

Australian Standard[®]

Non-destructive testing—Glossary of terms



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- Australian Aerospace Non-Destructive Testing Committee
 - Australian Industry Group
 - Australian Institute for Non-Destructive Testing
 - Australian Nuclear Science & Technology Organisation
 - Australian Pipeline Industry Association
 - Bureau of Steel Manufacturers of Australia
 - Engineers Australia
 - Metals Trade Industry Association
 - National Association of Testing Authorities Australia
 - New Zealand Non-Destructive Testing Association
 - NSW WorkCover Authority
 - Victorian WorkCover Authority
 - Welding Technology Institute of Australia
-

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Non-destructive testing—Glossary of terms

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PREFACE

This Standard was prepared by the Australian members of the Joint Standard Australia/New Zealand Committee MT-007, Non-destructive Testing and Metals and Materials. This Standard supersedes AS 1929—1981, *Non-destructive testing—Glossary of terms*.

After consultation with shareholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to provide a list of current terms used in the non-destructive testing industry and to delete terms from the Standard that have become redundant.

The objective of this edition is to revise the terms used in non-destruction testing and to introduce terms that relate to condition monitoring, in particular infrared thermography.

During the revision of this Standard, the committee considered only those terms in constant use in the non-destructive testing industry in Australia, and which relate to non-destructive testing methods.

During the preparation of this Standard, cognisance was taken of the following Standards:

ISO

5576 Non-destructive testing—Industrial X-ray and gamma ray radiography—Vocabulary

5577 Non-destructive testing—Ultrasonic inspection—Vocabulary

12706 Non-destructive testing—Terminology—Terms used in penetrant testing

12716 Non-destructive testing—Acoustic emission inspection—Vocabulary

13372 Condition monitoring and diagnostics of machines—Vocabulary

18434 Condition monitoring and diagnostics of machines—Thermography

18434-1 Part 1: General procedures

Terms that specifically relate to a particular field of testing have been placed in the appropriate section, and cross referencing has been used where terms are related.

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FOREWORD

Many terms that relate to the non-destruction testing industry are known by more than one name, but, unfortunately, each name is not always used with the same meaning; moreover, in the case of some defects/methods, the same name may be used by two persons to indicate two entirely different types of defects/methods. Such variations in meaning have led to confusion, especially where writing is the only form of communication in the exchange of ideas.

This Standard concentrates on definitions of those terms that relate to the non-destructive testing industry.

STANDARDS AUSTRALIA

Australian Standard
Non-destructive testing—Glossary of terms

SECTION 1 GENERAL TERMS AND
 DEFINITIONS

Term	Definition
acceptable quality level (AQL)	Maximum percent defective or the maximum number of units defective per hundred units which, for the purpose of a sampling test, can be considered satisfactory as a process average.
acceptance criteria	Criteria against which the specimen is examined in order to determine its acceptability.
acceptance level	Set of prescribed parameters setting the threshold for acceptance or rejection.
acoustic testing	The method of non-destructive testing which uses acoustic energy usually within the frequency range 1 MHz to 10 MHz.
artificial discontinuity	Discontinuities such as holes, grooves or notches that are introduced into a piece by machining or any process.
calibration, instrument	Comparison of an instrument with, or the adjustment of an instrument to, known reference(s).
defect	One or more flaws whose aggregate size, shape, orientation, location or properties do not meet specified acceptance criteria and are rejectable.
detection sensitivity	Capacity of an NDT technique to detect discontinuities NOTE: The higher the detection sensitivity, the greater its capability of detecting a small discontinuity (see detection threshold).
detection threshold	Lowest limit of detection of indications.
discontinuity	Lack of continuity or cohesion by way of an intentional or unintentional interruption in the physical structure or configuration of a material or component.
eddy current testing	The method in which eddy current flow is induced and monitored in the product under test. Changes in current flow are subsequently analysed.
electromagnetic testing	The method of non-destructive testing which uses electromagnetic energy having frequencies less than visible light. It covers eddy current, magnetic field, leakage field pick-up and direct current conduction tests.

Term	Definition
false indication	Representation or signal, in the format allowed by the non-destructive testing method used, which is interpreted to be caused by a condition other than a discontinuity or imperfection.
flaw	Imperfection or discontinuity that may be detectable by NDT and is not necessarily rejectable.
flaw characterization	Process of quantifying the size, shape, orientation, location, growth or other properties of a flaw, based on NDT response.
imperfection	Departure of a quality characteristic from its intended condition.
indication	Representation or signal from a discontinuity in the format allowed by the NDT method used.
interpretation	Determination of whether indications are relevant, non-relevant or false.
magnetic particle testing	The method of non-destructive testing which involves the generation of a magnetic flux within magnetic materials, used to detect surface or near surface discontinuities. Testing also involves the application of suitable magnetic particles to the surface of the material to give an indication of a discontinuity.
noise	Any undesired signal or response that tends to interfere with the reception, interpretation or processing of the desired signal or response.
non-destructive evaluation	<i>See non-destructive testing.</i>
non-destructive examination	<i>See non-destructive testing.</i>
non-destructive inspection	<i>See non-destructive testing.</i>
non-destructive testing (NDT)	Development and application of technical methods to examine materials or components in ways that do not impair their future usefulness and serviceability, in order to detect, locate, measure and evaluate flaws, to assess integrity, properties and composition, and to measure geometrical characteristics.
non-relevant indication	NDT indication that is caused by a condition or type of discontinuity that is not rejectable. NOTE: False indications are non-relevant.
penetrant testing	The method of non-destructive testing which involves the application of a penetrant to materials to detect and locate discontinuities such as laps, folds, cracks, porosity and fissures which are open to the surface. The method also involves the removal of excess penetrant, and if necessary, the application of a developer to produce a visible indication of a discontinuity.

