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

Essais non destructif — Contrôle par ultrasons — Vocabulaire

Sample Document

get full document from standards.iteh.ai



Reference number
ISO 5577:2017(E)

© ISO 2017

Sample Document

get full document from standards.iteh.ai



COPYRIGHT PROTECTED DOCUMENT

© ISO 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms related to frequencies, waves and pulses	1
3.1 Frequencies.....	1
3.2 Waves and pulses.....	2
3.3 Types of waves.....	4
4 Terms related to sound	5
4.1 Sound generation and reception.....	5
4.2 Sound propagation.....	6
4.3 Loss of sound pressure.....	9
4.4 Sound waves at interfaces.....	9
5 Terms related to test equipment	12
5.1 Instrument.....	12
5.2 Probes.....	15
5.3 Combined equipment.....	20
5.4 Calibration, reference and test blocks.....	21
6 Terms related to ultrasonic testing	22
6.1 Testing techniques.....	22
6.2 Test object.....	26
6.3 Coupling.....	28
6.4 Reflectors.....	28
6.5 Signals and indications.....	29
6.6 Presentations.....	31
6.7 Location.....	35
6.8 Evaluation of indications.....	36
Bibliography	38

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 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.

ISO 5577 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 138, *Non-destructive testing*, in collaboration with ISO Technical Committee TC 135, *Non-destructive testing*, Subcommittee SC 3, *Ultrasonic testing*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 5577:2000), which has been technically revised with changes to terms and definitions and structure.

Non-destructive testing — Ultrasonic testing — Vocabulary

1 Scope

This document defines the terms used in ultrasonic non-destructive testing and forms a common basis for standards and general use. This document does not cover terms used in ultrasonic testing with phased arrays.

NOTE Terms for phased array ultrasonic testing are defined in EN 16018.

2 Normative references

There are no normative references in this document.

3 Terms related to frequencies, waves and pulses

For the purposes of this document, the terms and definitions given in this clause and those given in Clauses 4, 5 and 6 for sound, test equipment and ultrasonic testing 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>

3.1 Frequencies

3.1.1

frequency

number of cycles per second

Note 1 to entry: Expressed in Hertz (Hz).

3.1.2

nominal frequency

probe frequency

frequency (3.1.1) of the *probe* (5.2.1) as stated by the manufacturer

3.1.3

test frequency

effective ultrasonic frequency of a system used to test a material or object

3.1.4

frequency spectrum

distribution of *amplitude* (3.2.2) in relation to *frequency* (3.1.1)

Note 1 to entry: See [Figure 1](#).

3.1.5

centre frequency

arithmetic mean of the cut-off frequencies

Note 1 to entry: See [Figure 1](#).

3.1.6

peak frequency

frequency (3.1.1) at which the maximum amplitude is observed

Note 1 to entry: See Figure 1.

3.1.7

cut-off frequency

frequency (3.1.1) at which the amplitude (3.2.2) of transmitted signal has dropped by a specified amount from the amplitude at peak frequency (3.1.6), for example, by 3 dB

Note 1 to entry: See Figure 1.

3.1.8

bandwidth

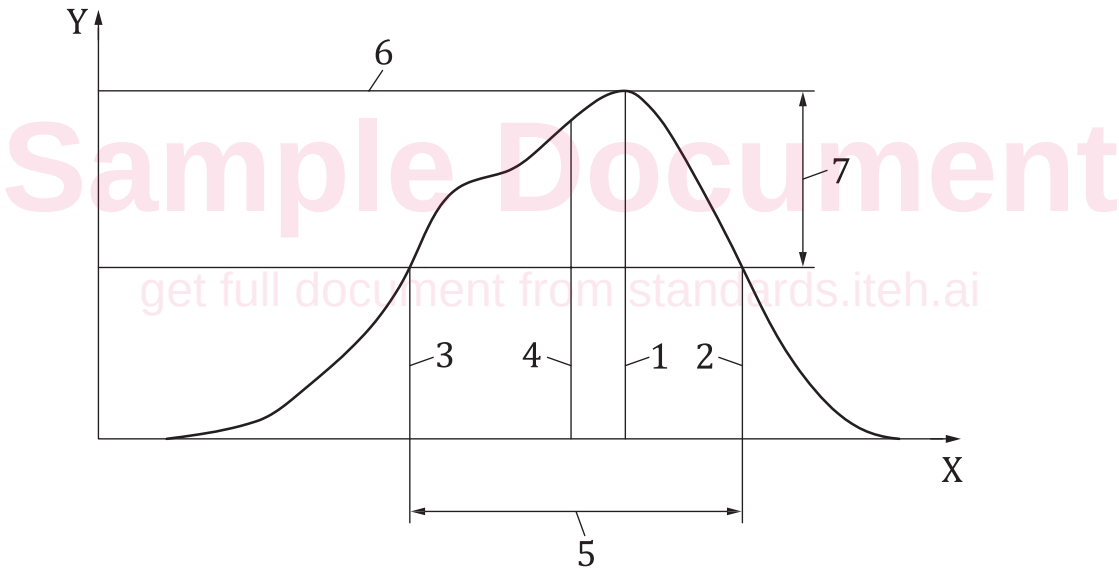
width of the frequency spectrum (3.1.4) between the upper and lower cut-off frequency

Note 1 to entry: See Figure 1.

