SEMPEO211

Preparing and using lathes for turning operations

Overview

This standard covers a broad range of basic turning 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 turning operations may be carried out on machines such as centre lathes, capstan or turret lathes, automatic or other specific turning machines. You will be expected to prepare for the turning activities by obtaining all the necessary information, documentation, tools and equipment required, and to plan how you intend to carry out the required turning activities and the sequence of operations you intend to use.

You will be required to prepare for the turning activities by mounting, positioning and correctly setting a range of workholding devices, to mount the workpiece and cutting tools and to set and use cutting feeds/speeds and techniques appropriate to the type of material, tooling, workpiece rigidity and operations being performed. You will be expected to produce components that combine a number of different features, such as parallel, stepped and tapered diameters, drilled, bored and reamed holes, internal and external threads, and special forms/profiles.

During, and on completion of, the turning 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 turning 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 turning activities, you will be expected to remove all cutting tools and 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 turning activities undertaken. You will need to take account of any potential difficulties or problems that may arise with the turning 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 produce.

Your underpinning knowledge will provide an understanding of your work, and will enable you to apply appropriate turning techniques safely. You will understand the turning 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 lathe, 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 turning operations, at least one of the machined components produced must be of a significant nature, and must have a minimum of **six** 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, directives and other relevant guidelines
2. plan the machining activities before you start them
3. obtain and prepare the appropriate materials, tools and equipment
4. mount and set the required workholding devices, workpiece and cutting tools
5. set and adjust the machine tool speeds and feeds to achieve the component specification
6. use the machine tool controls safely and correctly, in line with operational procedures to produce components
7. measure and check that 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 if you have problems that you cannot resolve
9. shut down the equipment to a safe condition on completion of the machining activities

Knowledge and understanding

You need to know and understand:

1. the safe working practices and procedures to be followed when preparing and using lathes (such as ensuring the correct isolation of the machine before mounting workholding devices; fitting and adjusting machine guards, ensuring that the workpiece is secure and that tooling is free from the workpiece before starting the machine)
2. the hazards associated with the turning operations (such as revolving/moving parts of machinery, airborne and hot metal particles, sharp cutting tools and burrs and sharp edges on component), and how they can be minimised
3. the personal protective equipment (PPE) to be worn for the turning 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 (such as emergency stop buttons, emergency treadle brakes), 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 machining operations (such as obtaining the component drawing, determining the machines required, selecting materials, selecting workholding methods and devices, selecting cutting tools, 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 lathe and the accessories that can be used (such as saddle, capstan/turret head, compound slide, tailstock, taper turning attachments, profile attachments, fixed and travelling steadies)
9. how to position and secure workholding devices to the machine spindle, and the checks to be made (such as ensuring that all seating/location faces are clean and

undamaged, that (where appropriate) the workholding device location marks are lined up with those on the machine spindle, and checking that all bolts, cam locks or other securing devices are tightened securely)

10. the effects of clamping the workpiece in a chuck/workholding device, and how this can cause damage or distortion in the finished components

11. the various turning operations that can be performed, and the shapes and types of tooling that can be used (such as solid high-speed tooling, brazed tip tooling, interchangeable tipped tooling)

12. how to mount and secure the cutting tools in the tool holding devices (such as front or rear tools posts; mounting drills in chucks or by the use of morse taper sockets; the importance of ensuring that the tool is at the correct centre height and that tool overhang is kept to a minimum)

13. how to check that cutting tools are in a safe and usable condition and how to handle and store tools safely/correctly

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

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

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

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

18. 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)

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

20. the problems that can occur with the turning activities (such as defects caused by incorrectly ground tools, inappropriate feeds/speeds, damage by workholding devices), and how these can be overcome

21. when to act on your own initiative and when to seek help and advice from others
22. the importance of leaving the work area and machine in a safe condition on completion of the turning activities (such as correctly isolated, cutting tools removed, 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 turning 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 cutting tools 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.

Machine 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 **three** of the following workholding devices:

3.1 three-jaw chucks with hard jaws
3.2 drive plate and centres
3.3 magnetic or pneumatic devices
3.4 three-jaw chucks with soft jaws
3.5 fixtures
3.6 fixed steadies or traveling steadies
3.7 four-jaw chucks
3.8 faceplates
3.9 special purpose workholding devices (such as wax chucks)
3.10 collet chucks

4.

Mount and use **eight** of the following types of tool:

4.1 turning
4.2 knurling
4.3 recessing/grooving
4.4 twist/core drills
4.5 thread forming tools
4.6 facing
4.7 parting off

4.8 chamfering
4.9 reamers
4.10 dies
4.11 boring
4.12 forming
4.13 centre drills
4.14 taps

5.

Produce machined components which combine different operations and have features that cover **all** of the following:

5.1 flat faces
5.2 stepped diameters
5.3 drilled holes
5.4 chamfers
5.5 parallel diameters
5.6 tapered diameters
5.7 reamed holes
5.8 grooves/undercuts

Plus **four** more of the following:

9. bored holes
10. internal threads
11. eccentric diameters
12. knurls or special finishes
13. profile forms
14. external threads
15. parting off

1.

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

1.1 external diameters
1.2 bore/hole size/fit
1.3 surface finish
1.4 parallelism
1.5 angle/taper
1.6 linear dimensions (such as lengths, depths)
1.7 grooves/undercuts (such as position, width, depth)

Plus **two** more of the following:

8. internal diameters
9. concentricity
10. eccentricity
11. ovality

12. thread fit

1.

Use **all** of 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 **four** more of the following

5. rules
6. bore/hole gauges
7. internal micrometers
8. thread gauges (such as ring, plug, profile)
9. depth micrometers
10. plug gauges
11. depth Verniers
12. radius/profile gauges
13. slip gauges
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 tool cuts, burrs and sharp edges
1.2 general dimensional tolerance +/- 0.25mm or +/- 0.010"
1.3 there must be one or more specific dimensional tolerances within +/- 0.1mm or +/- 0.004"
1.4 surface finish 63 µin or 1.6µm
1.5 reamed holes within H8
1.6 screw threads BS medium fit
1.7 angles within +/- 0.5 degree

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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