SLOVENSKI STANDARD
SIST EN 12681:2003

01-november-2003

Livarstvo – Radiografska preiskava

Founding - Radiographic examination

Gießereiwesen - Durchstrahlungsprüfung

Fonderie - Contrôle par radiographie

Ta slovenski standard je istoveten z: **EN 12681:2003**

ICS:

77.040.20	Neporušitveno preskušanje kovin	Non-destructive testing of metals

SIST EN 12681:2003 **en**

EUROPEAN STANDARD

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EN 12681

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English version

Founding - Radiographic examination

Fonderie - Contrôle par radiographie

Gießereiwesen - Durchstrahlungsprüfung

This European Standard was approved by CEN on 21 November 2002.

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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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 12681:2003) 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of an identical text or by endorsement, at the latest by July 2003, and conflicting national standards shall be withdrawn at the latest by July 2003.

Within its programme of work, Technical Committee CEN/TC 190 requested CEN/TC 190/WG 4.10 "Inner defects" to prepare the following standard:

EN 12681, *Founding — Radiographic examination.*

Annex A is informative.

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 Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Radiography can be used to detect internal discontinuities in a casting. The discontinuities can be gas cavities, non-metallic inclusions, shrinkage, cracks, chaplets or chills or inclusions that have lower or higher densities than the parent metal.

1 Scope

This European Standard gives specific procedures for industrial X-radiation and gamma radiography for discontinuity detection purposes, using film techniques. These procedures are applicable to castings produced by any casting process, especially for steel, cast iron, magnesium, zinc, copper, nickel, aluminium, titanium and any alloys of them.

This European Standard does not apply to:

— the testing of welded joints;

— acceptance criteria;

— radioscopy (real time inspection).

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 (including amendments).

EN 444:1994, *Non-destructive testing — General principles for radiographic examination of metallic materials by X- and gamma-rays.*

EN 462-1, *Non-destructive testing — Image quality of radiographs — Part 1: Image quality indicators (wire type) — Determination of image quality value.*

EN 462-2, *Non-destructive testing — Image quality of radiographs — Part 2: Image quality indicators (step/hole type) — Determination of image quality value.*

EN 462-3, *Non-destructive testing — Image quality of radiographs — Part 3: Image quality classes for ferrous metals.*

EN 462-4, *Non-destructive testing — Image quality of radiographs — Part 4: Experimental evaluation of image quality values and image quality tables.*

EN 25580, *Non-destructive testing — Industrial radiographic illuminators — Minimum requirements (ISO 5580 : 1985).*

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

3 Terms and definitions

For the purposes of this European Standard the terms and definitions given in EN 444:1994 apply.

4 General

4.1 Protection against ionizing radiations

Local, national or international safety precautions shall be strictly applied, when using ionizing radiation.

WARNING: Exposure of any part of the human body to X-rays or gamma-rays can be highly injurious to health.

4.2 General requirements

This European Standard shall be used in combination with EN 444.

Examination reports shall be made according to EN 444.

4.3 Agreements

Castings with a complex geometry can include areas which cannot be radiographically inspected or can only be partly inspected. Such areas shall be identified before starting the radiographic examination. Areas which cannot be radiographicly inspected shall be noted by all contracting parties and be marked on the film position plan.

The following items shall be agreed:

a) manufacturing stage;

b) extent of examination;

c) examination areas;

d) surface condition;

e) test class according to EN 444[1)];

f) information about the film position plan;

g) marking of examination areas on the casting;

h) image quality value according to EN 462-3 and EN 462-4;

i) marking of the films;

j) acceptance criteria.

Any additional items shall be agreed between the contracting parties.

Radiographs shall be evaluated by comparison to reference radiographs.

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1) It is recommended to perform the examination according to EN 444 test class A, if not otherwise specified. For alloys having a density of less than 5 kg/dm^3, test class B is recommended.

NOTE A selection of corresponding reference radiographs for materials and thickness ranges is given in annex A.

4.4 Personnel qualification

It is assumed that radiographic examination is performed by qualified and capable personnel. In order to prove this qualification, it is recommended to certify personnel in accordance with EN 473.

5 Examination arrangements

5.1 General

The examination arrangements to be used shall be in accordance with:

— Figures 1 to 6 for test areas of simple section;

— Figure 7 for double wall radiography;

— Figures 8 to 12 for test areas of complex section.

If these arrangements are not applicable, other arrangements may be used.

5.2 Single wall radiography of plane areas

The examination arrangement for single wall radiography of plane areas shall be in accordance with Figure 1.

5.3 Single wall radiography of curved areas

The test arrangement for single wall radiography of curved areas shall be in accordance with either Figures 2, 3 or 4.

NOTE If possible, the source of radiation should be placed in accordance with the arrangements shown in Figures 3 and 4 to achieve a more suitable direction of examination. The reduction in minimum source-to-object distance should not be greater than 40 % provided that the image quality requirements are met. EN 444:1994, 6.6 should be taken into account.

When the source is located centrally inside the object and the film outside (technique shown in Figure 4) and provided that the IQI requirements are met, this percentage can be increased. However, it is recommended that the reduction in minimum source-to-object distance is not greater than 50 %. Rigid cassettes can be used if the corresponding increase of b is considered for the calculation of the distance f between the source and source side of the test object.

