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Welding — Arc-welded joints in aluminium and its alloys — Quality levels for imperfections

Soudage — Assemblages en aluminium et alliages d'aluminium soudés à l'arc — Niveaux de qualité par rapport aux défauts

Reference number
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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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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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*.

This third edition cancels and replaces the second edition (ISO 10042:2005), of which it constitutes a minor revision. The changes compared to the previous edition are as follows:

— reference numbers from ISO 4063 have been deleted in the Scope;

— in Table 1, 1.3, reference number ISO 6520-1 has been changed from “2012 - uniformly distributed porosity ” to “2018 - surface porosity”;

— in Table 1, 1.8, a new figure has been inserted and changes to quality levels B and C have been made;

— in Table 1, 1.9, changes to quality level C have been made;

— in Table 1, 1.14, a drawing has been added;

— in Table 1, 1.15, changes to quality level D have been made;

— in Table 1, 1.18, a drawing has been deleted and a new one inserted, and reference to 6520-1-5013 “shrinkage groove” has been deleted;

— in Table 1, 1.19 to 1.21, imperfections have been added with values from ISO 5817: poor restart, stray arc, spatter;

— in Table 1, 2.2, changes to quality levels B and C have been made;

— in Table 1, 2.10, changes to quality levels C and D have been made;

— in Table 1, 2.11, a drawing has been deleted and new ones introduced, requirements for “Butt joint (full penetration)” have been updated;

— in Table 1, 2.12, a new drawing has been introduced with new requirements, and changes to quality levels C and D have been made;

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— editorial changes have been made.

Requests for official interpretation of 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.

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Introduction

This document is intended to be used as a reference in drafting application codes and/or other application standards. It contains a simplified selection of arc welding imperfections based on the designations given in ISO 6520-1.

Some imperfections described in ISO 6520-1 have been used directly while others have been grouped together. The basic numerical referencing system from ISO 6520-1 has been used.

The purpose of this document is to define the dimensions of typical imperfections which can be expected in normal fabrication. It can be used within a quality system for the production of welded joints. It provides three sets of dimensional values from which a selection can be made for a particular application. The quality level necessary in each case needs to be defined by the application standard or the responsible designer, in conjunction with the manufacturer, user and/or other parties concerned. The quality level are prescribed before the start of production, preferably at the enquiry or order stage. For special purposes, additional details can be necessary.

The quality levels given in this document provide basic reference data and are not specifically related to any particular application. They refer to the types of welded joint in fabrication and not to the complete product or component itself. It is possible, therefore, that different quality levels are applied to individual welded joints in the same product or component.

It is normally be expected that, for a particular welded joint, the dimensional limits for imperfections can all be covered by specifying one quality level. In some cases, it can be necessary to specify different quality levels for different imperfections in the same welded joint.

The choice of quality level for any application takes account of design considerations, subsequent processing (e.g. surfacing), mode of stressing (e.g. static, dynamic), service conditions (e.g. temperature, environment) and consequences of failure. Economic factors are also important and include not only the cost of welding but also of inspection, test and repair.

Although this document includes types of imperfection relevant to the arc welding processes given in Clause 1, only those which are applicable to the process and application in question are considered.

Imperfections are quoted in terms of their actual dimensions, and their detection and evaluation can require the use of one or more methods of non-destructive testing. The detection and sizing of imperfections is dependent on the testing methods and the extent of testing specified in the application standard or contract.

This document does not address the methods used for the detection of imperfections. However, ISO 17635 contains a correlation between the quality level and acceptance level for different NDT (non-destructive testing) methods.

This document is directly applicable to visual testing of welds and does not include details of recommended methods of detection or sizing by other non-destructive means. There are difficulties in using these limits to establish appropriate criteria applicable to NDT methods such as ultrasonic (UT), radiographic (RT) and penetrant testing (PT), for which additional requirements for testing can be necessary.

The values given for imperfections are for welds produced using normal welding practice. Requirements for smaller (more stringent) values as stated in quality level B can include additional manufacturing processes, e.g. grinding, TIG dressing.