Term	Definition
radiation testing	The method of non-destructive testing which uses X-rays or gamma rays in order to produce a graphic record on sensitized film which indicates comparative soundness of the material under test.
reference block	Piece of material, with specified metallurgical, geometrical and dimensional characteristics, used for the calibration and assessment of equipment. NOTE: A reference block may contain one or more artificial discontinuities.
reference test piece	Piece of material containing well-defined discontinuities used to set or check the sensitivity of the equipment and/or the process.
relevant indication	NDT indication that is caused by a condition or type of discontinuity that requires evaluation.
resolution	Ability to distinguish meaningfully between closely adjacent discontinuities.
sizing	Determination of the dimensions of discontinuities or indications for evaluation.
viewing	Systematic scanning of the data or evidence produced as a result of NDT in order to determine the presence or absence of indications.
viewing conditions	Description of the surrounding environmental conditions during the process of viewing.

SECTION 2 ACOUSTIC EMISSION INSPECTION

Term	Definition
acoustic emission (AE)	Class of phenomena whereby transient elastic waves are generated by the rapid release of energy from localized sources within a material, or the transient waves so generated. NOTE: Acoustic is the recommended term for general use. Other terms that have been used in AE literature include: (a) Stress wave emission. (b) Microseismic activity. (c) Emission or acoustic emission with other qualifying modifiers.
acousto-ultrasonics (AU)	Non-destructive examination method that uses induced stress waves to detect and assess diffuse defect states, damage conditions and variations of mechanical properties of a test structure combining aspects of acoustics emission (AE) signal analysis with ultrasonic materials characterization techniques.
AE signal duration	Time interval between AE signal start and AE signal end.
AE signal end	Recognized termination of an AE signal, usually defined as the last crossing of the threshold by that signal.
AE signal generator	Device which can repeatedly induce a specified transient signal into an AE instrument.
AE signal rise time	Time interval between AE signal start and the peak amplitude of that AE signal.
AE signal start	Beginning of an AE signal as recognized by the system processor, usually defined by an amplitude excursion proceeding threshold.
array	Group of two or more AE sensors positioned on a structure for the purposes of detecting and locating sources that would normally be within the array.
attenuation	Decrease in AE amplitude per unit distance normally expressed in dB per unit length.
average signal level	Rectified time-averaged AE logarithmic signal, measured on the AE amplitude logarithmic scale and reported in dB _{AE} units (where 0 dB _{AE} refers to 1 µV at the preamplifier input).

Term	Definition
channel, acoustic emission	Assembly of a sensor, preamplifier or impedance matching transformer, filters, secondary amplifier or other instrumentation as needed, connecting cables, and detector or processor. NOTE: A channel for examining fibreglass reinforced plastic (FRP) may utilize more than one sensor with associated electronics. Channels may be processed independently or in predetermined groups having similar sensitivity and frequency characteristics.
count, acoustic emission (N)	Number of times the acoustic emission signal exceeds a preset threshold during any selected portion of a test. NOTE: Also known as ‘count’, ‘ring-down’, ‘ring-down count’ or ‘emission count’.
count, event (N_e)	Number obtained by counting each discerned acoustic emission event once.
count rate, acoustic emission ($\dot{N}$)	Time rate at which emission counts occur. NOTE: Also known as ‘emission rate’ or ‘count rate’.
couplant	Material used at the structure-to-sensor interface to improve the transmission of acoustic energy across the interface during acoustic emission monitoring.
dead time	Instrumentation dead time any interval during data acquisition when the instrument or system is unable to accept new data for any reason.
distribution, amplitude, cumulative (acoustic emission) ($F(V)$)	Number of acoustic emission events with signals that exceed an arbitrary amplitude as a function of amplitude V.
distribution, threshold crossing, cumulative (acoustic emission) ($F_t(V)$)	Number of times the acoustic emission signal exceeds an arbitrary threshold as a function of the threshold voltage V.
distribution, differential ($f(V)$)	Number of acoustic emission events with signal amplitudes between amplitudes of V and $V + \Delta V$ as a function of the amplitude V where $f(V)$ is the absolute value of the derivative of the cumulative amplitude distribution $F(V)$. NOTE: Also known as ‘differential (acoustic emission) amplitude distribution’ or ‘(acoustic emission) amplitude’.
distribution, differential (acoustic emission) threshold crossing ($f_t(V)$)	Number of times the acoustic emission signal waveform has a peak between the thresholds V and $V + \Delta V$ as a function of the threshold V where $f_t(V)$ is the absolute value of the derivative of the cumulative threshold crossing distribution.

