SEMAE3217

Carrying out aircraft component CNC machine tool programming

Overview

This standard identifies the competences you need to produce, load and prove aircraft component machine tool programs on Computer Numerical Control (CNC) machine tools, in accordance with approved procedures. It covers both fixed wing and rotary winged aircraft components. You will be required to produce the component program, using manual data input or by use of a remote computer, saving the prepared program on storage media or by downloading it into the machine controller from the computer. You will need to check the program using single block run and program edit facilities. You will also be required to adjust the machine tool equipment and program, following proving/editing procedures, to achieve component specification. You must ensure that any edited programs are saved safely and correctly.

Your responsibilities will require you to comply with organisational policy and procedures for producing, loading and proving the 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 the machine tool programming procedures used in an aeronautical manufacturing environment. You will understand the CNC machine tools used in the process and their application and will know about the programming, editing and proving process, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the machine controller is set up to produce the aircraft components to the required specification.

You will understand the safety precautions required when working on the machine and its 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.

Setting workholding devices and tooling is the subject of other standards.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. create the required CNC machine tool program
3. use the correct control program and ensure it is correctly loaded into the machine controller
4. follow the correct procedures for calling up the program and dealing with any error messages or faults
5. confirm program integrity
6. adjust the equipment and program operating parameters to optimise the outcomes to be achieved
7. load and correctly set up all associated equipment
8. produce CNC programmes using appropriate methods and techniques
9. develop and prove part programmes using relevant methods and techniques
10. check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
11. deal promptly and effectively with problems within your control and report those that cannot be solved
12. leave the work area and machine in a safe and appropriate condition on completion of the activities

Knowledge and understanding

You need to know and understand:

1. the specific safety precautions to be taken when creating, loading and proving CNC machine tool operating programs
2. the requirements and importance of understanding and applying human factors as defined by the regulatory requirements and the potential impact if these are not adhered to
3. how to start and stop the machine in normal and emergency situations
4. the importance of wearing the appropriate protective clothing and equipment (PPE) and of keeping the work area clean and tidy
5. the computer coding language used in CNC programs with regard to machine axes, positional information, machine management and auxiliary functions
6. how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate CAA, FAA, BS, ISO or BSEN standards) in relation to work undertaken
7. how to interpret first and third angle drawings, imperial and metric systems of measurement, and system of tolerancing
8. how to interpret CNC drawings, and the use of workpiece zero/reference points
9. the systems of measurement used on CNC drawings, including absolute and incremental
10. the use of repetitive programs and canned cycles, to reduce program size and input time
11. how to prepare part programs, using operational sequences and machining techniques which avoid unnecessary tool/cutter movements or tool changes
12. the function keys and operating system of the machine computer control system being operated
13. how to set machine datums for each of the machine axes being used
14. how to set the machine controller in the program and editing mode and enter or download the prepared program
15. how to deal with error messages and faults on the program or equipment
16. how to access the program edit facility, in order to enter tooling data such as tool datums, positions, lengths, offsets and radius compensation
17. the use of tool posts, magazines and carousels and how to identify the tools in relationship to the operating program
18. how to conduct trial runs, using single block run, dry run and feed and speed

override controls

19. factors which will affect the feeds and speeds that can be used, and why they may need to be adjusted from the program setting (such as condition of material, workholding method, tooling used, tolerance and finish to be achieved)
20. the items that you need to check before allowing the machine to operate in full program run mode
21. how to save the completed programs in the appropriate format and the need to store media safely and correctly, away from contaminants and corruption sources
22. typical problems that can occur with the programming, loading and editing activities and what to do if they occur
23. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve

Scope/range related to performance criteria

1.

Carry out all of the following during the programming activities:

1.1 obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation)
1.2 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
1.3 use the appropriate reference manuals and programming codes to suit the machine controller
1.4 follow safe practice/approved programming procedures at all times
1.5 prepare the machine controller ready to accept the operating program
1.6 input/load the prepared program into the controller safely and correctly
1.7 store programs safely and correctly in the appropriate format and away from contaminants or corruption sources

2.

Prepare, load and prove programs for one of the following types of CNC machine tool:

2.1 two axis machine
2.2 multiple axis machines (5 or more)
2.3 three axis machine
2.4 machining centres
2.5 other specific CNC machine

3.

Produce CNC programs using one of the following methods:

3.1 written
3.2 entered directly into the machine controller
3.3 using computer software

4.

Develop part programs which contain all of the following, as applicable to the machine type:

4.1 all necessary positional information
4.2 appropriate letter address codes
4.3 preparatory commands and machine management/auxiliary functions
4.4 repetitive programs (sub-routines, canned cycles, labels)
4.5 absolute or incremental systems of measurement
4.6 tool/cutter change positions
4.7 tool information (lengths, offsets, radius compensation, wire size)

5.

Prove the part program using six of the following:

5.1 single block run

5.2 full dry run
5.3 program save/store facilities
5.4 graphic displays
5.5 search facilities
5.6 edit facilities
5.7 program override controls (speed, feed, tool data)
5.8 data input facilities

6.

Confirm that the machine and program operates safely and correctly, by checking all of the following:

6.1 all operations are carried out to the program co-ordinates
6.2 tool change positions are safe and clear of the workpiece and machine equipment
6.3 the correct tools are selected at the appropriate points in the program
6.4 tool cutter paths are executed safely and correctly
6.5 auxiliary functions operate at the correct point in the program (cutter start/stop, coolant flow)
6.6 programs have been saved in the appropriate format

Behaviours

You will be able to apply the appropriate behaviours required in the workplace to meet the job profile and overall company objectives, such as:

- strong work ethic
- positive attitude
- team player
- dependability
- responsibility
- honesty
- integrity
- motivation
- commitment

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