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## Overview

This standard identifies the competences you need to carry out radiographic testing on engineering products, materials or structures. Radiography can include real time radiography or computed tomography (CT scanning) methods. Radiographic testing can refer to either photographic film or digital detectors.

You will need to follow relevant statutory regulations, local rules and instructions. Because of the presence of ionising radiation, you will need to ensure that the safety features of controlled test zones are fully operational at all times. Where radioactive sources are used, you will be required to keep them in the designated store, except when in use, and correctly record their movement.

You will be required to check testing equipment, prepare products for testing, set up and adjust radiographic equipment, carry out exposure process exposed film/detectors check image quality and carry out further tests if necessary. Your responsibilities will require you to comply with organisational policy, procedures and techniques and to report any problems with equipment or activities, that you cannot resolve, or which are outside your permitted authority. You will take personal responsibility for your actions and for the quality and accuracy of the work that you carry out.

You will have a good understanding of your work, and will provide an informed approach to the inspection of engineering products by using radiographic testing techniques, with special reference to potential hazards and safe working practice. You will have adequate uncorrected or corrected vision in accordance with national standards to allow you to competently perform inspections. You will have an appreciation of hazards, safe working practice and safety precautions, have correct vision at all times. You will understand the safety precautions required when carrying out radiographic testing activities and when using the associated image processing materials and equipment.

This standard is for anyone who inspects engineering products using radiographic testing techniques.

## 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. identify, confirm and carry out specified inspection checks against agreed acceptance criteria
3. prepare radiographic test equipment, checking it complies with specification requirements, is safe to use, fit for purpose and set up correctly for intended operations
4. follow the appropriate procedures and techniques to use testing tools and equipment and to carry out radiographic tests
5. check controlled test zones comply with regulation requirements throughout testing activities
6. position engineering products and radiographic equipment to aid radiographic results
7. carry out specified radiographic tests to meet requirements
8. process exposed image data/detectors in appropriate conditions
9. analyse and evaluate test results
10. record accurately the results of the inspections in the appropriate format and in line with legislative and organisational requirements and pass to designated people
11. deal with problems within your control in line with organisational procedures and without delay, reporting those outside your control to designated people

## Knowledge and understanding

### *You need to know and understand:*

1. relevant health and safety and other regulations, directives, national standards and guidelines and your responsibilities to yourself and others including those relating to quality control,
2. hazards associated with radiographic testing including electrical contact, moving mechanical parts, radiation, toxic chemicals
3. safe working practice and specific safety precautions to minimise hazards when carrying out radiographic testing activities on engineering products, materials or structures including procedures to be adopted in the case of accident and emergency/incidents involving radioactive sources
4. relevant personal protective equipment (PPE) and how to obtain it including protective clothing, personal dosimeters, radiation survey meters, barriers and screens, warning signals, visual indicators and alarm systems
5. how to obtain and interpret job instructions/techniques and testing specifications
6. how to interpret and evaluate test results to identify defects or variations from specification
7. methods to control test zones including the identification and marking of boundary exclusion zones, the erection of physical barriers, warning lights and visual signs to restrict unauthorised entrance, the sighting of radiation survey meters, the positioning of appropriate radiation screens
8. the principles of radiographic testing including the use of x-ray and gamma radiation as a penetrating agent; shadow effect and projection and the capture of the image, developing, accretment, fixing, storage, and equipment used to view the images
9. the sources of radiation used in radiographic testing activities including X-ray tubes (generator) and radioactive isotopes
10. the principles of real time radiography, computed tomography and digital processing of X-rays
11. image formation including rectilinear propagation; the geometry of shadow projection, inverse square law, focal spot, formation of penumbra, filmless techniques and image quality indicators
12. preparation requirements of X-ray tube generators, and how to set up the tube or radiation source including equipment controls, establishment of testing

parameters, focal spot size, safety devices and the use of exposure charts

13. the use of manipulators to position products

14. care and control of testing equipment including checking the condition of electrical cables and connections, mechanical functions and safety devices

