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**Non-destructive testing — Automated  
ultrasonic testing — Selection and  
application of systems**

*Essais non destructifs — Contrôle automatisé par ultrasons —  
Sélection et application des systèmes*

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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](http://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](http://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 voluntary nature of standards, 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](http://www.iso.org/iso/foreword.html).

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

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# Non-destructive testing — Automated ultrasonic testing — Selection and application of systems

## 1 Scope

The information in this document covers all kinds of ultrasonic testing on components or complete manufactured structures for either correctness of geometry, for material properties (quality or defects), and for fabrication methodology (e.g. weld testing).

This document enables the user, along with a customer specification, or a given test procedure or any standard or regulation to select:

- ultrasonic probes, probe systems and controlling sensors;
- manipulation systems including controls;
- electronic sub-systems for the transmission and reception of ultrasound;
- systems for data storage and display;
- systems and methods for evaluation and assessment of test results.

With regard to their performance, this document also describes procedures for the verification of the performance of the selected test system.

This includes

- tests during the manufacturing process of products (stationary testing systems), and
- tests with mobile systems.

## 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*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5577 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

## 4 Basic system description

### 4.1 Systems

There are two major applications for automated ultrasonic testing systems:

- a) detection and evaluation of material defects (e.g. cracks, porosity, geometry);
- b) measurement and evaluation of material properties (e.g. sound velocity, scattering).

Essential components of an automated test system are:

- a) mechanically positioned and controlled ultrasonic probes and/or test objects;
- b) automatic data acquisition for the ultrasonic signals;
- c) acquisition and storage of probe positions in relation to the ultrasonic signals;
- d) storage of test results.

A test system usually consists of several individually identifiable components. These are:

- a) manipulators for probes or test objects;
- b) probes and cables;
- c) supply (pre-wetting), application and removal of the couplant;
- d) electronic ultrasonic sub-systems;
- e) data acquisition and processing devices;
- f) data evaluation and display devices;
- g) system controls;
- h) sorting and marking of tested objects.

The complexity of a test system depends on the scope of the test and application of the system.

Test systems may be divided into stationary and mobile devices.

Examples of stationary test systems are testing machines:

- for the continuous testing of steel products, e.g. billets, plates, tubes, rails;
- for the testing of components, e.g. steering knuckles, rollers, balls, bolts, pressure cylinders;
- for the testing of composite materials, such as aerospace structures, e.g. complete wings made of composite materials, CRFP and GFRP components;
- for the testing of random samples (batch test) in a process accompanying production checks, e.g. testing for hydrogen induced cracking in steel samples.

Examples of mobile test systems are test rigs:

- for pre-service and in-service testing of components, e.g. valves, vessels, bolts, turbine parts;
- for pre-service and in-service inspection of vehicles;
- for pre-service and in-service testing of pipelines, e.g. oil or gas pipelines;
- ultrasonic testing of rails in railway tracks.

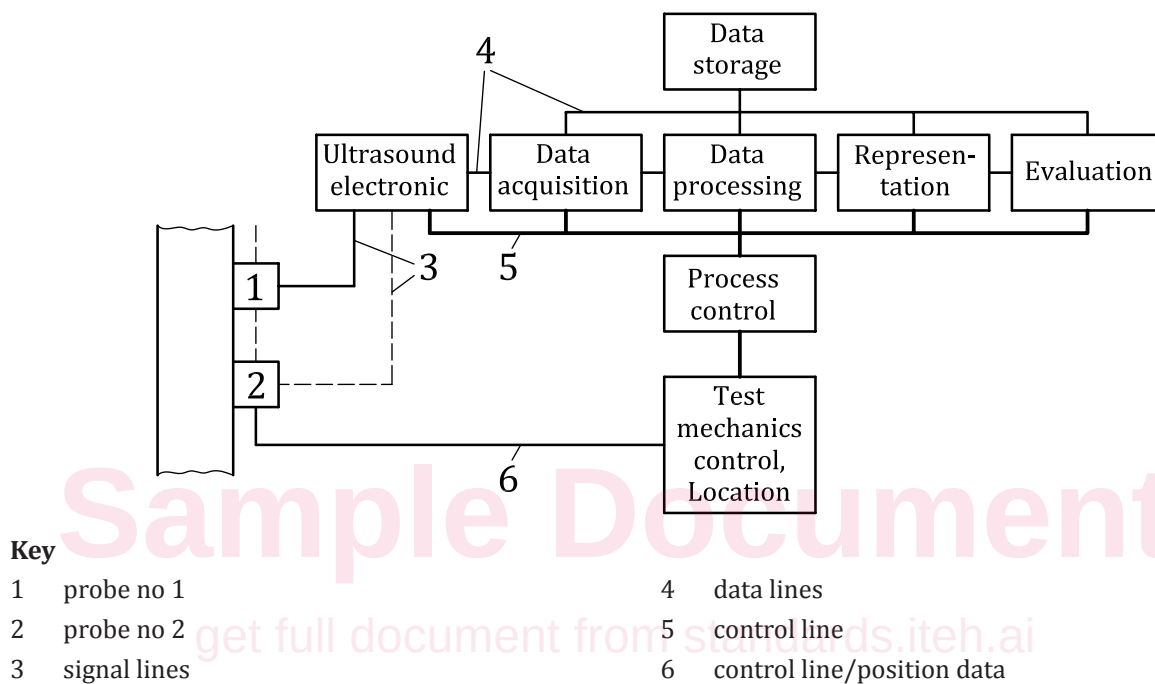
The test systems can be single or multichannel systems.

The complexity of the manipulator of the system depends on the examination task.

The complexity of the data acquisition and evaluation system depends on the number of test channels, on the required test speed, and on other test requirements.

## 4.2 System schematic

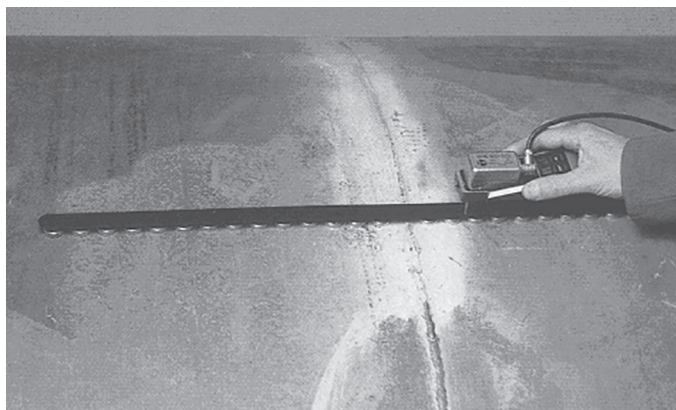
The essential components of an automated ultrasonic scanning system are shown in [Figure 1](#). More detailed descriptions can be found elsewhere in this document. A detailed description of the individual functions is given in [Clause 5](#).



**Figure 1 — System schematic**

The probe position shall be determined and be recorded together with the ultrasonic data. This can be achieved by using encoders, ultrasound, or video techniques.

The most simple ultrasonic system uses only one probe ([Figure 2](#)).



**Figure 2 — Simple system with one probe**

In order to fulfil more complex test requirement, the system can include several hundred probes, e.g. in a pig for pipeline testing, see [Figure 3](#).