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Welding — Arc-welded joints in aluminium and its alloys — Quality levels for imperfections

1 Scope

This document specifies quality levels for imperfections in arc-welded joints in aluminium and its alloys. It applies to material thicknesses above 0,5 mm.

Three quality levels are given in order to permit application to a wide range of welded constructions. They are designated by symbols B, C and D. Quality level B corresponds to the highest requirement on the finished weld. The quality levels refer to production quality and not to the fitness for purpose (see 3.2) of the product manufactured.

This document is applicable to all types of welds (e.g. butt welds, fillet welds and branch connections), to manual, mechanized and automated welding, and to all welding positions.

It is applicable to the following welding processes:

— metal inert gas welding (MIG welding); gas metal arc welding /USA;

— tungsten inert gas welding (TIG welding); gas tungsten arc welding /USA;

— plasma arc welding.

It is not applicable to metallurgical aspects (e.g. grain size, hardness).

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 6520-1, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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/

3.1
quality level
description of the quality of a weld on the basis of type, size and amount of selected imperfections

3.2
fitness for purpose
ability of a product, process or service to serve a defined purpose under specific conditions

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3.3
short imperfection
<welds of length ≥100 mm> imperfection whose total length is not greater than 25 mm in any 100 mm of their length

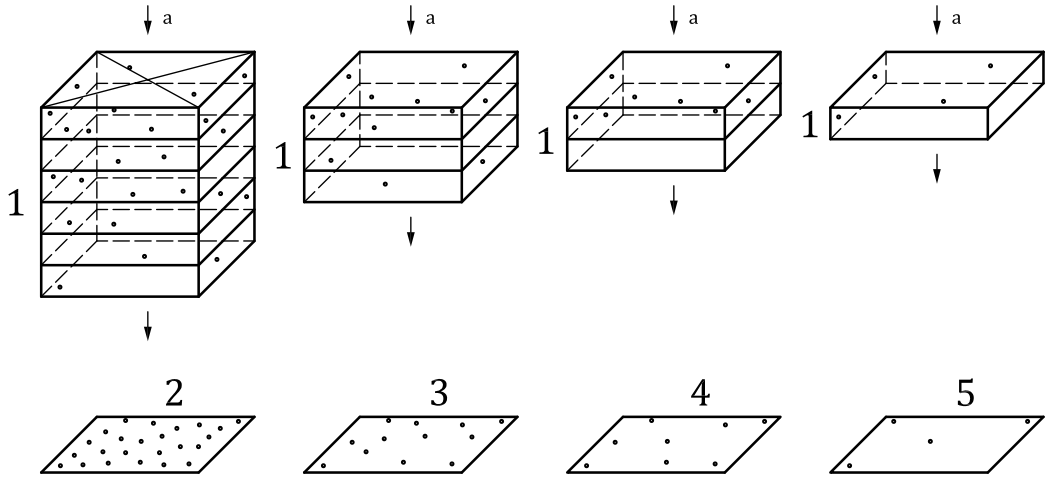
3.4
short imperfection
<welds less than 100 mm long> imperfection whose total length is not greater than 25 % of the length of the weld

3.5
systematic imperfection
imperfection that is repeatedly distributed in the weld over the weld length to be examined, the size of each individual imperfection being within the specified limits

3.6
cross-sectional area
area to be considered after fracture or sectioning

3.7
projected area
area where imperfections distributed along the volume of the weld under consideration are imaged two-dimensionally

Note 1 to entry: In contrast to the *cross-sectional area* (3.6), the occurrence of imperfections is dependent on the weld thickness when exposed radiographically (see Figure 1).



Key

1	4 pores per volume unit	4	2-fold thickness
2	6-fold thickness	5	1-fold thickness
3	3-fold thickness	a	Direction of X-rays.

Figure 1 — Radiographic films of specimens with identical occurrence of pores per volume unit

4 Symbols

The following symbols are used in Table 1.

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