SEMMPF315

Inspecting castings by magnetic particle testing methods

Overview

This standard identifies the competencies you need to carry out magnetic particle tests on ferromagnetic castings produced from sand or ceramic moulds, dies or investment shells, in accordance with approved procedures/techniques. The castings inspected will be circular, square or irregular in shape and will have projections and internal cavities. The profiles will be curved and tapered. The testing will generally take place after the castings have received a provisional visual examination and have been fettled.

You will be required to prepare the castings for the magnetic particle testing activities and to check that the equipment complies with the specification requirements, is safe to use and is fit for purpose. You must ensure that the ambient conditions are satisfactory for the tests to proceed and you will set up the equipment according to the non-destructive testing (NDT) instructions and requirements. You will carry out the specified tests using the correct procedures/techniques and you will observe and record the test indications. You will complete the tests by preparing/completing a NDT test report, containing the required test information and data along with your interpretation of the test indications. You will be expected to mark up the castings to show where there are any indications of surface defects. The completed inspection report, along with the castings, will be passed to the appropriate person, in accordance with procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the magnetic particle testing activities undertaken and to report any problems with the equipment in use 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 magnetic particle testing. You will have a working knowledge of the principles of magnetic particle testing, including the methods of generating magnetic fields. You will understand the different types of equipment, their advantages, limitations and care and the methods of calibration and performance checks.

You will have a detailed knowledge of testing practice, and will understand why this

method has significant limitations on its flaw detecting capabilities. Your knowledge will include an appreciation of hazards and safe working practice and you will understand the risks posed by casting defects and the consequences of component failure. The importance of compiling accurate and legible reports will also be a key issue in complying with this standard.

You will understand the safety precautions required when carrying out the magnetic particle testing activities and when using the associated tools 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 the correct specification/technique for the product or equipment being inspected
3. identify and confirm the inspection checks to be made and acceptance criteria to be used
4. carry out the inspections, using appropriate equipment and techniques
5. identify any casting defects/flaws or variations from specification
6. record the results of the inspections in the appropriate format
7. deal promptly and effectively with problems within your control and report those that cannot be solved
8. ensure that work records are completed, stored securely and available to others, as per organisational requirements
9. leave the work area in a safe condition on completion

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 obtain the job instructions and testing procedures/techniques and how to interpret the information
6. the reasons why it is important to test castings using non-destructive testing methods
7. why castings need to be tested by a range of different non-destructive testing methods (magnetic particle, penetrant flaw detection, ultrasonic and radiography)
8. the various types of magnetic particle detection equipment used (to include portable and fixed machines)
9. the components that make up the equipment (such as contact prods and heads, rigid and flexible coils, permanent magnets, electromagnets)
10. the basic concepts of magnetic particle testing (including creating the magnetic field, magnetisation of the casting, the use of a magnetic flux, disruption of the flux by discontinuities/flaws in the castings and imaging of the disruption by the magnetic media, how and when to de-magnetise parts)
11. how to check that the testing equipment is within current calibration dates
12. the types of checks that can be carried out on the equipment (sensitivity assessment, functional tests, operation of flux indicators and field strength meters, ammeters and quality of detecting medium)
13. the different detecting mediums that are used (to include inks and powders), methods of applying them and their removal on completion of the testing
14. how to set up the equipment parameters for the testing activities undertaken (to include 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 the casting test area (degreasing, grinding, filling, polishing and other mechanical operations and, where appropriate, the application of contrast aid paint)
16.
how to carry out the testing activities (including the application of the magnetic field, application of the detecting media, viewing conditions required such as ambient light or ultraviolet (UV), identification of the displayed defects, defect transfer techniques such as magnetic rubber and photographic)
17. the types of defects/flaws that are detectable using magnetic particle detection methods (sub-surface connected blowholes/shrinkage, inclusions, cracks, hot tears, cold shut, mis-runs, scab, oxide fold, and mould-metal reactions)
18. how to recognise defects/flaws in the castings from the displayed indications and how to identify false indication of effects and their cause
19. the level of defects/flaws that are acceptable in the castings; the influence of the defects/flaws on the service/performance of the casting
20. the system of quality control within the company and who is responsible for it
21. the extent of your own responsibility and whom you should report to if you have problems that you cannot resolve
22. how to access, use and maintain information to comply with organisational requirements and legislation

Scope/range related to performance criteria

1.

Inspect castings using magnetic particle testing methods, carrying out all of the following activities:

1.1 obtain the required magnetic particle testing equipment, and check it is correctly calibrated and in a safe condition
1.2 adhere to health and safety regulations, systems and procedures to realise a safe system of work
1.3 comply with job instructions/techniques, NDT testing inspection specifications
1.4 follow the defined testing procedures
1.5 leave the work area in a safe condition on completion of the activities

2.

Confirm that the ambient conditions for testing are satisfactory by checking all of the following:

2.1 temperature
2.2 humidity
2.3 free from vibration
2.4 free from pollutants

3.

Prepare the castings for testing, to include all of the following:

3.1 identifying and marking the test areas
3.2 removing any contaminants from the test area (such as by degreasing)
3.3 preparing the test surface to the specified finish (such as by grinding or polishing)

4.

Ensure that the specified equipment is fit for purpose and safe to use, by checking all of the following:

4.1 condition and security of electrical connections
4.2 operation of all mechanical functions
4.3 function of powder/ink application
4.4 correct operation of all safety devices

5.

Carry out the specified tests to include all of the following:

5.1 setting the equipment parameters to the appropriate levels
5.2 magnetising the casting
applying the detecting medium (ink or powder) correctly
5.3 using magnetic flux indicators
5.4 observing defect indications under correct lighting conditions (ambient light or ultraviolet (UV))

5.5 recording conclusions of observations
5.6 demagnetising and cleaning the casting on completion of the test

6.

Identify five of the following casting surface defects/flaws:

6.1 inclusions
6.2 cold shuts
6.3 scabs
6.4 mould metal reactions
6.5 cracks
6.6 mis-runs
6.7 oxide folds
6.8 sub-surface connected blowholes/shrinkages
6.9 hot tears
6.10 other defects/flaws (specify)

7.

Follow the correct procedure to deal with castings in all of the following categories:

7.1 castings which meet the specification
7.2 castings with identified defects/flaws
7.3 castings requiring further investigation
7.4 castings requiring other inspection methods

8.

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

8.1 marking up defective castings with all relevant information
8.2 recording all the required details of the inspection in the appropriate format
8.3 handing over the castings and inspection details to the appropriate people

SEMMPF315

Inspecting castings by magnetic particle testing methods

Developed by	Enginuity
Version Number	2
Date Approved	30 Mar 2020
Indicative Review Date	31 Mar 2023
Validity	Current
Status	Original
Originating Organisation	Semta
Original URN	SEMMPF315
Relevant Occupations	Engineering and Manufacturing Technologies, Manufacturing Technologies, Process Operatives, Process, Plant and Machine Operatives
Suite	Materials Processing and Finishing Suite 3
Keywords	Engineering; manufacturing; processing; inspection; ferromagnetic casting; magnetic partial; testing; procedure; method; equipment