



BSI Standards Publication

Non-destructive testing of welds — Radiographic testing

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

This is a preview of "BS EN ISO 17636-2:20...". [Click here to purchase the full version from the ANSI store.](#)

National foreword

This British Standard is the UK implementation of EN ISO 17636-2:2022. It is identical to ISO 17636-2:2022. It supersedes BS EN ISO 17636-2:2013, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee WEE/46/5, Radiographic Testing.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2022
Published by BSI Standards Limited 2022

ISBN 978 0 539 04733 2

ICS 19.100; 25.160.40

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2022.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

This is a preview of "BS EN ISO 17636-2:20...". Click here to purchase the full version from the ANSI store.

EUROPÄISCHE NORM

October 2022

ICS 25.160.40

Supersedes EN ISO 17636-2:2013

English Version

Non-destructive testing of welds - Radiographic testing - Part 2: X- and gamma-ray techniques with digital detectors (ISO 17636-2:2022)

Essais non destructifs des assemblages soudés -
Contrôle par radiographie - Partie 2: Techniques par
rayons X ou gamma à l'aide de détecteurs numériques
(ISO 17636-2:2022)

Zerstörungsfreie Prüfung von Schweißverbindungen -
Durchstrahlungsprüfung - Teil 2: Röntgen- und
Gammastrahlungstechniken mit digitalen Detektoren
(ISO 17636-2:2022)

This European Standard was approved by CEN on 23 August 2022.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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 CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

This is a preview of "BS EN ISO 17636-2:20...". [Click here to purchase the full version from the ANSI store.](#)

European foreword

This document (EN ISO 17636-2:2022) has been prepared by Technical Committee ISO/TC 44 "Welding and allied processes" in collaboration with Technical Committee CEN/TC 121 "Welding and allied processes" 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 April 2023, and conflicting national standards shall be withdrawn at the latest by April 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 17636-2:2013.

Any feedback and questions on this document should be directed to the users' national standards body/national committee. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Endorsement notice

The text of ISO 17636-2:2022 has been approved by CEN as EN ISO 17636-2:2022 without any modification.

This is a preview of "BS EN ISO 17636-2:20...". Click here to purchase the full version from the ANSI store.

Contents

	Page
Foreword	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Symbols and abbreviated terms	6
5 Classification of radiographic techniques and compensation principles	8
5.1 Classification.....	8
5.2 Compensation principles, CP I, CP II or CP III.....	8
5.2.1 General.....	8
5.2.2 Compensation principle I (CP I).....	8
5.2.3 Compensation principle II (CP II).....	8
5.2.4 Compensation principle III (CP III).....	8
5.2.5 Theoretical background.....	9
6 General preparations and requirements	9
6.1 Protection against ionizing radiation.....	9
6.2 Surface preparation and stage of manufacture.....	9
6.3 Location of the weld in the radiograph.....	9
6.4 Identification of radiographs.....	9
6.5 Marking.....	9
6.6 Overlap of digital images.....	10
6.7 Types and positions of image quality indicators (IQIs).....	10
6.7.1 General.....	10
6.7.2 Duplex wire IQIs.....	10
6.7.3 Single wire or step-hole IQIs.....	10
6.8 Evaluation of image quality.....	11
6.9 Minimum image quality values.....	12
6.10 Personnel qualification.....	12
7 Recommended techniques	13
7.1 Test arrangements.....	13
7.1.1 General.....	13
7.1.2 Single-wall penetration of plane objects (see Figure 1).....	14
7.1.3 Single-wall penetration of curved objects with the source outside the object (see Figures 2 to 4).....	14
7.1.4 Single-wall penetration of curved objects with the source inside the object for panoramic exposure (see Figures 5 to 7).....	15
7.1.5 Single-wall penetration of curved objects with the source located off-centre and inside the object (see Figures 8 to 10).....	16
7.1.6 Double-wall penetration and double-image evaluation (DWDI) of pipes with the elliptic technique and the source and the detector outside the object (see Figure 11).....	17
7.1.7 Double-wall penetration and double-image evaluation (DWDI) with the perpendicular technique and source and detector outside the object (see Figure 12).....	17
7.1.8 Double-wall penetration and single-image evaluation (DWSI) of curved objects for evaluation of the wall next to the detector (see Figures 13 to 16).....	18
7.1.9 Penetration of objects with different material thicknesses (see Figure 17 to 19).....	19
7.2 Choice of tube voltage and radiation source.....	20
7.2.1 X-ray devices up to 1 000 kV.....	20
7.2.2 Other radiation sources.....	21
7.3 Detector systems and metal screens.....	22
7.3.1 Minimum normalized signal-to-noise ratio (SNR _N).....	22

This is a preview of "BS EN ISO 17636-2:20...". Click here to purchase the full version from the ANSI store.

7.3.2	Compensation principle II.....	25
7.3.3	Metal screens for IPs and shielding.....	25
7.4	Alignment of beam.....	25
7.5	Reduction of scattered radiation.....	26
7.5.1	Metal filters and collimators.....	26
7.5.2	Interception of backscattered radiation.....	26
7.6	Source-to-object distance.....	26
7.7	Geometric magnification technique.....	33
7.8	Maximum area for a single exposure.....	34
7.9	Processing.....	34
7.9.1	Scan and read-out of images.....	34
7.9.2	Correction of acquired DDA images.....	35
7.9.3	Bad pixel interpolation.....	35
7.9.4	Image processing.....	35
7.10	Monitor viewing conditions and storage of digital radiographs.....	36
8	Test report.....	36
Annex A (normative)	Number of exposures for acceptable testing of a circumferential butt weld.....	38
Annex B (normative)	Minimum image quality values.....	43
Annex C (normative)	Determination of basic spatial resolution.....	51
Annex D (informative)	Determination of minimum grey values for CR practice.....	53
Annex E (informative)	Grey values — General remarks.....	58
Annex F (informative)	Considering the detector unsharpness for f_{\min}.....	60
Annex G (informative)	Calculation of recommended X-ray tube voltages from Figure 20.....	63
Bibliography		64

This is a preview of "BS EN ISO 17636-2:20...". Click here to purchase the full version from the ANSI store.

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](#);

This is a preview of "BS EN ISO 17636-2:20...". Click here to purchase the full version from the ANSI store.

- 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 is a preview of "BS EN ISO 17636-2:20...". Click here to purchase the full version from the ANSI store.

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*