

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

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English Version

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

Soudage par friction-malaxage - Aluminium - Partie 5:  
Exigences de qualité et de contrôle (ISO 25239-5:2011)

Rührreibschweißen - Aluminium - Teil 5: Qualitäts- und  
Prüfungsanforderungen (ISO 25239-5:2011)

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## Foreword

This document (EN ISO 25239-5:2011) 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of an identical text or by endorsement, at the latest by June 2012, and conflicting national standards shall be withdrawn at the latest by June 2012.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 25239-5:2011 has been approved by CEN as a EN ISO 25239-5:2011 without any modification.

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## 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 friction stir weld 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 5: Quality and inspection requirements

### 1 Scope

This part of ISO 25239 specifies a method for determining the capability of a manufacturer to use the friction stir welding (FSW) process for the production of products of the specified quality. It specifies quality requirements, but does not assign those requirements to any specific product group.

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 3452-1, *Non-destructive testing — Penetrant testing — Part 1: General principles*

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

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

ISO 9015-1, *Destructive tests on welds in metallic materials — Hardness testing — Part 1: Hardness test on arc welded joints*

ISO 9015-2, *Destructive tests on welds in metallic materials — Hardness testing — Part 2: Microhardness testing of welded joints*

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

ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel — General principles*

ISO 17636 (all parts), *Non-destructive testing of welds — Radiographic testing*<sup>1)</sup>

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

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

ISO 20807, *Non-destructive testing — Qualification of personnel for limited application of non-destructive testing*

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

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

ISO 25239-3, *Friction stir welding — Aluminium — Part 3: Qualification of welding operators*

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

### **3 Terms and definitions**

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

### **4 Quality requirements**

#### **4.1 General**

These requirements relate only to those aspects of product quality that may be influenced by FSW.

#### **4.2 Welding personnel**

##### **4.2.1 General**

Manufacturers shall have at their disposal sufficient competent personnel for the planning, performance and supervision of FSW production operations in accordance with specified requirements.

##### **4.2.2 Welding operator**

Welding operators shall be qualified in accordance with ISO 25239-3. Qualification records shall be kept up to date.

#### **4.3 Inspection and testing personnel**

##### **4.3.1 General**

Manufacturers shall have sufficient competent personnel for the planning, performance, and supervision of inspection and testing operations during the production of friction stir welded parts in accordance with specified requirements.

##### **4.3.2 Personnel performing non-destructive testing and visual testing**

Non-destructive and visual testing personnel shall be qualified in accordance with ISO 9712 or ISO 20807. When the use of an examination method not currently incorporated in ISO 9712 or ISO 20807 is specified, the manufacturer shall be responsible for developing the training programme, written practice, examination, and practical demonstrations equivalent to the requirements of ISO 9712 or ISO 20807. These shall establish the capability of the personnel performing the required examination.

##### **4.3.3 Destructive testing personnel**

Personnel performing destructive testing shall be trained for those test methods.

#### **4.4 Equipment**

##### **4.4.1 Suitability of equipment**

The equipment shall be adequate for the application concerned.