

Overview

This standard covers a broad range of basic grinding competences that will prepare you for entry into the engineering or manufacturing sectors, creating a progression between education and employment, or that will provide a basis for the development of additional skills and occupational competences in the working environment.

The grinding operations may be carried out on horizontal or vertical surface grinding machines, cylindrical or universal grinding machines. You will be expected to prepare for the grinding activities by obtaining all the necessary information, documentation, tools and equipment required, and to plan how you intend to carry out the required grinding activities and the sequence of operations you intend to use.

You will be required to prepare for the grinding activities by mounting, positioning and correctly setting a range of workholding devices, to mount the workpiece and use grinding techniques appropriate to the type of material, type of grinding wheel, workpiece rigidity and operations being performed. You will be expected to grind components that combine a number of different features, such as flat faces, parallel faces, faces square to each other, angular faces, steps and slots or parallel, stepped and tapered diameters, faces, bores and special forms/profiles.

During, and on completion of, the grinding operations, you will be expected to check the quality of the workpiece, using measuring equipment appropriate to the aspects being checked and the tolerances to be achieved. You will need to be able to recognise grinding defects, to take appropriate action to remedy any faults that occur and to ensure that the finished workpiece is within the drawing requirements. On completion of the grinding activities, you will be expected to remove the workholding devices and to leave the machine and work area in a safe and tidy condition.

Your responsibilities will require you to comply with health and safety requirements and organisational policy and procedures for the grinding activities undertaken. You will need to take account of any potential difficulties or problems that may arise with the grinding activities, and to seek appropriate help and advice in determining and implementing a suitable solution. You will work under a high level of supervision, whilst taking responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide an understanding of your work, and will

enable you to apply appropriate grinding techniques safely. You will understand the grinding process, and its application, and will know about the equipment, materials and consumables, to the required 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 with 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.

Specific Standard Requirements

In order to prove your ability to combine different grinding operations, at least one of the machined components produced must be of a significant nature, and must have a minimum of **three** of the features listed in scope 5.

Performance criteria

You must be able to:

1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines
2. plan the grinding activities before you start them
3. obtain and prepare the appropriate materials, tools and equipment
4. mount and set the required workholding devices, and set and secure the workpiece
5. set and adjust the machine tool speeds and feeds to achieve the component specification (where appropriate)
6. use the machine tool controls safely and correctly in line with operational procedures to produce components
7. measure and check all dimensional and geometrical aspects of the component are to the specification
8. deal promptly and effectively with problems within your control and seek help and guidance from the relevant people when you have problems you cannot resolve
9. shut down the equipment to a safe condition on completion of the grinding activities

Knowledge and understanding

You need to know and understand:

1. the safe working practices and procedures to be followed when preparing and using grinding machines (such as ensuring the correct isolation of the machine before mounting the workholding devices and workpiece; fitting and adjusting machine guards and dust extraction equipment, ensuring that the workpiece is secure and grinding wheels are free from damage and clear of the workpiece before starting the machine)
2. the hazards associated with the grinding operations (such as revolving/moving parts of machinery, sparks/airborne particles, bursting grinding wheels, insecure components, burrs and sharp edges on component), and how they can be minimised
3. the personal protective equipment (PPE) to be worn for the grinding activities (such as correctly fitting overalls and safety glasses; ensuring that, if you have long hair, it is tied back or netted; and removing any jewellery or other items that can become entangled in the machinery)
4. the safety mechanisms on the machine, and the procedure for checking that they function correctly
5. the correct operation of the machine controls in both hand and power modes, how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency
6. planning and preparing to carry out the grinding operations (such as obtaining the component drawing, determining the machines required, selecting workholding methods and devices, selecting grinding wheels, determining a suitable sequence of operations, determining quality checks to be made and equipment to be used)
7. how to use and extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken (to include first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing)
8. the main features of the grinding machine, and the accessories that can be used
9. the range of workholding methods and devices that are used on grinding machines (such as magnetic chucks and blocks, vices, angle plates, fixtures, centres, mandrels, collets and chucks)
10. how to position and secure workholding devices and the workpiece to the

machine table, and the checks to be made (such as ensuring that all seating/location faces are clean and undamaged, the device is suitably aligned using instruments or tenons, as appropriate, checking that all bolts or other securing devices are tightened securely)

11. the effects of clamping the workpiece in a vice or other workholding device, and how this can cause damage or distortion in the finished components

12. the various grinding operations that can be performed, and the types of grinding wheels that are used (such as surface grinding using solid, segmented and cup wheels; cylindrical grinding wheels and internal grinding wheels)

13. how to check that the grinding wheels are in a safe and serviceable condition (such as free from damage, cracks, correctly balanced)

14. the importance of 'trueing up' and dressing wheels to prevent glazing and burning of the workpiece, and methods of forming the wheels to the required profile (such as use of pantograph, diamond dressing units)

