INTERNATIONAL STANDARD

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Friction stir welding — Aluminium —

Part 5: Quality and inspection requirements

Soudage par friction-malaxage — Aluminium —

Partie 5: Exigences de qualité et de contrôle

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 25239-5 was prepared by the International Institute of Welding, which has been approved as an international standardizing body in the field of welding by the ISO Council.

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*

Requests for official interpretations of any aspect of this part of ISO 25239 should be directed to the ISO Central Secretariat, who will forward them to the IIW Secretariat for an official response.

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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.

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Friction stir welding — Aluminium —

Part 5: Quality and inspection requirements

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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*[1)]

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)

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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*

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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.

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