

Proposed draft for ISO/DIS 25239-2
by IIW/C-III/SC III-B/WG-B1

Friction stir welding of aluminium
General requirements
Part 2
Design of weld joints

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IIW Commission III

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Friction stir welding of aluminium - General Requirements — Part 2: Design of weld joints

Élément introductif — Élément central — Partie 2: Titre de la partie

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Foreword

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ISO 25239-2 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, *Unification of requirements in the field of metal welding*.

ISO 25239 consists of the following parts, under the general title *Friction stir welding of aluminium - General Requirements*:

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

Introduction

Welding processes are widely used in fabrication of engineered structures. During the second half of the twentieth century, welding of large structures was dominated by fusion welding processes wherein fusion is obtained by melting of the base metal and, usually, a filler metal. Friction stir welding, originating in the last decade of the twentieth century, is carried out entirely in the solid phase (no melting). There is an increasing need for friction stir welding standards. This standard focuses on friction stir welding of aluminium because, at the time this standard was created, the majority of commercial applications for friction stir welding involved aluminium. Examples include railway cars, consumer products, food processing equipment, aerospace, and marine vessels. Welding strongly influences the cost of fabrication and quality of such products. The increasing use of friction stir welding has created the need for a friction stir welding standard in order to assure that welding is carried out in the most effective way and that appropriate control is exercised over all aspects of the operation.

To this end, ISO is publishing this standard, which comprises five Parts. The first Part, entitled, Vocabulary, presents those terms and definitions specific to friction stir welding.

The second Part, entitled, *Design of Weld Joints*, presents the design requirements for friction stir weld joints in aluminium.

The third Part, entitled, *Qualification of friction stir welding operators*, specifies the requirements for the approval of welding operators for the friction stir welding of aluminium.

The fourth Part, entitled, *Specification and qualification of welding procedures*, specifies the requirements for the specification and qualification of welding procedures for the friction stir welding of aluminium.

The fifth Part, entitled, *Specification and qualification of welding procedures*, specifies a method to determine the capability of a manufacturer to use the friction stir welding process for production of aluminium products of the specified quality. It defines specific quality requirements but does not assign those requirements to any specific product group.

Friction stir welding of aluminium - General Requirements — Part 2: Design of weld joints

1 Scope

This Part specifies the design requirements for friction stir weld joints. In this standard, the term aluminium refers to aluminium and its alloys.

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 2553, *Welded, brazed and soldered joints*

ISO 25239-3, *Friction stir welding of aluminium and its alloys – General requirements – Part 3: Qualification of Welding Operators*

ISO 25239-4, *Friction stir welding of aluminium and its alloys – General requirements – Part 4: Specification and qualification of welding procedures*

ISO 25239-5, *Friction stir welding of aluminium and its alloys – General requirements – Part 5: Quality and inspection requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in Part 1 of this standard apply.

4 Design of weld joints

4.1 Joint design data

The weld joint design shall take into account the necessary material property data. Some examples of weld joints are shown in Figure 1.

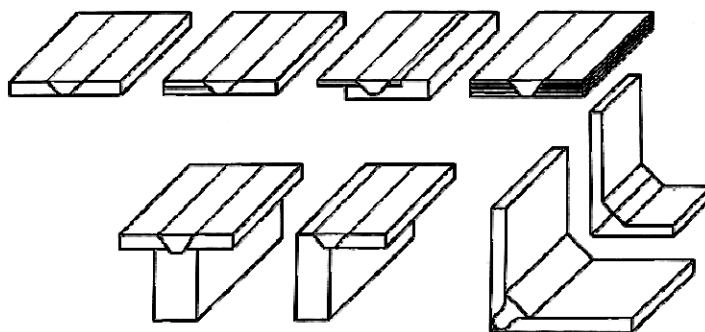


Figure 1 — Various joints showing the friction stir weld

4.2 Document requirements

4.2.1 Document information

The weldment shall be designed in accordance with defined requirements that support the end use of the product. Documentation shall clearly define special requirements, such as, fracture critical, durability critical, mission critical, or safety critical requirements that are imposed over and above the general requirements. Essential process controls shall be defined in order to substantiate that all design requirements can be met by the welds produced in accordance with the qualified welding procedure specification and inspection requirements.

Essential features of a weld shall be either described in the document or in referenced, supporting documentation. Weld symbols shall be those shown in the latest edition of ISO 2553, Welded, brazed and soldered joints. Special conditions shall be fully explained by added notes or details in the document.

4.2.1.1 Butt joints

The depth of penetration of butt joints shall be specified in the welding procedure specification (WPS).

4.2.1.2 Lap joints

The distance from the centerline of the tool to the edge of each overlapping member shall be specified in the WPS. The depth of penetration of the probe into the lap joint shall be specified in the WPS.

Note A minimum of two times the diameter of the tool's shoulder is a recommended distance.

4.2.2 Essential information

The following shall be specified for each weld:

- alloys and tempers
- parent material specification
- surface condition prior to welding, including any coatings
- weld location and extent of welding
- final weld contour and weld finishing requirements (as-welded or subsequently finished)
- postweld heat treatment

4.2.3 Weldment dimensions

Dimensions on the weldment drawing shall indicate the final dimensions of the weldment and shall not include allowances for shrinkage.

4.2.4 Welding operator qualification requirements

All welds shall be made by a welding operator qualified in accordance with Part 3 of this standard.

4.2.5 Welding procedure qualification requirements

All welds shall be made in accordance with a welding procedure specification that was qualified in accordance with Part 4 of this standard.

4.2.6 Inspection requirements

The document shall define the weld inspection requirements, inspection methods, and acceptance criteria. Welds shall be inspected and tested in accordance with Part 5 of this standard.