SEMETS311

Inspecting mechanical products

Overview

This standard identifies the competences you need to inspect mechanical products, in accordance with approved procedures. You will be required to prepare the work area, ensuring that it is safe and free from hazards, to obtain all relevant and current documentation, and to obtain the tools and equipment required. You will be required to select the appropriate inspection equipment, based on the features to be checked and the accuracy to be measured. This will involve checking that the appropriate equipment is within current test dates and, where necessary, setting up and calibrating the equipment ready for the inspection operations to be performed. In carrying out the inspection activities, you will be expected to check the components for both dimensional and geometrical accuracy, and this may be required to be undertaken at various stages of manufacture, such as random sampling during production, pre-assembly, intermediate and final assembly. Components to be inspected could include machined components, pressings, mouldings, castings, forgings, assemblies and sub-assemblies, treated and coated components.

Your responsibilities will require you to comply with organisational policy and procedures for inspecting mechanical products, and to report any problems that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to ensure that all tools and equipment used to inspect the mechanical product are correctly accounted for on completion of the activities and are returned to the correct location. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the 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 applying inspection techniques and procedures to mechanical products including, where appropriate, British, European and International standards. You will understand how to use the appropriate tools and equipment to inspect mechanical products, in adequate depth to provide a sound basis for carrying out the inspection activities and identifying where features of the products do not meet the required specification tolerances.

You will understand the safety precautions required when carrying out the inspection activities. 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 and other relevant regulations, directives and guidelines
2. follow the correct specification for the product or equipment being inspected
3. use the correct equipment to carry out the inspection
4. identify and confirm the inspection checks to be made and acceptance criteria to be used
5. carry out all required inspections as specified
6. identify any defects/flaws or variations from the specification
7. record the results, and complete inspection documentation in the appropriate format
8. deal promptly and effectively with problems within your control and report those that cannot be solved

Knowledge and understanding

You need to know and understand:

1. the specific health and safety precautions to be taken when inspecting mechanical components (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice)
2. Regulations with regard to the substances used in the inspection process
3. the hazards associated with inspecting mechanical products, and how they can be minimised
4. the appropriate personal protective equipment and clothing (PPE) to be worn during the inspection activities
5. how and where to obtain the required drawings and related specifications, and how to check that they are current and complete
6. how to extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken
7. how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
8. the use of relevant standards in determining if components and products are fit for purpose
9. the general principles of quality assurance systems and procedures
10. preparations to be undertaken before the product is inspected
11. the effects that the environment may have on the measurements taken (such as in particular where precision measurements are concerned)
12. the need to select and use set datum faces, and the effects of taking readings from different datums (such as accumulation of limits leading to errors)
13. the application and uses of the tools and equipment to inspect mechanical products (such as micrometers, verniers, gauges, special measuring equipment)
14. how to determine the correct equipment for the feature to be inspected, considering the dimensional size and tolerance to be achieved
15. the importance of ensuring that tools and equipment are set up correctly and are in a safe and useable condition
16. the procedure and methods used to check that tools and equipment are within calibration date

17. why sampling is used, and when it is an effective means of quality assurance
18. the typical defects and variations that can be found on mechanical products, and how to identify them
19. the need to carry out the checks and to record the results on the appropriate documentation
20. the procedure to be followed when inspected products are out of specification
21. the importance of completing inspection documentation, what needs to be recorded and where records are kept
22. 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 inspecting activities:

1.1 obtain and use the correct issue of drawings, job instructions and specifications
1.2 obtain and check the condition and calibration dates of tools, measuring instruments and equipment to be used
1.3 follow specified or appropriate inspection procedures
1.4 use the correct and appropriate tools and equipment at all times
1.5 apply adjustment of inspection results for temperature correction (where applicable)
1.6 identify and record any out-of-specificationfeatures, using the appropriate work procedures
1.7 investigate and, where appropriate, obtain a concession for out-of-specification products
1.8 place products in the correct location on completion of the inspection activities (compliant and non-compliant specifications)
1.9 leave the work area in a safe and tidy condition on completion of the activities

2.

Inspect one of the following types of mechanical product

2.1 machined components
2.2 castings
2.3 extrusions
2.4 mechanical assemblies/sub-assemblies
2.5 forgings
2.6 patterns
2.7 pressings
2.8 overhauled products
2.9 mouldings
2.10 treated/coated components
2.11 other specific mechanical product

3.

Carry out two of the following inspection procedures:

3.1 first/one-off
3.2 one hundred percent final inspection of components or products
3.3 in-process sample/patrol inspection
3.4 random/selective sampling of finished components or product
3.5 statistical quality control

4.

Inspect mechanical products, using twelve of the following:

4.1 rule or tape

4.2 gap gauge
4.3 surface texture comparison plates
4.4 external micrometer
4.5 feeler gauge
4.6 surface texture measuring machines
4.7 internal micrometer
4.8 hole gauge
4.9 optical equipment (such as shadowgraphs, microscopes)
4.10 depth micrometer
4.11 thread gauge
4.12 height micrometer
4.13 thread wires
4.14 temperature gauges
4.15 specialist micrometers
4.16 slip gauge
4.17 flow meters
4.18 length vernier
4.19 protractors
4.20 pressure gauges
4.21 depth vernier
4.22 sine bar or table
4.23 co-ordinate measuring machines (CMM)
4.24 height vernier
4.25 dial test indicator
4.26 electrical measuring equipment
4.27 straight edge
4.28 radius/profile gauges
4.29 visual checks for appearance and completion
4.30 engineer's square
4.31 torque wrench
4.32 inclinometer
4.33 other specific equipment

5.

Use the relevant equipment to measure and check twelve of the following features:

5.1 external diameters
5.2 thread fit
5.3 holes or slots on linear/angular pitch
5.4 internal diameters/bores
5.5 thread form/profile
5.6 special forms (such as gear, spline, serrations)
5.7 length/linear dimensions
5.8 internal profiles/forms/surfaces
5.9 shoulders and steps
5.10 external profiles/forms/surfaces
5.11 fit/working clearance
5.12 depth
5.13 angular faces

5.14 physical properties (such as hardness)
5.15 internal tapers
5.16 chamfers and radii
5.17 bonding strength
5.18 external tapers
5.19 grooves/undercuts
5.20 coating thickness
5.21 eccentric features
5.22 counterbored/countersunk holes
5.23 torque
5.24 recesses
5.25 holes or slots on pitch circles
5.26 electrical characteristics
5.27 slots

6.

Use appropriate equipment to check eight of the following geometric features:

6.1 flatness
6.2 position/location
6.3 verticality
6.4 alignment
6.5 orientation
6.6 parallelism
6.7 squareness
6.8 concentricity
6.9 geometry
6.10 ovality/lobing
6.11 eccentricity
6.12 distortion
6.13 straightness
6.14 level
6.15 surface finish

7.

Complete inspection documentation, to include one from the following, and pass to the appropriate people:

7.1 inspection report
7.2 concession report
7.3 job card
7.4 customer specific documentation

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