15. the effects of backlash in machine slides and screws, and how this can be overcome, as appropriate

16. the techniques of taking trial cuts and checking dimensional accuracy; the application of roughing and finishing cuts and the effect on wheel life, surface finish and dimensional accuracy

17. factors that affect the selection of grinding feeds and speeds, and the depth of cut that can be taken (such as type of material, type of grinding wheel, operations being performed, workholding method/security of workpiece, condition of machine, finish and tolerance required)

18. the application of cutting fluids with regard to a range of different materials, and why some materials do not require cutting fluids to be used

19. how to recognise grinding faults, and how to identify when grinding wheels need dressing

20. the checks to be carried out on the components before removing them from the machine, and the equipment that will need to be used (including micrometers, verniers and surface texture comparison methods)

21. how to check that the measuring equipment is within current calibration dates and that the instruments are correctly zeroed; measuring linear dimensions (such as diameters, lengths, depths, slots, positions, angles, profiles); measuring geometric features (such flatness, squareness, parallelism); how to check surface finish (such as by using comparison blocks or instruments)

22. the problems that can occur with the grinding activities (such as defects caused by glazed wheels, inappropriate feeds/speeds, damage by workholding devices),

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and how these can be overcome

23. when to act on your own initiative and when to seek help and advice from others

24. the importance of leaving the work area and machine in a safe condition on completion of the grinding activities (such as correctly isolated, cleaning the machine and removing and disposing of waste)

Scope/range related to performance criteria

1.

Ensure that you apply **all** of the following checks and practices at all times during the grinding activities:

- 1.1 adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment (PPE) and other relevant safety regulations
- 1.2 machine guards are in place and are correctly adjusted
- 1.3 components are held securely (without damage or distortion)
- 1.4 grinding wheels are maintained in a suitable/safe condition
- 1.5 make sure the work area is maintained and left in a safe and tidy condition

2.

Grind components made from **two** of the following types of material:

- 2.1 low carbon/mild steel
- 2.2 cast iron
- 2.3 plastic/nylon/composite
- 2.4 high carbon steel
- 2.5 brass/brass alloys
- 2.6 aluminium/aluminium alloys
- 2.7 other specific material

3.

Mount, secure and machine components using **two** of the following workholding devices:

- 3.1 magnetic chuck or blocks
- 3.2 angle plates
- 3.3 chucks
- 3.4 fixed vice
- 3.5 vee block and clamps
- 3.6 centres
- 3.7 swivel or universal vice
- 3.8 fixtures
- 3.9 mandrels

4.

Prepare grinding wheels to include carrying out **two** of the following:

- 4.1 dressing and 'trueing up' grinding wheels
- 4.2 relieving the wheel sides
- 4.3 wheel forming (such as chamfers, radii, angular forms, profiles)

5.

Produce ground components that combine different operations and have features that cover **five** of the following:

- 5.1 flat faces

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- 5.2 parallel diameters
- 5.3 parallel faces
- 5.4 stepped diameters
- 5.5 faces square to each other
- 5.6 tapered diameters
- 5.7 vertical faces
- 5.8 counterbores
- 5.9 angular faces
- 5.10 tapered bores
- 5.11 steps and shoulders
- 5.12 parallel bores
- 5.13 slots
- 5.14 profile forms

6.

Carry out the necessary checks for accuracy, to include **all** of the following:

- 6.1 dimensions
- 6.2 parallelism
- 6.3 surface texture

Plus **two** more from the following

- 4. flatness
- 5. profile
- 6. concentricity
- 7. squareness
- 8. angle/taper
- 9. ovality/lobbing

1.

Use the following measuring equipment during the machining and checking activities:

- 1.1 external micrometers
- 1.2 dial test indicators (DTI)
- 1.3 vernier/digital/dial callipers
- 1.4 surface finish equipment (such as comparison plates, machines)

Plus **two** more of the following:

- 5. squares
- 6. feeler gauges
- 7. internal micrometers
- 8. bore/hole gauges
- 9. depth micrometers
- 10. slip gauges
- 11. depth verniers

12. radius/profile gauges
13. comparators (external or internal)
14. protractors
15. coordinate measuring machine (CMM)

1.

Produce components to **all** of the following quality and accuracy standards, as applicable to the operation:

- 1.1 components to be free from false grinding cuts, wheel marks, burrs and sharp edges
- 1.2 general dimensional tolerance $\pm 0.125\text{mm}$ or $\pm 0.005"$
- 1.3 there must be one or more specific dimensional tolerances within $\pm 0.025\text{mm}$ or $\pm 0.001"$
- 1.4 flatness and squareness within 0.025mm per 25mm or $0.001"$ per inch
- 1.5 surface texture $8 \mu\text{in}$ or $0.2\mu\text{m}$
- 1.6 angles/tapers within ± 30 minutes

Behaviours

Additional Information

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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