
Aluminium alloy castings — Visual method for assessing porosity

*Pièces moulées en alliages d'aluminium — Méthode visuelle
d'évaluation de la porosité*

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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).

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 79, *Light metals and their alloys*, Subcommittee SC 7, *Aluminium and cast aluminium alloys*.

This second edition cancels and replaces the first edition (ISO 10049:1992), which has been technically revised. The main changes compared with the previous edition are as follows:

- the NOTE in the Scope has been modified;
- [Clause 3](#) for terms and definitions has been added;
- Table 1 has been converted into [Figures 1](#) to [6](#) and the figures have been redrawn;
- the subclauses in [Clause 5](#) have been reordered.

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.

Aluminium alloy castings — Visual method for assessing porosity

1 Scope

This document specifies a visual method for assessing the porosity of the machined surface of aluminium alloy castings.

The method does not apply to assessing porosity shown on radiograms.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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 Inspection requirements

The inspection requirements and acceptance criteria shall be clearly stated at the time of tendering and price enquiry, and specifically in the order sent to the founder and accepted by him or her.

Porosity is assessed on the machined surface of the casting, or one part of it, after total or partial machining as agreed between the parties concerned. The machined surface for inspection is thus a selected operating surface or a surface that has been machined only for reasons of inspection at a specific point on the casting, contiguous sample or hot top (see 5.1).

For each part of the casting to be inspected, the degree of severity shall be stated (see Figures 1 to 6).

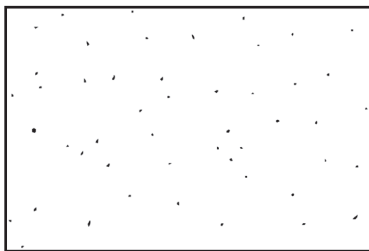
The test is regarded as satisfactory if the indications of discontinuities obtained are of levels that are equal to or lower than those shown in Figures 1 to 6 and given in Clause 7.

If this is not the case, the casting is either rejected, or it is brought into conformity with the contractually agreed specification, by a method approved by the customer.



Number and size of pores over 100 mm² (see 5.2): No pores visible on the surface inspected.

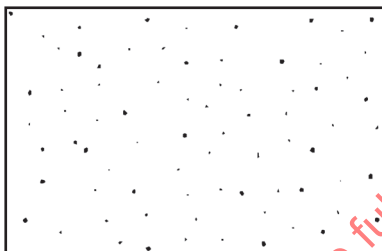
Figure 1 — Severity level 0



Number and size of pores over 100 mm² (see 5.2): ≤ 5 , including:

- 4 up to 0,1 mm;
- 1 up to 0,2 mm.

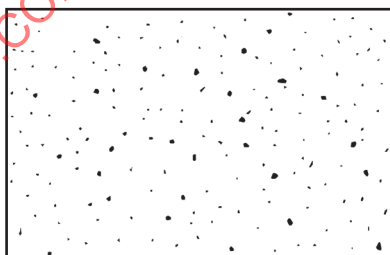
Figure 2 — Severity level 1



Number and size of pores over 100 mm² (see 5.2): ≤ 10 , including:

- 8 up to 0,1 mm;
- 2 up to 0,2 mm.

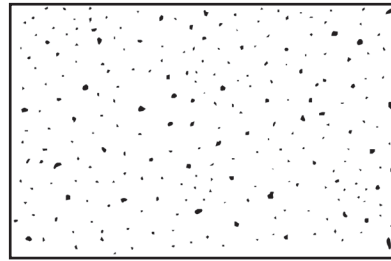
Figure 3 — Severity level 2



Number and size of pores over 100 mm² (see 5.2): ≤ 15 , including:

- 12 up to 0,3 mm;
- 3 up to 0,5 mm.

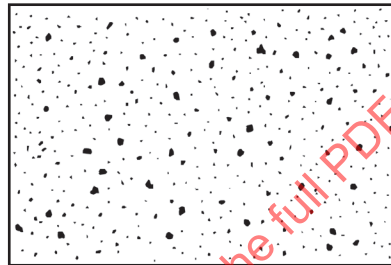
Figure 4 — Severity level 3



Number and size of pores over 100 mm² (see 5.2): ≤ 20, including:

- 14 up to 0,5 mm;
- 6 up to 1,0 mm.

Figure 5 — Severity level 4



Number and size of pores over 100 mm² (see 5.2): ≤ 25, including:

- 15 up to 0,5 mm;
- 7 up to 1,0 mm;
- 3 up to 1,5 mm.

Figure 6 — Severity level 5

5 Method of inspection

5.1 Surface conditions

The surface to be inspected shall be clean and free from grease and any other impurities, such as fine chips, that could have an adverse effect on the result of the inspection. It shall be machined in such a way as to obtain the maximum roughness agreed between the founder and the customer. The roughness shall be representative of the surface quality required for the finished casting.

NOTE It is also possible to use a treatment by grinding followed by chemical attack. Finishing by grinding is carried out on paper of grain size 20 µm to 28 µm. Finishing is followed by attack with a 10 % (by mass) to 15 % (by mass) sodium hydroxide solution at a temperature of 60 °C to 80 °C until a dark film is removed from the surface by a 20 % (by mass) to 30 % (by mass) solution of nitric acid.

5.2 Inspection conditions

Inspection is done with the naked eye or with a magnifying glass of magnification not more than ×10, only for measuring the diameter of the pores.

5.3 Lighting conditions

The porosity of the surface being inspected shall be assessed under good lighting conditions. The most suitable lighting is at an angle of 10° to 15° according to the quality of machining and in a direction opposite to that of the inspection. The assessment of the surface under diffused lighting conditions is not recommended.

5.4 Qualification of the operators

The tests shall be carried out and interpreted by technically competent operators, whose qualifications have been approved at the time of tendering and ordering.

6 Acceptance conditions

6.1 Image of discontinuities

By assessing porosity, the quality of the metallurgical treatment of the material and its macro-homogeneity can be evaluated.

Only the number of pores and their mean diameter on the surface are assessed. The depth of the pores is not determined.

6.2 Severity levels

For an assessment according to [Figures 1](#) to [6](#), a frame with a 10 mm × 10 mm aperture is used. The number and size of the individual pores are determined on the surface within the aperture.

7 Interpretation of results

The examination shall be carried out on agreed areas of the surface of the casting, where the largest amount of pores is noted. The casting shall be considered as satisfactory if, in a window of 10 mm × 10 mm corresponding to the highest concentration of porosity in the agreed area, the level of porosity is less than or equal to that specified in the order.

Unless otherwise specified in the order, a degree of quality exceeding the specified level by one degree is permitted, provided that the area is less than 25 % of the total area under examination.

In all other cases, the casting shall be considered unsatisfactory.

The reference images are given only as a guide and the classification by a level of severity is based on the number and diameter of the pores, as shown in [Figures 1](#) to [6](#).

8 Order

The tender and/or order shall state the following:

- a) the parts of the casting and the percentage of castings to be inspected (see [Clause 4](#)),
- b) the specified surface conditions (see [5.1](#));
- c) the machining stage(s) at which the inspection is to be carried out, by agreement between the parties concerned (see [Clause 4](#)),
- d) the severity level for each part of the castings to be inspected (see [Figures 1](#) to [6](#));
- e) the qualifications of the operators carrying out the inspection (see [5.4](#)).