SEMMPF320

Carrying out radiographic testing activities on castings

Overview

This standard identifies the competencies you need to carry out radiographic testing activities on castings, in accordance with approved procedures and techniques. The castings will have been produced from sand or ceramic moulds, dies or investment shells and they will be circular, square or irregular in shape and will have projections and internal cavities. The casting profiles will also be curved and tapered. The testing will generally take place after the castings have completed and passed all the other specified inspection and testing requirements. The term radiography is used in this standard and can include real time radiography or computed tomography (CT scanning) methods. Also the term radiographic testing can be using either photographic film or digital detectors.

Because of the presence of ionising radiation, a key requirement of radiographic testing is to ensure that you work in accordance with the relevant statutory regulations, local rules and instructions and that the safety features of the Controlled Test Area are fully operational at all times. You will be required to check that the radiographic test equipment complies with the specification requirements, is safe to use, fit for purpose and that it is set up correctly for the intended operations.

You will prepare the castings for testing, identifying the test area for future reference and you will check the casting for features which might interfere with the radiographic tests. You will set up and adjust the radiographic equipment, carry out the exposure and process the exposed film/detectors in the prepared facility. Following processing, you will be expected to check the image quality before storing the image ready for interpretation. Where radioactive sources are used, you will be required to keep these in the designated store, except when is use and to correctly record their movement.

Your responsibilities will require you to comply with organisational policy and procedures/techniques for the radiographic testing activities undertaken and to report any problems with the equipment in use, or the testing activities, that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work with a minimum of supervision, taking personal responsibility for your actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to the inspection of castings using radiographic testing techniques. You will have a sound understanding of radiographic principles, the nature and characteristics of ionising radiation and the equipment for X-ray and gamma radiography. You will understand how

images are formed, and the factors that affect image quality. You will also have knowledge of image processing, accruement and fixing requirements, along with the safe storage requirements of the image at all stages of use. Also your knowledge will

include the use of digital and computer radiography methods. You 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 potential hazards and safe working practice. You will understand the safety precautions required when carrying out the radiographic testing activities and when using the associated image processing materials 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.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety legislation, regulations, directives and other relevant guidelines
2. follow relevant instructions and specifications for testing activities
3. follow the appropriate procedures/techniques for use of tools and equipment to carry out the required tests
4. select and obtain tools, equipment and materials for the tests
5. set up and carry out the tests using the correct procedures/techniques and within agreed timescales
6. record the results of the tests in the appropriate format
7. review the results and carry out further tests if necessary
8. deal promptly and effectively with problems within your control and report those that cannot be solved
9. ensure that work records are completed, stored securely and available to others, as per organisational requirements
10. leave the work area in a safe condition on completion of the activities, as per organisational and legal requirements

Knowledge and understanding

You need to know and understand:

1. the specific safety precautions to be taken whilst carrying out the activities (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)
2. the health and safety requirements of the work area and the activities, and the responsibility these requirements place on you
3. the hazards associated with the activities, and how to minimise them and reduce risks
4. the personal protective equipment and clothing (PPE) to be worn during the activities
5. how to check the controlled test area complies with regulatory requirements (the identification and marking of boundary exclusions, 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)
6. the principles of radiographic testing (including the use of X-ray and gamma radiation as a penetrating agent; shadow effect and the projection and capture of the image developing, accruement, fixing, storage and the equipment used to view the images)
7. the sources of radiation used in radiographic testing activities (to include the X-ray tube generator and the use of radioactive isotopes)
8. the principles of real time radiography, computed tomography and digital processing of X-rays
9. image formation (including rectilinear propagation; the geometry of shadow projection, inverse square law, focal spot, formation of penumbra, filmless techniques and Image Quality Indicators)
10. 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; the use of exposure charts)
11. the use of manipulators to help position the castings to aid radiography
12. care and control of the equipment (to include checking condition of all electrical cables and connections, all mechanical functions and safety devices)
13. care of gamma-ray source containers and storage procedures for radioactive sources
    how to transport radioactive materials safely and correctly and the safe storage of the radioactive source containers
14. how to prepare the casting for the radiographic testing activities (including the identification of the test area and the use of lead markers)

15. the types and selection of radiographic films or digital detectors and the image processing/manipulation systems
16. how natural shrinkage, processing faults characteristic curves and the effect of development conditions on the finished image quality
17. radiographic image quality (to include sensitivity, density, contrast and definition and the effect of scattered radiation on the image)
18. the response of casting defects/flaws to penetrative radiation and the resulting images
19. the setting up/maintenance of storage/archiving 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. how to access, use and maintain information to comply with organisational requirements and legislation

Scope/range related to performance criteria

1. Inspect castings using radiographic testing techniques, carrying out all of the following:
    1. comply with Ionising Radiation Regulations/Directives, local rules, instructions issued by the radiation protection supervisor
    2. follow the defined radiographic testing techniques
    3. adhere to health and safety regulations, systems and procedures to realise a safe system of work
    4. leave the work area in a safe condition on completion of the activities
2. Prepare for the radiographic testing, carrying out all of the following checks:
    1. checking that all features of the controlled test area are in place and operating correctly (such as barriers, lights, signs, radiation survey meters)
    2. ensuring that the casting test areas/zones are correctly prepared and identified
    3. checking that all equipment and consumables are as specified and fit for purpose
    4. removing gamma ray source containers from the approved store, and recording details in the Source Movement Register
3. Set up the radiographic testing equipment, to provide all of the following:
    1. correct source location
    2. source focal distance (SFD) and beam orientation
    3. specified exposure parameters
    4. specified radiographic film or detectors and intensifying screens applied to the test areas
    5. correctly located Image Quality Indicator (IQIs) and identification markers
4. Carry out radiographic exposures on the castings to include all of the following activities:
    1. activating exposure warning devices
    2. monitoring the radiation survey meters
    3. storing the exposed image in the designated safe place
5. Process the exposed image data in the prepared facility, according

to manufacturer's instructions, carrying out all of the following:

1. using correct personal protective equipment
2. preparing the correct processing chemicals (as appropriate)
3. carrying out the processing requirements in the correct sequence and for the correct time
4. storing processed images in a safe place
5. disposing of used materials, in line with organisational and environmental safe practice

6. Check the quality of the developed image for all of the following features:

    1. processing faults
    2. sensitivity
    3. contrast
    4. image quality
    5. density

7. Complete an NDT report, recording all of the following data:

    1. casting identification
    2. test areas covered by identified radiographs
    3. test area geometries and thickness
    4. radiographic parameters/technique followed
    5. testing conditions
    6. type of Image Quality Indication (IQI)
    7. film/detector type
    8. processing conditions
    9. personal data

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

    1. closing down the equipment to a safe condition
    2. returning gamma radiation source containers to the approved store
    3. recording actions in the Source Movement Register (as appropriate)
    4. removing warning notices and barriers and reinstating the work area

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