SLOVENSKI STANDARD
oSIST prEN 1714:2007

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Neporuġitvene preiskave zvarnih spojev - Ultrazvoļ ne preiskave

Non-destructive testing of welds - Ultrasonic testing of welded joints

Zerstörungsfreie Prüfung von Schweißverbindungen - Ultraschallprüfung von Schweißverbindungen

Contrôle non destructif des assemblages soudés - Contrôle par ultrasons des assemblages soudés

Ta slovenski standard je istoveten z: **prEN 1714**

ICS:

25.160.40 Varjeni spoji in vari Welded joints

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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 121.

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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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Foreword

This document (prEN 1714:2007) has been prepared by Technical Committee CEN/TC 121 “Welding”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1714:1997, EN 1714:1997/A1:2002, EN 1714:1997/A2:2003.

1 Scope

This European Standard specifies techniques for the manual ultrasonic testing of fusion welded joints in metallic materials equal to and above 8 mm thick which exhibit low ultrasonic attenuation (especially that due to scatter) at object temperatures from 0°C to 60°C. It is primarily intended for use on full penetration welded joints where both the welded and parent material are ferritic.

Where material dependent ultrasonic values are specified in this standard they are based on steels having an ultrasonic sound velocity of 5920 ± 50 m/s for longitudinal waves, and 3255 ± 30 m/s for transverse waves.

The standard specifies four testing levels, each corresponding to a different probability of detection of imperfections. Guidance on the selection of testing levels A, B and C is given in annex A.

The requirements of testing level D, which is intended for special applications, shall be in accordance with the general requirements of this standard and may only be used when defined by specification. This includes tests of metals other than ferritic steel, tests on partial penetration welds, tests with automated equipment, tests at object temperatures outside the range.

This standard may be used for the assessment of indications, for acceptance purposes, by either of the following techniques:

a) Evaluation based primarily on length and echo amplitude of the signal indication;

b) Evaluation based on characterization and sizing of the indication by probe movement techniques.

The techniques used shall be specified.

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.

EN 473, *Qualification and certification of NDT personnel — General principles*

EN 583-1, *Non-destructive testing — Ultrasonic examination — Part 1: General principles*

EN 583-2, *Non-destructive testing — Ultrasonic examination — Part 2: Sensitivity and range setting*

EN 583-4, *Non-destructive testing — Ultrasonic examination — Part 4: Examination for discontinuities perpendicular to the surface*

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

EN 1712, *Non-destructive examination of welds — Ultrasonic examination of welded joints — Acceptance levels*

EN 1713, *Non-destructive examination of welds — Ultrasonic examination — Characterization of imperfections in welds;*

EN 12062, *Non-destructive examination of welds — General rules for metallic materials;*

EN ISO 5817, *Arc-welded joints in steel — Guidance on quality levels for imperfections;*

EN 12668-1, *Non-destructive testing — Characterization and verification of ultrasonic examination equipment — Part 1: Instruments*

EN 12668-2, *Non-destructive testing — Characterization and verification of ultrasonic examination equipment — Part 2: Probes*

EN 12668-3, *Non-destructive testing — Characterization and verification of ultrasonic examination equipment — Part 3: Combined equipment*

3 Definitions and symbols

For the purposes of this standard, the definitions given in EN12062 and EN 1330-4 apply.

For quantities and symbols, see table 1.

Indications shall be considered to be either longitudinal or transverse, depending on the direction of their major dimension with respect to the weld axis, x, in accordance with figure 2.

Table 1 — Quantities and symbols

Symbol	Quantity	Unit
t	Thickness of parent material (thinnest part)	mm
D_{DSR}	Diameter of a disc shaped reflector	mm
D_{SDH}	Diameter of a side-drilled hole	mm
l	Length of the indication	mm
h	Extension of the indication in depth direction	mm
x	Position of the indication in the longitudinal direction	mm
y	Position of the indication in the transverse direction	mm
z	Position of the indication in depth	mm
l_z	Projected length of the indication in depth	mm
l_x	Projected length of the indication in the x-direction	mm
l_y	Projected length of the indication in the y-direction	mm
p	Full skip distance	mm

4 General

The purpose of this standard is to describe general techniques of ultrasonic testing, using standard criteria, for the most commonly used weld joints at object temperatures in the range of 0°C and 60°C. The specific requirements specified by this standard cover the equipment, preparation, performance of the testing and reporting. The parameters specified, in particular those for the probes, are compatible with the requirements of

EN 1712 and EN 1713, and are also suitable for use with other acceptance criteria standards. The techniques recommended in this standard are suitable for the detection of those weld imperfections specified in typical weld acceptance standards. Techniques to be used for ultrasonic assessment of indications and acceptance criteria shall be defined by specification.

If the agreed acceptance criteria require a more precise determination of the height and nature of the defect, this may necessitate the use of techniques outside the scope of this standard.

