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## Overview

This standard identifies the competences you need to prepare manual, semi-automatic or fully automatic ultrasonic flaw detection equipment, in readiness for the testing activities, in accordance with approved procedures. The correct outcome of ultrasonic testing demands great care in setting up the equipment, in order that the test indications may be confidently interpreted. The use of both contact and non-contact ultrasonic flaw detector equipment is covered in this standard.

You will be required to check that the flaw detector, its probes and calibration blocks are as specified in the non-destructive testing (NDT) instructions. You will be required to check that the equipment is in a safe and usable condition, and that all electrical connections, cables and fittings are securely connected and fit for purpose. You will also be expected to check the performance of the equipment, and to calibrate the probe-flaw detector system for range, sensitivity and beam spread; distance-amplitude correction (DAC) curves will be generated when required.

Your responsibilities will require you to comply with organisational policy and procedures for the setting up of the ultrasonic test equipment, and to report any problems with the equipment in use, or the setting up activities, that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to take personal responsibility for your actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will show a good understanding of your work, and will provide an informed approach to the setting up of the ultrasonic equipment being used. You will have a good understanding of the principles of the pulse-echo system, and of the transmissions/reflection characteristics of ultrasonic waves. You will have an understanding of how the properties of materials will affect wave propagation, and the response of different types of reflector formed by internal features and defects/flaws. You will have a good knowledge of flaw detectors and their characteristics, and of the different types of probes, their application and calibration requirements. Your knowledge will include an appreciation of hazards and safe working practice, and you will understand the risks posed by material defects/flaws, and the consequences of component failure.

You will understand the safety precautions required when setting up the ultrasonic flaw detection equipment, and when using the associated tools and equipment. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

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## Performance criteria

### You must be able to:

1. work safely at all times, complying with health and safety legislation and other relevant regulations, directives and guidelines
2. obtain all the required equipment and ensure that it is in a safe and usable condition
3. set up, check and adjust the equipment in line with work requirements/techniques
4. make sure that required safety arrangements are in place to protect other workers from activities likely to disrupt normal working
5. report completion of preparations in line with organisational procedures
6. deal promptly and effectively with problems within your control and report those that cannot be solved

## Knowledge and understanding

### You need to know and understand:

1. the specific safety precautions to be taken when setting up ultrasonic flaw detection equipment
2. the hazards associated with setting up the ultrasonic flaw detection equipment (such as electrical contact, moving mechanical parts), and how they can be minimised
3. the type(s) of personal protective equipment (PPE) to be used, and how to obtain it
4. how to obtain the necessary job instructions/techniques, equipment setting-up procedures and testing specifications, and how to interpret their information
5. the basic principles of ultrasonic flaw detection testing (including sound transmission and reflection; the echo principle; ultrasound; pulse echo system; defects as reflectors and transmission time as a measuring system)
6. the basic components of the ultrasonic flaw detection equipment (such as use of pulse generators; transducers to transmit and receive ultrasound the receiver to recognise echo signals the amplifier and signal display panel)
7. the generation of ultrasonic waves (to include types of transducer; pulse length; frequency and bandwidth and the coupling of the transducer to the component/product)
8. the ultrasonic beam (to include beam diameter and spread; intensity versus radius; near field and far field; the influence of frequency, velocity and transducer size)
9. factors which will affect the selection of suitable probes (such as type, frequency, size, angle and product to be tested, the influence of expected defects on the probe selection)
10. manual, semi-automatic and automatic probe manipulation systems (including multiple probe systems)
11. how the properties of the materials to be tested will affect the way the equipment performs (such as size of object; surface conditions (such as flat or curved, smooth or rough), any heat treatment or repairs to the component/product).
12. how to set up and calibrate the ultrasonic flaw detection equipment, using specified calibration blocks, setting range appropriate to component/product being inspected; the effect of different sound velocities in calibration block and material of components/products being inspected; the effect of casting shape and surface finish on range, sensitivity and signal-to-noise ratio
13. how to recognise defects (such as the various signals received from flaws; equipment response to probe manipulation and measurement of defect/ flaw size)

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14. care and control of the equipment (to include checking condition of insulation, all electrical cables and connections, equipment operating controls and displays, mechanical functions and probes)
  15. the extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

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## Scope/range

1. Carry out all of the following during the preparation of the ultrasonic equipment:
  1. comply with job instructions/techniques, equipment setting up documentation, NDT testing specifications, relevant regulation and risk assessment documentation
  2. use appropriate personal protective equipment
  3. follow the defined setting-up procedures/techniques, and apply safe working practices and procedures at all times
  4. leave the work area in a safe condition on completion of the activities
2. Prepare ultrasonic flaw detection equipment that is either:
  1. analogue
  2. digital
3. Prepare one of the following types of ultrasonic testing equipment in readiness for use:
  1. manual
  2. semi-automatic
  3. fully automatic
4. Set up, check and adjust the equipment, to include carrying out all of the following:
  1. obtaining all necessary cables and fittings
  2. checking that all electrical connections, cables and fittings are secure and in a safe condition
  3. ensuring that probes are of the required type, size, frequency and angle
  4. ensuring that the probe is in good condition and contact faces are undamaged
  5. obtaining appropriate reference and calibration blocks
  6. obtaining the required couplant
5. Check the performance of the ultrasonic flaw detector, using the correct reference block for both of the following:
  1. timebase linearity
  2. amplifier linearity
6. Calibrate the probe-flaw detector system, using the specified calibration block(s) for all of the following:
  1. range
  2. sensitivity
  3. beam spread
  4. DA curves (where appropriate)

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## Glossary

Discontinuity – Any imperfection in the material / component / structure

Flaw – A significant discontinuity to be recorded but within specified limits and tolerances

Defect – A flaw outside specified limits and tolerances causing the material / component / structure to be non-compliant and rejected

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