SEMETS331

Producing operating programs for co-ordinate measuring machines (CMM)

Overview

This standard identifies the competences you need to produce 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 produce the component program, and to check that the system is operating correctly. You must ensure that you have been provided with accurate, current, complete data and information, in order to produce the program. You will be required to produce 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 producing the co-ordinate measuring machine 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 process, and their application. You will also know about the programming methods and codes, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the program produced will check the 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.

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. produce computer control programs that contain all the relevant and necessary data for the engineering activity to be carried out
3. produce the computer control programs in the appropriate formats
4. make sure that codes and other references used in the programs are applicable to the type of controller used
5. pass on the programs to the appropriate people, within agreed timescales
6. save and back up the program detail, and store securely in accordance with organisational requirements
7. undertake changes to program details, within agreed control procedures

Knowledge and understanding

You need to know and understand:

1. the specific safety precautions to be taken when working with computer systems (to include safety guidance relating to the use of visual display unit (VDU), equipment and workstation environment, repetitive strain injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections)
2. how to return the work area to a safe and useable condition (such as cleaning down work surfaces; putting media, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)
3. the basic set-up and operation of the computer system, and any peripheral devices that are used
4. the correct start-up and shutdown procedures to be used for the computer system
5. 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
6. the importance of protecting the computer system from viruses, and the implications if the correct procedure is not followed
7. how to power up, log on and activate the computer system and programming software correctly
8. how to deal with system problems (such as error messages received, peripherals which do not respond as expected)
9. the checks to be carried out to ensure that peripheral devices are connected correctly
10. the correct procedure to shut down the operating and programming system
11. how to create and structure directories and files correctly (such as 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 axes, positional information, probe identification and selection, probe paths, machine management and auxiliary functions

15. the main machine controllers that are available, and the importance of understanding that a different machine controller may use a completely different codes for similar functions
16. the information and data required in order to produce complete and accurate co-ordinate measuring machine programs
17. how to extract and interpret general and technical data and information from different sources (such as drawings, computer models, symbols and conventions, BS or ISO standards) in order to produce the co-ordinate measuring machine program
18. 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 component tolerances)
19. how to produce effective and efficient programs, to avoid unnecessary measuring operations and probe movements
20. the methods and procedures used to check that the completed program will measure the component safely, accurately and efficiently
21. how to save the completed programs in the appropriate format, and the need to store programs safely and correctly
22. how to back up completed or edited programs, and the implications if this is not carried out effectively
23. the problems that can occur with the downloading and running of the program, and how these can be overcome
24.
the correct procedure to be followed before the program is released to the end user
25.
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, in preparation for the programming activity:

1.1 check that all the equipment is correctly connected, and is in a safe and usable condition (such as cables undamaged, correctly connected, safely routed)
1.2 power up the equipment and activate the programming software
1.3 set up the computer system to be able to produce the program
1.4 ensure that you have the necessary component data and information to produce the program
1.5 identify and deal with problems (such as information based and/or technical)

2.

Produce computer control programs, using one of the following sources of information:

2.1 computer aided design data
2.2 component/model
2.3 engineering drawings
2.4 digitized data
2.5 scanned data
2.6 other specific source of data

3.

Carry out all of the following, as applicable to the programming method selected:

3.1 import computer aided design (CAD) component data file
3.2 position the reference/master component on the co-ordinate measuring machine
3.3 select a suitable or specified datum/alignment point
3.4 select absolute and/or incremental system of measurement
3.5 select imperial or metric system of measurement
3.6 input the safe start position
3.7 input probe information (such as number, type, diameter, radius correction, head configuration)
3.8 input/check measuring parameters, to avoid collisions (such as direction, feed in/out)
3.9 input preparatory commands and machine management/auxiliary functions
3.10 use repetitive programs (sub-routines, canned cycles, labels, macros)
3.11 select and input probe change positions
3.12 input any additional information to convert the program into the correct format (post processing)

4.

Produce computer control programs that will measure ten of the following:

4.1 diameters

4.2 threads
4.3 recesses
4.4 internal diameters/bores
4.5 eccentric features
4.6 slots
4.7 tapered diameters
4.8 angular faces
4.9 holes or slots on linear/angular pitch
4.10 tapered bores
4.11 internal profiles/forms/surfaces
4.12 holes or slots on pitched circles
4.13 shoulders and steps
4.14 external profiles/forms/surfaces
4.15 counterbored/countersunk holes
4.16 linear dimensions (lengths)
4.17 grooves/undercuts
4.18 special forms (such as gear, spline, serrations)
4.19 depths

5.

Produce programs to check four of the following geometric features:

5.1 flatness
5.2 position/location
5.3 parallelism
5.4 alignment
5.5 orientation
5.6 geometry
5.7 squareness
5.8 concentricity
5.9 surface finish
5.10 ovality/lobbing

6.

Carry out all of the following, on completion of the programming activity:

6.1 check and review the program format and content
6.2 edit the program using the correct procedure (where appropriate)
6.3 check that the program has the correct identification name and reference
6.4 ensure that programs are stored safely and correctly, in the correct format and location in accordance with organisation requirements
6.5 ensure that the program has been checked and approved before forwarding to the end user
6.6 create a separate back-up copy of the program, in case of file corruption or accidental deletion

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