
**Non-destructive testing — Ultrasonic
testing — General principles**

Essais non destructifs — Contrôle par ultrasons — Principes généraux

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 16810 was prepared by Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee SC 3, *Ultrasonic testing*.

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Introduction

This International Standard is based on EN 583-1:1998, *Non-destructive testing — Ultrasonic examination — Part 1: General principles*.

The following International Standards are linked.

ISO 16810, *Non-destructive testing — Ultrasonic testing — General principles*

ISO 16811, *Non-destructive testing — Ultrasonic testing — Sensitivity and range setting*

ISO 16823, *Non-destructive testing — Ultrasonic testing — Transmission technique*

ISO 16826, *Non-destructive testing — Ultrasonic testing — Examination for discontinuities perpendicular to the surface*

ISO 16827, *Non-destructive testing — Ultrasonic testing — Characterization and sizing of discontinuities*

ISO 16828, *Non-destructive testing — Ultrasonic testing — Time-of-flight diffraction technique as a method for detection and sizing of discontinuities*

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Non-destructive testing — Ultrasonic testing — General principles

1 Scope

This International Standard defines the general principles required for the ultrasonic examination of industrial products that permit the transmission of ultrasound.

The specific conditions of application and use of ultrasonic examination, which depend on the type of product examined, are described in documents which could include:

- product standards;
- specifications;
- codes;
- contractual documents;
- written procedures.

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Unless otherwise specified in the referencing documents the minimum requirements of this International Standard are applicable.

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This International Standard does not define

- extent of examination and scanning plans;
- acceptance criteria.

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 personnel*

ISO 7963, *Non-destructive testing — Ultrasonic testing — Specification for calibration block No. 2*

ISO 16811, *Non-destructive testing — Ultrasonic testing — Sensitivity and range setting*

ISO 16823, *Non-destructive testing — Ultrasonic testing — Transmission technique*

ISO 2400, *Non-destructive testing — Ultrasonic testing — Specification for calibration block No. 1*

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 Qualification and certification of personnel

The examination shall be performed by personnel qualified in accordance with ISO 9712.

The requirements for qualification and certification shall be specified in the product standards and/or other applicable documents.

4 Information required prior to examination

Prior to examination the following information shall be available, as applicable:

- purpose of examination;
- qualification and certification of personnel;
- environmental conditions and state of examination object;
- requirement for a written examination procedure;
- any special requirements for preparation of scanning surface;
- examination volume;
- examination sensitivity and method of setting-up sensitivity;
- requirements for evaluation and recording level;
- acceptance criteria;
- extent of examination including scanning plan;
- requirements for a written examination report.

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5 Principles of ultrasonic examination

5.1 General

An ultrasonic examination is based on propagation of ultrasonic waves through the object to be examined, and monitoring either the transmitted signal (termed the transmission technique), or the signal reflected or diffracted from any surface or discontinuity (termed the pulse echo technique).

Both techniques can employ a single probe acting as both transmitter and receiver, or double (twin) transducer probe, or separate transmitting and receiving probes. Similarly, both techniques can involve intermediate reflection from one or more surfaces of the object under examination.

The examination can be performed manually or by the use of semi-automatic or fully automatic equipment, and can use contact, gap or immersion scanning, or other coupling methods adapted to specific problems.

5.2 Vibration mode and direction of sound propagation

The most commonly used types of waves are longitudinal and transverse, and these can be propagated either perpendicular, or at an angle, to the test surface. Other types of modes, e.g. Lamb waves or Rayleigh waves can also be used for special applications.

The choice of wave mode and direction of propagation will depend on the purpose of the examination, and should take into account the specular nature of reflection from planar reflectors. Except when using Lamb waves, the direction of sound propagation, for single probe pulse echo scanning, should be as nearly perpendicular to the plane of the reflector as possible.

5.3 Transmission technique (standards.iteh.ai)

This technique is based on measuring the signal attenuation after the passage of an ultrasonic wave through the examination object.

The signal used for measurement can be either:

- a) a backwall echo, or;
- b) any other signal transmitted either directly, or after intermediate reflection from the surfaces of the object.

Further details of this technique are contained in ISO 16823.

5.4 Pulse echo technique

This technique utilizes the reflected or diffracted signal from any interface of interest within the object under examination. This signal is characterized by its amplitude and position along the timebase; the latter related to the distance between the reflector and the probe. The location of the reflector is determined from the knowledge of its distance, the direction of sound propagation, and the position of the probe.

It is recommended that the signal amplitude be measured by comparison with either:

- a) a distance amplitude correction (DAC) curve, or a series of DAC curves, obtained by using artificial reflectors (sidedrilled holes, flat-bottomed holes or notches etc.) within one or more reference blocks;
- b) an equivalent reflector diagram (DGS system);
- c) echoes from suitable notches; or
- d) echoes from large planar reflectors perpendicular to the acoustic axis (e.g. back wall echo).