SLOVENSKI STANDARD
oSIST prEN 13100-2:2018

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Neporušitveno preskušanje zvarjenih spojev plastomernih polizdelkov - 2. del: Rentgensko (radiografsko) preskušanje

Non-destructive testing of welded joints in thermoplastics semi-finished products - Part 2: X-ray radiographic testing

Zerstörungsfreie Prüfung von Schweißverbindungen thermoplastischer Kunststoffe - Teil 2: Röntgenprüfung

Essais non destructifs des assemblages soudés sur produits semi-finis en thermoplastiques - Partie 2: Contrôle radiographique par rayons X

Ta slovenski standard je istoveten z: prEN 13100-2:2018

ICS:

25.160.40	Varjeni spoji in vari	Welded joints and welds
83.140.01	Izdelki iz gume in polimernih materialov na splošno	Rubber and plastics products in general

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English Version

Non-destructive testing of welded joints in thermoplastics semi-finished products - Part 2: X-ray radiographic testing

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 249.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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Ref. No. prEN 13100-2:2018:2018 E

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European foreword

This document (prEN 13100-2:2018) has been prepared by Technical Committee CEN/TC 249 “Plastics”, the secretariat of which is held by NBN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13100-2:2004.

In comparison with the previous edition, the following technical modifications have been made:

— updating of the normative references;

— definitions added and consequently editorial modifications in the text and in the figures.

1 Scope

This document specifies fundamental radiographic techniques with film which enable repeatable results to be obtained economically.

This document applies to the X-ray radiographic examination of heated tool, electrofusion, extrusion and hot gas joints in plastics materials.

It applies to joints in solid wall pipes and plates with a range of thicknesses from 5 mm to 100 mm. It only applies to pipes containing air or other gases at the time of X-ray testing.

This document does not specify acceptance levels of the indications.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 19232-1, *Non-destructive testing - Image quality of radiographs - Part 1: Determination of the image quality value using wire-type image quality indicators (ISO 19232-1)*

EN ISO 19232-2, *Non-destructive testing - Image quality of radiographs - Part 2: Determination of the image quality value using step/hole-type image quality indicators (ISO 19232-2)*

EN ISO 9712, *Non-destructive testing - Qualification and certification of NDT personnel (ISO 9712)*

EN ISO 11699-1, *Non-destructive testing - Industrial radiographic film - Part 1: Classification of film systems for industrial radiography (ISO 11699-1)*

EN ISO 11699-2, *Non-destructive testing - Industrial radiographic films - Part 2: Control of film processing by means of reference values (ISO 11699-2)*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
nominal thickness
nominal thickness of the parent material

Note 1 to entry: Manufacturing tolerances are not taken into account.

3.2
penetrated thickness
thickness of material in the direction of the radiation beam including the thickness of the weld beads on butt fusion joints (if appropriate), or the additional thickness of the socket for electrofusion joints, or the combined thickness of the top and bottom half of the joint for multiple wall techniques

3.3
object-to-film distance
distance between the radiation side of the test object and the film surface, measured along the central axis of the radiation beam

3.4
source size
size of the radiation source, e.g. the focal spot size of the X-ray tube

3.5
source-to-film distance
distance between the radiation source and the film measured in the direction of the beam

3.6
source-to-object distance
distance between the radiation source and the source side of the test object, measured along the central axis of the radiation beam

3.7
nominal outside diameter
***d*n**
specified outside diameter, in millimetres, assigned to a nominal size DN/OD

[SOURCE:EN 12201-1:2011, definition 3.1.1.2]

3.8
outside diameter at any point
***d*e**
value of the measurement of the outside diameter through its cross-section at any point of the pipe or spigot end, rounded to the next greater 0,1 mm

[SOURCE: EN 12201-1:2011, definition 3.1.1.3]

4 Symbols and abbreviations

Symbols and abbreviations are given in Table 1.

Table 1 — Symbols and abbreviations

Symbols and abbreviations	Designations	Units
b	Object-to-film distance	mm
d	Source size	mm
de	Outside diameter at any point	mm
dn	Nominal outside diameter	mm
f	Source-to-object distance	mm
f_{min}	Minimum source-to-object distance	mm
SFD	Source-to-film distance	mm
t	Nominal thickness	mm
w	Penetrated thickness	mm
S	Radiation source	—
F	Film	—
α	Inclination angle	°
SDR	d_n /t	—

5 General

5.1 Security measures

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

WARNING NOTICE - Exposure of any part of the human body to X-rays can be highly injurious to health. Wherever X-ray equipment is in use, appropriate legal requirements shall be applied.

