

Setting CNC turning machines for production

Overview

This standard identifies the competences you need to prepare and set up Computer Numerical Control (CNC) turning machines or CNC machining centres, in accordance with approved procedures. You will be expected to select the appropriate workholding devices, and to mount and secure them to the machine spindle. You will also be required to select the appropriate cutting tools, mount and secure them to the appropriate tool holding devices, and place the cutting tools in the relevant positions within the tool posts, turrets, slides or tool change magazine/carousel, where this is applicable.

You will need to ensure that all the tools have been allocated a relevant tool number, and that the relevant data on their co-ordinates and datum positions are entered into the operating program and machine. This will involve loading and proving component programs, checking for errors/faults, editing and saving program changes.

You must produce trial components and prove the machine is working satisfactorily before declaring the machine ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of your role.

Your responsibilities will require you to comply with organisational policy and procedures for the machine setting activities undertaken, and to report any problems with the equipment, tooling, programs or setting-up 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 the setting-up procedures used. You will understand the CNC turning machine used, and its application, and will know about the workholding devices, tooling, machine operating programmes and setting-up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults, and ensuring the work output is produced to the required specification.

You will understand the safety precautions required when working with 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.

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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. follow the correct specifications for the component to be produced
3. determine what has to be done and how the machine will be set to achieve this
4. mount, set and secure the required workholding devices, workpiece and cutting tools
5. set the machine tool operating parameters to achieve the component specification
6. check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
7. complete the required production documentation
8. deal promptly and effectively with problems within your control and report those that cannot be solved

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Knowledge and understanding

You need to know and understand:

1. how to work safely at all times, complying with health and safety and other relevant regulations, directives and guidelines
2. how to start and stop the machine in normal and emergency situations
3. the importance of ensuring that the machine is isolated from the power supply before mounting cutting tools and workholding devices
4. the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
5. the hazards associated with working on CNC lathes and how to minimise them
6. how to handle and store cutting tools and CNC programs, safely and correctly
7. how to save the programs in the appropriate format, and the importance of storing programs and storage devices safely and correctly, away from contaminants and possible corruption
8. the methods and procedures used to minimise the chances of infecting a computer with a virus
9. the implications if the computer you are using does become infected with a virus and who to contact if it does occur
10. how to extract and use information from engineering drawings or data and related specifications (to include symbols and conventions to appropriate standards) in relation to work undertaken
11. how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
12. the range of workholding methods and devices that are used on CNC lathes
13. why it is important to set the workholding device in relationship to the machine datum's and reference points
14. the methods of setting the workholding devices, and the tools and equipment that can be used
15. the range of cutting tools that are used on CNC lathes, and typical applications
16. how to check that the cutting tools are in a safe and serviceable condition
17. the use of tungsten carbide, ceramic and diamond indexable tips, and the factors which will determine their selection and use
18. the various tool holding devices that are used, and the methods of correctly mounting and securing the cutting tools to the tool holders
19. the advantages of using pre-set tooling, and how to set the tooling using setting jigs/fixtures
20. the use of tool posts, magazines and carousels, and how to position

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- and identify the tools in relationship to the operating program
21. how to place the machine into the correct operating mode, and how to access the program edit facility in order to enter tooling data, such as tool datums, positions, lengths, offsets and radius compensation
 22. how to conduct trial runs using single block run, dry run and feed and speed override controls
 23. why you would conduct a full dry run and single block run
 24. the items that you need to check before allowing the machine to operate in full program run mode
 25. how the various types of materials used will affect the feeds and speeds that can be used
 26. the application of cutting fluids with regard to a range of different materials, and why some materials do not require the use of cutting fluids
 27. typical problems that can occur with the setting up of the tooling and workholding devices, and what to do if they occur
 28. the extent of your own responsibility and to whom you should report if you have problems that you cannot resolve

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Scope/range related to performance criteria

1. Carry out all of the following during the setting-up activities:
 1. obtain and use the appropriate documentation
 2. adhere to procedures or systems in place for risk assessment, personal protective equipment and other relevant safety regulations and procedures to realise a safe system of work
 3. follow safe practice/approved setting up procedures at all times
 4. confirm that the correct operating program has been loaded
 5. check that the tooling is in a usable condition
 6. ensure that the workpiece is correctly positioned and secured without distortion
 7. update the program tool data, as applicable
 8. ensure that correctly adjusted machine guards are in place
 9. leave the work area and machine in a safe and appropriate condition on completion of the activities
2. Prepare one of the following CNC turning machines in readiness for production:
 1. CNC lathe
 2. CNC machining centre
3. Position and secure workpieces using two of the following workholding methods and devices:
 1. chucks with hard jaws
 2. chucks with soft jaws
 3. fixtures
 4. drive centres
 5. collet chucks
 6. faceplates
 7. magnetic/pneumatic devices
 8. other specific workholding device
4. Select and mount the appropriate tool holding device and eight of the following types of cutting tool:
 1. roughing tool
 2. screw-thread tool
 3. centre drills
 4. reamers
 5. finishing tool
 6. profiling tools
 7. twist/core drills
 8. maxi-tipped drills
 9. parting-off tool
 10. form tools
 11. boring tools
5. Prepare the tooling for operation, by carrying out all the following activities, as applicable to the machine type:

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1. positioning tools in the correct position in the tool posts, turrets, magazine or carousel
2. checking tools have a specific tool number in relation to the operating program
3. entering all relevant tool data to the operating program (tool lengths, tool offsets, radius compensation)
4. pre-setting tooling using setting jigs/fixtures
5. setting tool datum
6. saving changes to the program (as appropriate)
6. Set up the machine to produce components combining several different operations, covering ten from:
 1. parallel diameters
 2. internal profiles
 3. eccentric diameters
 4. stepped diameters
 5. external profiles
 6. external screw threads
 7. tapered diameters
 8. reamed holes
 9. internal screw threads
 10. flat faces
 11. tapped holes
 12. chamfers and radii
 13. internal undercuts
 14. drilled holes
 15. bored holes
 16. external undercuts
 17. parting-off
 18. grooves
7. Machine one of the following types of material:
 1. ferrous
 2. non-ferrous
 3. non-metallic
8. Set the machine to produce components within all of the following quality and accuracy standards, as applicable to the operations performed:
 1. General dimensional tolerance $\pm 0.15\text{mm}$ or $0.006''$
 2. surface finish $32\mu\text{in}$ or $0.8\mu\text{m}$
 3. reamed and bored holes within H8
 4. angles within ± 0.25 degree
 5. screw threads BS medium fit
 6. one or more specific dimensional tolerances within $\pm 0.05\text{mm}$ or $\pm 0.002''$

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