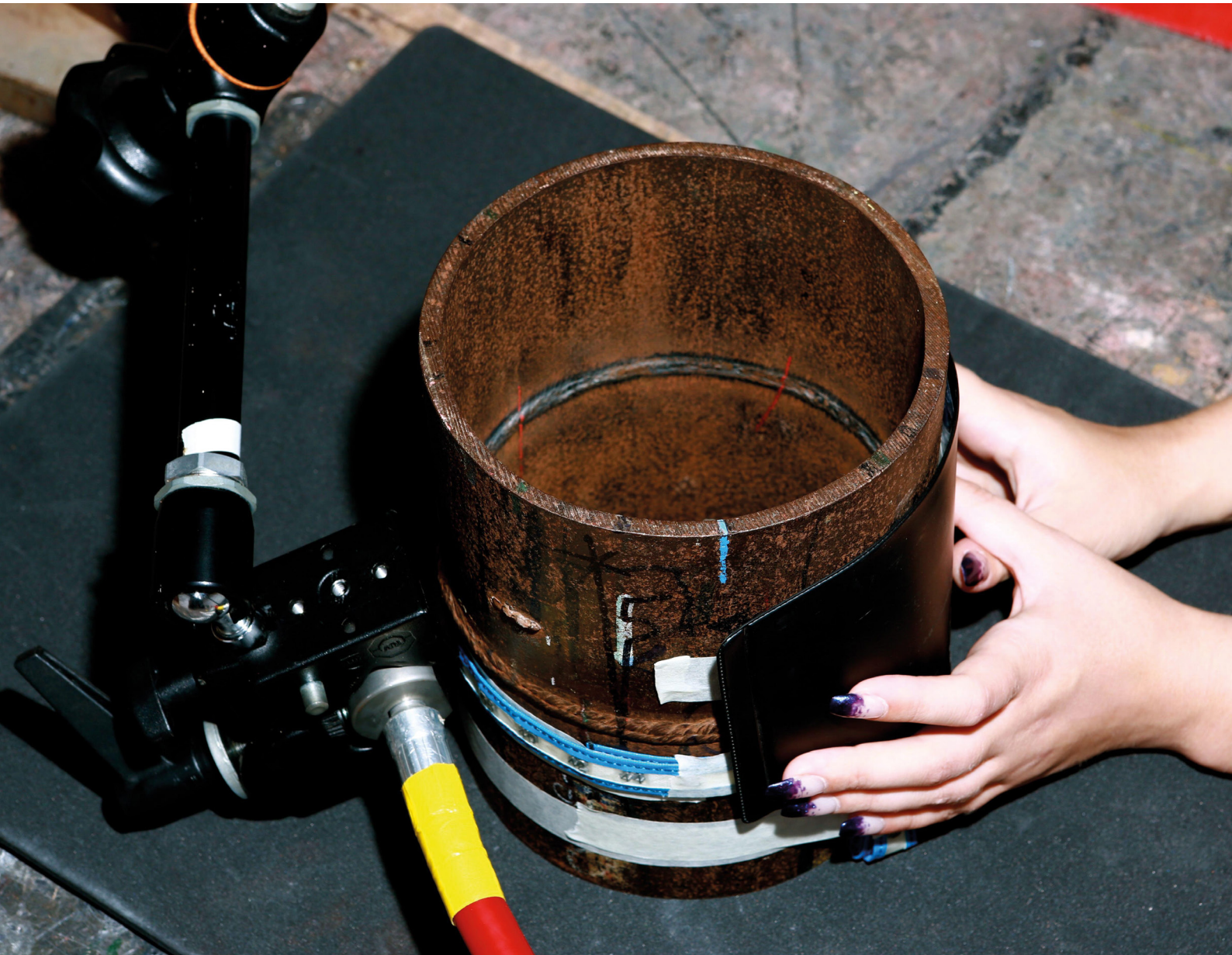


Employer's Unit of Competence – Radiographic testing of materials, products and plant

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Document: AA065 • Issue 2 • May 2016



