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Entwurf

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DIN EN ISO 25239-4:2012-03

**Rührreibschweißen –
Aluminium –****Teil 4: Anforderung und Qualifizierung von Schweißverfahren
(ISO/DIS 25239-4:2019);
Englische Fassung prEN ISO 25239-4:2019**

Friction stir welding –
Aluminium –

Part 4: Specification and qualification of welding procedures (ISO/DIS 25239-4:2019);
English version prEN ISO 25239-4:2019

Soudage par friction-malaxage –
Aluminium –

Partie 4: Descriptif et qualification des modes opératoires de soudage
(ISO/DIS 25239-4:2019);
Version anglaise prEN ISO 25239-4:2019

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Dieser Norm-Entwurf mit Erscheinungsdatum 2019-05-17 wird der Öffentlichkeit zur Prüfung und
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Gesamtumfang 31 Seiten

DIN-Normenausschuss Schweißen und verwandte Verfahren (NAS)

Nationales Vorwort

Dieses Dokument (prEN ISO 25239-4:2019) wurde vom Internationalen Schweißverband IIW in Zusammenarbeit mit dem technischen Komitee CEN/TC 121 „Schweißen und verwandte Verfahren“ erarbeitet, dessen Sekretariat von DIN (Deutschland) gehalten wird.

Das zuständige deutsche Normungsgremium ist der Arbeitsausschuss NA 092-00-27 AA „Rührreibschweißen (DVS AG V 11.2)“ im DIN-Normenausschuss Schweißen und verwandte Verfahren (NAS).

Dieses Dokument enthält unter Berücksichtigung des DIN-Präsidialbeschlusses 1/2004 nur die Englische Fassung von prEN ISO 25239-4:2019.

Für die in diesem Dokument zitierten internationalen Dokumente wird im Folgenden auf die entsprechenden deutschen Dokumente hingewiesen:

ISO 3452 (all parts)	siehe DIN EN ISO 3452 (alle Teile)
ISO 4136	siehe DIN EN ISO 4136
ISO 5173	siehe DIN EN ISO 5173
ISO 6520-1	siehe DIN EN ISO 6520-1
ISO 9017	siehe DIN EN ISO 9017
ISO 10042	siehe DIN EN ISO 10042
ISO 13916	siehe DIN EN ISO 13916
ISO 15607:2003	siehe DIN EN ISO 15607:2004-03
ISO 15613	siehe DIN EN ISO 15613
ISO 15614-2	siehe DIN EN ISO 15614-2
ISO 17637	siehe DIN EN ISO 17637
ISO 17639	siehe DIN EN ISO 17639
ISO 17640	siehe DIN EN ISO 17640
ISO 25239-1	siehe DIN EN ISO 25239-1
ISO 25239-5:2011	siehe DIN EN ISO 25239-5:2012-03
ISO 80000-1:2009	siehe DIN EN ISO 80000-1:2013-08

Änderungen

Gegenüber DIN EN ISO 25239-4:2012-03 wurden folgende Änderungen vorgenommen:

- a) Aktualisierung der normativen Verweisungen;
- b) Aktualisierung der Literaturhinweise;
- c) redaktionelle und technische Überarbeitung.

Nationaler Anhang NA (informativ)

Literaturhinweise

DIN EN ISO 3452 (alle Teile), *Zerstörungsfreie Prüfung — Eindringprüfung*

DIN EN ISO 4136, *Zerstörende Prüfung von Schweißverbindungen an metallischen Werkstoffen — Querkzugversuch*

DIN EN ISO 5173, *Zerstörende Prüfungen von Schweißnähten an metallischen Werkstoffen — Biegeprüfungen*

DIN EN ISO 6520-1, *Schweißen und verwandte Prozesse — Einteilung von geometrischen Unregelmäßigkeiten an metallischen Werkstoffen — Teil 1: Schmelzschweißen*

DIN EN ISO 9017, *Zerstörende Prüfung von Schweißverbindungen an metallischen Werkstoffen — Bruchprüfung*