15. safe and correct care of gamma-ray source containers, storage procedures for radioactive sources how to return them after use and how to transport radioactive materials

16. how to prepare products, materials or structures for radiographic testing including identifying test areas, using lead markers and checking for features that might interfere with the radiographic tests

17. the types and selection of radiographic films or digital detectors and image processing/manipulation systems

18. radiographic image quality including sensitivity, density, contrast, definition, the effect of scattered radiation on image, processing faults, characteristic curves, and the effect of development conditions on finished image quality, the response of defects/flaws to penetrative radiation, and the resulting images

19. the setting up/maintenance of storage/archive facilities for unexposed film/detectors, exposed images and images which have been developed/processed

20. the extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

21. the role of the Radiation Protection Supervisor

## Scope/range

1. Carry out all of the following during the radiographic testing activities:
  - 1.1 obtain the required radiographic testing equipment and materials, and check that they are in a safe and usable condition
  - 1.2 use appropriate personal protective equipment
  - 1.3 comply with job instructions/techniques, NDT testing inspection specifications, risk assessments and other relevant safety standards
  - 1.4 follow the defined testing procedures/techniques, and apply safe working practices and procedures at all times
  - 1.5 leave the work area in a safe condition on completion of the activities
2. Prepare for the radiographic testing, to include carrying out three of the following:
  - 2.1 checking that all features of the Controlled Test Zone are in place and operating correctly (barriers, lights, signs, radiation survey meters)
  - 2.2 ensuring that the product test areas are correctly prepared and identified
  - 2.3 checking that all equipment and consumables are as specified and fit for purpose
  - 2.4 removing gamma ray source containers from the approved store and recording as designated by policy and procedure
3. Set up the radiographic testing equipment to provide all of the following:
  - 3.1 correct source location
  - 3.2 source focal distance (SFD) and beam orientation
  - 3.3 specified exposure parameters
  - 3.4 specified radiographic film or detectors and intensifying screens applied to the test areas
  - 3.5 correctly located Image Quality Indicators (IQIs) and identification markers
4. Carry out radiographic exposures on the engineering products, to include carrying out all of the following:
  - 4.1 activating exposure warning devices
  - 4.2 monitoring the radiation survey meters
  - 4.3 storing the exposed image in the designated safe place
5. Carry out radiographic testing on one of the following:
  - 5.1 welded joints
  - 5.2 castings
  - 5.3 wrought products/materials (forged, rolled, extruded)
  - 5.4 cold formed products (such as by bending, pressing, rolling)
  - 5.5 heat treated components
  - 5.6 structures (such as airframes, lifting beams, pressure vessels)
  - 5.7 other specific products
6. Process the exposed image data in the prepared facility, according to manufacturer's instructions, to include carrying out two of the following:
  - 6.1 using the correct personal protective equipment
  - 6.2 preparing the correct processing chemicals (as appropriate)

6.3 carrying out the processing requirements, in the correct sequence and for the correct time

6.4 viewing the image under suitable lighting conditions

6.5 storing processed images in a safe place

6.6 disposing of used materials, in line with organisation and environmental safe practice

7. Analyse and evaluate the quality of the developed image for five of the following features:

7.1 processing faults

7.2 defective pixels

7.3 image quality

7.4 contrast

7.5 sensitivity

7.6 density

8. Complete the radiographic testing activities, by carrying out one of the following:

8.1 closing down the equipment to a safe condition

8.2 returning gamma radiation source containers to the approved store and recording as designated by policy and procedure

8.3 removing warning notices and barriers, and reinstating the work area (as appropriate)

9. Complete the inspection activities, to include carrying out all of the following:

9.1 recording all the required details of the inspection in the appropriate format

9.2 handing over the inspection details to the designated people

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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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