International Standard

ISO 18491

Welding and allied processes — Measurement of arc energies

Soudage et techniques connexes — Mesure des énergies de l'arc

First edition
2026-06

Reference number
ISO 18491:2026(en)

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Published in Switzerland

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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).

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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 first edition of ISO 18491 cancels and replaces ISO/TR 18491:2015, which has been technically revised.

The main changes are as follows:

— update of normative references in Clause 2;

— update of terms used throughout this document;

— addition of precisions regarding the guidelines for voltage measurement in 7.2;

— addition of a new Annex B "Conversion factors";

— update of the Bibliography.

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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Introduction

Welding “arc energy” or “heat input” are fundamental values used to manage the consistency of weld metal and heat-affected zone properties. The ISO 15614 series requires the measurement of the welding energies implemented during a welding procedure qualification, but it does not give details about the methods to be used. Likewise, during the construction of a welded assembly, inspectors should make sure that the welding energies conform with the Welding Procedure Specification (WPS); however, the details of the methods to be used are again not specified. Therefore, there can be a lack of consistency between the methods used to measure the welding energies during welding of the test piece and the methods used during the manufacturing process. This is a potential source of error which could have implications on the safety or quality of a welded component or structure.

Moreover, modern technology in microprocessors and electrical power manipulation have yielded welding power sources and control systems that are capable of generating complex waveforms. However, these control systems and waveforms increase the difficulties related to voltage and current intensity measurements, as their values are manipulated at frequencies which can reach thousands of Hertz. The measuring instruments generally used by inspectors, such as TRMS clamp meters, can no longer be relied on to correctly measure the welding energy since differences exceeding 30 % with respect to the true energy can sometimes be found.

This document provides guidance on how to accurately measure welding energy, both in the case of traditional welding systems and those that employ complex waveforms.

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Welding and allied processes — Measurement of arc energies

1 Scope

This document specifies methods for measuring the parameters needed to calculate arc energies for arc welding processes.

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 17662, *Welding — Calibration, verification and validation of equipment used for welding, including ancillary activities*

ISO/TR 17671 (all parts), *Welding — Recommendations for welding of metallic materials*

ISO/TR 25901-1, *Welding and allied processes — Vocabulary — Part 1: General terms*

ISO/TR 25901-3, *Welding and allied processes — Vocabulary — Part 3: Welding processes*

ISO/TR 25901-4, *Welding and allied processes — Vocabulary — Part 4: Arc welding*

IEC 60974-14, *Arc welding equipment – Part 14: Calibration, validation and consistency testing*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TR 25901-1, ISO/TR 25901-3, ISO/TR 25901-4 and the ISO/TR 17671 series and the following 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

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

3.1
power
product of arc voltage and welding current

3.2
energy
product of arc voltage and welding current and arc time

3.3
arc energy
E
product of:

a) arc voltage and welding current divided by welding speed; or

b) *energy* (3.2) divided by length of the run; or

c) *power* (3.1) divided by welding speed

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