Employer's Unit of Competence – **Magnetic particle testing of materials, products and plant**

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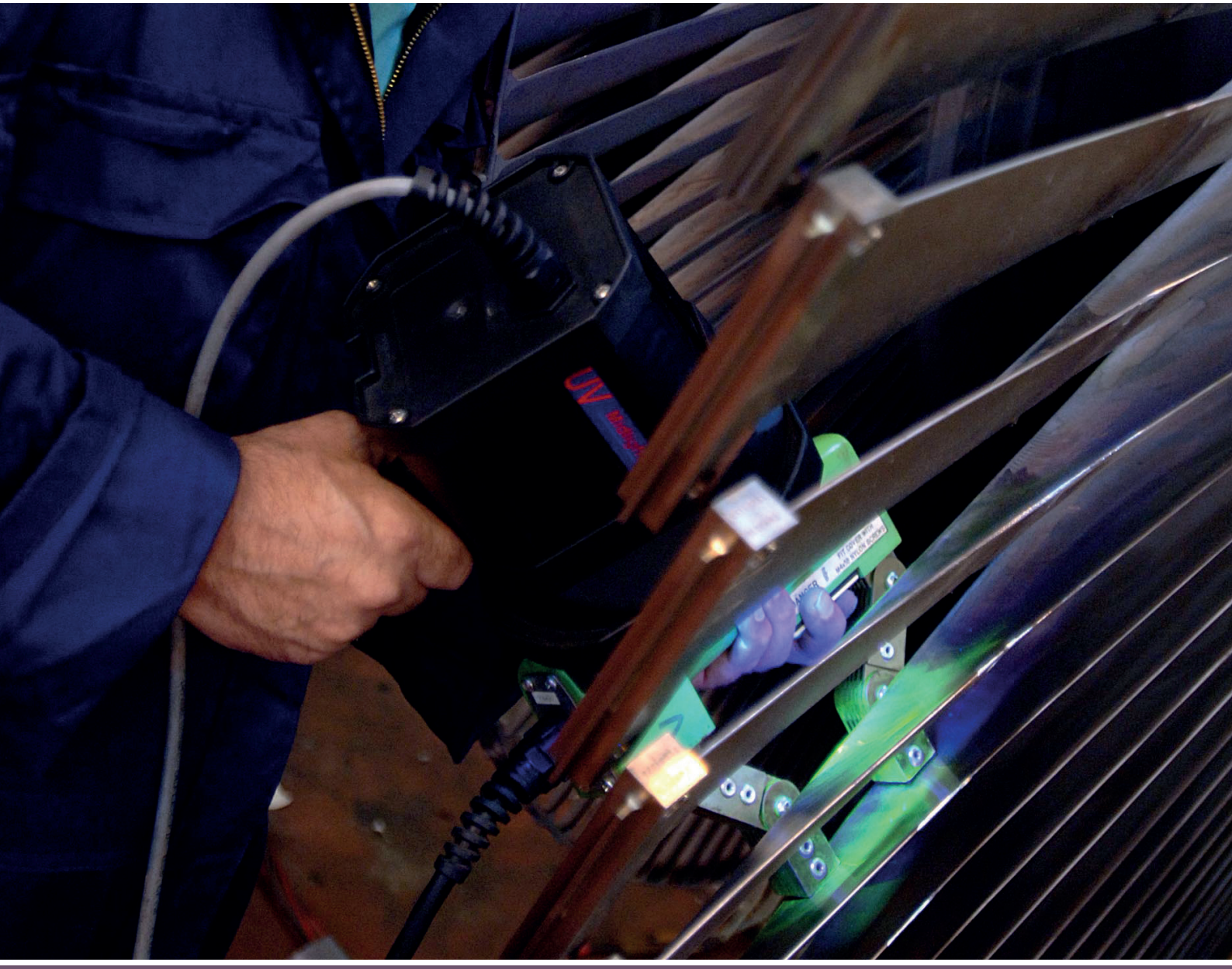

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Overview

This unit identifies the competencies required to carry out magnetic particle tests on ferromagnetic components, materials or structures in accordance with approved procedures.

The apprentice will be required to prepare the components, materials or structures for the magnetic particle testing activities and to check that the equipment complies with the specification requirements, is safe to use and fit for purpose. They must ensure that the ambient conditions are satisfactory for the tests to proceed and will set up the equipment according to the non-destructive testing (NDT) instructions and requirements. They will carry out the specified tests using the correct procedures and observe and record the test indications. They will complete the tests by producing an NDT test report containing the required test information and data, along with their interpretation of the test indications. They will be expected to mark up the components, materials or structures to show where there are indications of surface defects. The completed inspection report will be passed to the appropriate person, in accordance with organisational procedures.

The apprentice's responsibilities will require them to comply with organisational policy and procedures for the magnetic particle 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 the work and will provide an informed approach to the inspection of components, materials or structures by using magnetic particle testing methods. They will have a working knowledge of the principles of magnetic particle testing, including the methods of generating magnetic fields. They will understand the different types of equipment, their advantages, limitations and care, and the methods of calibration and performance checks. They will have detailed knowledge of testing practice and will understand why this method has significant limitations in its flaw detecting capabilities. Their knowledge will include an appreciation of hazards and safe working practices and they will understand the risks posed by material defects and the consequences of failure. The importance of compiling accurate and legible reports will also be a key issue in completing this unit.

