceleration techniques based on model simplification or other software strategies which neglect sources or calculation steps

2.18
user documentation
information about use, features, interfaces, *calculation methods* (2.3), and obtainable results

Note 1 to entry: The user documentation can also support the solving of problems. Documentation can be supported as data-files or in paper form. Examples are user manuals, reference handbooks, online help, or websites.

2.19
verification
process of running *test suite* (2.16) calculations and comparing computational results with published *correct results* (2.5)

3 Quality assurance of software with calculation methods implemented

Quality assurance according to ISO 17534-1 is based on a clear separation between the software platform in the sense of the licensed product on one side and the implemented calculation methods on the other side. Many features and operations supporting the modelling and the presentation and analysing of results are independent from the calculation method applied. Calculation methods and software technologies have been developed progressively the last decades and therefore nearly all predictions and simulations are based on the application of software. Experience shows that weaknesses or even faults in the calculation methods are often earliest detected if the method has been implemented in software and can be applied with realistic scenarios and input data. In such cases, it shall be avoided that each software producer creates and implements his own solution as long as these problems are not solved and included in official documentation. If this is not possible or as an intermediate step, agreed solutions shall be described as “Additional recommendation” in a method-specific Technical Report according to Figure 1.

Calculation methods shall be complete in the specified range of application and need a clear and unambiguous documentation. Under view of quality assurance, it is not acceptable that unspecified terms and procedures shall be interpreted during software implementation with an inevitably large spread of different solutions. The developer implementing a calculation method in software shall be supported by test cases with correct results and preferably with step-by-step results. The documentation, the existence

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