SLOVENSKI STANDARD
SIST EN 1371-2:2000

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Livarstvo - Preiskava s penetrirno tekočino - 2. del: Precizijsko uliti ulitki

Founding - Liquid penetrant inspection - Part 2: Investment castings

Gießereiwesen - Eindringprüfung - Teil 2: Feingußstücke

Fonderie - Contrôle par ressuage - Partie 2: Pieces en moulage de précision (cire perdue)

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ICS:

77.140.80 Železni in jekleni ulitki Iron and steel castings

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English version

Founding - Liquid penetrant inspection - Part 2: Investment castings

Fonderie - Contrôle par ressuage - Partie 2: Pièces en moulage de précision (cire perdue)

Gießereiwesen - Eindringprüfung - Teil 2: Feingußstücke

This European Standard was approved by CEN on 9 April 1998.

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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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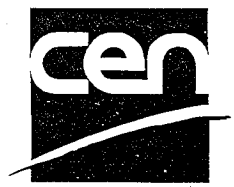

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Foreword

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of an identical text or by endorsement, at the latest by November 1998, and conflicting national standards shall be withdrawn at the latest by November 1998.

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 1371-2
Founding – Liquid penetrant inspection – Part 2: Investment castings

This is one of two European Standards for liquid penetrant inspection of castings. The other standard is:

EN 1371-1
Founding – Liquid penetrant inspection – Part 1: Sand, gravity die and low pressure die castings

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

Introduction

This European Standard complements EN 1371-1. It deals with the liquid penetrant inspection of investment castings. It has been written to take account of the difference of dimension of the reference area, the difference in thickness of the casting and the difference of nature of discontinuities with regard to other casting processes.

The structure of this standard is similar to EN 1371-1.

1 Scope

This European Standard specifies the application of liquid penetrant testing to all castings (except copper-tin and/or copper-tin-lead alloy castings, where copper is the major constituent) produced by investment casting for general purposes.

This standard does not apply to aerospace investment castings (see prEN 2002-16).

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 571-1
Non-destructive testing – Penetrant testing – Part 1: General principles

EN 1370
Founding – Surface roughness inspection by visualtactile comparators

EN 1371-1
Founding – Liquid penetrant inspection – Part 1: Sand, gravity die and low pressure die castings

prEN 1956
Non-destructive testing – Penetrant testing and magnetic particle testing – Viewing conditions

prEN ISO 3452-4
Non-destructive testing – Penetrant testing – Part 4: Equipment (ISO/FDIS 3452-4:1998)

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

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1 investment casting

Process of fabrication of a ceramic or plaster mould usually around a wax or thermoplastic pattern which is removed after drying and prior to the pouring of molten metal into the resultant cavity.

NOTE: Investment casting is sometimes referred to as lost-wax casting.

3.2 reference area

Area defined by a square frame of 25 mm × 25 mm.

4 Conditions for liquid penetrant inspection

The manufacturing stage(s) when liquid penetrant inspection is to be performed shall be clearly defined by agreement between the manufacturer and the purchaser.

Inspection shall be carried out only on those areas of the castings and on the percentage of castings agreed. Inspection requirements shall be clearly stated in the call for tender, in the request for prices and, more particularly, in the order sent to the manufacturer and accepted by him, so that the manufacturer can assess the costs of manufacturing to satisfy the required severity level and the costs of additional inspections and operations, and the manufacturing risks involved.

For each agreed area of the casting to be inspected, the following shall be indicated:

- type of discontinuity;
- severity level.

If a wiping method is required by the purchaser the testing conditions shall be agreed upon.

Sensitivity can differ depending on the method of liquid penetrant inspection agreed. Therefore the severity levels required shall be selected as a function of the liquid penetrants used and the method agreed upon between the manufacturer and the purchaser.

The type of discontinuity and the severity level can be different depending on the area of the casting inspected (see table 1 for type of discontinuity and tables 2 and 3 for severity levels).

5 Method of inspection

5.1 Operating mode

Inspection shall be carried out as described in EN 571-1. The characteristics of the penetrant materials shall be checked in accordance with specifications to be agreed between the manufacturer and the purchaser.

