



**SLOVENSKI STANDARD**  
**SIST EN 1369:1997**

**01-december-1997**

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**Livarstvo - Preiskave z magnetnimi prahovi**

Founding - Magnetic particle inspection

Gießereiwesen - Magnetpulverprüfung

Fonderie - Contrôle par magnétoscopie

**Ta slovenski standard je istoveten z: EN 1369:1996**

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**ICS:**

25.120.30	Livarska oprema	Moulding equipment
77.160	Metalurgija prahov	Powder metallurgy

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EUROPEAN STANDARD

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English version

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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.

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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

## Contents

	Page		Page
Foreword .....	3	<b>8 Inspection documents .....</b>	<b>10</b>
Introduction .....	4	<b>Table 1: Nature of discontinuities and types of corresponding magnetic particle inspection indications .....</b>	<b>11</b>
<b>1 Scope .....</b>	<b>4</b>	<b>Table 2: Severity levels for magnetic particle inspection – Non-linear indications isolated (SM) .....</b>	<b>11</b>
<b>2 Normative references .....</b>	<b>4</b>	<b>Table 3: Severity levels for magnetic particle inspection – Linear (LM) and aligned (AM) indications .....</b>	<b>12</b>
<b>3 Conditions for magnetic particle inspection .....</b>	<b>5</b>	<b>Table 4: Linear (LM) and aligned (AM) indications .....</b>	<b>13</b>
<b>4 Method of inspection .....</b>	<b>5</b>	<b>Table 5: Recommended surface finish for magnetic particle inspection .....</b>	<b>13</b>
4.1 Operating mode .....	5	<b>Annex A (informative) Bibliography .....</b>	<b>14</b>
4.2 Qualification of the operators .....	6	<b>Annex B (informative) Reference figures – Non-linear indications designated SM ...</b>	<b>14</b>
4.3 Surface preparation .....	6	<b>Annex C (informative) Reference figures – Linear and aligned indications designated LM and AM .....</b>	<b>17</b>
4.4 Conditions of inspection .....	6	<b>Annex D (informative) Model of a magnetic particle inspection document .....</b>	<b>21</b>
<b>5 Acceptance criteria .....</b>	<b>6</b>		
5.1 Indications of discontinuities .....	6		
5.2 Definition of magnetic inspection indications .....	6		
5.3 Severity levels .....	7		
<b>6 Classification of the indications and interpretation of results .....</b>	<b>9</b>		
6.1 Classification of the indications using tables 2 and 3 .....	9		
6.2 Classification of the indications using the reference figures .....	9		
6.3 Interpretation of results .....	9		
<b>7 Cleaning after examination and demagnetization .....</b>	<b>10</b>		

## 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:

### EN 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

Qualification and certification of NDT personnel – General principles

EN 1370

Founding – Surface roughness inspection by visual/tactile comparators

prEN 1559-1

Founding – Technical conditions of delivery – Part 1: General

prEN 1956

Non-destructive testing – Penetrant testing and magnetic particle testing – Viewing conditions

prEN ISO 9934-1

Non-destructive testing – Magnetic particle testing – Part 1: General principles

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. <https://standards.iteh.ai/catalog/standards/sist/3c9f26d0-3b98-45eb-bce1-45a0905c0c51/sist-en-1369-1997>

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 characterisation 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.

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## 5 Acceptance criteria

### 5.1 Indications of discontinuities

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The discontinuities that are usually seen in a casting are given in table 1 by the symbols (A, B, C, D, E, F, H or K). 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 3  $W$ .

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



### 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).

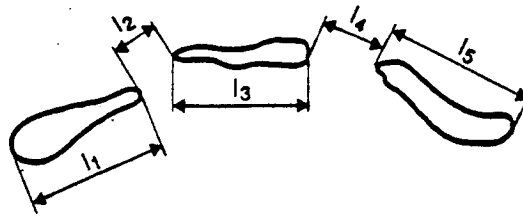


Figure 1: Example for  $L$

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

## 5.3 Severity levels

### 5.3.1 General

The severity levels are designed as a reference scale and are defined depending on the types of indications.

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### 5.3.2 Non-linear indications

For the non-linear indications, the severity levels (see table 2) are defined by:

- the length (largest dimension)  $L_1$  of the smallest indication to be taken into account;
- if applicable, the maximum total surface area of the indications in a given surface (the frame 105 mm × 148 mm corresponds to the ISO format A6);
- the maximum length  $L_2$  of the indications.