3.1.9

relative bandwidth

ratio of the bandwidth (3.1.8) to the centre frequency (3.1.5), in per cent



Key

X	frequency	4	centre frequency
Y	amplitude	5	bandwidth at specified amplitude drop
1	peak frequency	6	peak amplitude
2	upper cut-off frequency	7	specified amplitude drop
3	lower cut-off frequency		

Figure 1 — Terms related to frequency and bandwidth

3.2 Waves and pulses

3.2.1

ultrasonic wave

any acoustic wave having a frequency (3.1.1) higher than the audible range of the human ear, generally taken as higher than 20 kHz

3.2.2**amplitude**

absolute or relative measure of a sound wave's magnitude

3.2.3**phase**

momentary condition of a vibration expressed as an arc measurement or an angle

3.2.4**wavelength**

distance between consecutive corresponding points of the same *phase* (3.2.3)

Note 1 to entry: See [Figure 2](#).

3.2.5**wavefront**

continuous surface joining all the most forward points of a wave that have the same *phase* (3.2.3)

3.2.6**time-of-flight****TOF**

time it takes an ultrasonic pulse to travel from the transmitter probe through the test object to the receiver probe

3.2.7**pulse**

electrical or ultrasonic signal of short duration

3.2.8**pulse amplitude**

maximum amplitude of a *pulse* (3.2.7) (peak-to-peak)

Note 1 to entry: For rectified pulses (A-scan), baseline-to-peak.

3.2.9**pulse rise time**

time taken for a *pulse amplitude* (3.2.8) to change between two defined levels

3.2.10**pulse duration**

time interval between the leading and trailing edges of a *pulse* (3.2.7) measured at a defined level below the peak amplitude

3.2.11**pulse shape**

diagrammatic representation of the *amplitude* (3.2.2) of a *pulse* (3.2.7) as a function of time

3.2.12**pulse envelope**

contour of a *pulse shape* (3.2.11) including all the peaks in terms of *amplitude* (3.2.2) and time

3.2.13**pulse energy**

total energy within a *pulse* (3.2.7)

3.2.14**pulse reverberation**

undesirable vibration at the beginning and end of a *pulse* (3.2.7) above a defined level

3.2.15**broad-band pulse**

pulse (3.2.7) in which the *relative bandwidth* (3.1.9) is ≥ 65 %

3.2.16

medium-band pulse

pulse (3.2.7) in which the *relative bandwidth* (3.1.9) is >35 % and <65 %

3.2.17

narrow-band pulse

pulse (3.2.7) in which the *relative bandwidth* (3.1.9) is ≤35 %

3.2.18

pulse repetition frequency

PRF

number of pulses (3.2.7) generated per second, expressed in Hertz (Hz)

3.3 Types of waves

3.3.1

longitudinal wave

compressional wave

wave in which the direction of displacement of particles is in the same direction as the propagation of the wave

Note 1 to entry: See [Figure 2 a](#)).

3.3.2

transverse wave

shear wave

wave in which the direction of displacement of particles is perpendicular to the direction of the propagation of the wave

Note 1 to entry: See [Figure 2 b](#)).

3.3.3

surface wave

Rayleigh wave

wave which propagates on the surface of a material with an effective penetration depth of less than one *wavelength* (3.2.4)

3.3.4

creeping wave

wave generated at the first *critical angle* (4.4.11) of incidence and propagated along the surface as a *longitudinal wave* (3.3.1)

Note 1 to entry: It is not influenced by the test object's surface conditions, nor does the beam follow undulations on the surface.

