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Friktionsomrörningssvetsning – Aluminium – Del 3: Kvalificering av svetsoperatörer (ISO 25239-3:2011)

Friction stir welding – Aluminium – Part 3: Qualification of welding operators (ISO 25239-3:2011)

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The European Standard EN ISO 25239-3:2011 has the status of a Swedish Standard. This document contains the official version of EN ISO 25239-3:2011.

Förhållandet till övriga delar under samma huvudtitel - Utdrag ur Förord i ISO 25239-3:2011/ Relations to other parts under the same general title - Extract from the Foreword of ISO 25239-3:2011

ISO 25239 consists of the following parts, under the general title *Friction stir welding — Aluminium*:

- *Part 1: Vocabulary*
- *Part 2: Design of weld joints*
- *Part 3: Qualification of welding operators*
- *Part 4: Specification and qualification of welding procedures*
- *Part 5: Quality and inspection requirements*

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Denna standard är framtagen av kommittén för Svetsteknik, SIS/TK 134.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 25239-3

December 2011

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English Version

Friction stir welding - Aluminium - Part 3: Qualification of welding operators (ISO 25239-3:2011)

Soudage par friction-malaxage - Aluminium - Partie 3: Qualification des opérateurs soudeurs (ISO 25239-3:2011)

Rührreibschweißen - Aluminium - Teil 3: Qualifizierung der Bediener (ISO 25239-3:2011)

This European Standard was approved by CEN on 4 June 2011.

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Foreword

This document (EN ISO 25239-3:2011) has been prepared by the International Institute of Welding in collaboration with Technical Committee CEN/TC 121 “Welding” the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2012, and conflicting national standards shall be withdrawn at the latest by June 2012.

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Endorsement notice

The text of ISO 25239-3:2011 has been approved by CEN as a EN ISO 25239-3:2011 without any modification.

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 International Standard 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 International Standard 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 International Standard are listed in the foreword.

Part 1 defines terms specific to FSW.

Part 2 specifies design requirements for FSW joints in aluminium.

Part 3 specifies requirements for the qualification of an operator for the FSW of aluminium.

Part 4 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 specifies a method for determining the capability of a manufacturer 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 3: Qualification of welding operators

1 Scope

This part of ISO 25239 specifies requirements for the qualification of welding operators for the friction stir welding (FSW) of aluminium. In this part of ISO 25239, the term «aluminium» refers to aluminium and its alloys.

This part of ISO 25239 does not apply to friction stir spot welding.

2 Normative references

The following referenced documents are indispensable for the application 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 17636 (all parts), *Non-destructive testing of welds — Radiographic testing*[1)]

ISO 17640, *Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment*

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

ISO 25239-4:2011, *Friction stir welding — Aluminium — Part 4: Specification and qualification of welding procedures*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 25239-1 apply.

4 Requirements

4.1 Welding operator qualification

Welding operators shall be qualified by one of the following tests, as detailed in 4.3:

— standard welding test, see 4.3.1;

1) To be published. (Revision of ISO 17636:2003)

— welding procedure test, see 4.3.2;

— pre-production welding test or production welding test, see 4.3.3;

— production welding sample test, see 4.3.4.

In addition, the welding operator's knowledge of the welding unit to be used for the qualification test shall be tested. See Annex A.

Any of the welding operator qualification tests can be supplemented by a test of knowledge related to welding technology. Such a test is recommended, but it is not mandatory. Annex B includes an example of such an examination.

The essential variables and ranges of qualification are specified in 4.2 and the validity is specified in Clause 5. Provided that the welding operator works in accordance with a welding procedure specification (WPS), the range of qualification shall be limited only as specified in 4.2.

A suggested form for the welding operator's qualification certificate is shown in Annex C.

4.2 Essential variables and ranges of qualification

4.2.1 General

The qualification of welding operators is based on essential variables, as specified in 4.2.2 to 4.2.5. For each essential variable, a range of qualification is defined. If a welding operator is required to weld outside the range of qualification, then a new qualification test is required.

NOTE Friction stir welding is a mechanized process. However, because it is also a solid-state welding process, the essential variables are different from those applicable to fusion welding processes.