Term	Definition
distribution, logarithmic ($g(V)$)	Number of acoustic emission events with signal amplitudes between V and αV (where α is a constant multiplier) as a function of the amplitude. NOTES: 1 Also known as ‘logarithmic (acoustic emission) amplitude distribution’. 2 This is a variant of the differential amplitude distribution.
dynamic range	Difference, in decibels, between the overload level and the minimum signal level (usually fixed by one or more of the noise levels, low-level distortion, interference or resolution level) in a system or sensor.
effective velocity	Velocity calculated on the basis of arrival times and propagation distances determined by artificial AE generation and used for computed location.
emission, burst	Burst emission, qualitative description of the discrete signal related to an individual emission event occurring within the material. NOTE: Use of the term ‘burst emission’ is recommended only for describing the qualitative appearance of emission signals. Figure 2.1 shows oscilloscope traces of a continuous emission at two different sweep rates.
emission, continuous	Continuous emission, qualitative description of the sustained signal level produced by rapidly occurring acoustic emission events. NOTE: Use of the term ‘continuous emission’ is recommended only for describing the qualitative appearance of emission signals. Figure 2.2 shows oscilloscope traces of a continuous emission signal at two different sweep rates.
energy, acoustic emission event	Total elastic energy released by an emission event.
evaluation threshold	Threshold value used for analysis of the examination data. NOTE: Data may be recorded with a system examination threshold lower than the evaluation threshold. For analysis purposes, dependence of measured data on the system examination threshold must be taken into consideration.
event, acoustic emission	Local material change giving rise to acoustic emission.
examination area	That portion of a structure being monitored using acoustic emission.
examination region	That portion of the test evaluated using acoustic emission technology.
felicity effect	Presence of detectable acoustic emission at a fixed predetermined sensitivity level at stress levels below those previously applied.

Term	Definition
felicity ratio	Ratio of the stress at which the felicity effect occurs to the previously applied maximum stress. NOTE: The fixed sensitivity level will usually be the same as was used for the previous loading or test.
floating threshold	Any threshold with amplitude established by a time average measure of the input signal.
hit	Any signal that exceeds the threshold and causes a system channel to accumulate data.
interval, arrival time (Δt_{ij})	Time interval between the detected arrivals of an acoustic emission wave at the i th and j th sensors of a sensor array.
kaiser effect	Absence of detectable acoustic emission at a fixed sensitivity level, until previously applied stress levels are exceeded.
location cluster	Location method based upon a specified amount of AE activity located within a specified length or area, e.g. 5 events within 12 linear units (e.g. cm) or 12 square units (e.g. cm ²).
location, computed	Source location method based on algorithmic analysis of the difference in arrival times among sensors. NOTES: 1 Also known as 'adaptive location'. 2 Several approaches to computed location are used, including linear location, three dimensional location and adaptive location.
linear location	One-dimensional source location requiring two or more channels.
planar location	Two-dimensional source location requiring three or more channels.
3-D location	Three-dimensional source location requiring five or more channels.
adaptive location	Source location by iterative use of simulated sources in combination with computed location.
location, continuous AE signal	Method of location based on continuous AE signals, as opposed to hit or difference in arrival time location methods. NOTE: This type of location is commonly used in leak location due to the presence of continuous emission. Some common types of continuous signal location methods include signal attenuation and correlation analysis methods.
signal attenuation-based source location	Source location method that relies on the attenuation versus distance phenomenon of AE signals, by monitoring the AE signal magnitudes of the continuous signal at various points along the object, the source is determined based on the highest magnitude or by interpretation or extrapolation of multiple readings.

Term	Definition
correlation-based source location	Source location method that compares the changing AE signal levels (usually waveform based amplitude analysis) at two or more points surrounding the source and determines the time displacement of these signals, this time displacement data being used with conventional hit-based location techniques to arrive at a solution for the source site.
location, source	Any of several methods of evaluating AE data to determined the position on the structure from which it originated. NOTE: Several approaches to source location are used, including zone location, computed, and continuous location.
location, zone	Any of several techniques for determining the general region of an acoustic emission source, e.g. total AE counts, energy, hits, etc. NOTES: 1 Also known as 'first-hit location'. 2 Several approaches to zone location are used, including independent channel zone location, first-hit zone location and arrival sequence zone location.
independent channel zone location	Zone location technique that compares the gross amount of activity from each channel.
first-hit zone location	Zone location technique that compares only activity from the first-hit channel among a group of channels.
arrival sequence zone location	Zone location technique that compares the order of arrival among sensors.
location accuracy	Comparison of the actual position of an AE source (or simulated AE source) to the computed location.
overload recovery time	Interval of nonlinear operation of an instrument caused by a signal with amplitude in excess of the instrument's linear operating range.
processing, capacity	Number of hits that can be processed at the processing speed before the system must interrupt data collection to clear buffers or otherwise prepare for accepting additional data.
processing speed	Sustained rate in hits per second, as a function of the parameter set and number of active channels, at which AE signals can be continuously processed by a system without interruption for data transport.
rate, event count ($\dot{N}_e$)	Time rate of the event count.
sensor, acoustic emission	Detection device, generally piezoelectric, that transforms the particle motion produced by an elastic wave into an electrical signal. NOTE: Also known as 'acoustic emission transducer'.

