



POLSKA NORMA

ICS 25.160.40

PN-EN ISO 4761

Wprowadza

EN ISO 4761:2022, IDT

ISO 4761:2022, IDT

Zastępuje

-

Badania nieniszczące spoin

Badania ultradźwiękowe z głowicą mozaikową (UT-PA) dla cienkościennych elementów stalowych

Poziomy akceptacji

Norma Europejska EN ISO 4761:2022 *Non-destructive testing of welds -- Phased array ultrasonic testing (UT-PA) for thin-walled steel components -- Acceptance levels (ISO 4761:2022)* ma status Polskiej Normy

PN-EN ISO 4761:2023-06

Przedmowa krajowa

Niniejsza norma została zatwierdzona przez Prezesa PKN 28 kwietnia 2023 r.

Komitetem krajowym odpowiedzialnym za normę jest PKN/KT 165 ds. Spawania i Procesów Pokrewnych.

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Nota uznaniowa

Norma Europejska EN ISO 4761:2022 została uznana przez PKN za Polską Normę PN-EN ISO 4761:2023-06.

EUROPEAN STANDARD

EN ISO 4761

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2022

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English Version

Non-destructive testing of welds - Phased array ultrasonic testing (UT-PA) for thin-walled steel components - Acceptance levels (ISO 4761:2022)

Essais non destructifs des assemblages soudés -
Technique ultrasons multi-éléments (UT-PA) pour les
composants en acier à paroi mince - Niveaux
d'acceptation (ISO 4761:2022)

Zerstörungsfreie Prüfung von Schweißverbindungen -
Phased-Array-Ultraschallprüfung (UT-PA)
dünnwandiger Stahlkomponenten -
Zulässigkeitsgrenzen (ISO 4761:2022)

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European foreword

The text of ISO 4761:2022 has been prepared by Technical Committee ISO/TC 44 "Welding and allied processes" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 4761:2022 by 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of an identical text or by endorsement, at the latest by June 2023, and conflicting national standards shall be withdrawn at the latest by June 2023.

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Endorsement notice

The text of ISO 4761:2022 has been approved by CEN as EN ISO 4761:2022 without any modification.

INTERNATIONAL STANDARD

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2022-01

Non-destructive testing of welds — Phased array ultrasonic testing (UT- PA) for thin-walled steel components — Acceptance levels

*Essais non destructifs des assemblages soudés — Technique ultrasons
multi-éléments (UT-PA) pour les composants en acier à paroi mince
— Niveaux d'acceptation*



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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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This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 5, *Testing and inspection of welds*.

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Non-destructive testing of welds — Phased array ultrasonic testing (UT-PA) for thin-walled steel components — Acceptance levels

1 Scope

This document specifies acceptance levels for the phased array ultrasonic testing technique (UT-PA) of full-penetration welds in low-alloy and/or fine-grained steels in the wall thickness range from 3,2 mm to 8 mm which correspond to the quality levels of ISO 5817.

These acceptance levels are applicable to indications detected according to ISO 20601.

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 5577, *Non-destructive testing — Ultrasonic testing — Vocabulary*

ISO 20601, *Non-destructive testing of welds — Ultrasonic testing — Use of automated phased array technology for thin-walled steel components*

ISO 23243, *Non-destructive testing — Ultrasonic testing with arrays — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5577, ISO 20601 and ISO 23243 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/>

4 Symbols

l	indication length
l_1, l_2	length of individual indications
l_c	corrected length
l_{cu}	cumulative length
l_w	weld length
t	thickness

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5 Sensitivity setting and levels

The setting of the sensitivity shall be performed on a 1,0 mm diameter side-drilled hole as specified in ISO 20601, this is also the reference level. This sensitivity setting shall be used for the subsequent testing.

Three levels as defined in ISO 5577 are to be used:

- reference level, level defined by the echo amplitude of a defined reference reflector;
- acceptance level, level defining limits for acceptance regarding echo height, position, classification (if applicable) and number of indications or size of discontinuities;
- evaluation level, level above or below which indications shall be evaluated or examined further.

All levels are linked to the reference reflector and are specified in [Clauses 8](#) and [9](#).

6 Acceptance levels

Three different acceptance levels are defined. The relation between these acceptance levels and the quality levels as mentioned in accordance with ISO 5817 are given in [Table 1](#).

