

This is a preview of "ISO 12715:1999". [Click here to purchase the full version from the ANSI store.](#)

First edition
1999-08-15

Ultrasonic non-destructive testing — Reference blocks and test procedures for the characterization of contact search unit beam profiles

*Contrôles non destructifs par ultrasons — Blocs de référence et modes
opératoires des essais pour la caractérisation des faisceaux des
traducteurs utilisés dans les contrôles par contact*



Reference number
ISO 12715:1999(E)

This is a preview of "ISO 12715:1999". [Click here to purchase the full version from the ANSI store.](#)

Contents	Page
1 Scope	1
2 Normative references	1
3 Symbols and abbreviations	2
3.1 Symbols	2
3.2 Abbreviations	3
4 Descriptions of the reference blocks	3
4.1 Hemi-step (HS) block	3
4.2 Side-drilled hole (SDH) block	5
5 Techniques and Procedures	6
5.1 Straight beam search units (normal probe)	6
5.2 Angle beam search unit (angle probe)	10
5.3 Dual element search unit (twin crystal probe)	16
Annex A (normative) Time base calibration	19
Annex B (normative) Time of flight (TOF) beam profile	21
Annex C (informative) Skew (or squint) angle, far field and near field resolution	23
Bibliography	24

This is a preview of "ISO 12715:1999". [Click here to purchase the full version from the ANSI store.](#)

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 3.

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.

International Standard ISO 12715 was prepared by Technical Committee ISO/TC 135, *Non-destructive testing*, Subcommittee 3, *Acoustical methods*.

Annexes A and B form an integral part of this International Standard. Annex C is for information only.

This is a preview of "ISO 12715:1999". [Click here to purchase the full version from the ANSI store.](#)

Introduction

In ultrasonic non-destructive inspection, pulse/echo contact tests with a straight beam search unit (also known as a normal probe), an angle beam search unit (also known as an angle probe), or a dual element search unit (also known as a twin crystal probe) are often used. To reliably detect and characterize a flaw inside a structural material, a knowledge of the sound field (or the beam profile) produced by the search unit in contact testing is needed. This International Standard establishes two metal reference blocks to be adopted for various materials such as forged or rolled steel, aluminum and titanium alloy products. The frequency range of the search units used in this International Standard range from 1 MHz to 15 MHz. Depending on the microstructure of the materials under evaluation, in general, 1 MHz to 5 MHz is most suitable for steel products and 5 MHz to 15 MHz is most suitable for aluminum and titanium alloys.

The two reference blocks introduced are the hemi-step (HS) and the side-drilled-hole (SDH) blocks, from which the beam profiles produced by straight beam, focused beam, angle beam and dual element search units can be measured. This International Standard establishes the techniques and procedures to be used for the characterization of the search unit beam profiles in solids.

In pulse/echo ultrasonic tests, the reflected pulse (hereafter called echo) is used for the detection of discontinuities existing in a material. The discontinuities (hereafter called flaw or defect) such as porosity, voids or cracks in different sizes and shapes, may be located close to the surface or deep inside, or close together and oriented at different angles. A sound pulse incident on such flaws may reflect or refract into longitudinal (also known as compressional) or transverse (also known as shear) waves, or both, possibly with multiple reflections and refractions. In order to accurately characterize the location, size and shape of a flaw inside a material, the sound field produced and detected by the search unit and the instrument must be known.

The sound field inside a solid produced by a search unit in contact testing depends on the type, size, and frequency bandwidth of the search unit and other parameters such as focused, beam refraction angle in the test object, materials properties and the ultrasonic test instrument characteristics.

ISO 2400 establishes a reference block, known as the IIW No. 1 Block. For straight beam tests, this block is used for checking or establishing the near field resolution, far field resolution and time base (or horizontal) linearity of the test equipment. For angle beam tests, the block is used to determine the search unit index (hereafter called probe index) and the angle of refraction. This block also provides a means for checking the longitudinal (compressional) wave and transverse (shear) wave velocities of the test material.

ISO 7963 establishes a small calibration block, known as the IIW No. 2 Block, which is quite suitable for field use. It provides guidelines for material selection, preparation and mechanical tolerances of the reference block. It also provides procedures for testing the refraction angle and sensitivity settings of the signals.

The sound field of a straight beam search unit (normal probe) can be calculated or measured in immersion testing with the procedures given in ISO 10375.

In addition to the above International Standards, the present International Standard introduces two ultrasonic reference blocks and provides a general methodology of using these blocks in order to establish the sound fields or beam profiles in contact tests. The terminology used in this International Standard is in compliance with ISO 5577.

The objectives of this International Standard are the following.

- To determine search unit axes so that consistent tests can be performed.
- To establish a complete sound field or beam profile inside solid materials for search units of both straight beam and angle beam types, including focused beam and dual element search units.

This is a preview of "ISO 12715:1999". [Click here to purchase the full version from the ANSI store.](#)

- To provide a method for calculating the correct retraction angle when an angle beam search unit designed for use in steel is to be used in materials other than steel.
- To provide a beam profile measurement capability for future applications, such as an Electromagnetic Acoustical Transducer (EMAT).
- To provide a capability for lateral angle beam profile measurements.
- To provide means for time base calibration of angle beam search units to be used with ultrasonic imaging systems (see annex A).
- To provide means for time-of-flight (TOF) beam profile measurements for search units to be used with ultrasonic imaging systems (see annex B).
- To provide a technique, by hand held method and by using a mechanical scanner and UT imaging system to obtain both the amplitude and TOF beam profiles (see Figure B.1).
- To provide means for the determination of the skew (or squint) angle, far field and near field resolutions of angle beam search units (see annex C).

NOTE This document was initiated in the ISO/TC 135/SC3 meeting at Philadelphia, USA in 1985. The scope and contents of this document were discussed at Yokohama, Japan in 1987, at Berlin, Germany in 1989, at Ispra, Italy in 1991, at Pretoria, South Africa in 1993, at Berlin, Germany in 1995 and at Paris, France in 1997 among members of TC135/SC3/WG1.