Term	Definition
signal, acoustic emission	Electrical signal obtained by detection of one or more acoustic emission events. NOTE: Also known as 'emission signal'.
signal amplitude, acoustic emission	Peak voltage of the largest excursion attained by the signal waveform from an emission event.
signal overload level	That level above which operation ceases to be satisfactory as a result of signal distortion, overheating or damage.
signal overload point	Maximum input signal amplitude at which the ratio of output to input is observed to remain within a prescribed linear operating range.
signature, acoustic emission	Characteristics set of reproducible attributes of acoustic emission signals associated with a specific test article as observed with a particular instrumentation system under specified test conditions. NOTE: Also known as 'signature'.
stimulation	Application of a stimulus such as force, pressure, heat, etc, to a test article to cause activation of acoustic emission sources.
system examination threshold	Electronic instrument threshold (see evaluation threshold) at which data is detected.
transducers, acoustic emission	Active element in an acoustic emission sensor, usually piezoelectric.
voltage threshold	Voltage level on an electronic comparator above which signals will be recognized. NOTE: The voltage threshold may be user-adjustable, fixed or automatic floating.
waveguide, acoustic emission	Device that couples elastic energy from a structure or other test object to a remotely mounted sensor during AE monitoring. NOTE: An example of an acoustic emission waveguide would be a solid wire or rod that is coupled at one end to a monitored structure, and to a sensor at the other end.

