

IIW

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**Friction stir welding — Aluminium —
Part 2:
Design of weld joints**

*Soudage par friction-malaxage — Aluminium —
Partie 2: Conception des assemblages soudés*

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Reference number
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Foreword

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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).

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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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 25239-1:2011), which has been technically revised.

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

- new definition and figures for half overlap joint have been added;
- [Figure 2](#) has been improved.

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. 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.

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Friction stir welding — Aluminium —

Part 2: Design of weld joints

1 Scope

This document specifies design requirements for friction stir weld joints.

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.

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 2553, *Welding and allied processes — Symbolic representation on drawings — Welded joints*

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

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

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

ISO/TR 25901 (all parts), *Welding and allied processes — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 25239-1 and ISO/TR 25901 (all parts) 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 Design requirements

4.1 Documentation

The weldment shall be designed in accordance with defined requirements that support the end use of the product. Documentation shall define all requirements for the weld. Essential process controls shall be defined to substantiate that all design requirements can be met by the welds that were produced in accordance with the welding procedure specification (WPS) and inspection requirements.

Weld symbols shall be in accordance with ISO 2553.

4.2 Joint design

4.2.1 General

The weld joint design shall take into account the necessary material property data. Some examples of weld joints are shown in [Table 1](#).

Table 1 — Various weld joints shown before and after friction stir welding

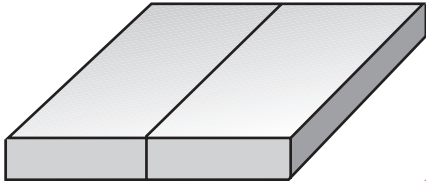
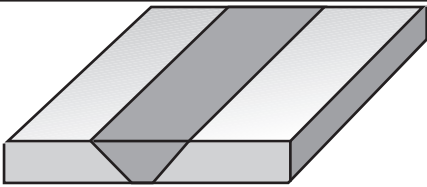
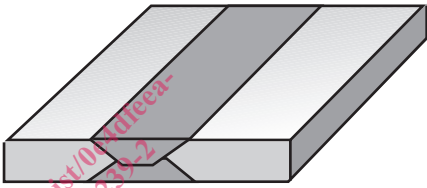
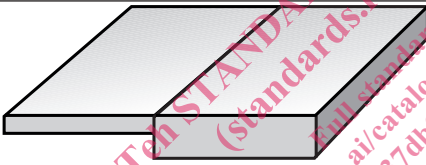
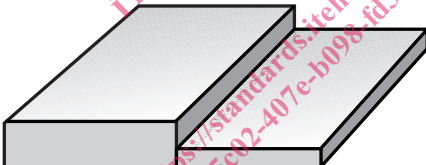
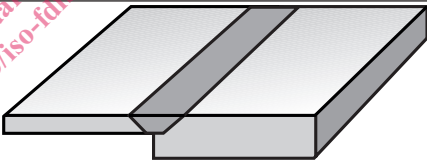
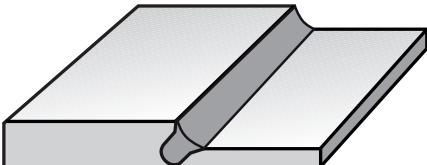
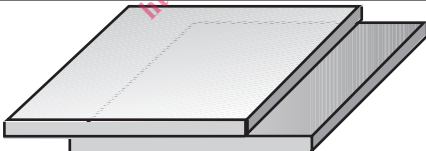
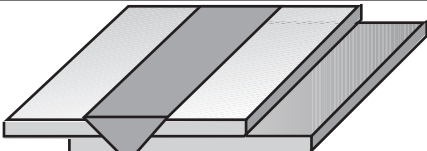
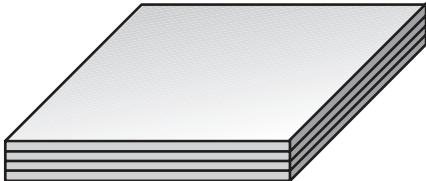
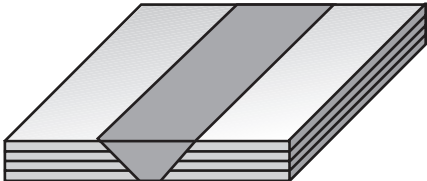
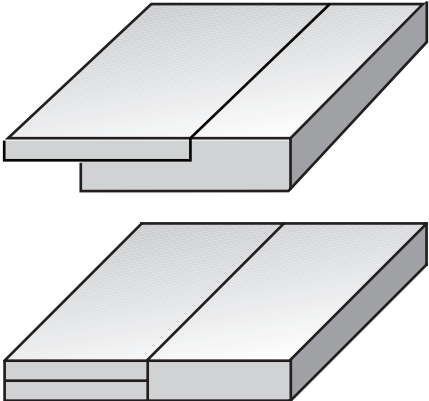
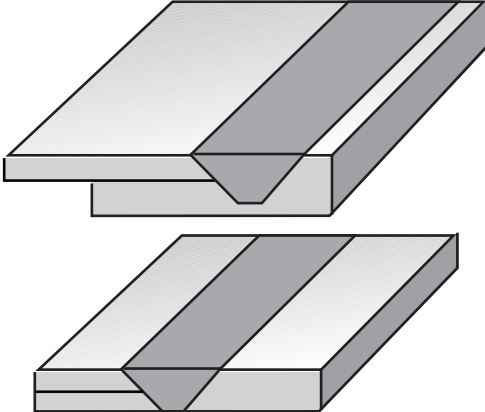
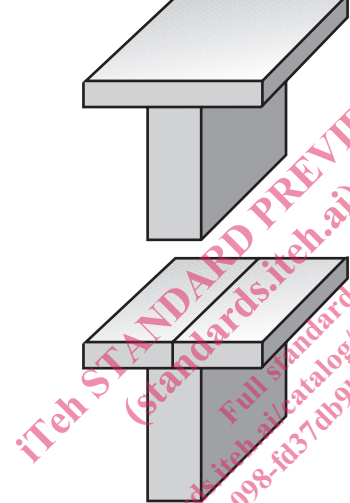
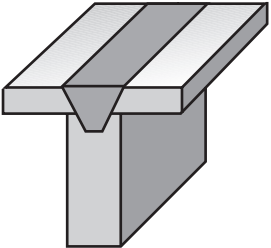
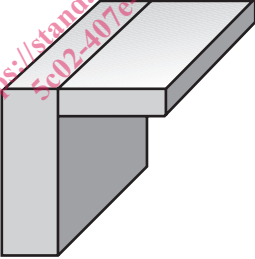
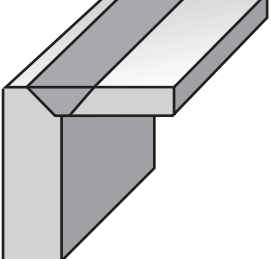
	Joint design	Before welding	After welding
1	Butt joint		 <p data-bbox="1050 757 1254 786">Single sided weld</p>  <p data-bbox="1050 994 1254 1023">Double sided weld</p>
2	Butt joint with different thicknesses	 	 
3	Lap joint		
4	Multi sheet lap joint		

Table 1 (continued)

	Joint design	Before welding	After welding
5	Half overlap		
6	T-joint		
7	Corner joint		
8	Fillet joint	