

Founding — Magnetic particle inspection

The European Standard EN 1369 : 1996 has the status of a
British Standard

ICS 77.040.20

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee ISE/NFE/9, Foundry technology, upon which the following bodies were represented:

- Association of Bronze and Brass Founders
- BCIRA
- British Investment Casting Trade Association
- Castings Technology International
- Institute of British Foundrymen
- METCOM
- Zinc Alloy Die Casters Association

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National foreword

This British Standard has been prepared under the direction of the Engineering Sector Board and is the English language version of EN 1369 : 1996, published by the European Committee for Standardization (CEN).

This British Standard supersedes BS 4080 : Part 1 : 1989 which is withdrawn.

Cross-references

Publication referred to	Corresponding British Standard
EN 473	BS EN 473 : 1993 <i>General principles for qualification and certification of NDT personnel</i>

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 20, an inside back cover and a back cover.

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Descriptors: Foundry engineering, castings, steels, cast iron, surface condition, inspection, non-destructive tests, magnetic particle testing, surface defects, acceptability

English version

Founding — Magnetic particle inspection

Fonderie –
Contrôle par magnétoscopie

Gießereiwesen –
Magnetpulverprüfung

This European Standard was approved by CEN on 1996-10-20. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 190, Foundry technology, the Secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 1997, and conflicting national standards shall be withdrawn at the latest by May 1997.

Within its programme of work, Technical Committee CEN/TC 190 requested CEN/TC 190/WG 4.20, Surface inspection, to prepare the following standard:

prEN 1369 *Founding – Magnetic particle inspection*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

This European Standard complements the general principles of magnetic particle inspection described in prEN ISO 9934-1 for the additional requirements of the foundry industry.

Magnetic particle inspection as well as any other non-destructive examination is part of a general or specific assessment of the quality of the casting to be agreed between the purchaser and the manufacturer at the time of acceptance of the order.

1 Scope

This European Standard applies to the magnetic particle inspection of ferro-magnetic iron and steel castings.

It also gives acceptance criteria through severity levels defined by the nature, the area and the dimensions of the discontinuities present.

This standard applies to all ferro-magnetic castings independent of the moulding method.

An iron or steel casting is considered to be ferro-magnetic if the magnetic induction is greater than 1 T (Tesla) for a magnetic field strength of 2,4 kA/m.

This standard only applies to those areas of the castings specified for inspection and the percentage of castings to be inspected.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 473	<i>Qualification and certification of NDT personnel — General principles</i>
EN 1370	<i>Founding — Surface roughness inspection by visual/tactile comparators</i>
prEN 1559-1	<i>Founding — Technical conditions of delivery — Part 1: General</i>
prEN 1956	<i>Non-destructive testing — Penetrant testing and magnetic particle testing — Viewing conditions</i>
prEN ISO 9934-1	<i>Non-destructive testing — Magnetic particle testing — Part 1: General principles</i>

NOTE. Informative references to documents used in the preparation of this standard, and cited at the appropriate places in the text, are listed in a bibliography, see annex A.

3 Conditions for magnetic particle inspection

Magnetic particle inspection shall be specified by the purchaser in agreement with the manufacturer. Severity levels shall be agreed between the manufacturer and the purchaser in relation to the service applications of the castings concerned.

The areas of the castings and the percentage of the castings to be inspected shall be indicated in the enquiry.

The manufacturing stage(s), when magnetic particle inspection(s) is (are) to be performed, shall be defined by agreement between the manufacturer and the purchaser.

The sensitivity can differ depending on the method of magnetic particle inspection selected. Hence the required severity levels and the method shall be agreed between the manufacturer and the purchaser.

The order shall be subject to an agreement between the manufacturer and the purchaser and shall specify at least the following points:

- the qualification or certification of the operators who will carry out the inspection (see 4.2);
- the required surface finish of the areas to be inspected (see 4.3);
- if inspection is to be performed in only one direction (see 4.1);
- the method to be used (type of detection media);
- whether or not the casting is to be demagnetized after inspection has been performed (viz. maximum residual field strength values).

For each area of the casting to be inspected (see clause 5 and clause 6):

- the type of discontinuity;
- the severity level.

NOTE. The type of discontinuity and the severity level can vary depending on the area of the casting inspected.

For the classification, depending on the shape of the indication of the discontinuities (see table 1), reference shall be made to the severity levels defined in tables 2 and 3 (see 6.1).