3.3.5

plate wave

Lamb wave

wave which propagates within the whole thickness of a plate and which can only be generated at particular values of angle of incidence, *frequency* (3.1.1) and plate thickness

3.3.6

plane wave

wave with a planar wave front

3.3.7

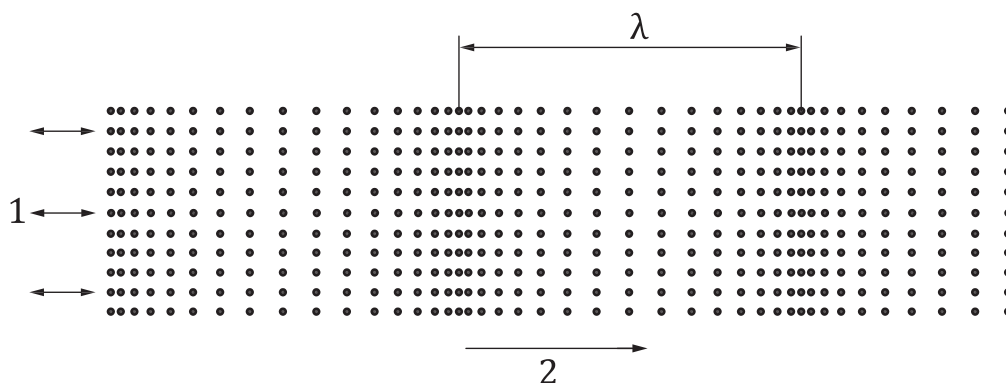
cylindrical wave

wave with a cylindrical wave front

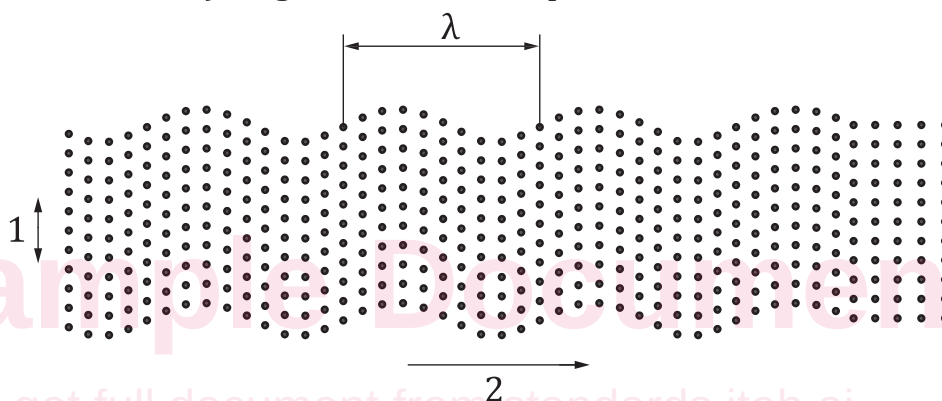
3.3.8

spherical wave

wave with a spherical wave front



a) Longitudinal wave; compressional wave



b) Transverse wave; shear wave

Key

- 1 direction of oscillation
- 2 direction of propagation
- λ wavelength

Figure 2 — Types of waves

4 Terms related to sound

4.1 Sound generation and reception

4.1.1

transducer

active element of a *probe* (5.2.1) which converts electrical energy into sound energy and vice versa

4.1.2

piezo-electric transducer

transducer (4.1.1) made from piezo-electric material

4.1.3

composite transducer

plate consisting of piezo-electric ceramic rods embedded in a polymer matrix

4.1.4

electro-magnetic acoustic transducer

EMAT

transducer (4.1.1) which uses magnetostriction or Lorentz force to generate ultrasound in paramagnetic materials

4.1.5

focusing transducer

piezo-electric transducer (4.1.2) having at least one curved surface, used for focusing the sound beam (4.2.2)

4.2 Sound propagation

4.2.1

sound field

three-dimensional pressure distribution produced by transmitted sound energy

4.2.2

sound beam

ultrasonic beam

part of the *sound field* (4.2.1) within which the major part of the ultrasonic energy is transmitted

4.2.3

beam axis

line through the points of maximum sound pressure at different distances

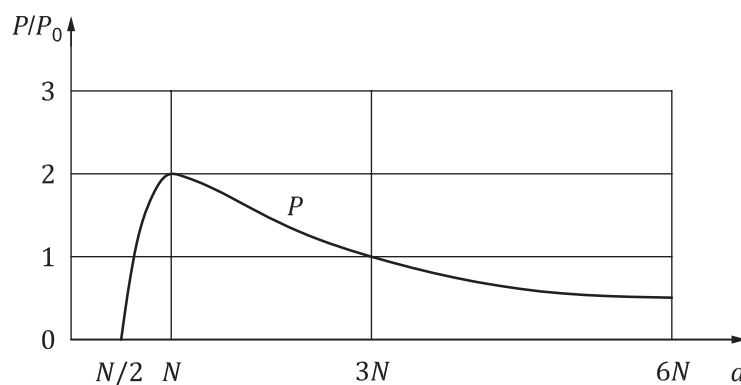
Note 1 to entry: See [Figures 3 b\)](#), [8](#), [9](#), [10](#) and [11](#).