5.2 Surface preparation and stage of manufacture

Prior to radiography the joint shall be cleaned to remove all traces of dirt etc. from the component surface, which might later cause difficulty in detecting defects.

In the case of heated tool butt welded pipes, the external weld bead shall be removed prior to radiography.

5.3 Location of the weld in the radiograph

Where the weld is not likely to be clearly visible on the radiograph, high-density markers (e.g. lead) shall be placed on either side of the weld before testing.

5.4 Identification of radiographs

Symbols (normally lead markers) shall be affixed to each section of the object being radiographed. The images of these symbols shall appear in the radiograph outside the region of interest and shall ensure unambiguous identification of the section.

5.5 Marking

Permanent markings on the object to be examined shall be made in order to accurately locate the position of each radiograph.

Where the nature of the material and/or its service conditions do not permit permanent marking, the location of each radiograph may be recorded by means of accurate sketches.

5.6 Overlap of films

When radiographing an area with two or more separate films, the films shall overlap sufficiently to ensure that the complete region of interest is radiographed. This shall be verified by a high-density marker on the surface of the object, which will appear on each film.

5.7 Types and position of image quality indicators (IQI)

The quality of image shall be verified by use of image quality indicator(s) (IQI) in accordance with EN ISO 19232-1 or EN ISO 19232-2. The IQI(s) shall be made from the same material as the inspected material or a material with a similar absorption with a tolerance of ± 10 % in the absorption coefficient. In accordance with EN ISO 19232-1 or EN ISO 19232-2 the applied IQI(s) shall have the inscription with the name of the document, the number of the thickest wire or the first step hole and the material. For plastic materials, this requires the name of the material (e.g.: PE- polyethylene, PP- polypropylene, PVC- polyvinylchloride, etc.) and the materials density given in g/cm3 with at least two significant digits.

The IQI used shall be placed preferably on the source side of the test object at the centre of the area of interest on the parent material beside the weld. The IQI shall be in close contact with the surface of the object.

It shall be located in a section of uniform thickness characterized by a uniform optical density on the film. According to the IQI type used, two cases shall be considered.

a) When using a wire IQI, the wires shall be directed perpendicular to the weld and its location shall ensure that at least 10 mm of the wire length will show in a section of uniform optical density, which is normally in the parent material adjacent to the weld. At exposures in accordance with Figures 3 and 4 the IQI should not be projected into the image of the weld.

b) When using a step/hole IQI, it shall be placed in such a way that the hole number required is placed close to the weld.

At exposures in accordance with Figures 3 and 4 the IQI may be placed on the film side. In this case reference shall be made to Tables A.5 and A.6 given in Annex A.

Where the IQIs are placed at the film side, the lead letter 'F' shall be placed near the IQI and it shall be noted in the test report.

If steps have been taken to guarantee that radiographs of similar test objects and regions are produced with identical exposure and processing techniques, and no differences in the image quality value are likely, the image quality need not be verified for every radiograph, the extent of image quality verification being subject to agreement between the contracting parties.

For panoramic exposures of pipes (see Figure 2) with diameter 200 mm and above, at least three IQIs shall be placed equally spaced around the circumference. The film(s) showing IQI images are then considered representative for the whole circumference.

5.8 Evaluation of image quality

The films shall be viewed in accordance with EN 25580.

From the examination of the image of the IQI on the radiograph, the number of the smallest wire or hole, which shall be discerned, shall be determined. The image of a wire shall be accepted if a continuous length of at least 10 mm is clearly visible in a section of uniform optical density. In the case of the step/hole type IQI, if there are two holes of the same diameter, both shall be discernible in order that the step is considered as visible.

The image quality obtained shall be indicated on the examination report of the radiographic examination. In each case, the type of indicator used shall be clearly stated, as shown on the IQI.

5.9 Minimum image quality values

Tables A.1 to A.6 in Annex A show the minimum image quality values for plastics materials.