The indications resulting from an inspection can be compared to the reference figures (see table 4). The reference figures are included for convenience only. In the event of a dispute, reference shall be made to the tables.

4 Method of inspection

4.1 Operating mode

The operating mode shall be as described in prEN ISO 9934-1.

The characterization of products shall be verified in accordance with the requirements of prEN ISO 9934-1.

Unless otherwise specified (see clause 3), it is necessary to carry out an inspection magnetizing sequentially in two directions (see prEN ISO 9934-1), in order to ensure that the discontinuity runs against the flux in at least one direction. When the direction of stress is known, the inspection may be performed in one direction only, in order to take into account the most detrimental discontinuity.

NOTE. The magnetic images need not necessarily correspond to discontinuities as pseudo-defects can appear.

4.2 Qualification of the operators

The inspections shall be performed by personnel qualified in accordance with EN 473 or by a certification scheme which is considered to be equivalent. The qualification level of the personnel shall be agreed between the manufacturer and the purchaser by the time of acceptance of the order.

4.3 Surface preparation

The surface to be inspected shall be clean, free from oil, grease, sand, scale, moulding and coating residues, or any other contaminant which can interfere with the correct implementation and interpretation of the magnetic inspection test results.

The surface may be either shot blasted with round or angular shot, or sand blasted, or ground or machined so that the smallest indication can be taken into account (see table 5).

The surface to be inspected may be painted to provide a contrast before inspection (see prEN ISO 9934-1).

The quality of the surface finish in the areas to be inspected shall be agreed by the time of enquiry and order.

NOTE. It is recommended that the assessment of surface finish be carried out using a visual cast surface roughness comparator rather than an instrumental method (see EN 1370).

4.4 Conditions of inspection

The inspection shall be carried out with the naked eye or at a maximum magnification of 3 and viewing conditions in conformity with prEN 1956.

5 Acceptance criteria

5.1 Indications of discontinuities

The discontinuities that are usually seen in a casting are given in the symbols (A, B, C, D, E, F, H or K) of table 1. These discontinuities can give indications, magnetic diagrams and groups of indications on any given surface. These indications can all be of different types.

5.2 Definition of magnetic inspection indications

5.2.1 General

The discontinuity indications revealed by the magnetic particle inspection can have different shapes and sizes. The distinction between the discontinuity indications is made depending on the ratio of the length L of the indication to its width W in the manner described in 5.2.2 and 5.2.3.

5.2.2 Non-linear indications (SM)

The indications are considered to be non-linear when the length L is smaller than three times the width W .

The symbol for non-linear indications is SM (S for surface and M for magnetic particle).

5.2.3 Linear and aligned indications (LM and AM)

5.2.3.1 Linear indications (LM)

The indications are considered to be linear when L is greater than or equal to $3W$.

The symbol for linear indications is LM (L for linear and M for magnetic particle).

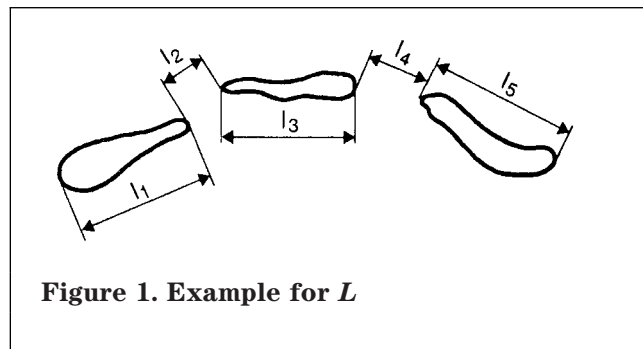


Figure 1. Example for L

5.2.3.2 Aligned indications (AM)

Indications are considered to be aligned in the following cases:

- non-linear: the distance between indications is less than 2 mm and at least three indications are noted;
- linear: the distance between two indications is smaller than the length L of the longest discontinuity in the alignment.

An alignment of indications is considered to be a unique indication. Its length is equal to the overall length L of the alignment.

NOTE. The overall length L is the developed distance between the starting point of the first discontinuity and the finishing point of the last discontinuity.

Example $L = l_1 + l_2 + l_3 + l_4 + l_5$ (see figure 1).

The symbol for aligned indications is AM (A for aligned and M for magnetic particle).