SEMETS323

Inspecting engineering products by magnetic particle testing

Overview

This standard identifies the competences you need to carry out magnetic particle tests in accordance with approved procedures/techniques. This can apply to ferromagnetic components, materials or structures.

You will be required to prepare components, materials or structures, check equipment and ambient conditions, set up equipment, carry out tests, interpret test indications, prepare NDT test reports and mark up components, materials or structures to indicate surface defects. Your responsibilities will require you to comply with organisational policy and procedures and to report any problems with activities or equipment 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 penetrant flaw detection testing techniques. 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 and you will understand the risks posed by material defects/flaws and the consequences of component failure and how to carry out magnetic particle testing activities and use associated tools and equipment safely.

This standard is for anyone who inspects engineering products using magnetic particle 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 testing equipment, checking it complies with specification requirements, is safe to use and fit for purpose
4. calibrate and carry out performance checks on magnetic particle testing equipment at appropriate times
5. prepare and set up equipment parameters for testing activities in line with job requirements
6. prepare ambient conditions, ensuring they are satisfactory for tests to proceed
7. apply detecting media and apply magnetic fields in line with manufacturers' instructions and organisational procedures
8. carry out all required inspection checks as specified and identify any defects or variations
9. analyse test indications and identify any defects/flaws or variations from specification
10. mark up products or equipment to show where there are indications of defects/flaws
11. record accurately the results of the inspections in the appropriate format and in line with legislative and organisational requirements and pass to designated people
12. deal with problems within your control in line with organisational procedures without delay, reporting problems outside your control to designated people

Knowledge and understanding

You need to know and understand:

1. relevant health and safety, quality control 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 magnetic particle inspection activities including electrical, mechanical, toxic and fire
3. safe working practice and specific safety precautions to minimise hazards when carrying out magnetic particle inspection activities and using associated tools and equipment on components, materials and structures including personal protective equipment (PPE) to be used, and how to obtain it
4. how to obtain and interpret job instructions and testing specifications
5. Know how to interpret and evaluate test results to identify defects or variations from specification
6. the reasons why some components, materials or structures require to be tested using non-destructive testing methods and why it is sometimes necessary to use a range of different non-destructive testing methods
7. magnetic particle testing practice and its uses and limitations including the types of defect/flaw that are detectable, how to recognise them from displayed indications, and how to identify false indication of effects, and their causes
8. the various types of portable and fixed magnetic particle detection equipment and the components that make up the equipment
9. the basic concepts of magnetic particle testing including creating magnetic fields, magnetisation of components, the use of magnetic flux, disruption of the flux by discontinuities/flaws in components and imaging disruption by magnetic media
10. required viewing conditions including ambient or ultraviolet (UV) light
11. how to check that testing equipment is within current calibration dates
12. checks that can be carried out on equipment including sensitivity assessment, functional tests, operation of flux indicators and field strength meters, ammeters and quality of detecting medium
13. the different detecting mediums and defect transfer techniques and when and how to use them.
14. how to set up equipment parameters for testing activities including selection of magnetising technique, field strength, direction of current flow, calculation of

magnetising current required and flux density required
15. the preparations to be carried out on test areas and where appropriate, the application of contrast aid paint
16. acceptable levels of defects/flaws in components, materials or structures and the influence of defects/flaws on the service/performance
17. the importance of accurate test reports, the data and information required, organisational formats and how to prepare and complete them
18. the extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

Scope/range

1. Carry out all of the following during the magnetic particle inspection activities:
   1.1 obtain the required magnetic particle detection 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. Check and confirm that all of the following ambient testing conditions are satisfactory:
   2.1 temperature
   2.2 humidity
   2.3 freedom from contaminants
   2.4 lighting
3. Prepare the components, materials or structures for testing, to include carrying out all of the following:
   3.1 identifying and marking the test areas
   3.2 removing any contaminants from the test area (such as cleaning or degreasing)
   3.3 preparing the surface of the test area 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:
   4.1 the condition and security of electrical cables and connections
   4.2 the operation of all mechanical functions
   4.3 the function of powder/ink application
   4.4 the correct operation of all safety devices
5. Carry out all of the following tests, in accordance with instructions:
   5.1 setting the equipment parameters to the appropriate levels
   5.2 magnetising the components
   5.3 applying the detecting medium (ink or powder) correctly
   5.4 using magnetic flux indicators
   5.5 observing defect indications under correct lighting conditions (ambient light or ultraviolet (UV) light)
   5.6 analysing and interpreting results to identify defects of variations from specification
   5.7 recording conclusions of observations
   5.8 demagnetising (if required) and cleaning the components on completion of the test
6. Carry out magnetic particle testing on one of the following:

6.1 welded joints
6.2 castings
6.3 wrought products/materials (such as forged, rolled, extruded)
6.4 cold formed products (such as by bending, pressing, rolling)
6.5 heat treated components
6.6 structures (such as airframes, lifting beams, pressure vessels)
6.7 other specific products

7. Identify all of the following:
   7.1 defect/flaw type
   7.2 location of the defect/flaw
   7.3 dimensional size of the defect/flaw
8. Follow the correct procedure for materials or structures which fall into all of the following categories:
   8.1 components, materials or structures which meet the specification
   8.2 components, materials or structures with identified defects/flaws
   8.3 components, materials or structures requiring further investigation
   8.4 components, materials or structures requiring other inspection methods
9. Complete the inspection activities, to include carrying out all of the following:
   9.1 marking up defective components, materials or structures with all relevant information
   9.2 recording all the required details of the inspection in the appropriate format
   9.3 handing over the inspection details to the designated people

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

SEMETS323

Inspecting engineering products by magnetic particle testing

Developed by	Enginuity
Version Number	3
Date Approved	30 Mar 2021
Indicative Review Date	01 Mar 2024
Validity	Current
Status	Original
Originating Organisation	Enginuity
Original URN	SEMETS323
Relevant Occupations	Engineering, Engineering and Manufacturing Technologies, Engineering Technicians
Suite	Non Destructive Testing, Engineering Technical Support Suite 3
Keywords	engineering; technical; support; inspecting; magnetic particle; testing; ferromagnetic; components; welded joints; castings; structures