International Standard

ISO 17662

Welding — Calibration, verification and validation of equipment used for welding, including ancillary activities

Soudage — Étalonnage, vérification et validation du matériel utilisé pour le soudage, y compris pour les procédés connexes

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Foreword

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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 document 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).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, *Quality management in the field of welding,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 17662:2016), which has been technically revised.

The main changes are as follows:

— Clause 13 (Stud welding) technically revised;

— Clause 14 (Brazing) soldering added;

— bibliography updated.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

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Welding — Calibration, verification and validation of equipment used for welding, including ancillary activities

1 Scope

This document specifies requirements for calibration, verification and validation of equipment used for:

— control of process variables during fabrication,

— control of the properties of equipment used for welding or welding allied processes,

where the resulting output cannot be readily or economically documented by subsequent monitoring, inspection and testing. This involves process variables influencing the fitness-for-purpose and in particular the safety of the fabricated product.

NOTE This document is based on the lists of process variables stated in International Standards for specification of welding procedures, in particular, but not exclusively in the ISO 15609 series. Future revisions of these International Standards can result in addition or deletion of parameters considered necessary to specify.

Some guidance is, in addition, given in Annex B for requirements for calibration, verification and validation as part of acceptance testing of equipment used for welding or allied processes.

This document does not specify requirements to calibrate, verify and validate as part of inspection, testing, non-destructive testing or measuring of final welded products performed in order to verify product conformance.

This document applies only to calibration, verification and validation of equipment for use in production or on site.

This document does not apply to the manufacture and installation of equipment for welding. Requirements for new equipment are formulated in directives and product codes (standards), as necessary.

Annex C provides information when other parties are involved in calibration, verification and validation activities.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 669, *Resistance welding — Resistance welding equipment — Mechanical and electrical requirements*

ISO 5171, *Gas welding equipment — Pressure gauges used in welding, cutting and allied processes*

ISO 5826, *Resistance welding equipment — Transformers — General specifications applicable to all transformers*

3 Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp

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— IEC Electropedia: available at https://www.electropedia.org/

3.1
accuracy class
class of measuring instruments or measuring systems that meets stated metrological requirements that are intended to keep measurement errors or instrumental measurement uncertainties within specified limits under specified operating conditions

[SOURCE: ISO/IEC Guide 99:2007, 4.25]

3.2
accuracy
closeness of agreement between a measured quantity value and a true quantity value of a measurand

Note 1 to entry: The term measurand is defined by the VIM (ISO/IEC Guide 99:2007, 2.3) as a "quantity intended to be measured".

3.3
calibration
set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by measurement standards

Note 1 to entry: The term "material measure" means a device intended to reproduce or supply, in a permanent manner during its use, one or more known values of a given quantity.

3.4
measurement
process of experimentally obtaining one or more quantity values that can reasonably be attributed to a quantity

[SOURCE: ISO/IEC Guide 99:2007, 2.1]

3.5
measuring instrument
device used for making measurements, alone or in conjunction with one or more supplementary devices

[SOURCE: ISO/IEC Guide 99:2007, 3.1]

3.6
measuring system
set of one or more *measuring instruments* (3.5) and often other devices, including any reagent and supply, assembled and adopted to give information used to generate measured quantity values within specified intervals for quantities of specified kinds

[SOURCE: ISO/IEC Guide 99:2007, 3.2]

3.7
repeatability
<results of measurements> closeness of the agreement between the results of successive measurements of the same measurement carried out under the same conditions of measurement

3.8
traceability
property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties

3.9
validation
confirmation through the provision of objective evidence that the requirements for a specific intended use (e.g. client specification) or application (e.g. product standard) have been fulfilled

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3.10
verification
confirmation through the provision of objective evidence that specified requirements have been fulfilled

Note 1 to entry: Verification is also interpreted as a confirmation that an available process achieved an expected level of success.

4 General requirements

4.1 General

Measuring, inspection and test equipment are used for many purposes and as part of many work operations during welding fabrication. However, the purposes can be grouped as follows:

a) demonstration of conformance of a product to specified requirements;

b) control of processes where the resulting output cannot be readily or economically verified by subsequent monitoring, inspection and testing;

c) general process control.

Measuring, inspection and test equipment used for demonstration of conformance of product to specified requirements (4.1 a)) should be properly calibrated, verified, or validated. This is, for example, required in ISO 9001. Many of the procedures used for demonstration of conformance inspection are covered by standards, which typically include provisions for calibration, verification, or validation. This is, for example, the case for standards for non-destructive testing and/or destructive testing of welds. Further, requirements for documentation of such quality characteristics (e.g. non-destructive testing) are stated in application standards and/or contracts. Calibration, verification and validation of measuring devices used for this category of application are not covered by this standard, apart from a few comments on welding inspection and visual examination. The relevant standards for inspection and testing shall be consulted.

However, some quality characteristics (also related to safety) cannot be inspected or tested on the finished structure or product. This is, for example, the case for the materials properties of weld metals and to the heat-affected zones adjacent to welds. Such quality characteristics shall be documented indirectly by proper documentation of the fabrication process (4.1 b)). The guidance given in this standard is limited mainly to calibration, verification and validation of measuring devices used for such indirect documentation of quality characteristics, influenced by welding. The measuring, inspection and test equipment can be separate measuring instruments or built-in instruments in, for example, the power sources used for welding.

Measuring, inspection and test equipment used for general process control can also need to be calibrated, verified or validated (4.1 c)). This is, for example, recommended in ISO 9004[1)]. However, specifications of such requirements are left entirely to the discretion of the manufacturer, the requirements cannot be standardized and they are not covered by this document.

A key issue of this document is discussion of the influence of various process variables on the resulting output and in particular of the possibilities for verification of the output by subsequent monitoring, inspection and testing. The distinction between process variables in group (4.1 b)) and group (4.1 c)) is not always easy but essential for the interpretation of contractual and/or legal requirements. The main basis for selection of the relevant variables is the standards for specification of welding procedures.

The specific requirements for calibration, verification and validation of a particular instrument shall be derived from the required performance and shall be compatible with the permissible range as specified in the welding procedure specification (WPS) for the variable(s) in question. Many types of instruments used for control of welding, such as ammeters, voltmeters, thermocouples, stopwatches, are also used for non-welding purposes. It should be noted that the requirements to accuracy, when used for welding purposes can be less stringent than for other applications of the instruments. “Normal” (standardized) procedures for calibration, verification and validation of the instruments can be too stringent and costly, if applied for welding purposes.

1) Note that ISO 9004 is not intended for certification, regulatory or contractual use.

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