



# ULTRASONIC INSPECTION PROCEDURE

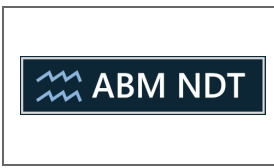
Reference: PROC/GEN/UT/ISO16809 Issue:01| Date of Issue: **SAMPLE**



## Procedure For The Ultrasonic Thickness Measurements Of Materials In Accordance With BS EN ISO 16809:2019

**SAMPLE ONLY - NOT FOR PRODUCTION USE.**  
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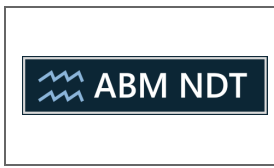
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## 1. Scope

This is a general procedure that describes the methods and principles for manual ultrasonic thickness measurements and corrosion monitoring of metallic materials. The examinations are to be carried out by direct contact, based on measurement of the time of flight of ultrasonic pulses.

The procedure covers the measurement of materials and components in-service, during manufacture or under repair.

The procedure is written in accordance with BS EN ISO 16809:2019

## 2. Applicable documents

**ISO 9712:2012** Non-destructive Testing – Qualification and certification of NDT personnel.

**BS EN ISO 16809:2019** Non-destructive testing - Ultrasonic Thickness Measurement

**BS EN ISO 5577:2017** Terminology used in ultrasonic testing.

**BS EN 12668-1:2010** Non-destructive testing - Characterization and verification of ultrasonic equipment - Instruments

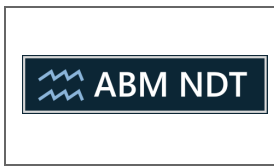
**BS EN 12668-2:2010** Non-destructive testing - Characterization and verification of ultrasonic equipment - Probes

**BS EN 12668-3:2013** Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 3 Combined equipment

**BS EN ISO 2400:2012** Non-destructive testing - Ultrasonic testing - Specification for calibration block No 1

**BS EN ISO 7963:2010** Non-destructive testing - Ultrasonic testing - Specification for calibration block No 2

**BS EN ISO 16810:2014** Non-destructive testing - Ultrasonic Testing. General Principles



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## 3. Safety

Personnel working to this procedure shall work in such a manner as to comply with the Health and Safety at Work act (1974)

All consumables used shall have accompanying COSHH data sheets and shall be disposed of in a way that is non-injurious to site personnel or to the environment.

Personnel working to this procedure shall at all times wear mandatory PPE; overalls, safety boots, hard hat, high visibility clothing, etc.

Any equipment that requires the use of mains electricity shall have successfully passed a PAT test within the last 12 months and be in good working condition.

## 4. Personnel qualification

Operators trained and qualified in ultrasonic testing to PCN (ISO 9712) Level 2 will be employed to carry out ultrasonic thickness measurements in accordance with this procedure.

The operator shall have a detailed understanding and training related to ultrasonic thickness measurements. In addition, the operator shall have knowledge of the product and material to be measured.

All personnel shall meet the eyesight requirements of ISO 9712 Part 7.4 and shall be certified annually to ensure this.

Documentation relating to operators shall be kept on file at the administration offices for review purposes

## 5. Measurement Modes

The thickness of a part or structure is determined by accurately measuring the time required for a short ultrasonic pulse generated by a transducer to travel through the thickness of the material once, twice or several times.