### 5.3.3 Linear and aligned indications

#### 5.3.3.1 General

For the linear and aligned indications, the severity levels (see table 3) are defined by:

- the length (largest dimension)  $L_1$  of the smallest indication to be taken into account;
- the maximum length  $L_2$  of the linear and aligned indications;
- the sum of the lengths of the linear and aligned indications exceeding the length  $L_1$  in the frame measuring 105 mm × 148 mm.

### 5.3.3.2 Section thickness type

Three section thickness types are specified (see table 3):

- a:  $t \leq 16$  mm;
- b:  $16 \text{ mm} < t \leq 50$  mm;
- c:  $t > 50$  mm;

where  $t$  is the section thickness.

### 5.3.4 Selection of the severity level

The severity levels shall be selected from tables 2 and/or 3 in conjunction with, if necessary, the reference figures given in annexes B and C. The reference figures are drawn to a scale of 1 : 1 and are examples.

Table 2 and annex B correspond to non-linear indications (isolated) (SM).

Table 3 and annex C correspond to linear (LM) indications and aligned (AM) indications<sup>1)</sup>.

NOTE: The severity levels cannot be considered in the same progression from table 2 to table 3 and from annex B to annex C. So they should not be considered as equivalent as regards inspection severity. The severity criteria and the severity levels can differ from one part of a casting to another due, for example, to any stresses applied.

The choice of the reference figure depends on the section thickness type.

### 5.3.5 Designation of severity levels

The requirements in the order or in the specifications shall conform to the terminology used in this standard.

Examples of correct terminology are given below:

- non-linear indications, level 2 : SM 2 (see 5.2);
- linear and aligned indications, level 5 : LM 5c/AM 5c (see 5.3).

NOTE: "c", in LM 5c, means: the section thickness type  $t$  is greater than 50 mm.

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<sup>1)</sup> It should be noted that several equivalent severity levels defined by table 3 are represented by the same reference figure as shown in table 4. In certain cases, the equivalence of the figure is only approximate because of slight differences in the parameters in table 3. In such cases the equivalences are indicated by <sup>1)</sup> in table 4.

## 6 Classification of the indications and interpretation of results

### 6.1 Classification of the indications using tables 2 and 3

#### 6.1.1 General

In order to classify a discontinuity indication, it is necessary to place a 105 mm × 148 mm frame in the most unfavourable location, i.e. showing the greatest severity for discontinuities.

#### 6.1.2 Non-linear indications

Only those indications with a length greater than  $L_1$  shall be taken into account (see table 2).

The sum of the surface areas of these indications shall be calculated<sup>2)</sup>.

The length of these indications shall be measured.

The level of the (SM) indications shall be established using table 2.

#### 6.1.3 Linear and aligned indications

The length  $L$  of the isolated indications greater than the minimum length taken into account, defined by the required severity level, shall be measured. The sum of the indications included in the 105 mm × 148 mm frame shall be calculated.

The section thickness  $t$  at the inspection location shall be measured.

The level of the LM and AM indications shall be established using table 3.

The lengths of the linear and aligned indications greater than the minimum length shall be summated and the result shall be compared to the "cumulative" length specified in table 3.

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### 6.2 Classification of the indications using the reference figures

The severity level 5 corresponds to the largest indications. The severity level 001 corresponds to the smallest indications.

Normally, only the reference figures for the severity levels 1, 2, 3, 4 and 5 are used.

The reference figures equating to the non-linear as well as linear and aligned indications (see tables 2 and 3) are shown in annexes B and C.

An actual figure and a reference figure are equivalent when the same total surface of indications (non-linear) and/or the same length of linear or aligned indications of similar appearance have been detected. The maximum permissible discontinuities may appear simultaneously on the area of 105 mm × 148 mm.

### 6.3 Interpretation of results

The casting shall be considered as conforming with this standard when the observed severity level is equal to or better than that specified in the order. If for any indication type, the observed severity level is worse than that specified in the order, the casting shall be considered not to conform with this standard.

NOTE: Non linear as well as linear and aligned indications can appear simultaneously on the same part of the casting.

<sup>2)</sup> If the casting surface is smaller in area than the reference surface area, the surface of the indications should be proportionally reduced.