

INTERNATIONAL STANDARD

ISO
10049

First edition
1992-04-01

Aluminium alloy castings — Visual method for assessing the porosity

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



Reference number
ISO 10049:1992(E)

Foreword

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International Standard ISO 10049 was prepared by Technical Committee ISO/TC 79, *Light metals and their alloys*, Sub-Committee SC 7, *Aluminium and cast aluminium alloys*.

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International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland
Printed in Switzerland

Aluminium alloy castings — Visual method for assessing the porosity

1 Scope

This International Standard specifies a visual method for assessing the porosity¹⁾ of the machined surface of aluminium alloy castings.

NOTE 1 The method cannot be used for assessing porosity present on radiograms.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7722:1985, *Aluminium alloy castings produced by gravity, sand, or chill casting, or by related processes — General conditions for inspection and delivery*.

3 Inspection requirements

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

Porosity is assessed on the machined surface of the casting or on 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 which has been machined only for reasons of inspection at a specific point on the casting, contiguous sample or hot top (see 4.3).

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

The test is regarded as satisfactory if the indications of discontinuities obtained are of levels which are equal to or lower than those defined in table 1 and given in clause 6.

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

4 Method of inspection

4.1 Procedure

The porosity of the point 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.

4.2 Qualification of 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.

4.3 Surface condition

The surface to be inspected shall be clean and free from grease and any other impurities which 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

1) General terms for small blisters, sponging and (possibly) non-metallic inclusions.

representative of the surface quality required for the finished casting.

NOTE 2 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 % (m/m) to 15 % (m/m) sodium hydroxide aqueous solution at a temperature of 60 °C to 80 °C until a dark film forms on the surface under inspection. After rinsing, the dark film is removed from the surface by a 20 % (m/m) to 30 % (m/m) aqueous solution of nitric acid.

4.4 Inspection conditions

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

5 Acceptance conditions

5.1 Images of discontinuities

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

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

5.2 Severity levels

For an assessment according to table 1, a template with a 10 mm $\times$ 10 mm aperture is used. The number and size of the individual pores are determined on the surface within the aperture.

6 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 $\times$ 10 mm corresponding to the highest concentration of pores 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 rated at such a quality is less than 25 % of the total area under examination.

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

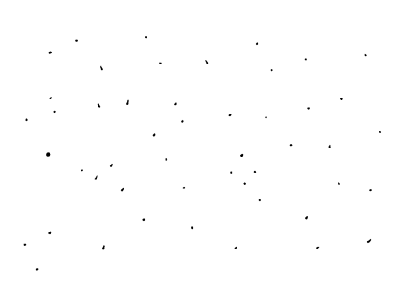
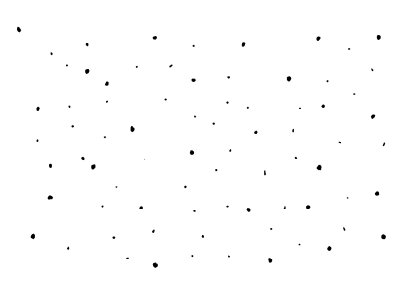
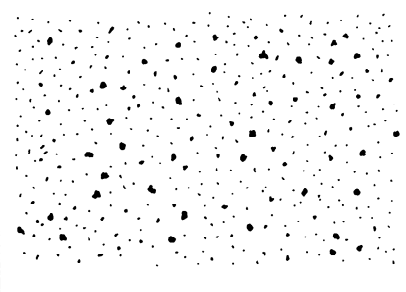
The reference images are given only as a guide and the classification by level of severity is based on the number and diameter of the images, as shown in table 1.

7 Order

The tender and/or order shall state the following:

- a) the parts of the castings and the percentage of castings to be inspected (see clause 3);
- b) the specified surface conditions (see 4.3);
- c) the machining stage(s) at which inspection is to be carried out, by agreement between the parties concerned (see clause 3);
- d) the severity level for each part of the castings to be inspected (see table 1);
- e) the qualifications of the operators carrying out the inspection (see 4.2).

Table 1 — Severity levels

Degree	Reference image	Number and size of pores over 1 cm ² (see 4.4)
01		No pores visible on the surface inspected
1		Up to 5, including 4 up to 0,1 mm 1 up to 0,2 mm
2		Up to 10, including 8 up to 0,1 mm 2 up to 0,2 mm
3		Up to 15, including 12 up to 0,3 mm 3 up to 0,5 mm
4		Up to 20, including 14 up to 0,5 mm 6 up to 1,0 mm
5		Up to 25, including 15 up to 0,5 mm 7 up to 1,0 mm 3 up to 1,5 mm

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