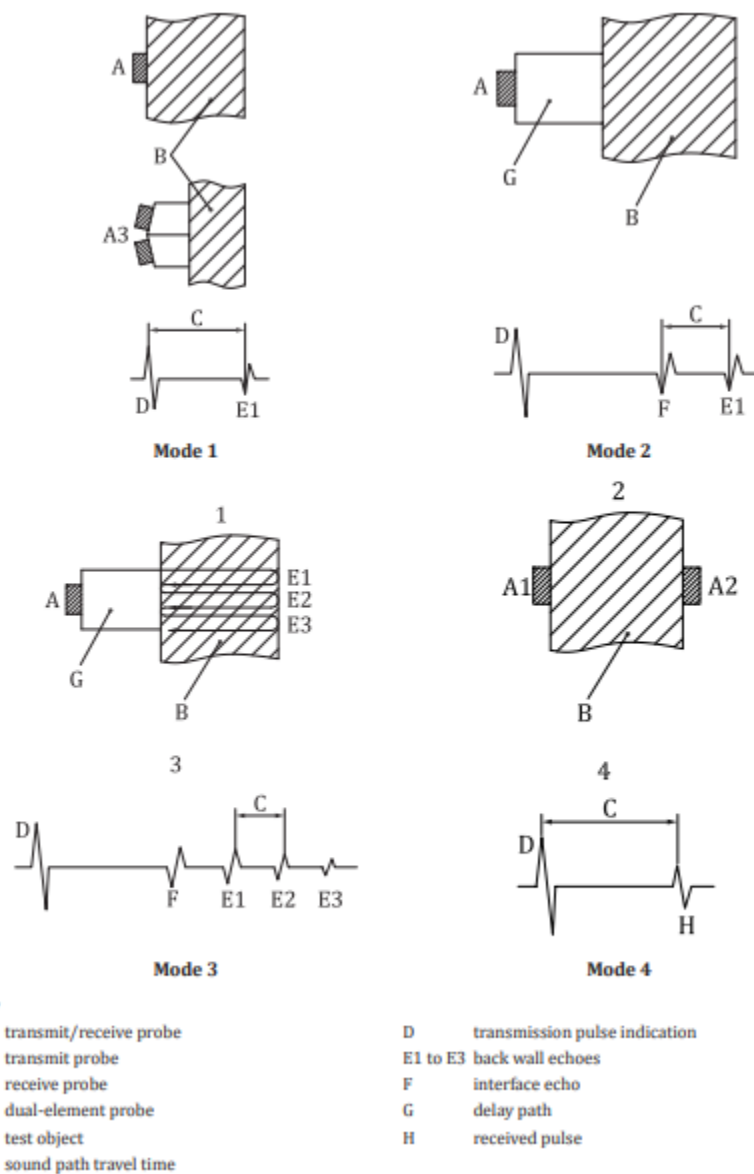
The material thickness is calculated by multiplying the known sound velocity of the material with the transit time by the number of times the pulse transits the material wall.

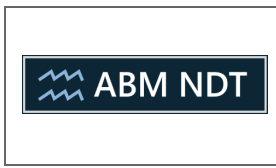
This principle can be accomplished by applying one of the following modes, see figure 1

- Mode 1: Measure the transit time from the initial excitation pulse to a first returning echo, minus a zero correction to account for the thickness of the transducer wear surface and the couplant layer (first backwall echo mode)

- ❑ Mode 2: Measure the transit time from the end of the delay line to the first backwall echo (first backwall echo delay line mode)
- ❑ Mode 3: Measure the transit time between backwall echoes (multiple echoes)
- ❑ Mode 4: Measure the transit time for a pulse travelling from the transmitter to a receiver in contact with the backwall (through transmission mode)

Figure 1 – Measurement Modes





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## 6. Surface conditions & surface preparation

Using the pulse-echo method means that the ultrasonic pulse needs to pass the contact surface between the test object and the probe at least twice: when entering the object and when leaving it.

Therefore, a clean and even contact area with at least twice the probe's diameter is preferred. Poor contact will result in loss of energy, distortion of signals and sound path.

To enable sound propagation all loose parts and non-adherent coatings shall be removed by brushing or grinding.

Attached layers, like colour coating, plating, enamels, may stay on the object, but only a few thickness meters are able to exclude these layers from being measured.

Very often, thickness measurements need to be done on corroded surfaces, e.g. storage tanks and pipelines. To increase measuring accuracy the contact surface should be ground within an area at least two times the probe's diameter. This area should be clean from corrosion products.

Care should be taken not to reduce the thickness below the minimum acceptable value

## 7. Equipment

### 7.1 Instruments

Thickness measurements can be achieved by using the following types of instruments:

- a. Dedicated ultrasonic thickness measurement instruments with numerical display showing the measured value;
- b. Dedicated ultrasonic thickness measurement instruments with numerical display showing the measured value and A-scan presentation (waveform display);
- c. Instruments designed primarily for detection of discontinuities with A-scan presentation of signals. This type of instrument may also include numerical display of thickness values.

The 'A' scan flaw detector shall conform to the requirements of EN 12668 and shall have a valid calibration certificate of calibration. The instrument shall be capable of operating at frequencies over the range of at least 2 MHz to 5 MHz as a minimum. It shall be equipped with a stepped gain control in units of 2.0 dB or less

Combined UT equipment checks - daily and weekly checks shall be carried in accordance with BS EN 12668-3:2013.