SEMMPF3068

Developing casting inspection programs for co-ordinate measuring machines (CMM)

Overview

This standard identifies the competences you need to develop casting inspection programs for co-ordinate measuring machines (CMM), in accordance with approved procedures. You will be required to set up and activate the programming software, to develop the casting inspection program and to check that the system is operating correctly. You must ensure that you have been provided with accurate, current, complete casting component data and information, in order to produce the program. You will be required to develop efficient and effective programs, which combine a range of different operations. The programs will be formatted to avoid unnecessary measurements and probe movements and will use the correct reference codes and preparatory commands for the machine management and auxiliary functions. On completion of the programming activities, you will be required to save the program in the correct format and location.

Your responsibilities will require you to comply with organisational policy and procedures for developing the co-ordinate measuring machine casting inspection programs and to report any problems with these 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 own 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 applying programming techniques and procedures for co-ordinate measuring machines. You will understand the co-ordinate measuring machine capabilities, the various types of probes used in the measuring and inspection process, and their application. You will also know about the programming methods and language, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the inspection program developed will check the cast components to the required specification in the most efficient way.

You will understand the safety precautions required when working on a computer system and with its associated 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 and towards the environment.

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 program development
3. prepare information and equipment for development work
4. develop computer control programs using the approved data for the casting inspection to be carried out
5. ensure the format, language and references used in programs are appropriate for the type of controller
6. make amendments to program parameters, within agreed control procedures
7. conduct the checks on completion of programming activities
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

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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. the correct start-up and shutdown procedures to be used for the computer system
6. how to access the specific programming software and the use of manuals and related documents to solve problems and aid the efficient programming of co-ordinate measuring machines
7. the importance of protecting the computer system from viruses and the implications if the correct procedure is not followed
8. how to power up, log on and activate the computer system and programming software correctly
9. how to deal with system problems (error messages received, peripherals which do not respond as expected)
10. the checks to be carried out to ensure that peripheral devices are connected correctly
11. how to create and structure directories and files correctly (importing, copying, transferring, exporting, deleting, backing up and saving files)
12. the different types of storage media that can be used to save program files
13. the source data used to produce co-ordinate measuring machine programs (such as computer aided design (CAD) data, components and models)
14. the different codes/references used to identify factors such as measuring axis, positional information, probe type, identification and selection, probe paths, machine management and auxiliary functions
15. the general and technical information and data required to produce complete and accurate co-ordinate measuring machine inspection programs how to extract and interpret data from different sources (drawings, computer models, symbols and conventions, current industry standards and codes of practice)
16. the factors to be taken into account when producing co-ordinate measuring machine programs (including, the type of machine and its machining capabilities, the measuring probes available, safety,

workholding equipment and the cast component tolerances)
17. how to produce effective and efficient programs, to avoid unnecessary measuring operations and probe movements
18. the methods and procedures used to check that the completed program will inspect the casting safely, accurately and efficiently
19. how to back up completed or edited programs and the implications if this is not carried out effectively
20. the problems that can occur with the downloading and running of the program, and how these can be overcome
21. the correct procedure to be followed before the program is released to the end user
22. the extent of your own responsibility and whom you should report to if you have problems that you cannot resolve
23. how to access, use and maintain information to comply with organisational requirements and legislation

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Scope/range related to performance criteria

1. Prepare for programming activities by carrying out all of the following:

   1. check that all the equipment is correctly connected and is in a safe and usable condition (such as cables undamaged, correctly connected, safely routed)
   2. power up the equipment and activate the programming software
   3. set up the computer system to be able to produce the program
   4. ensure that you have the necessary cast component data and information to develop the program
   5. identify and deal with problems (such as information based and/or technical)

2. Develop co-ordinate measuring machine casting inspection programs, using one of the following sources of information:

   1. computer aided design data
   2. component/model
   3. engineering drawings
   4. digitized data
   5. scanned data
   6. other specific data

3. Develop co-ordinate measuring machine casting inspection programs using one of the following methods:

   1. entered directly into the measuring machine controller
   2. remote/offline programming

4. Ensure the programming take into account ten of the following requirements:

   1. the sequence that the casting features/dimensions should be checked
   2. security/clamping requirements of the cast component
   3. geometric features to be inspected
   4. dimensional tolerances required
   5. suitable or specified datum/alignment point
   6. absolute and/or incremental system of measurement
   7. imperial or metric system of measurement
   8. safe start position
   9. probe information (such as number, type, diameter, radius correction, head configuration)

10. measuring parameters, to avoid collisions (such as direction, feed in/out)
11. preparatory commands and machine management/auxiliary functions
12. use repetitive programs
13. probe change positions
14. any additional information to convert the program into the correct format (post processing)

5. Develop co-ordinate measuring machine programs that will measure ten of the following:

   1. diameters
   2. threads
   3. recesses
   4. internal diameters/bores
   5. eccentric features
   6. slots
   7. tapered diameters
   8. angular faces
   9. holes or slots on linear/angular pitch
   10. tapered bores
   11. internal profiles/forms/surfaces
   12. holes or slots on pitched circles
   13. shoulders and steps
   14. external profiles/forms/surfaces
   15. counterbored/countersunk holes
   16. linear dimensions (lengths)
   17. grooves/undercuts
   18. depths
   19. special forms (such as gear, spline, serrations)

6. Develop programs to check four of the following geometric features:

   1. flatness
   2. position/location
   3. parallelism
   4. alignment
   5. orientation
   6. geometry
   7. squareness
   8. concentricity
   9. ovality/lobbing

7. Conduct the following checks on completion of the programming activity:

   1. check and review the program format and content
   2. edit the program using the correct procedure (where

appropriate)
3. check that the program is correctly titled and referenced
4. ensure that programs are stored safely and correctly, in the correct format and location
5. ensure that the program has been checked and approved before the inspection activity is undertaken
6. create a separate back-up copy of the program, in case of file corruption or deletion

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