Table 1 — Related levels for phased array ultrasonic testing of small wall thickness

Quality level according to ISO 5817	Testing level according to ISO 20601	Acceptance level according to this document
B (stringent)	C	1
C (intermediate)	C	2
D (moderate)	C	3
Special application	D	By agreement

7 Evaluation of indications

Indications detected when applying ISO 20601 and having an amplitude above the evaluation level (reference level -12 dB) shall be evaluated according to the specified acceptance level by using the indication length and maximum amplitude. Unless specified otherwise, indications from the object geometry, such as weld reinforcement, are considered not relevant.

For two-sided testing, [Clause 8](#) shall be applied. For single-sided testing, [Clause 9](#) shall be applied.

The length of an indication shall be determined by measuring the length along the weld using the 6 dB drop method. Only for unfocused sound beams in lateral direction, a length correction may be applied according to [Formula \(1\)](#).

$$l_c = l_s \times \frac{D_0 - 2d}{D_0} \quad (1)$$

where

l_c is the corrected length;

l_s is the length measured along the surface;

D_0 is the outside diameter;

d is the depth of indication.

When reporting of indications below the acceptance level is specified, the details for reporting shall also be specified.

8 Acceptance criteria for two-sided testing

8.1 General

When indications are detected, length and maximum amplitude shall be determined in accordance with [Clause 7](#).

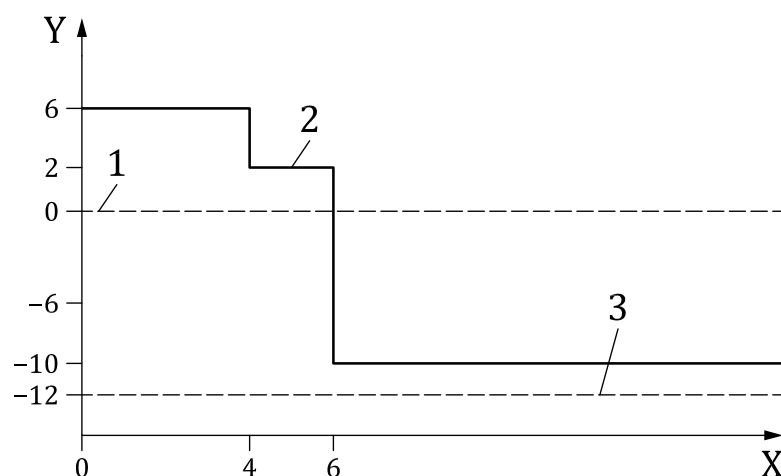
Indications shall be evaluated according to their acceptance level and the acceptance criteria listed in this clause.

All indications with an amplitude greater than the reference level -12 dB shall be evaluated for acceptance by using the criteria given in [8.2](#), [8.3](#) and [8.4](#).

8.2 Longitudinal indications

Table 2 — Criteria for acceptance level 1

Indication length, l mm	Evaluation level dB relative to the reference level	Maximum allowable amplitude dB relative to the reference level
$l \leq 4$	-12	+6
$4 < l \leq 6$	-12	+2
$l > 6$	-12	-10



Key

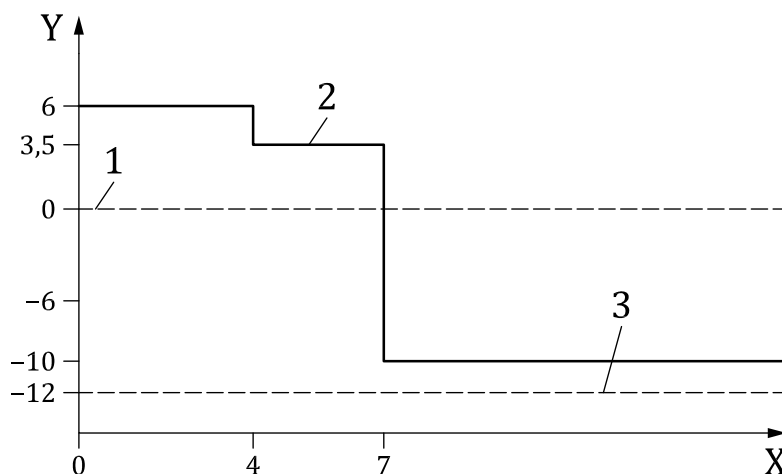
- X indication length, in mm
- Y amplitude, in dB
- 1 reference level
- 2 acceptance level 1
- 3 evaluation level

Figure 1 — Criteria for acceptance level 1

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Table 3 — Criteria for acceptance level 2

Indication length, l mm	Evaluation level dB relative to the reference level	Maximum allowable amplitude dB relative to the reference level
$l \leq 4$	-12	+6
$4 < l \leq 7$	-12	+3,5
$l > 7$	-12	-10