5 Information required prior to testing

5.1 Items to be specified

— method for setting the reference level;

— method to be used for evaluation of indications;

— acceptance levels;

— testing level;

— manufacturing and operation stage(s) at which the testing is to be carried out;

— qualification of personnel;

— extent of the testing for transverse indications;

— requirements for additional tandem testing (see EN 583-4);

— parent metal testing prior to and/or after welding;

— whether or not a written testing procedure is required;

— requirements for written testing procedures.

5.2 Specific information required before testing

Before any testing of a welded joint can begin, the operator shall have access to the following essential information:

— written testing procedure, if required (see 5.3);

— type(s) of parent material and product form (i.e. cast, forged, rolled);

— manufacturing or operation stage at which testing is to be made including heat treatment, if any;

— time and extent of any post-weld heat treatment;

— joint preparation and dimensions;

— requirements to surface conditions;

— welding procedure or relevant information on the welding process;

— reporting requirements;

— acceptance levels;

— extent of testings, including requirements for transverse indications, if relevant;

— testing level;

— personnel qualification level;

— procedures for corrective actions when unacceptable indications are revealed.

5.3 Written testing procedure

The definitions and requirements in this standard will normally satisfy the need for a written procedure. Where this is not the case, or where the techniques described in this standard are not applicable to the weld joint to be examined, additional written procedures shall be used, if required by specification.

6 Requirements for personnel and equipment

6.1 Personnel qualifications

Personnel performing testing in accordance with this standard shall be qualified to an appropriate level in ultrasonic testing in accordance with EN 473 or equivalent in the relevant industrial sector.

In addition to a general knowledge of ultrasonic weld inspection, they shall also be familiar with testing problems specifically associated with the type of weld joints to be examined.

6.2 Equipment

Any equipment used in conjunction with this standard shall comply with the requirements of EN 12668-1, EN 12668-2 and EN 12668-3.

6.3 Probe parameters

6.3.1 Test frequency

The frequency shall be within the range 2 MHz to 5 MHz, and shall be selected to comply with the specified acceptance levels.

For the initial testing, the frequency shall be as low as possible, within the above range, when the evaluation is carried out according to acceptance levels based on length and amplitude e.g. EN 1712. Higher frequencies may be used to improve range resolution if this is necessary when using standards for acceptance levels based on characterization of imperfections, e.g. EN 1713.

Frequencies of approximately 1 MHz may be used for testing at long sound paths where the material shows above average attenuation.

6.3.2 Angles of incidence

When testing is carried out with transverse waves and techniques that require the ultrasonic beam to be reflected from an opposite surface, care shall be taken to ensure that the incident angle of the beam, with the opposite reflecting surface, is not less than 35 ° and preferably not greater than 70 °. Where more than one probe angle is used, at least one of the angle probes used shall conform with this requirement. One of the probe angles used shall ensure that the weld fusion faces are examined at, or as near as possible to, normal incidence. When the use of two or more probe angles is specified, the difference between the nominal beam angles shall be 10 ° or greater.

Angles of incidence at the probe and opposite reflecting surface, when curved, may be determined by drawing a sectional view of the weld or in accordance with the techniques given in EN 583-2. Where angles of incidence cannot be determined as specified by this standard the testing report shall contain a comprehensive description of the scans used and the extent of any incomplete coverage caused together with an explanation of the difficulties encountered.

6.3.3 Element size

The element size shall be chosen according to the ultrasonic path to be used and the frequency.

The smaller the element, the smaller the length and width of the near field and the larger the beam spread in the far field at a given frequency.

Small probes having 6 mm to 12 mm diameter elements (or rectangular elements of equivalent area) are therefore most useful when working at short beam path ranges. For longer ranges, i. e. greater than 100 mm for single normal beam probes and greater than 200 mm for angle beam probes, an element size of 12 mm to 24 mm is more suitable.

6.3.4 Adaption of probes to curved scanning surfaces

The gap between test surface and bottom of the probe shoe shall not be greater than 0,5 mm. For cylindrical or spherical surfaces this requirement will normally be met when the following equation is fulfilled:

$$D \geq a^2/2 \text{ mm} \qquad (1)$$

where :

D is the diameter in millimetres of the component;

a is the dimension in millimetres of the probe shoe in the direction of testing.

If this requirement cannot be met the probe shoe shall be adapted to the surface and the sensitivity and range shall be set accordingly.

6.3.5 Coupling media

The coupling media shall be in accordance with EN 583-1.

7 Testing volume

The testing volume (see figure 1) is defined as the zone which includes weld and parent material for at least 10 mm on each side of the weld, or the width of the heat affected zone, whichever is greater.

In all cases scanning shall cover the whole testing volume. If individual sections of this volume cannot be covered in at least one scanning direction, or if the angles of incidence with the opposite surface do not meet the requirements of 6.3.2, alternative or supplementary ultrasonic techniques or other non-destructive techniques shall be agreed upon. This may, in some cases, require removal of the weld reinforcement.

Supplementary techniques may require testing using dual element angle beam probes, creeping wave probes, further ultrasonic techniques or any other suitable method, for example, liquid penetrant, magnetic particle, radiographic testing. In selecting alternative or supplementary techniques, due consideration should be given to the type of weld and probable orientation of any imperfections to be detected.