SLOVENSKI STANDARD

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Neporušitvene preiskave - Sevalne metode za računalniško tomografijo - 3. del: Delovanje in razlaga (ISO 15708-3:2017)

Non-destructive testing - Radiation methods for computed tomography - Part 3: Operation and interpretation (ISO 15708-3:2017)

Zerstörungsfreie Prüfung - Durchstrahlungsverfahren für Computertomografie - Teil 3: Durchführung und Auswertung (ISO 15708-3:2017)

Essais non destructifs - Méthodes par rayonnements pour la tomographie informatisée - Partie 3: Fonctionnement et interprétation (ISO 15708-3:2017)

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19.100 Neporušitveno preskušanje Non-destructive testing

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Non-destructive testing - Radiation methods for computed tomography - Part 3: Operation and interpretation (ISO 15708-3:2017)

Essais non destructifs - Méthodes par rayonnements pour la tomographie informatisée - Partie 3: Fonctionnement et interprétation (ISO 15708-3:2017)

Zerstörungsfreie Prüfung - Durchstrahlungsverfahren für Computertomografie - Teil 3: Durchführung und Auswertung (ISO 15708-3:2017)

This European Standard was approved by CEN on 11 February 2019.

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

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

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European foreword

The text of ISO 15708-3:2017 has been prepared by Technical Committee ISO/TC 135 "Non-destructive testing" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 15708-3:2019 by Technical Committee CEN/TC 138 "Non-destructive testing" the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by October 2019, and conflicting national standards shall be withdrawn at the latest by October 2019.

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.

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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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 15708-3:2017 has been approved by CEN as EN ISO 15708-3:2019 without any modification.

INTERNATIONAL STANDARD

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Non-destructive testing — Radiation methods for computed tomography —

Part 3: Operation and interpretation

Essais non destructifs — Méthodes par rayonnements pour la tomographie informatisée —

Partie 3: Fonctionnement et interprétation

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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).

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

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html

This document was prepared by the European Committee for Standardization (CEN) (as EN 16016-3) and was adopted, under a special "fast-track procedure", by Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 5, *Radiographic testing*, in parallel with its approval by the ISO member bodies.

This first edition of ISO 15708-3 cancels and replaces ISO 15708-2:2002, of which it forms the subject of a technical revision. It takes into consideration developments in computed tomography (CT) and computational power over the preceding decade.

A list of all parts in the ISO 15708 series can be found on the ISO website.

Non-destructive testing — Radiation methods for computed tomography —

Part 3:
Operation and interpretation

1 Scope

This document presents an outline of the operation of a computed tomography (CT) system and the interpretation of results with the aim of providing the operator with technical information to enable the selection of suitable parameters.

It is applicable to *industrial* imaging (i.e. non-medical applications) and gives a consistent set of CT performance parameter definitions, including how those performance parameters relate to CT system specifications.

This document deals with computed axial tomography and excludes other types of tomography such as translational tomography and tomosynthesis.

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 15708-1:2017, *Non-destructive testing — Radiation methods for computed tomography — Part 1: Terminology*

ISO 15708-2:2017, *Non-destructive testing — Radiation methods for computed tomography — Part 2: Principle, equipment and samples*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15708-1 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

4 Operational procedure

4.1 General

For target-oriented computer tomography (CT) inspection procedures, the test and measurement tasks are defined in advance with regard to the size and type of features/defects to be verified; for example, through the specification of appropriate acceptance levels and geometry deviations. In the following, the process steps of a CT application are described and information on its implementation provided.

4.2 CT system set-up

4.2.1 General

The CT system set-up is oriented towards the requirements for the given task. The required spatial resolution (taking into account the tube focal spot size), contrast resolution, voxel size and the CT image quality can be derived from these requirements. The quality of the CT image is determined by different parameters, which under certain circumstances counteract each other.

In the following, system parameters are described and information is provided on setting up a CT system for inspection. Due to the interactions of the different system parameters, it may be necessary to run through the set-up steps several times in order to acquire optimal data.

The optimal energy is that which gives the best signal-to-noise ratio and not necessarily that which gives the clearest radiograph (the dependency of the detector efficiency on the energy is to be taken into account). However, in order to differentiate between materials of different chemical composition it may be necessary to adjust the accelerating voltage to maximise the difference in their linear attenuation coefficients.

4.2.2 Geometry

The source-detector and source-object distances and thus also the beam angle used should be specified. In order to achieve high resolutions, the projection can be magnified onto the detector. The magnification is equal to the ratio of the source-detector distance to the source-object distance. Increasing source-detector distance leads to a reduced intensity at the detector and thus to a reduced signal to noise ratio. Accordingly, this also applies when using detectors with improved detector resolution, which can result in a reduction of the signal-to-noise ratio due to the reduced intensity per pixel. In general, for this reason, minimisation of the source-object distance is to be preferred.

In order to obtain high beam intensity at the detector, the source-detector distance should be selected so that it is as small as possible taking into account the required resolution so that the beam cone still fully illuminates the detector. In the case of 3D-CT, the (in general vertical) total cone beam angle measured parallel to the rotation axis should typically be less than 15°, but this is specimen dependant, in order to minimise reconstruction-determined (Feldkamp) distortions of the 3D model. In addition, these restrictions do not apply for the perpendicular (in general horizontal) beam angle. For a higher geometric magnification, the object must be positioned as near as possible to the source, taking into consideration the limit on sharpness imposed by focal spot size. The rotation of the object must take place at at least 180 °plus beam angle of the X-ray beam, whereby an improved data quality is the result of an increasing number of angular increments. For this reason, the object is typically turned through 360 °. Ideally, the number of angular increments should be at least $\pi/2 \times$ matrix size (uneven number of projections per 360°) where the matrix size is the number of voxels across the sample diameter or the largest dimension. For more information, refer to 5.5.

The number of projections should be > $\pi \times$ matrix size for best reconstruction quality (even or uneven number of projections per 360°).

In order to obtain as complete information as possible on the specimen, the requirement in general for a CT is that the object (or the interesting section of the object) is completely mapped in each projection on the detector. For large components that exceed the beam cone, a so-called measurement range extension is used. This measurement range extension is accomplished by laterally displacing either the object or the detector, recording the projection data in sequential measurements, and finally concatenating (joining) them. Under certain circumstances, it is also possible to only scan a part of the object (region-of-interest CT), which may lead to a restricted data quality in the form of so-called truncations.

A possible deviation of the recording geometry (offset between the projected axis of rotation and the centre line of the image) must be corrected for in order to obtain a reconstruction which is as precise as possible. This can be achieved by careful realignment of the system or be corrected using software.