4.2.2 Friction stir welding methods

A successful welding operator qualification test made with any type of FSW method qualifies an operator only for that welding method. This subclause applies to FSW methods that include, but are not limited to, robotic, single spindle, multiple spindle, bobbin tool, retractable probe, or any other FSW method defined in the WPS used for that qualification test.

4.2.3 Welding equipment

The following changes require a new qualification:

— a change from welding with a joint sensor to welding without, although welding without a joint sensor also qualifies an operator to weld with a joint sensor;

— a change from one type of welding machine to another type of welding machine that requires additional training to operate — a test made with any type of machine qualifies only that type of machine, although the addition or removal of jigs and fixtures, feeding units and other ancillary equipment does not change the type of machine;

— addition, removal or change of control system.

4.2.4 Parent materials

A successful test weld made in any aluminium alloy qualifies an operator for all aluminium alloys.

A successful test weld of any parent material thickness qualifies an operator for all parent material thicknesses.

A successful test weld of any parent material form (including, but not limited to, sheet, tube, castings, forgings or extrusions) qualifies an operator for all parent material forms and for all tube diameters.

4.2.5 Weld joint geometry

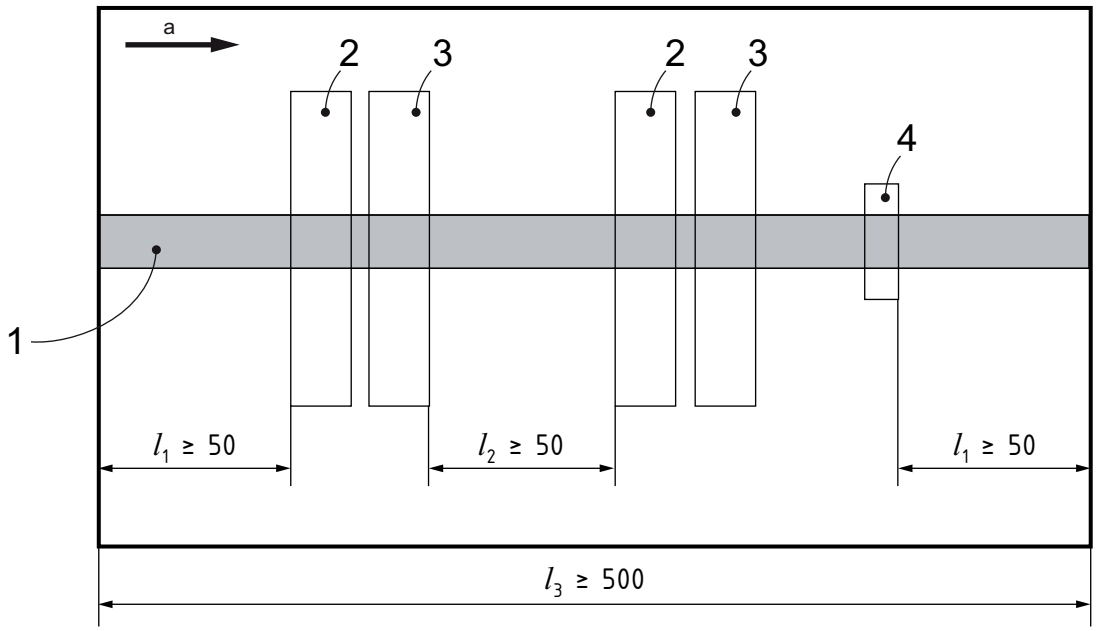
A successful test weld made in any weld joint geometry qualifies an operator for all weld joint geometries.

4.3 Qualification methods

4.3.1 Qualification based on standard welding test

The test piece shown in Figure 1 shall be used for the standard welding test. A welding operator who has successfully completed the welding test in accordance with 4.4 shall be considered qualified for the method and type of welding machine used for the test.

Dimensions in millimetres



Key

1 weld
2 root bend test piece
3 face bend test piece
4 macroscopic examination test specimen
l_1 minimum length of weld from the edge of the test piece to a test specimen
l_2 minimum length of weld between face bend and root bend test specimens
l_3 minimum total length of weld

[a] Weld direction.

The width of the test piece shall be sufficient for extracting the bend test specimens.

Figure 1 — Location of destructive test specimens