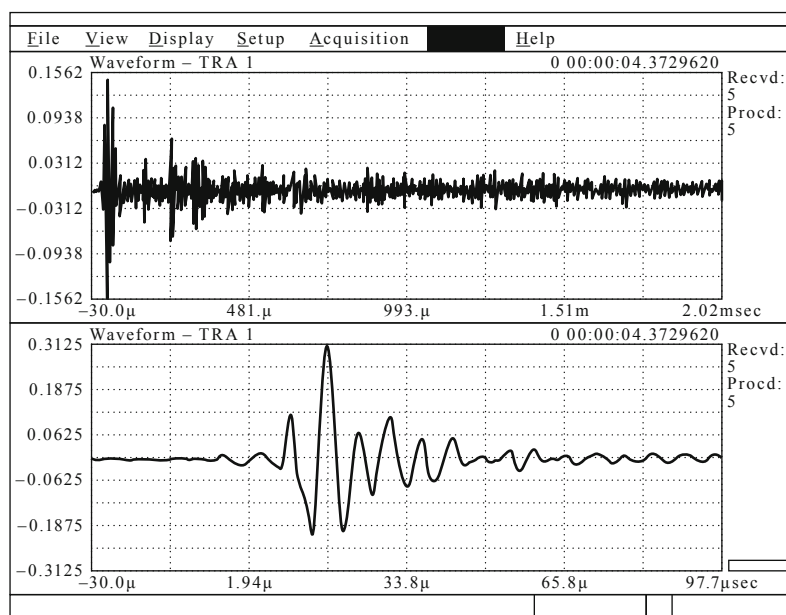


FIGURE 2.1 SAME BURST EMISSION SIGNAL AT TWO DIFFERENT SWEEP RATES

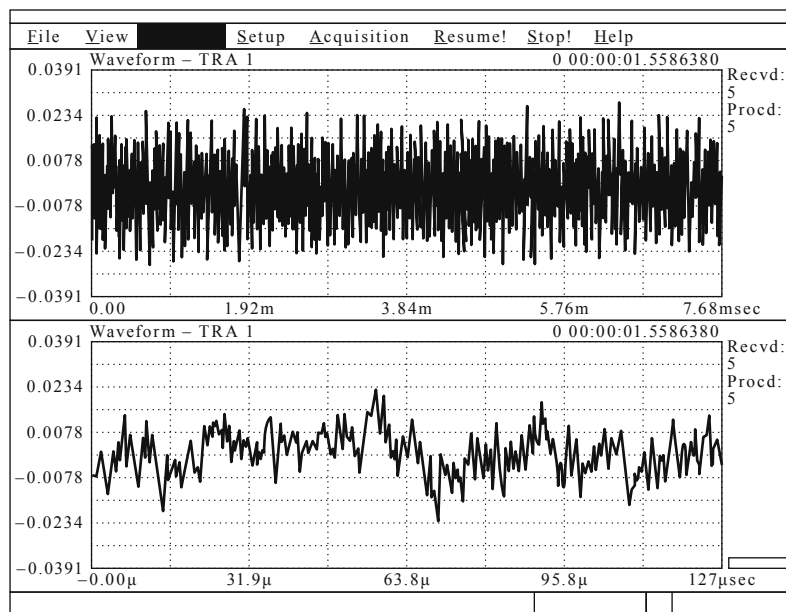


FIGURE 2.2 SAME CONTINUOUS EMISSION SIGNAL AT TWO DIFFERENT SWEEP RATES

SECTION 3 ULTRASONIC INSPECTION

3.1 GENERAL

Term	Definition
acoustical absorption	Component of the attenuation resulting from transformation of ultrasonic energy into other types of energy (e.g. thermal).
acoustical anisotropy	In relation to piezo-electric materials, the relative differences of sound strengths generated in different directions, for a given stimulus.
acoustical impedance	Ratio of sound pressure to sound velocity at a point of a given material, usually expressed as the product of sound velocity and density.
acoustic shadow	Shadow zone, region in a body which cannot be reached by ultrasonic energy travelling in a given direction because of the geometry of the body or a discontinuity in it, see Figure 3.6.
attenuation	Sound attenuation, decrease of a sound pressure when a wave travels through a material, arising from absorption and scattering.
attenuation co-efficient	Coefficient used to express attenuation per unit of distance travelled, dependent on material properties, wavelength and wave mode, usually expressed in dB/m.
beam axis	Line through the points of maximum sound pressure in the far field extended to the source of sound, see Figures 3.2, 3.10, 3.11, 3.12 and 3.16.
beam edge	Boundary of the ultrasonic beam in the far field where the sound pressure has fallen in a given fraction of the value on the beam axis, measured at the same distance from the probe. See Figure 3.2.
beam profile	Form of the sound beam that is defined by the beam edges.
beam spread	Divergence of the sound beam as the sound travels through a material.
decibel (dB)	Twenty times the base ten logarithm of the ratio of two ultrasonic signal amplitudes. $Db = 20 \times \log_{10} (\text{amplitude ratio})$
discontinuity	See Section 1 and also see Figures 3.6, 3.10, 3.11, 3.13, 3.14, 3.16, 3.17.1, 3.17.2, 3.17.3, 3.18 and 3.19.
edge effect	Phenomenon resulting from the diffraction of an ultrasonic wave by the edges of the reflector.
far field	Zone of the ultrasonic beam that extends beyond the last pressure maximum of the beam axis, see Figure 3.2.

Term	Definition
flaw	Defect, discontinuity which is deemed to be recordable, see Figures 3.6, 3.10, 3.11, 3.13, 3.14, 3.16, 3.17.1, 3.17.2, 3.17.3, 3.18 and 3.19.
interface	Boundary between two materials in acoustic contact, having different acoustic impedances, see Figure 3.4.
loss of back reflection	Absence or significant reduction in the amplitude of the indication from the back surface of the part under test.
near field	Fresnel zone, zone of the ultrasonic beam where sound pressure is not related directly to distance because of interference, see Figure 3.2.
near field length	Distance from the source of the ultrasonic signal to the near field point, see Figure 3.3.
near field point	Position in an ultrasonic beam where the sound pressure on the beam axis reaches a final maximum before far field, see Figure 3.3.
propagation time	Time of flight, time for the transmitted ultrasonic signal to reach the receiving points.
reflection coefficient	Ratio of total reflected sound pressure to incident sound pressure at a reflecting surface.
reflector	Interface at which an ultrasonic beam encounters a change in acoustic impedance.
scattering	Random reflection caused by grain structure and/or by small reflectors in the beam path.
sound-field	Three-dimensional pressure pattern produced by transmitted sound energy, see Figure 3.3.
sound velocity	Velocity of propagation phase or group velocity of an acoustic wave in a non dispersive material relative to the propagating direction.
test frequency	Effective ultrasonic wave frequency used to test the object, usually measured at the receiving point.
ultrasonic beam	Sound beam field within the major part of the ultrasonic energy is transmitted in a non-dispersive material, see Figures 3.2 and 3.6.
ultrasonic wave	Any acoustic wave having a frequency higher than the audible range of the human ear, generally taken as higher than 20 kHz.

3.2 WAVES

compressional wave	Longitudinal wave, wave mode in which the particle motion is in the same direction as the propagation of the wave, see Figure 3.1(a).
continuous wave	Constant flow of ultrasonic waves, as opposed to pulsation.
creeping wave	Wave generated at the first critical angle of incidence and propagated along the surface as longitudinal wave.

