

**Non-destructive testing of welds - Ultrasonic testing -
Use of time-of-flight diffraction technique (TOFD) (ISO
10863:2011)**

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

<p>Käesolev Eesti standard EVS-EN ISO 10863:2011 sisaldab Euroopa standardi EN ISO 10863:2011 ingliskeelset teksti.</p> <p>Standard on kinnitatud Eesti Standardikeskuse 30.09.2011 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.</p> <p>Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 01.09.2011.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p>	<p>This Estonian standard EVS-EN ISO 10863:2011 consists of the English text of the European standard EN ISO 10863:2011.</p> <p>This standard is ratified with the order of Estonian Centre for Standardisation dated 30.09.2011 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.</p> <p>Date of Availability of the European standard text 01.09.2011.</p> <p>The standard is available from Estonian standardisation organisation.</p>
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English Version

Non-destructive testing of welds - Ultrasonic testing - Use of
time-of-flight diffraction technique (TOFD) (ISO 10863:2011)

Contrôle non destructif des assemblages soudés - Contrôle
par ultrasons - Utilisation de la technique de diffraction des
temps de vol (méthode TOFD) (ISO 10863:2011)

Zerstörungsfreie Prüfung von Schweißverbindungen -
Ultraschallprüfung - Anwendung der
Beugungslaufzeittechnik (TOFD) (ISO 10863:2011)

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Foreword

This document (ISO 10863:2011) has been prepared by Technical Committee CEN/TC 121 "Welding", the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 44 "Welding and allied processes".

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of an identical text or by endorsement, at the latest by March 2012, and conflicting national standards shall be withdrawn at the latest by March 2012.

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Non-destructive testing of welds — Ultrasonic testing — Use of time-of-flight diffraction technique (TOFD)

1 Scope

This International Standard specifies the application of the time-of-flight diffraction (TOFD) technique to the semi- or fully automated ultrasonic testing of fusion-welded joints in metallic materials of minimum thickness 6 mm. It applies to full penetration welded joints of simple geometry in plates, pipes, and vessels, where both the weld and parent material are low-alloyed carbon steel. Where specified and appropriate, TOFD can also be used on other types of materials that exhibit low ultrasonic attenuation (especially that due to scatter).

Where material-dependent ultrasonic parameters are specified in this International Standard, they are based on steels having a sound velocity of $(5\,920 \pm 50)$ m/s for longitudinal waves, and $(3\,255 \pm 30)$ m/s for transverse waves. It is necessary to take this fact into account when examining materials with a different velocity.

This International Standard makes reference to the basic standard EN 583-6 and provides guidance on the specific capabilities and limitations of TOFD for the detection, location, sizing and characterization of discontinuities in fusion-welded joints. TOFD can be used as a stand-alone method or in combination with other non-destructive testing (NDT) methods or techniques, for manufacturing inspection, and for in-service inspection.

This International Standard specifies four testing levels (A, B, C, D) in accordance with ISO 17635 and corresponding to an increasing level of inspection reliability. Guidance on the selection of testing levels is provided.

This International Standard permits assessment of TOFD indications for acceptance purposes. This assessment is based on the evaluation of transmitted, reflected and diffracted ultrasonic signals within a generated TOFD image.

This International Standard does not include acceptance levels for discontinuities.

2 Normative references

The following referenced documents are indispensable for the application 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 9712, *Non-destructive testing — Qualification and certification of NDT personnel — General principles*

ISO 17635, *Non-destructive testing of welds — General rules for metallic materials*

ISO 17640:2010, *Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment*

EN 473, *Non-destructive testing — Qualification and certification of NDT personnel — General principles*

EN 583-6, *Non-destructive testing — Ultrasonic examination — Part 6: Time-of-flight diffraction technique as a method for detection and sizing of discontinuities*

EN 1330-4, *Non-destructive testing — Terminology — Part 4: Terms used in ultrasonic testing*

EN 12668 (all parts), *Non-destructive testing — Characterization and verification of ultrasonic examination equipment*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1330-4 and the following apply.

3.1
time-of-flight diffraction setup
TOFD setup
probe arrangement defined by probe characteristics (e.g. frequency, probe element size, beam angle, wave mode) and probe centre separation

3.2
probe centre separation
PCS
distance between the index points of the two probes

NOTE The PCS for two probes located on a curved surface is the straight-line, geometric separation between the two probe index points and not the distance measured along the surface.

3.3
beam intersection point
point of intersection of the two main beam axes

3.4
time-of-flight diffraction indication
TOFD indication
pattern or disturbance in the time-of-flight diffraction image which may need further evaluation

3.5
time-of-flight diffraction image
TOFD image
two-dimensional image, constructed by collecting adjacent A-scans while moving the time-of-flight diffraction setup

NOTE The signal amplitude of the A-scans is typically represented by grey-scale values.

3.6
offset scan
scan parallel to the weld axis, where the beam intersection point is not on the centreline of the weld

4 General remarks on the capabilities of the technique

General principles of the TOFD technique are described in EN 583-6. For the testing of fusion-welded joints, some specific capabilities and limitations of the technique have to be considered.

The TOFD technique is an ultrasonic image-generating technique, which offers the capability of detection, location, and sizing. To a certain extent, characterization of discontinuities in the weld material as well as in the adjacent parent material is also possible.

Compared with purely reflection-based techniques, the TOFD technique, which is based upon diffraction as well as reflection, is less sensitive to the orientation of the discontinuity. Discontinuities oriented perpendicular to the surface, and at intermediate angles of tilt, are detectable as well as discontinuities in the weld fusion faces.