The apprentice will understand the safety precautions required when carrying out the magnetic particle testing activities and when using the associated tools 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 Follow the correct specification for the product or equipment being inspected
P3 Use the correct equipment to carry out the inspection
P4 Identify and confirm the inspection checks to be made and acceptance criteria to be used
P5 Carry out all required inspections as specified
P6 Identify any defects or variations from the specification
P7 Record the results of the inspection in the appropriate format
P8 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 magnetic particle inspection activities on components, materials or structures

K2 The hazards associated with carrying out the magnetic particle inspection activities (such as electrical, mechanical, toxic and fire) and how they can be minimised

K3 The type(s) of personal protective equipment (PPE) to be used and how to obtain it

K4 The COSHH regulations relating to materials used during the magnetic particle inspection process

K5 How to obtain the necessary job instructions and testing specifications and how to interpret this information

K6 The reasons why some components, materials or structures need to be inspected using non-destructive testing methods

K7 Why it is sometimes necessary to use a range of different non-destructive testing methods (such as magnetic particle inspection, penetrant flaw detection, ultrasonics and radiography)

K8 The various types of magnetic particle detection equipment used (to include portable and fixed machines)

K9 The various components that make up the equipment (such as contact prods and heads, rigid and flexible coils, permanent magnets and electromagnets)

K10 The basic concepts of magnetic particle testing (including creating the magnetic field, magnetisation of the component, the use of a magnetic flux, disruption of the flux by discontinuities/flaws in the components and imaging of the disruption by the magnetic media)

K11 How to check that the testing equipment is within current calibration dates

K12 The checks that can be carried out on the equipment (such as sensitivity assessment, functional tests, operation of flux indicators and field strength meters, ammeters and the quality of the detecting medium)

K13 The different detecting media that are used (to include inks and powders), methods of applying them and their removal on completion

K14 How to set up the equipment parameters for the testing activities undertaken (to include selection of the magnetising technique, field strength, direction of current flow and calculation of the magnetising current and flux density required)

K15 The preparations to be carried out on the components, materials or structure test area (such as degreasing, grinding, filling, polishing and other mechanical operations and, where appropriate, the application of contrast aid paint)

K16 How to carry out the testing activities (including application of the magnetic field, application of the detecting media, the viewing conditions required, such as ambient light or ultraviolet (UV) light, identification of the displayed defects and defect transfer techniques (such as magnetic rubber and photographic))

K17 The types of defect that are detectable using magnetic particle detection methods

K18 How to recognise defects in the components, materials or structures from the displayed indications and how to identify a false indication of effects and their cause

K19 The level of defects that are acceptable in the components, materials or structures and the influence of the defects on the service/performance of the components, materials or structures

K20 The system of quality control within the company and who is responsible for it

K21 Why it is critical that records of magnetic particle inspections on the components are accurate, comprehensive and maintained legibly

K22 The person that the inspection records need to be passed to, the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Scope/range related to performance criteria

The apprentice must be able to:

1. Carry out **all** of the following during the magnetic particle inspection activities:
   - Obtain the required magnetic particle testing equipment and check it is in a safe and correctly calibrated condition
   - Use appropriate personal protective equipment
   - Comply with job instructions, NDT testing inspection specifications, relevant COSHH sheets and risk assessment documentation
   - Follow the defined 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. Check and confirm that **all** of the following ambient testing conditions are satisfactory:
   - Temperature
   - Humidity
   - Freedom from vibration
   - Freedom from pollutants.
3. Prepare the components, materials or structures for testing, to include carrying out **all** of the following:
   - Identifying and marking the test areas
   - Removing any contaminants from the test area (such as degreasing)
   - Preparing the test surface to the specified finish (such as grinding or polishing).
4. Ensure that the equipment is fit for purpose and safe to use, by checking **all** of the following:
   - The condition and security of electrical cables and connections
   - The operation of all mechanical functions
   - The function of powder/ink application
   - The correct operation of all safety devices.
5. Carry out **all** of the following tests, in accordance with instructions:
   - Setting the equipment parameters to the appropriate levels
   - Magnetising the components
   - Applying the detecting medium (ink or powder) correctly
   - Using magnetic flux indicators
   - Observing defect indications under correct lighting conditions (ambient light or ultraviolet (UV) light)
   - Recording the conclusions of observations
   - Demagnetising and cleaning the components on completion of the test.
6. Carry out magnetic particle 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 or pressure vessels)
- Other specific products.

7. Identify **all** of the following:

- Defect type
- Location of the defect
- Dimensional size of the defect.

8. Follow the correct procedure to deal with components, materials or structures that cover the following categories:

- Components, materials or structures that meet the specification
- Components, materials or structures with identified defects
- Components, materials or structures requiring further investigation
- Components, materials or structures requiring other inspection methods.

9. Complete an NDT report, to include recording **all** of the following:

- Product identification
- Material of construction
- Geometry, thickness and surface condition where defect indications were found
- Equipment settings (where applicable)
- Ambient testing conditions
- Defects identified
- Comparison of flaw data with acceptance criteria
- Conclusions and recommendations
- Personal data.

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

- Marking up defective components, materials or structures with all relevant information
- Recording all the required details of the inspection in the appropriate format
- Handing over the inspection details to the appropriate people.

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