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Non-destructive testing of welds — Radiographic testing —

Part 2: X- and gamma-ray techniques with digital detectors

Essais non destructifs des assemblages soudés — Contrôle par radiographie —

Partie 2: Techniques par rayons X ou gamma à l'aide de détecteurs numériques

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 5, *Testing and inspection of welds*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 17636-2:2013), which has been technically revised.

The main changes are as follows:

— the normative references have been updated;

— the figures have been updated;

— manual and automated inspection with DDAs has been considered in 6.6, 6.7, and 7.8;

— references to Figures 1 to 19 have been updated throughout the document;

— in 6.7 a), the acceptance of a wire visibility shorter than 10 mm for pipes with an external diameter < 50 mm has been added;

— in 6.7.1, the use of ASTM wires and other IQIs by agreement of the contracting parties has been added;

— 6.8, “Evaluation of image quality” for digital radiography has been added;

— in 6.9 and 7.2.2, the lower thickness limit for Se-75 applications has been deleted;

— in 6.8, 6.9 and 7.3.1, a clarification for the IQI usage for DWDI technique has been added;

— permission to reduce SNR_N if the tube voltage is reduced or energy-resolving detectors are used to < 80 % of the values given in Figure 20 has been added in 7.3.1;

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— in 7.3.2, the compensation principle II (CP II) has been extended to three wire pairs without the agreement of the contracting parties;

— Annex C has been shortened to avoid duplication with ISO 19232-5;

— in D.2, a new note on fading has been added;

— a new Annex F has been added;

— a new Annex G has been added.

A list of all parts in the ISO 17636 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

This corrected version of ISO 17636-2:2022 incorporates the following corrections:

— the formulae in 3.11, 3.13, Formula (D.1) and Figure D.2 have been updated to include units for the constant c;

— Formulae (6) and (7) revised and D_d defined as "diagonal size of the detector area".

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Non-destructive testing of welds — Radiographic testing —

Part 2:
X- and gamma-ray techniques with digital detectors

1 Scope

This document specifies techniques of digital radiography with the object of enabling satisfactory and repeatable results. The techniques are based on generally recognized practice and fundamental theory of the subject.

This document applies to the digital radiographic testing of fusion welded joints in metallic materials. It applies to the joints of plates and pipes. Besides its conventional meaning, "pipe", as used in this document, covers other cylindrical bodies such as tubes, penstocks, boiler drums and pressure vessels.

This document specifies the requirements for digital radiographic X- and gamma-ray testing by either computed radiography (CR) or radiography with digital detector arrays (DDAs) of the welded joints of metallic plates and tubes for the detection of imperfections. It includes manual and automated inspection with DDAs.

Digital detectors provide a digital grey value image which can be viewed and evaluated using a computer (Annex E). This document specifies the recommended procedure for detector selection and radiographic practice. Selection of computer, software, monitor, printer and viewing conditions are important, but are not the main focus of this document. The procedure specified in this document provides the minimum requirements for radiographic practice which permits exposure and acquisition of digital radiographs with equivalent sensitivity for the detection of imperfections as film radiography (specified in ISO 17636-1).

This document does not specify acceptance levels for any of the indications found on the digital radiographs. ISO 10675 provides information on acceptance levels for weld inspection.

If contracting parties apply lower test criteria, it is possible that the quality achieved will be significantly lower than when this document is strictly applied.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5576, *Non-destructive testing — Industrial X-ray and gamma-ray radiology — Vocabulary*

ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel*

ISO 16371-1:2011, *Non-destructive testing — Industrial computed radiography with storage phosphor imaging plates — Part 1: Classification of systems*

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

ISO 19232-4, *Non-destructive testing — Image quality of radiographs — Part 4: Experimental evaluation of image quality values and image quality tables*

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ISO 19232-5, *Non-destructive testing — Image quality of radiographs — Part 5: Determination of the image unsharpness and basic spatial resolution value using duplex wire-type image quality indicators*

EN 12543 (all parts), *Non-destructive testing — Characteristics of focal spots in industrial X-ray systems for use in non-destructive testing*

EN 12679, *Non-destructive testing — Radiographic testing — Determination of the size of industrial radiographic gamma sources*

ASTM E747, *Standard Practice for Design, Manufacture and Material Grouping Classification of Wire Image Quality Indicators (IQI) Used for Radiology*

JIS Z2306, *Radiographic image quality indicators for non-destructive testing*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5576 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
computed radiography
CR
complete system comprising a *storage phosphor imaging plate* (IP) (3.2) and a corresponding read-out unit (scanner or reader), which converts the information from the IP into a digital image

3.2
storage phosphor imaging plate
IP
photostimulable luminescent material capable of storing a latent radiographic image of a material being tested and which, upon stimulation by a source of red light of appropriate wavelength, generates luminescence proportional to radiation absorbed

Note 1 to entry: When performing *computed radiography* (3.1), an IP is used in lieu of a film. When establishing techniques related to *source size* (3.20) or focal geometries, the IP is referred to as a detector, i.e. *source-to-detector distance* (3.21).

3.3
digital detector array
DDA
electronic device converting ionizing or penetrating radiation into a discrete array of analogue signals which are subsequently digitized and transferred to a computer for display as a digital image corresponding to the radiologic energy pattern imparted upon the input region of the device

3.4
structure noise
<imaging plate> local sensitivity variations due to inhomogeneities in the sensitive layer (structure, graininess) and surface of an imaging plate

Note 1 to entry: After scanning of the exposed imaging plate, the inhomogeneities appear as overlaid fixed pattern noise in the digital image.

Note 2 to entry: This noise limits the maximum achievable image quality of digital CR images and can be compared with the graininess in film images.

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