

Setting CNC grinding machines for production

Overview

This standard identifies the competences you need to prepare and set up Computer Numerically Control (CNC) grinding machines, such as CNC universal grinding machines, CNC gear grinding machines, CNC ring grinding machines, and CNC grinding machining centre, in accordance with approved procedures. You will be expected to select the appropriate workholding devices, and to mount and secure them to the machine table or spindle in the designated or appropriate position, as required by the machine operating program. You will also be expected to select the appropriate grinding wheels, and to balance, dress, mount and secure them to the appropriate machine spindles and/or tool change magazine/carousel, where this is applicable.

You will need to ensure that all grinding wheels 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 controller. This will involve loading and proving component programs, checking for errors/faults, editing and saving program changes. 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, grinding wheels, 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 grinding machine used, and its application, and will know about the workholding devices, grinding wheels, machine operating programs 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 hazards associated with working on CNC grinding machines and how to minimise them and reduce any risks
4. the Grinding Wheel Regulations covering the use and operation of grinding wheels and equipment
5. the importance of ensuring that the machine is isolated from the power supply before mounting grinding wheels and workholding devices
6. the importance of wearing the appropriate protective clothing (PPE) and equipment, and of keeping the work area clean and tidy
7. how to handle and store grinding wheels, spindles and programs, safely and correctly
8. 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
9. the methods and procedures used to minimise the chances of infecting a computer with a virus
10. the implications if the computer you are using does become infected with a virus and who to contact if it does occur
11. 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
12. how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
13. the range of workholding methods and devices that are used on CNC grinding machines
14. why it is important to set the workholding device in relation to the machine datums and reference points
15. the methods of setting the workholding devices, and the tools and equipment that can be used
16. the range of grinding wheels that are used on CNC lathes, and typical applications
17. how to check that the grinding wheels are in a safe and serviceable condition
18. the use of silicon carbide, aluminium oxide and diamond wheels, and the material conditions determining their use
19. selecting the correct grade and type of grinding wheel for the materials being machined

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20. the various grinding tool holding devices that are used, and the methods of correctly mounting and securing the grinding wheels to the machine spindle and tool holders
21. the advantages of using pre-set tooling, and how to set the tooling using setting jigs/fixtures
22. the use of magazines and carousels, and how to position and identify the tools in relation to the operating program
23. how to place the machine into the correct operating mode, and how to access the program edit facility in order to enter tooling data
24. how to conduct trial runs, using single block run, dry run and feed/speed override controls
25. why you would conduct a full dry run and single block run
26. the items that you need to check before allowing the machine to operate in full program run mode
27. how the various materials will affect the feeds and speeds that can be used
28. 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
29. typical problems that can occur when setting-up of grinding wheels and workholding devices, and what to do if they occur
30. 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 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 grinding wheels are in a safe and 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 grinding machines in readiness for production:
 1. CNC universal grinder
 2. CNC gear grinder
 3. CNC thread grinder
 4. CNC grinding machining centre
 5. CNC ring grinder
3. Position and secure workpieces using six of the following workholding methods and devices:
 1. chucks
 2. machine vices
 3. centers
 4. mandrels/arbours
 5. collets
 6. faceplates
 7. fixtures
 8. power chucks/blocks
 9. clamps
 10. vee-blocks
 11. angle plates
 12. other specific workholding arrangements
4. Select/mount grinding wheels and dress five of the following types of feature on the grinding wheel:
 1. rough grinding
 2. finish grinding
 3. for thread grinding
 4. for gear grinding
 5. male radius
 6. angles
 7. component form profile

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8. female radius
 5. Prepare the tooling by carrying out all of the following activities, as applicable to the machine type:
 1. pre-setting grinding wheels/spindles using balancing units and setting jigs/fixtures
 2. setting tool datum
 3. positioning grinding wheels/spindles in the correct position in the machine spindle, magazine or carousel
 4. checking wheels/spindles have a specific tool number in relation to the operating program
 5. entering all relevant tooling data to the operating program (wheel/spindle position offsets)
 6. saving changes to programme (as appropriate)
 6. Set up to produce ground components, which combine different operations and cover eight of the following:
 1. plain diameters
 2. internal profiles
 3. external profiles
 4. parallel bores
 5. stepped diameters
 6. eccentric diameters
 7. tapered bores
 8. tapered diameters
 9. external screw threads
 10. involute forms
 11. helical forms
 12. flat faces and shoulders
 13. chamfers (including gear tip chamfers)
 14. radii (including gear root)
 15. curvic couplings
 16. special forms (such as concave, convex)
 17. internal/external undercuts/bearing tracks
 7. Machine one different type of material from:
 1. ferrous
 2. non-ferrous
 3. 4. 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. dimensional tolerance equivalent to relevant standards
 2. flatness and squareness 0.0005" per inch or 0.0012mm per 25mm
 3. angles within +/- 0.25 degree
 4. surface texture 16µin or 0.4µm
 5. ground bores/holes within H8
 6. screw threads BS medium fit
 7. company standards
 8. spur and helical gears to current relevant standards

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