Term	Definition
mode conversion	Mode transformation, wave conversion, transformation of a wave mode to another during refraction or reflection.
plate wave	Lamb wave, wave mode which propagates within the thickness of thin plate and which can be generated only at particular values of angle of incidence, frequency and plate thickness.
shear wave	Transverse wave, wave mode in which the particle motion at each point in a medium is at right angles to the direction of the propagation of the wave, see Figure 3.1(b). NOTE: This exists only in solids.
spherical wave	Wave with a spherical wavefront.
surface wave	Rayleigh wave, wave mode which propagates on the surface of a medium with an effective penetration of approximately one wavelength.
wavefront	Continuous surface joining all points of a wave that have the same phase.
wavelength (λ)	Distance travelled by a wave during a complete cycle, see Figure 3.1.
wave train	Succession of a determined number of ultrasonic waves, arising from the same source and having the same character, propagating along the same path.

3.3 ANGLE

angle of incidence	Angle between the incident beam axis and the normal to the interface, see Figures 3.4 and 3.9.
angle of reflection	Angle between the reflected beam axis and the normal to the interface, see Figure 3.4.
angle of refraction	Angle between the refracted beam axis and the normal to the interface, see Figures 3.4, 3.9 and 3.10.
critical angle	Angle of incidence at an interface between two different materials beyond which the mode of propagation is changed after refraction. NOTE: The first critical angle is the angle beyond which the incident sound is only refracted as shear waves. The second critical angle is the angle beyond which no more shear waves are refracted. The Rayleigh angle is the angle at which surface waves (Rayleigh waves) are generated.
divergence angle	Angle within the far field between the beam axis and the beam edge at which the amplitude has fallen to a defined level, see Figure 3.2.

3.4 PULSE AND ECHO

Term	Definition
back wall echo (B)	Pulse reflected from a boundary surface which is perpendicular to the ultrasonic beam axis normally used for the echo from the opposite surface when testing an object with parallel surfaces with a normal probe, see Figures 3.17.1 and 3.17.2. NOTE: Also known as 'bottom echo', 'back surface echo' or 'back reflection'.
delayed echo	Echoes which reach the same receiving point later than other echoes from the same reflector, due to mode conversion or different path.
echo	Sound pulse reflected to the probe. NOTE: Also known as 'reflexion'.
flaw echo	Indication of an echo from a flaw or discontinuity, see Figures 3.17.1, 3.17.2 and 3.17.3. NOTE: Defect echo (F), Discontinuity echo (D).
ghost echo	Echo originating from a transmitted pulse generated in a previous cycle. NOTE: Also known as 'phantom echo' or 'wrap-around'.
grass	Spatially random signals arising from the echoes from grain boundaries and/or microscopic reflectors in a material. NOTE: Also known as 'structural echoes'.
interface echo	Echo from the interface between dissimilar materials.
multiple echo	Repeated reflections of an ultrasonic pulse between two or more interfaces or discontinuities. NOTE: Also known as 'multiple reflection'.
pulse	Electrical or ultrasonic signal of short duration
side wall echo (W)	Indication of an echo from a surface other than the back wall and test surface, see Figure 3.17.1.
spurious echo	Indication not associated with a discontinuity. NOTE: Also known as 'parasitic echo'
surface echo	Indication of an echo from the first boundary of a body to the probe, usually used in immersion testing techniques or contact testing techniques using delay material with probe, see Figure 3.17.2.
transmission pulse indication (T)	Response of the ultrasonic test instrument display to the transmitter pulse, usually used in an A-scan display, see Figures 3.17.1, 3.17.2 and 3.17.3.
transmitter pulse	Electrical pulse for exciting the probe generated by the transmitter section in the ultrasonic test instrument.

3.5 PROBE

Term

Definition

angle probe

Probe having an angle of incidence other than normal to the test surface, see Figures 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.16, 3.17.2 and 3.17.3.

NOTE: Also known as ‘angle beam probe’ or ‘angle beam search unit’.

centre frequency

Arithmetic mean of the frequencies at which the amplitude is 3 dB below the amplitude at the peak frequency for a through-transmission test and 6 dB for a pulse echo test.

convergence distance

Distance between the test surface of the object and convergence zone for a double transducer probe, see Figure 3.8.

convergence zone

Convergence point, zone or point at the intersection of the axes of the transmitting and receiving beams of a double transducer probe, see Figure 3.8.

delay path

Distance between the transducer and the point of entry into the test object.

depth of field

Zone in the ultrasonic beam of a focussing probe in which the sound pressure remains above a level related to the maximum value, see Figure 3.20.

NOTE: Also known as ‘focal zone’ or ‘focal range’.

double transducer probe

Probe comprising two separate acoustically isolated transducers in a single housing, one for transmission and the other for reception of ultrasonic waves, see Figure 3.8.

NOTE: Also known as ‘twin transducer probe dual search unit’.

effective transducer size

Reduced area of the mechanical size of the transducer, capable of transforming electrical oscillations into sound energy or vice-versa, resulting from the magneto-inductive effect (Lorentz effect)

focal length

Distance from the focal point to the source of sound for a focussing probe, see Figure 3.20.

focal point

Focus point showing the maximum sound pressure at the greatest distance from the source of sound, see Figure 3.20.

focussing probe

Probe from which the sound beam is concentrated by special devices (shaped transducer, lens, electronic process, etc.) to produce a focussing beam or focal point, see Figure 3.20.

immersion probe

Compressional wave probe specially designed to be used in a liquid, see Figure 3.17.2.

nominal angle of probe

Stated nominal value of the refraction angle of a probe for a given material and temperature.

nominal frequency

Nominal frequency of a probe as stated by manufacturer.