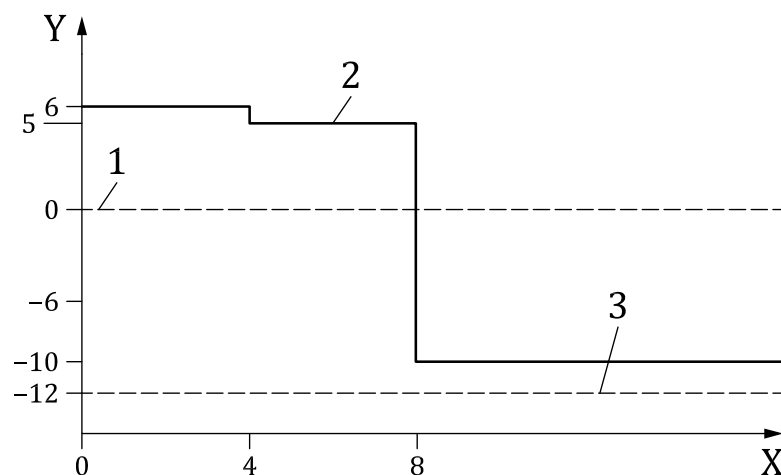
Key

- X indication length, in mm
 Y amplitude, in dB
 1 reference level
 2 acceptance level 2
 3 evaluation level

Figure 2 — Criteria for acceptance level 2

Table 4 — Criteria for acceptance level 3

Indication length, l mm	Evaluation level dB relative to the reference level	Maximum allowable amplitude dB relative to the reference level
$l \leq 4$	-12	+6
$4 < l \leq 8$	-12	+5
$l > 8$	-12	-10

**Key**

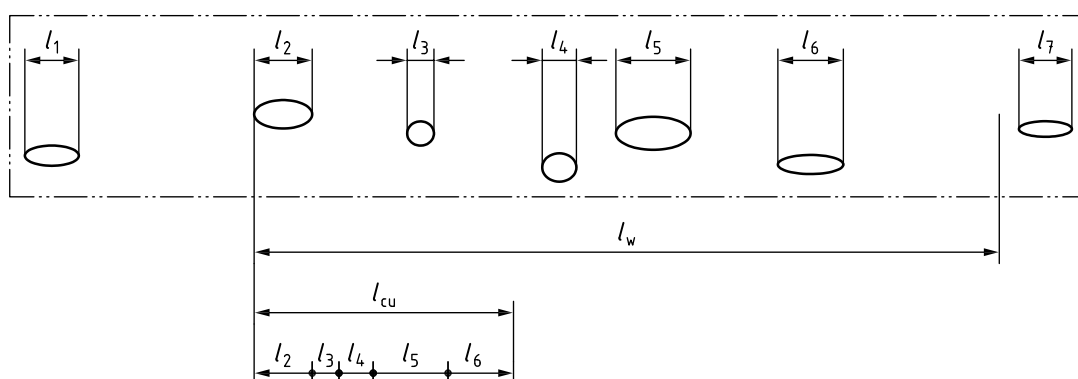
- X indication length, in mm
- Y amplitude, in dB
- 1 reference level
- 2 acceptance level 3
- 3 evaluation level

Figure 3 — Criteria for acceptance level 3**8.3 Transverse indications**

When detection of transverse indications is specified, these indications are only acceptable if amplitude and length can be determined and meet the acceptance levels stated in [8.2](#).

8.4 Cumulative length of indications

The cumulative length of all individually acceptable indications above the evaluation level shall be calculated within a specified section of weld length, l_w , as the sum of lengths of both single indications and linearly aligned indications (see [Figure 4](#)).

**Key**

- l_{cu} cumulative length, $l_{cu} = l_2 + l_3 + l_4 + l_5 + l_6$
- l_w weld length
- l_n length of individual indications, where $n = 1 \dots 7$

Figure 4 — Cumulative length of indications

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For wall thickness t , the sum of the lengths of the individual indications measured along the weld over a length of $12 t$ shall be:

- a) $\leq 3,5 t$ for acceptance level 1;
- b) $\leq 4,0 t$ for acceptance level 2;
- c) $\leq 4,5 t$ for acceptance level 3.

9 Acceptance criteria for single-sided testing

9.1 General

When indications are detected, length and maximum amplitude shall be determined in accordance with [Clause 7](#).

Indications shall be evaluated according to their acceptance level and the acceptance criteria listed in this clause.