DIN EN ISO 10042, *Schweißen — Lichtbogenschweißverbindungen an Aluminium und seinen Legierungen — Bewertungsgruppen von Unregelmäßigkeiten*

DIN EN ISO 13916, *Schweißen — Messung der Vorwärm-, Zwischenlagen- und Haltetemperatur*

DIN EN ISO 15607:2004-03, *Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe — Allgemeine Regeln (ISO 15607:2003); Deutsche Fassung EN ISO 15607:2003*

DIN EN ISO 15613, *Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe — Qualifizierung aufgrund einer vorgezogenen Arbeitsprüfung*

DIN EN ISO 15614-2, *Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe — Schweißverfahrensprüfung — Teil 2: Lichtbogenschweißen von Aluminium und seinen Legierungen*

DIN EN ISO 17637, *Zerstörungsfreie Prüfung von Schweißverbindungen — Sichtprüfung von Schmelzschweißverbindungen*

DIN EN ISO 17639, *Zerstörende Prüfung von Schweißverbindungen an metallischen Werkstoffen — Makroskopische und mikroskopische Untersuchungen von Schweißnähten*

DIN EN ISO 17640, *Zerstörungsfreie Prüfung von Schweißverbindungen — Ultraschallprüfung — Techniken, Prüfklassen und Bewertung*

DIN EN ISO 25239-1, *Rührreibschweißen — Aluminium — Teil 1: Begriffe*

DIN EN ISO 25239-5:2012-03, *Rührreibschweißen — Aluminium — Teil 5: Qualitäts- und Prüfungsanforderungen (ISO 25239-5:2011); Deutsche Fassung EN ISO 25239-5:2011*

DIN EN ISO 80000-1:2013-08, *Größen und Einheiten — Teil 1: Allgemeines (ISO 80000-1:2009 + Cor 1:2011); Deutsche Fassung EN_ISO_80000-1:2013*

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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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 IIW, International Institute of Welding, Commission III, *Resistance Welding, Solid State Welding and Allied Joining Process*.

This second edition cancels and replaces the first edition (ISO 25239-4:2011), which has been technically revised.

The main changes compared to the previous edition are as follows:

— to be entered closer to publication

A list of all parts in the ISO 25239- series can be found on the ISO website.

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.

Introduction

Welding processes are widely used in the fabrication of engineered structures. During the second half of the twentieth century, fusion welding processes, wherein fusion is obtained by the melting of parent material and usually a filler metal, dominated the welding of large structures. Then, in 1991, Wayne Thomas at TWI invented friction stir welding (FSW), which is carried out entirely in the solid phase (no melting).

The increasing use of FSW has created the need for this document in order to ensure that welding is carried out in the most effective way and that appropriate control is exercised over all aspects of the operation. This document focuses on the FSW of aluminium because, at the time of publication, the majority of commercial applications for FSW involved aluminium. Examples include railway carriages, consumer products, food processing equipment, aerospace structures, and marine vessels.

The parts of this document are:

Part 1: Vocabulary, defines terms specific to FSW.

Part 2: Design of weld joints, specifies design requirements for friction stir weld joints in aluminium.

Part 3: Qualification of welding operators, specifies requirements for the qualification of a welding operator for the FSW of aluminium.

Part 4: Specification and qualification of welding procedures, specifies requirements for the specification and qualification of welding procedures for the FSW of aluminium. A welding procedure specification (WPS) is needed to provide a basis for planning welding operations and for quality control during welding. Welding is considered a special process in the terminology of standards for quality systems. Standards for quality systems usually require that special processes be carried out in accordance with written procedure specifications. Metallurgical deviations constitute a special problem. Because non-destructive testing of the mechanical properties is impossible at the present level of technology, this has resulted in the establishment of a set of rules for qualification of the welding procedure prior to the release of the WPS to actual production. ISO 25239-4 defines these rules.