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Overview

This unit identifies the competencies required to carry out radiographic testing activities on engineering products, materials or structures in accordance with approved procedures. Because of the presence of ionising radiation, a key requirement of radiographic testing is to ensure that the apprentice works in accordance with the relevant statutory regulations, local rules and instructions and that the safety features of the controlled test zone are fully operational at all times. They will be required to check that the radiographic test equipment complies with the specification requirements, is safe to use, fit for purpose and is set up correctly for the intended operations. They will prepare the products for testing, identifying the test area for future reference and checking the material of the products for features that might interfere with the radiographic tests. They will set up and adjust the radiographic equipment, carry out the exposure and process the exposed films in the prepared facility. Following processing, they will be expected to check the image quality before storing the film, ready for interpretation. Where radioactive sources are used, they will be required to keep these in the designated store, except when in use, and correctly record their movement.

The apprentice's responsibilities will require them to comply with organisational policy and procedures for the radiographic testing activities undertaken. Any problems with the activities or equipment in use that they cannot personally resolve, or are outside their permitted authority, will be reported to the relevant people. They will be expected to work with minimal supervision, taking personal responsibility for their actions and for the quality and accuracy of the work they carry out.

The apprentice's underpinning knowledge will demonstrate a good understanding of their work and will provide an informed approach to the inspection of engineering products using radiographic testing techniques. They will have a sound understanding of radiographic principles, the nature and characteristics of ionising radiation and the equipment for X- and gamma radiography. They will understand how images are formed and the factors that affect image quality. They will also have detailed knowledge of film processing, fixing, washing and drying requirements, along with the safe storage requirements of the film at all stages of use. They will have a detailed knowledge of radiographic testing practice, including the equipment calibration requirements, equipment performance checks and routine care of the equipment.

Knowledge of radiographic practice will be a key feature, with special reference to hazards and safe working practices. The apprentice will understand the safety precautions required when carrying out the radiographic testing activities and when using the associated film processing materials and equipment. They will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Performance Criteria

The apprentice must be able to:

- P1 Work safely at all times, complying with health & safety and other relevant regulations and guidelines
- P2 Work in accordance with relevant ionising radiations statutory regulations, local rules and instructions and ensure that the safety features of the controlled test zones are fully operational at all times
- P3 Follow the appropriate procedures for the use of tools and equipment to carry out the required tests
- P4 Set up and carry out the tests using the correct procedures and within agreed timescales
- P5 Record the results of the tests in the appropriate format
- P6 Review the results and carry out further tests if necessary
- P7 Deal promptly and effectively with problems within their control and report those that cannot be solved.

Knowledge and Understanding

The apprentice needs to know and understand:

- K1 The specific safety precautions to be taken when carrying out radiographic testing activities on engineering products, materials or structures
- K2 The hazards associated with radiographic testing activities (such as electrical contact, moving mechanical parts, radiation and toxic chemicals) and how they can be minimised
- K3 The regulations and codes of practice to be followed when using radiographic testing equipment (such as ionising radiation regulations, COSHH regulations, local rules, the role of the Radiation Protection Supervisor and the use of the radioactive source movement register)
- K4 The type(s) of personal protective equipment (PPE) to be used and how to obtain it (such as protective clothing, personal dosimeters, radiation survey meters, barriers and screens, warning signals, visual indicators and alarm systems)
- K5 Procedures to be adopted in the case of an accident and emergencies/incidents involving radioactive sources
- K6 How to check that the controlled test zone complies with regulation requirements (such as 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 and the positioning of appropriate radiation screens)
- K7 The basic principles of radiographic testing (including the use of X- and gamma radiation as a penetrating agent, the shadow effect and projection, the capture of the image on photographic type film, development, fixing, washing and drying of the film and the equipment used to view the exposed images)
- K8 The sources of radiation used in radiographic testing activities (to include the X-ray tube (generator) and the use of radioactive isotopes)
- K9 Image formation (including rectilinear propagation, the geometry of shadow projection, inverse square law, focal spot, formation of penumbra and image quality indicators)
- K10 The preparation requirements of the X-ray tube generator and how to set up the tube or radiation source (including equipment controls, establishment of testing parameters, focal spot size and safety devices and the use of exposure charts)
- K11 Care and control of the equipment (to include checking the condition of all electrical cables and connections, all mechanical functions and safety devices)
- K12 Care of gamma ray source containers and storage procedures for radioactive sources
- K13 How to transport radioactive materials safely and correctly, and the safe storage of the radioactive source containers
- K14 How to prepare the products, materials or structures for radiographic testing activities (including identification of the test area and the use of lead markers)
- K15 The types and selection of radiographic films (including emulsion types, intensifying screens, film development, fixing, washing and drying, the significance of temperature on the film and how it is controlled)
- K16 Processing faults, characteristic curves and the effect of development conditions on the finished film quality
- K17 Radiographic image quality (to include sensitivity, density, contrast and definition, and the effect of scattered radiation on the image)
- K18 The response of defects to penetrative radiation and the resulting images on the film
- K19 The setting up/maintenance of storage facilities for unexposed film, exposed film and film that has been developed
- K20 The extent of their own responsibility and to whom they should report if they have problems that cannot be resolved.