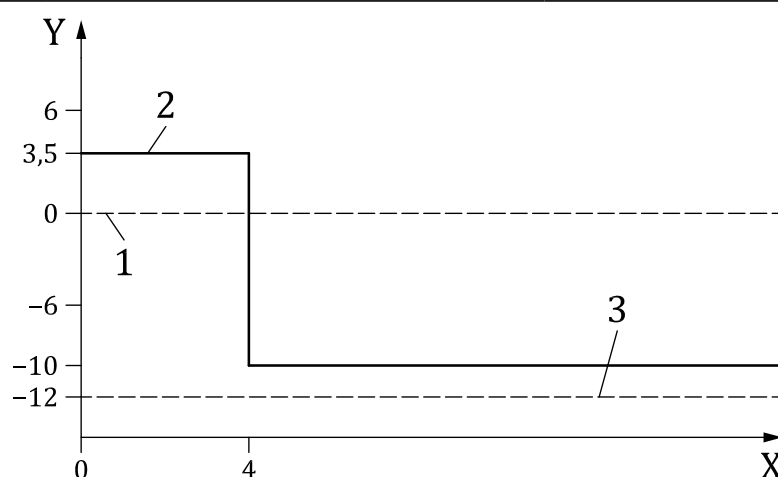
All indications with an amplitude greater than the reference level -12 dB shall be evaluated for acceptance by using the criteria given in [9.2](#), [9.3](#) and [9.4](#).

For single-sided testing no acceptance criteria are defined for acceptance level 1 (stringent).

9.2 Longitudinal indications

Table 5 — Criteria for acceptance level 2 for single-sided testing

Indication length, l mm	Evaluation level dB relative to the reference level	Maximum allowable amplitude dB relative to the reference level
$l \leq 4$	-12	+3,5
$l > 4$	-12	-10



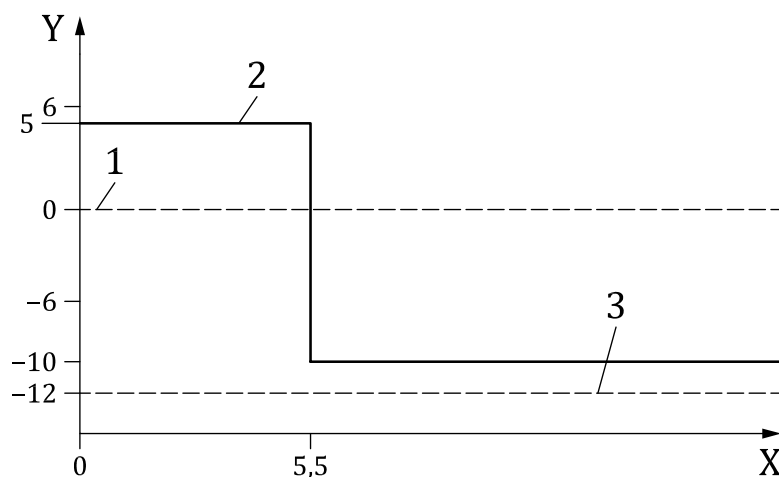
Key

- X indication length, in mm
- Y amplitude, in dB
- 1 reference level
- 2 acceptance level 2
- 3 evaluation level

Figure 5 — Criteria for acceptance level 2 for single-sided testing

Table 6 — Criteria for acceptance level 3 for single-sided testing

Indication length l mm	Evaluation level dB relative to the reference level	Maximum allowable amplitude dB relative to the reference level
$l \leq 5,5$	-12	+5
$l > 5,5$	-12	-10

**Key**

- Y amplitude, in dB
- X indication length, in mm
- 1 reference level
- 2 acceptance level 3
- 3 evaluation level

Figure 6 — Criteria for acceptance level 3 for single-sided testing**9.3 Transverse indications**

When detection of transverse indications is specified, these indications are only acceptable if amplitude and length can be determined and meet the acceptance levels stated in [9.2](#).

9.4 Cumulative length of indications

The cumulative length of all individually acceptable indications above the evaluation level shall be calculated within a specified section of weld length, l_w , as the sum of lengths of both single indications and linearly aligned indications (see [Figure 4](#)).

For wall thickness t , the sum of the lengths of the individual indications measured along the weld over a length of $12 t$ shall be:

- a) $\leq 4,0 t$ for acceptance level 2;
- b) $\leq 4,5 t$ for acceptance level 3.

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- [1] ISO 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections*
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- [7] KINT project report *Development of Acceptance Criteria for Ultrasonic Phased Array Examination of Steel Components with Small Wall Thickness*, 2019

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