Term	Definition
nominal transducer size	Physical size of the transducer. NOTE: Also known as 'transducer size' or 'element size'.
normal probe	Probe from which waves propagate at 90° to the test surface (beam axis at normal incidence), see Figures 3.2, 3.3, 3.6, 3.7(a) and 3.17.1 NOTE: Also known as 'straight beam probe' or 'straight beam search unit'.
peak frequency	Frequency at which the maximum amplitude is observed.
peak number	Number of cycles having an amplitude greater than 20% (−14 dB) of the maximum amplitude in the waveform duration of the received signals, usually used to express the waveform duration of the received echo signal, see Figure 3.5. NOTE: The reciprocal of this number is called 'probe damping factor'.
phased array probe	Probe consisting of several elementary transducers capable of working independently with different amplitudes or phases resulting in various beam angles and focal distances.
probe	Electro-acoustic device usually incorporating one or more transducers intended for transmission and/or reception of the ultrasonic waves. NOTE: Also known as 'search unit device'.
probe damping factor	Reciprocal of the peak number.
probe index	Intersection point of the sound beam axis with the probe surface, see Figures 3.9, 3.12, 3.17.3 and 3.19. NOTE: For an angle probe, this point is usually delineated on lateral face of the probe.
probe shoe	Shaped piece of material which is interposed between the probe and the test object for the purpose of improving the coupling and/or of protecting the probe.
roof-angle	Angle which is half of the angle between the normals to the transducer faces of a double transducer probe, see Figure 3.8. NOTE: Also known as 'toe-in-semi-angle'.
squint angle	The angle between the geometrical axis of the probe and the projection of the beam axis on the test surface, see Figure 3.9. NOTE: Also known as 'angle probe'.
surface wave probe	Probe for generating and/or receiving surface waves.
transducer	Active element of the probe causing the conversion of electrical energy sound energy and vice versa, see Figures 3.7(a), 3.7(b) and 3.8. NOTE: Also known as 'crystal' or 'element'.

Term	Definition
transducer backing	Material coupled to the rear surface of a transducer to increase damping, see Figures 3.7(a), 3.7(b) and 3.8.
variable angle probe	Probe in which the angle of refraction can be changed.
wear plate	Thin layer of protective material forming an integral part of the probe and separating the transducer from direct contact with the test object, see Figure 3.7(a). NOTE: Also known as ‘diaphragm’.
wedge	Specially shaped component (usually made of plastic material) which causes an ultrasonic wave to be refracted into the test object at a defined angle, when placed in acoustical contact between a transducer and a test object, see Figure 3.7(b). NOTE: Also known as ‘refracting prism’.
wheel probe	Probe incorporating one or more transducers mounted inside a liquid-filled flexible tyre the sound beam being coupled to the test object through the rolling contact area of the tyre. NOTE: Also known as ‘wheel search unit’.

3.6 ULTRASONIC TEST INSTRUMENT

amplitude linearity	Measure of the proportionality of the amplitude of the signal input to the receiver and the amplitude of the signal appearing on the display of the ultrasonic test instrument or an auxiliary display.
dead zone	Zone adjacent to the test surface within which the echoes of interest are not revealed.
delayed time-base sweep	Time-base sweep triggered with a given delay—fixed or adjustable—in relation to the transmitter pulse or a reference echo. NOTE: Also known as ‘correction of zero point’.
dynamic range	Range of signal amplitudes that can be handled by the ultrasonic test equipment without overloading or excessive distortion and without being too small for detection.
electronic distance-amplitude-compensation (EDAC)	Function of a device which electronically changes the amplification of echoes from reflectors of equal size but different distances and results in equal height of the echoes.
expanded time-base sweep	Increased speed of time-base sweep which enables echoes from a selected region within the thickness or length of the test object to be displayed in greater detail in the screen image NOTE: Also known as ‘scale expansion’.
flaw (defect) detection sensitivity	Characteristics of ultrasonic test equipment defined by the smallest detectable reflector.

