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Welding — Friction welding of metallic materials

Soudage — Soudage par friction des matériaux métalliques

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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 Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, *Quality management in the field of welding*.

Any feedback, question or request for official interpretation related to any aspect of this document should be directed to the Secretariat of ISO/TC 44/SC 10 via your national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

This second edition cancels and replaces the first edition (ISO 15620:2000), which has been technically revised.

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

— Clause 2 has been updated;

— in Clause 3, terms not used in the text have been deleted;

— in Annex B of 4 processes based on friction have been added;

— the recommended test to perform on test weld has been clarified (addition of Table 4).

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Introduction

Friction welding is a method for making welds in the solid phase in which one component is moved relative to and in pressure contact with the mating component to produce heat at the faying surfaces, the weld being completed by the application of a force during or after the cessation of relative motion. There are several forms of supplying energy and various forms of relative movements.

The generation of friction heating results in a comparatively low joining temperature at the interface. This is largely the reason why friction welding is suitable for materials and material combinations which are otherwise difficult to weld. The weld region is generally narrow and normally has a refined microstructure.

While the friction welding process deals primarily with components of circular cross-section it does not preclude the joining of other component shapes.

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Welding — Friction welding of metallic materials

1 Scope

This document specifies requirements for the friction welding of components manufactured from metals.

It specifies requirements particular to rotational friction welding related to welding knowledge, quality requirements, welding procedure specification, welding procedure approval and welding personnel.

This document is appropriate where a contract, an application standard or a regulatory requirement requires the demonstration of the manufacturer's capability to produce welded constructions of a specified quality. It has been prepared in a comprehensive manner to be used as a reference in contracts. The requirements given can be adopted in full or some can be deleted, if not relevant to the construction concerned.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological database 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/

3.1
axial force
force in axial direction between components to be welded

3.2
burn-off length
loss of length during the friction phase

3.3
burn-off rate
rate of shortening of the *components* (3.4) during the friction welding process

3.4
component
single item before welding

3.5
component induced braking
reduction in *rotational speed* (3.18) resulting from friction between the interfaces

3.6
external braking
braking located externally reducing the *rotational speed* (3.18)

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3.7
faying surface
surface of one *component* (3.4) that is to be in contact with a surface of another *component* (3.4) to form a joint

3.8
forge force
force applied normal to the *faying surfaces* (3.7) at the time when relative movement between the *components* (3.4) is ceasing or has ceased

3.9
forge burn-off length
amount by which the overall length of the *components* (3.4) is reduced during the application of the *forge force* (3.8)

3.10
forge phase
interval time in the friction welding cycle between the start and finish of application of the *forge force* (3.8)

3.11
forge pressure
pressure (force per unit area) on the *faying surfaces* (3.7) resulting from the axial *forge force* (3.8)

3.12
forge time
time for which the *forge force* (3.8) is applied to the *components* (3.4)

3.13
friction force
force applied perpendicularly to the *faying surfaces* (3.7) during the time that there is relative movement between the *components* (3.4)

3.14
friction phase
interval time in the friction welding cycle in which the heat necessary for making a weld is generated by relative motion and the *friction force(s)* (3.13) between the *components* (3.4), i.e. from contact of *components* (3.4) to the start of deceleration

3.15
friction pressure
pressure (force per unit area) on the *faying surfaces* (3.7) resulting from the axial friction force

3.16
friction time
time during which relative movement between the *components* (3.4) takes place at *rotational speed* (3.18) and under application of the *friction force(s)* (3.13)

3.17
interface
contact area developed between the *faying surfaces* (3.7) after completion of the welding operation

3.18
rotational speed
number of revolutions per minute of rotating *component* (3.4)

3.19
stick-out
distance a *component* (3.4) sticks out from the fixture, or chuck in the direction of the mating *component* (3.4)

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3.20
deceleration phase
interval in the friction welding cycle in which the relative motion of the *components* (3.4) is decelerated to zero

3.21
deceleration time
time required by the moving *component* (3.4) to decelerate from friction speed to zero speed

3.22
total length loss (upset)
loss of length that occurs as a result of friction welding, i.e. the sum of the *burn-off length* (3.2) and the *forge burn-off length* (3.9)

3.23
total weld time
time elapsed between *component* (3.4) contact and end of forging phase

3.24
welding cycle
succession of operations carried out by the machine to make a weldment and return to the initial position, excluding *component* (3.4) - handling operations

3.25
weldment
two or more components joined by welding

4 Welding knowledge

4.1 Process

4.1.1 General

The classification of friction welding processes is listed in Table 1.

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