5.10 Personnel qualification

Personnel performing non-destructive examination in accordance with this document shall be qualified in accordance with the relevant document, e.g. EN ISO 9712.

6 Recommended techniques for making radiographs

6.1 Test arrangements

Normally radiographic techniques in accordance with Figures 1 to 9 shall be used.

In the case of heated tool butt welded pipes, the external weld bead shall be removed prior to radiography.

For test arrangements in accordance with Figures 3, 5 and 6, the inclination of the beam shall be kept as small as possible, but sufficient to prevent superimposition of the two images. The source-to-object distance, f, should be kept as small as possible, in accordance with 6.5. For Figures 5 and 6, the IQI shall be placed close to the film with a lead letter 'F'.

The elliptical technique (double wall/double image) in accordance with Figure 3 shall not be used for *d*e > 100 mm and t > 8 mm.

Other radiographic techniques may be specified when appropriate, e.g. for reasons such as the geometry of the piece or differences in material thickness.

Annex B gives the minimum number of radiographs necessary to obtain an acceptable radiographic coverage of a butt weld in pipe of *d*e > 100 mm.

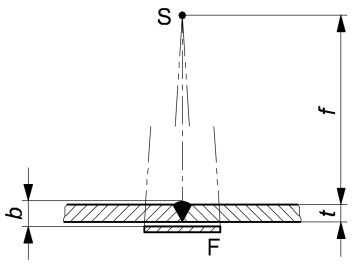

Figure 1 — Test arrangement for single-wall penetration of plates

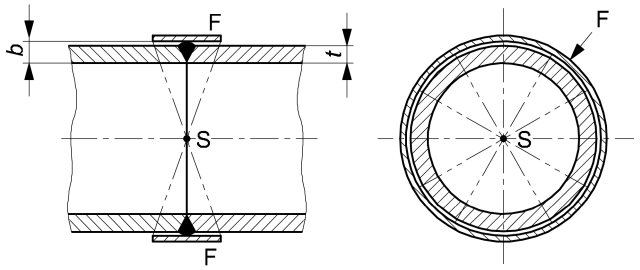

Figure 2 — Panoramic technique – Test arrangement for single-wall penetration of curved objects with the radiation source located centrally inside the object

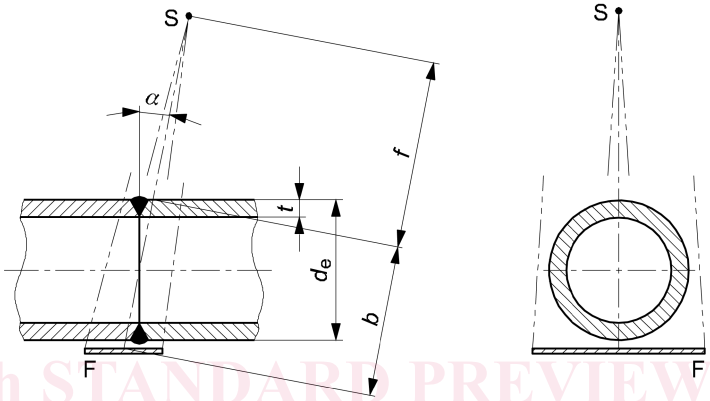

Figure 3 — Elliptical technique – Test arrangement for double-wall penetration, double image of curved objects for evaluation of both walls simultaneously

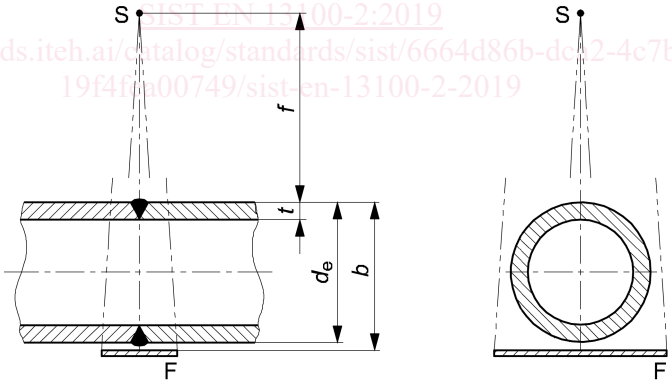

Figure 4 — Perpendicular technique – Test arrangement for double-wall penetration, double image of curved objects for evaluation of both walls simultaneously