

## Machining components using grinding machines

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### Overview

This standard identifies the competences you need to carry out grinding operations, using machines such as horizontal and vertical surface grinding, external cylindrical, internal cylindrical, universal, centreless, profile and thread grinding machines, in accordance with approved procedures. You will be required to check that the machine is ready for the operations to be performed, and that all the required components, consumables and measuring equipment is available. You will be expected to grind a range of component shapes, such as internal and external parallel, stepped and tapered diameters, flat, parallel, square and angular faces, steps, slots, radii, chamfers, threads and special forms.

You must operate the machine in line with safe working practices and approved procedures, and continuously monitor the grinding operations, making any necessary adjustments to settings in order to ensure that the work output is to the required quality and accuracy. Meeting production targets will be an important issue, and your production records must show consistent and satisfactory performance.

Your responsibilities will require you to comply with organisational policy and procedures for the grinding activities undertaken, and to report any problems with the grinding equipment or grinding 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 actions and for the quality and accuracy of the work that you produce.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying grinding procedures. You will understand the grinding process undertaken, and its application, and will know about the equipment, materials and consumables, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

You will understand the safety precautions required when working with the grinding machine and its associated grinding wheels 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.

This standard does not cover CNC applications, for which other standards apply.

Setting up of the machine, its tooling and associated workholding devices, is the subject of another standard.

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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. confirm that the machine is set up and ready for the machining activities to be carried out
3. manipulate the machine tool controls safely and correctly in line with operational procedures
4. produce components to the required quality and within the specified dimensional accuracy
5. carry out quality sampling checks at suitable intervals
6. deal promptly and effectively with problems within your control and report those that cannot be solved
7. complete the required production documentation
8. shut down the equipment to a safe condition on conclusion of the machining activities

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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. your duties and responsibilities under the abrasive wheels regulations, with particular reference to the mounting of abrasive wheels
3. the hazards associated with carrying out the grinding operations and how they can be minimised
4. the safety mechanisms on the machine, and the procedure for checking that they function correctly
5. operation of the machine controls in both hand and power modes, and how to stop the machine in an emergency
6. the personal protective equipment (PPE) to be worn, and where this can be obtained
7. the importance of keeping the work area clean and tidy
8. where to obtain the component drawings, specifications and/or job instructions required for the components to be machined
9. how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate standards) in relation to work undertaken
10. how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
11. terminology used in grinding in relation to the activities undertaken
12. the various grinding operations that are used to produce the required forms, and the types of grinding wheels used
13. how to dress and reshape grinding wheels, and the equipment to be used
14. the methods that can be used to position the workpiece in relation to the grinding wheel
15. the importance of checking the concentricity and/or position/alignment of the workpiece before grinding, and the tools and equipment that are used
16. the effects of backlash in machine slides and screws, and how this can be overcome
17. how to handle and store grinding wheels safely and correctly
18. factors which affect the selection of grinding wheel feeds and speeds, and the depth of cut that can be taken
19. the application of roughing and finishing cuts, and the effect on wheel life, surface finish and dimensional accuracy
20. the reason for using cutting fluids, and the type of fluid used
21. the effects of clamping the workpiece, and how this can cause distortion in the finished components

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22. how to recognise grinding faults and identify when grinding wheels need re-dressing/forming
23. the quality control procedures used, inspection checks to be carried out, and the equipment to be used
24. the problems that can occur with the grinding activities, and how these can be overcome
25. the extent of your own authority 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. Ensure that you apply all of the following during the machining activities:
  - obtain and use the appropriate documentation
  - 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
  - ensure that machine guards are in place and correctly adjusted
  - hold components securely without distortion
  - maintain grinding wheels in a safe and usable condition
  - apply safe working practices at all times
  - adjust machine settings, as required, to maintain the required accuracy
  - ensure that components produced meet specification
  - leave the work area and machine in a safe and appropriate condition on completion of the activities
2. Operate two of the following types of grinding machine:
  - horizontal surface
  - external cylindrical
  - universal
  - thread grinding
  - vertical surface
  - internal cylindrical
  - centreless
  - profile grinding
  - roll grinding
  - gear grinding
  - company specification
3. Finish grind components which include six of the following features:
  - flat faces
  - parallel diameters
  - internal threads
  - vertical faces
  - tapered diameters
  - vee form threads
  - external threads
  - parallel faces
  - counter bores
  - left hand threads
  - angular faces
  - faces square to each other
  - tapered bores

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- right hand threads
  - shoulders and faces
  - parallel bores
  - single start threads
  - slots
  - profile forms
  - multi-start threads
  - other specific thread forms
4. Grind components made from one of the following types of material:
- ferrous
  - non-ferrous
  - non-metallic
5. Carry out the necessary checks for accuracy during production for four of the following:
- dimensions
  - thread form
  - parallelism
  - surface texture
  - squareness
  - angle/taper
  - profile
  - ovality/lobing
  - concentricity
6. Produce components with dimensional accuracy, form and surface texture within all the following standards:
- tolerance to relevant standards
  - surface texture  $8\mu\text{in}$  or  $0.2\mu\text{m}$
  - components to be free from false grinding cuts, burrs and sharp edges
  - company standards

## Machining components using grinding machines

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