Term	Definition
gain control	Instrument control normally calibrated in decibels with which a signal may be adjusted to a convenient height. NOTE: Also known as 'dB control' or 'gain adjustment'.
gate	Electronic means of selecting a segment of the time base for monitoring or further processing. NOTE: Also known as 'time gate'.
gate level	Defined amplitude level above or below which echo signals in a gate are selected for further processing. NOTE: Also known as 'monitor level'.
pulse (echo) amplitude	Maximum amplitude of a pulse (echo) usually base to peak when an A-scan display is used. NOTE: Also known as 'signal amplitude'.
pulse energy	Total energy within a pulse.
pulse (echo) length	Time interval between the leading and trailing edges of a pulse (echo) measured at a defined level.
pulse repetition frequency (prf)	Number of pulses generated per unit of time, usually expressed in hertz. NOTE: Also known as 'pulse repetition rate'.
pulse shape	Form or a pulse in the time domain.
rejection	Reduction of noise indications (grass) by eliminating all indications below a predetermined amplitude level (threshold level). NOTE: Also known as 'suppression', 'reject' or 'grass cutting'.
resolution	Characteristics of the ultrasonic test equipment defined by the minimum distance between two reflectors providing two dissociable indications. NOTE: Distinction is made between the axial resolution following the direction of propagation and the lateral resolution following a direction perpendicular to it.
time base	Trace (usually horizontal) on the display unit calibrated in time or distance of sound path. NOTE: Also known as 'sweep'.
time base control	Instrument which is used to adjust the time base to a preselected distance. NOTE: Also known as 'sweep control'.
time base linearity	Proportionality between the indication position on the time base and input signals supplied by a calibrated time generator or by multiple echoes from a plate having known thickness.
time base range	Ultrasonic path length that is displayed on a particular time-base. NOTE: Also known as 'test range'.

Term	Definition
ultrasonic test equipment	Equipment consisting of ultrasonic test instrument, probes, cables and all devices connected to the instrument during testing.
ultrasonic test instrument	Instrument used together with the probe or probes which transmits, receives, processes and displays ultrasonic signals for non-destructive signals for non-destructive testing purposes.

3.7 TEST BLOCKS

calibration block	Piece of material of specified composition, surface finish, heat treatment and geometric form, by means of which ultrasonic test equipment can be assessed and calibrated. NOTE: Also known as standard test block.
flat bottom hole (FBH)	Plane circular disc reflector. NOTE: Also known as 'disc flaw' or 'disc shaped reflector'.
reference block	Block of similar composition to component/material under test containing well-defined reflectors, used to adjust the amplitude and/or time scale of the ultrasonic test equipment in order to compare detected discontinuity indications with those arising from the known reflectors, see Figure 3.21.
reference flaw (defect)	Reflector with known form, size and distance from test surface in the calibration block or reference block, which is used for calibration or assessment of flaw detection sensitivity, see Figure 3.21. NOTE: Also known as 'reference reflector'.
side drilled hole (SDH)	Circular cylinder reflector which is created parallel to the test surface. NOTE: Also known as 'side cylindrical hole'.

3.8 TEST TECHNIQUES

angle beam technique	Technique using the ultrasonic beam with an angle probe of incidence other than normal to the test surface, see Figure 3.17.3.
automatic scanning	Mechanical displacement of the probe over the test surface.
contact testing technique	Scanning by means of an ultrasonic probe (or probes) in direct contact with the test object (with or without couplant, see Figure 3.17.1.
direct scan technique	Technique in which an ultrasonic beam is directed into a region of a test object without the intermediate reflection, see Figure 3.10. NOTE: Also known as 'single traverse technique'.
double probe technique	Ultrasonic testing technique involving the use of two probes both of which can be used as a transmitter and a receiver. NOTE: Also known as 'pitch and catch technique'.

Term	Definition
double traverse technique	Technique in which ultrasonic beam is directed into a region of a test object after having been reflected by one surface of the test object, see Figure 3.11.
gap testing technique	Technique in which the probe is not in direct contact with the surface of the test object but it is coupled to it through a column of liquid, not more than a few wavelengths thick, see Figure 3.12. NOTE: Also known as ‘gap scanning’.
immersion technique	Ultrasonic testing technique in which the test object and probe are immersed in liquid used as a coupling medium and/or refracting prism, see Figure 3.17.2. NOTES: 1 Also known as ‘immersion testing’. 2 Immersion can be total or partial. Applications using a water jet or wheel probe are also included.
indirect scan technique	Technique in which the ultrasonic beam is directed into a region of a test object by means of using reflection at its surface (or surfaces).
manual scanning	Manual displacement of the probe over the test surface.
multiple-echo technique	Technique in which repeated echoes from either the back surface or the discontinuity are used for the evaluation of amplitude and of path length. NOTES: 1 In order to evaluate the quality of a material or bonding, the amplitudes of successively echoes are used. 2 In order to increase the accuracy of a wall thickness (path length) measurement, a multiple echo of highest possible number is used.
multiple traverse technique	Technique in which an ultrasonic beam is directed into a region of a test object after having been reflected several times from its surfaces, see Figure 3.11.
normal beam technique	Technique using a normal probe. NOTE: Also known as ‘straight beam technique’.
orbital scanning	Technique used to obtain information about the form of a previously located reflector, scanning being made around the reflector, see Figure 3.13.
pulse echo technique	Technique in which ultrasonic pulses are transmitted and received after reflection in one cycle. NOTE: Also known as ‘reflection (pulse) technique’.
scanning	Systematic relative displacement between the sound beam and the test object.
single probe technique	Technique which makes use of only one probe for the generation and detection of ultrasonic waves.
spiral scanning	Scanning by means of longitudinal displacement and simultaneous rotation of the tube or probe.