Part 5: Quality and inspection requirements, specifies a method for determining the capability of a fabricator to use the FSW process for the production of aluminium products of the specified quality. It defines specific quality requirements but does not assign those requirements to any specific product group. To be effective, welded structures should be free from serious problems in production and in service. To achieve that goal, it is necessary to provide controls from the design phase through material selection, fabrication, and inspection. For example, poor design can create serious and costly difficulties in the workshop, on site, or in service. Incorrect material selection can result in welding problems, such as cracking. Welding procedures have to be correctly formulated and qualified to avoid imperfections. To ensure the fabrication of a quality product, management should understand the sources of potential trouble and introduce appropriate quality and inspection procedures. Supervision should be implemented to ensure that the specified quality is achieved.

Friction stir welding — Aluminium —

Part 4: Specification and qualification of welding procedures

1 Scope

This part of ISO 25239 specifies the requirements for the specification and qualification of welding procedures for the friction stir welding (FSW) of aluminium. In this document, the term “aluminium” refers to aluminium and its alloys.

This document does not apply to friction stir spot welding which is covered by the ISO 18785- series.

NOTE Service requirements, materials or manufacturing conditions can require more comprehensive testing than is specified in this document.

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 209, *Aluminium and aluminium alloys — Chemical composition*

ISO 857-1, *Welding and allied processes — Vocabulary — Part 1: Metal welding processes*

ISO 3134 (all parts), *Light metals and their alloys — Terms and definitions*

ISO 4136, *Destructive tests on welds in metallic materials — Transverse tensile test*

ISO 5173, *Destructive tests on welds in metallic materials — Bend tests*

ISO 6520-1, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding*

ISO 9017, *Destructive tests on welds in metallic materials — Fracture test*

ISO 10042, *Welding — Arc-welded joints in aluminium and its alloys — Quality levels for imperfections*

ISO 15607:2003, *Specification and qualification of welding procedures for metallic materials — General rules*

ISO 15613, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test*

ISO 15614-2, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 2: Arc welding of aluminium and its alloys*

ISO 17637, *Non-destructive testing of welds — Visual testing of fusion-welded joints*

ISO 17639, *Destructive tests on welds in metallic materials — Macroscopic and microscopic examination of welds*

ISO/TR 17671-1, *Welding — Recommendations for welding of metallic materials — Part 1: General guidance for arc welding*

ISO 25239-1, *Friction stir welding — Aluminium — Part 1: Vocabulary*

ISO 25239-5:2011, *Friction stir welding — Aluminium — Part 5: Quality and inspection requirements*

ISO 80000-1:2009, *Quantities and units — Part 1: General*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 209, ISO 857-1, ISO 3134, ISO 6520-1, ISO 10042, ISO 15607, ISO 15613, ISO 15614-2, ISO/TR 17671-1, and ISO 25239-1 apply.

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

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

4 Symbols and abbreviated terms

For the purposes of qualification of welding procedures, the abbreviations listed in ISO 15607:2003, Table 1, apply.

5 Development and qualification of welding procedures

5.1 General

Qualification of welding procedures shall be performed prior to production welding.

The fabricator shall prepare a preliminary welding procedure specification (pWPS) and shall ensure that it is applicable for production using experience from previous production jobs and the general fund of knowledge of welding technology.

A pWPS shall be used as the basis for the establishment of a welding procedure qualification record (WPQR). The pWPS shall be tested in accordance with one of the methods listed in Clause 6 (welding procedure test) or Clause 7 (pre-production welding test). Clause 6 shall be used when the production part or joint geometry is accurately represented by a standardized test piece or pieces, as shown in 6.2. Clause 7 shall be used when the production part or joint geometry is not accurately represented by the standardized test pieces, as shown in 6.2. The information required in a pWPS is given in 5.2.

NOTE For some applications, it can be necessary to supplement or reduce the content of the pWPS given in 5.2.

A welding procedure specification (WPS) covers a certain range of parent material thicknesses as well as a range of aluminium alloys.

Ranges and tolerances in accordance with the relevant International Standard (see Clause 2) and the fabricator's experience shall be specified when appropriate.

An example of a pWPS form for force and position controlled friction stir welding is shown in Annex A.

Alternative process control methods can be used such as temperature control. Essential variables of the alternative process control method need to be documented in the pWPS.

5.2 Technical content of a pWPS

5.2.1 General

The following information, as a minimum, shall be included in a pWPS.