4.2.4

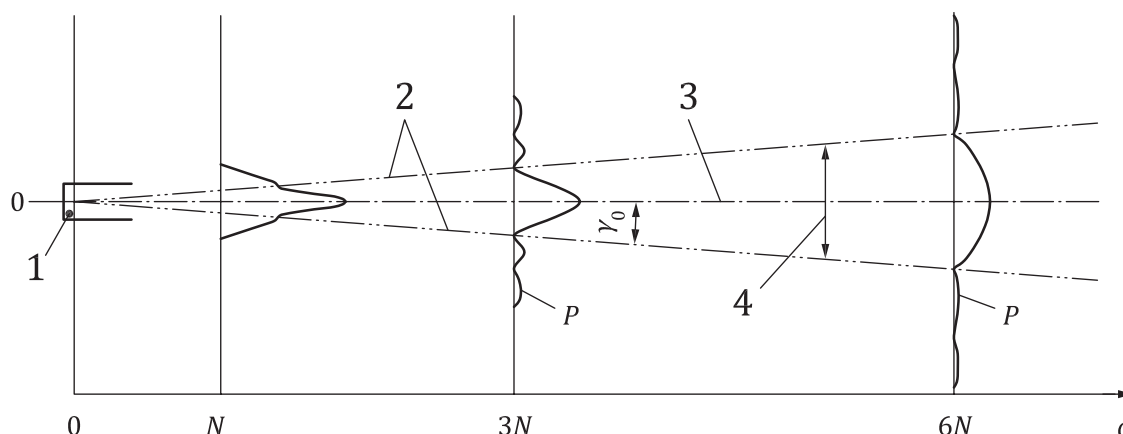
beam profile

curve which shows the signal amplitude along the *beam axis* (4.2.3) or perpendicular to the beam axis at a defined distance from the *probe* (5.2.1)

Note 1 to entry: See [Figure 3](#).



a) Profile along the beam axis



b) Profiles perpendicular to the beam axis

Key

1	transducer	γ_0	angle of divergence (drop to zero)
2	beam boundary	a	distance
3	beam axis	N	near-field length
4	beam width at a given distance	P	sound pressure

Figure 3 — Beam profiles**4.2.5
beam boundary**

boundary of the ultrasonic beam where the sound pressure has fallen to a given fraction of the value on the *beam axis* (4.2.3), measured at the same distance from the *probe* (5.2.1)

Note 1 to entry: See Figures 3 b), 8, 9 and 11.

**4.2.6
beam width**

dimension of the beam perpendicular to the *beam axis* (4.2.3) measured between the beam boundaries at a defined distance from the *probe* (5.2.1)

Note 1 to entry: See Figure 3 b).

**4.2.7
angle of divergence**

angle within the *far-field* (4.2.11) between the *beam axis* (4.2.3) and the *beam boundary* (4.2.5)

Note 1 to entry: See Figures 3 b), 8 and 11.

**4.2.8
near-field**

Fresnel zone

zone of the *sound beam* (4.2.2) where sound pressure does not change monotonically with distance because of interference

Note 1 to entry: See Figure 8.

**4.2.9
near-field point**

position on the *beam axis* (4.2.3) where the sound pressure reaches a final maximum

4.2.10

near-field length

distance between the *transducer* (4.1.1) and the *near-field point* (4.2.9)

Note 1 to entry: See [Figure 3](#).

4.2.11

far-field

zone of the *sound beam* (4.2.2) that extends beyond the *near-field point* (4.2.9)

Note 1 to entry: See [Figures 8](#) and [11](#).

4.2.12

focal point

focus

point where the sound pressure on the *beam axis* (4.2.3) is at its maximum

4.2.13

focal distance

focal length

distance from the *probe* (5.2.1) to the *focal point* (4.2.12)

Note 1 to entry: See [Figures 8](#) and [11](#).

4.2.14

focal zone

focal range

zone in *sound beam* (4.2.2) of a *probe* (5.2.1) in which the sound pressure remains above a defined level related to its maximum

4.2.15

length of the focal zone

distance along the *beam axis* (4.2.3) from the start to the end of the *focal zone* (4.2.14)

4.2.16

width of the focal zone

dimension of the *focal zone* (4.2.14) at *focal distance* (4.2.13) perpendicular to the *beam axis* (4.2.3)

4.2.17

acoustical properties

characteristic parameters of a material which control the propagation of sound in the material

4.2.18

acoustically anisotropic material

material which has differing sound velocities in differing directions of propagation

4.2.19

sound velocity

velocity of propagation

phase velocity (4.2.20) or *group velocity* (4.2.21) of a sound wave in a material in the direction of propagation

Note 1 to entry: In a non-dispersive material, there is no difference between phase and group velocity.

Note 2 to entry: In an anisotropic material, the velocities may depend on the direction of propagation.

4.2.20

phase velocity

velocity of propagation (4.2.19) of a wave front