5.4 Double wall radiography of plane and curved areas

The examination arrangement for double wall radiography of plane and curved areas shall be in accordance with either Figure 5, 6 or 7.

Double wall radiography shall be used, as an overview technique according to Figure 7, if the geometrical conditions make other examination arrangements difficult to apply or if there is a better sensitivity for detecting discontinuities by using this technique. It shall be assured that unacceptable discontinuities are detected with sufficient certainty. The required image quality shall be met.

In the case of examination arrangements according to Figures 6 and 7, the discontinuities shall be classified with reference to the single wall thickness. In the case of different wall thicknesses the reference shall be the smaller one.

In the case of examination arrangements according to Figure 5, the distance of the source from the surface of the area under examination shall be minimized provided that the requirements of IQI are met.

5.5 Choice of examination arrangements for complex geometries

Unless otherwise agreed, the examination arrangements for complex geometry areas shall be in accordance with Figures 8 to 12 (as appropriate).

5.6 Acceptable examination area dimensions

In addition to the requirements given in EN 444, the angle of incident radiation shall not exceed 30°.

NOTE This value can be larger, if special orientations of discontinuities can be detected in this way or if it is the only way to test areas otherwise impossible to test.

5.7 Explanation of symbols used in the figures

In Figure 1, the following symbols apply:

Q is the source of radiation;

t is the nominal thickness of the material in the region under examination;

b is the distance between the radiation side of the test object side and the film surface measured along the central axis of the radiation beam;

B is the radiographic film;

f is the distance between the source of radiation and the source side of the test object measured along the central axis of the radiation beam;

w is the thickness of material in the direction of the radiation beam calculated on the basis of the nominal thickness (see clause 6). If the actual thickness of the material deviates from the nominal one by more than 10 %, the actual wall thickness shall be used (see *t* and *w*).

In Figures 2 to 12, the symbols given in Figure 1 apply accordingly.

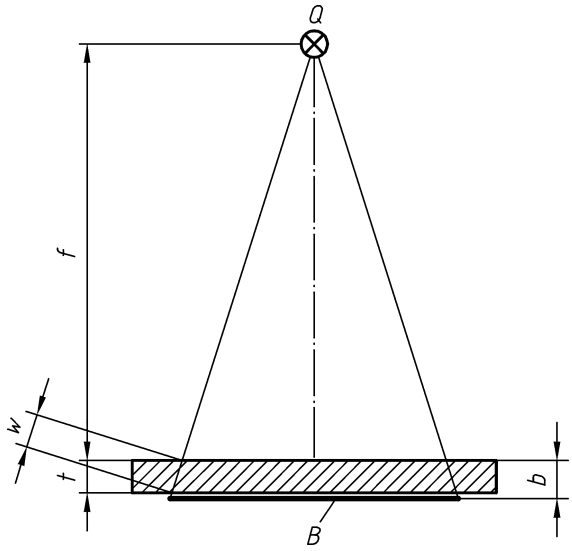

Figure 1 — Examination arrangement for single wall radiography of plane areas

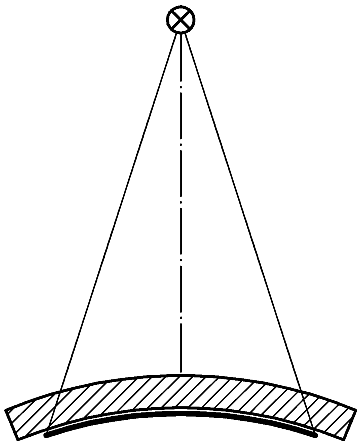

Figure 2 — Examination arrangement for single wall radiography of curved areas with the source on the convex side and the film on the concave side of the area under examination

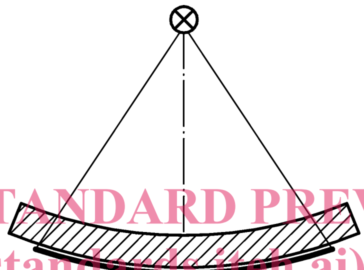

Figure 3 — Examination arrangement for single wall radiography of curved areas with eccentric positioning of the source on the concave side and the film on the convex side of the area under examination

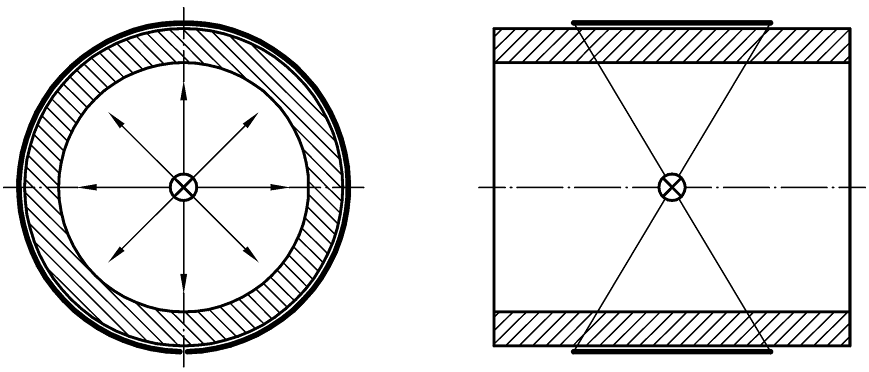

Figure 4 — Examination arrangement for single wall radiography of curved areas with central positioning of the source on the concave side and the film on the convex side of the area under examination