Scope/range related to performance criteria

The apprentice must be able to:

1. Carry out **all** of the following during the radiographic testing activities:
 - Use appropriate personal protective equipment
 - Comply with ionising radiation regulations, local rules, instructions issued by the Radiation Protection Supervisor, relevant COSHH sheets and risk assessment documentation
 - Follow the defined radiographic testing procedures and apply safe working practices and procedures at all times
 - Leave the work area in a safe condition on completion of the activities.
2. Prepare for the radiographic testing, to include carrying out **all** of the following:
 - Checking that all features of the controlled test zone are in place and operating correctly (such as barriers, lights, signs and radiation survey meters)
 - Ensuring that the product test areas are correctly prepared and identified
 - Checking that all equipment and consumables are as specified and fit for purpose
 - Removing gamma ray source containers from the approved store and recording in the source movement register.
3. Set up the radiographic testing equipment to provide **all** of the following:
 - Correct source location, source focal distance (SFD) and beam orientation
 - Specified exposure parameters
 - Specified radiographic film and intensifying screens applied to the test areas
 - Correctly locating image quality indicators (IQIs) and identification markers.
4. Carry out radiographic exposures on the engineering products, to include carrying out **all** of the following:
 - Activating exposure warning devices
 - Monitoring the radiation survey meters
 - Storing the exposed film in the designated safe place.
5. Carry out radiographic testing on **one** of the following:
 - Welded joints
 - Castings
 - Wrought products/materials (such as forged, rolled or extruded)
 - Cold-formed products (formed, for example, by bending, pressing or rolling)
 - Heat-treated components
 - Structures (such as airframes, lifting beams and pressure vessels)
 - Other specific products.
6. Process the exposed films in the prepared facility, according to manufacturer's instructions, to include carrying out **all** of the following:
 - Using the correct personal protective equipment
 - Preparing the correct processing chemicals

- Carrying out the processing requirements, in the correct sequence and for the correct time
 - Viewing the image under suitable lighting conditions
 - Storing processed film in a safe place
 - Disposing of used materials, in line with organisation and environmental safe practice.
7. Check the quality of the developed image for **all** of the following features:
- Processing faults
 - Image quality
 - Contrast
 - Sensitivity
 - Density.
8. Complete an NDT report, to include recording **all** of the following:
- Product identification
 - Test areas covered by identified radiographs
 - Test area geometries and thickness
 - Radiographic parameters
 - Testing conditions
 - Type of image quality indication (IQI)
 - Film type
 - Processing conditions
 - Personal data.
9. Complete the radiographic testing activities, by carrying out **all** of the following:
- Closing down the equipment to a safe condition
 - Returning gamma radiation source containers to the approved store
 - Recording actions in the source movement register
 - Removing warning notices and barriers and reinstating the work area.