5.2 Qualification of the operators

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

5.3 Suitability of the equipment

The equipment shall conform to EN 571-1 and prEN ISO 3452-4.

5.4 Surface preparation

The surface preparation shall conform to EN 571-1.

The surface finish of the casting in the area to be tested shall have sufficient brightness and contrast of colour and adequate shape to determine the required severity level.

NOTE 1: The surface roughness may be selected from table 4, unless otherwise specified at the time of acceptance of the order.

NOTE 2: It is recommended that the assessment of surface roughness is carried out using a visual tactile comparator.

Liquid penetrant inspection shall be performed on castings at the manufacturing stage agreed by the time of acceptance of the order. If sand blasting or shot blasting is required, it shall avoid sealing or closing up possible discontinuities. If the risk of sealing or closing up possible discontinuities is unacceptable then blasting may be followed by chemical etching in order to make detection of discontinuities easier. The chemical composition of the etching bath and other parameters such as concentration, temperature, immersion time, rinsing and neutralizing shall be defined by agreement between the manufacturer and the purchaser by the time of acceptance of the order.

5.5 Penetrant testing sensitivity level

Penetrant testing sensitivity level shall be agreed upon between the manufacturer and the purchaser by the time of acceptance of the order.

5.6 Viewing conditions

Inspection shall be carried out in accordance with the requirements of prEN 1956.

NOTE 1: Use of a transparent ruler is recommended.

Inspection shall be carried out with the naked eye or at a maximum magnification of 3.

NOTE 2: In special cases, a greater magnification can be used by agreement between the manufacturer and the purchaser by the time of acceptance of the order.

6 Acceptance criteria

6.1 Indications of discontinuities

6.1.1 General

The indications of discontinuities can be non-linear (isolated or clustered), aligned or linear. Although liquid penetrant inspection cannot generally be used to determine the size of detected discontinuities, it allows discontinuities to be assessed by measurement of the length L and the width W of the indication.

Hereafter the following symbols apply:

- L indicates length;
- W indicates width;
- t indicates section thickness;
- P indicates liquid penetrant;
- SP indicates non-linear isolated indication;
- CP indicates non-linear clustered indication;
- AP indicates aligned indication;
- LP indicates linear indication.

6.1.2 Criteria

The various types of penetrant indication can correspond to the discontinuities (A, B, C, etc.) shown in table 1.

Table 1 gives non-linear or linear or aligned liquid penetrant inspection indications in relation to the nature of discontinuities.

6.2 Definition of liquid penetrant inspection indication

a) non-linear, such that $L < 3\ W$:

- isolated (SP);
- clustered (CP): area of multiple indications that form one measurable area.

The minimum distance between two isolated or clustered indications in order to consider them separately shall be at least twice their largest dimension.

b) aligned (AP):

- 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 of the longest discontinuity in the alignment.

c) linear (LP), such that $L \geq 3\ W$.

6.3 Severity levels

6.3.1 General

Several severity levels are recognized in accordance with tables 2 and 3. It is necessary to carry out the test on a surface corresponding to a given degree of finish (see table 4) depending on the severity level desired.

The liquid penetrant inspection for each type of indication and its severity levels shall be specified by the purchaser at the time of ordering, depending on the use of the castings. The manufacturer shall give his agreement.

The penetrant indications to be taken into account shall have dimensions in accordance with the severity level.

The required severity level shall be selected accordingly and specified in the order by agreement between the manufacturer and the purchaser.

6.3.2 Criteria

Tables 2 and 3 show the minimum lengths below which the indications shall not be taken into consideration in the severity level concerned.

6.3.3 Liquid penetrant inspection indications

Table 2 corresponds to non-linear isolated or non-linear clustered indications.

Table 3 corresponds to linear or aligned indications.

Tables 2 and 3 are independent of each other.

NOTE: Differing severity levels can be selected from tables 2 and 3.

7 Interpretation of results

In order to interpret the indication of a discontinuity, a frame containing the reference area should be placed in the most unfavourable location. The observed indications shall be in relation to the reference severity levels as described in this standard and compared to the equivalent or immediately better severity level.

If the casting area to be examined is smaller than the reference area, then the maximum admissible number or dimensions of indications shall be agreed by the manufacturer and the purchaser by the time of acceptance of the order.