Unit 811 Preparing and using lathes for turning operations

UAN:	L/600/5859
Level:	Level 2
Credit value:	15
GLH:	68
Relationship to NOS:	This unit has been derived from national occupational standard Performing Engineering Operations Unit No. 11: Preparing and using lathes for turning operations (Suite 2).
Endorsement by a sector or regulatory body:	This unit is endorsed by SEMTA.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to cover a broad range of basic turning activities that will prepare the learner 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. The learner will be expected to prepare for the turning activities by obtaining all the necessary information, documentation, tools and equipment required, and to plan how they intend to carry out the required turning activities and the sequence of operations they intend to use. The learner 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. The learner 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, the learner 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. The learner 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, the learner 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.

The learner's responsibilities will require them to comply with health and safety requirements and organisational policy and procedures for the turning activities undertaken. The learner 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. The learner will work under a high level of supervision, whilst taking responsibility for their own actions and for the quality and accuracy of the work that they produce.

The learner's knowledge will provide an understanding of their work, and will enable them to apply appropriate turning techniques safely. The learner 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.

The learner will understand the safety precautions required when working with the lathe, and with its associated tools and equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. Prepare and use lathes for turning operations
Assessment criteria
The learner can: 1.1 Work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines 1.2 Ensure that they apply all of the following checks and practices at all times during the turning activities: • adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment (PPE) and other relevant safety regulations • machine guards are in place and are correctly adjusted • components are held securely (without damage or distortion) • cutting tools are maintained in a suitable/safe condition • make sure the work area is maintained and left in a safe and tidy condition 1.3 Plan the machining activities before they start them 1.4 Obtain and prepare the appropriate materials, tools and equipment 1.5 Machine components made from two of the following types of material: • low carbon/mild steel • high carbon steel • aluminium/aluminium alloys • cast iron • brass/brass alloys • plastic/nylon/composite • other specific material 1.6 Mount and set the required workholding devices, workpiece and cutting tools 1.7 Mount, secure and machine components using three of the following workholding devices: • three-jaw chucks with hard jaws • three-jaw chucks with soft jaws • four-jaw chucks • collet chucks • drive plate and centres • fixtures • faceplates • magnetic or pneumatic devices • fixed steadies or traveling steadies • special purpose workholding devices (such as wax chucks) 1.8 Mount and use eight of the following types of tool: • turning • facing • boring

- knurling
- parting off
- forming
- recessing/grooving
- chamfering
- centre drills
- twist/core drills
- reamers
- taps
- thread forming tools
- dies

1.9 Set and adjust the machine tool speeds and feeds to achieve the component specification

1.10 Use the machine tool controls safely and correctly, in line with operational procedures

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

- flat faces
- parallel diameters
- stepped diameters
- tapered diameters
- drilled holes
- reamed holes
- chamfers
- grooves/undercuts

Plus four more of the following:

- bored holes
- profile forms
- internal threads
- external threads
- eccentric diameters
- parting off
- knurls or special finishes

1.12 Measure and check that all dimensional and geometrical aspects of the component are to the specification

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

- external diameters
- parallelism
- bore/hole size/fit
- angle/taper
- surface finish
- linear dimensions (such as lengths, depths)
- grooves/undercuts (such as position, width, depth)

Plus two more of the following:

- internal diameters
- concentricity

- eccentricity
- ovality
- thread fit

1.14 Use all of the following measuring equipment during the machining and checking activities:

- external micrometers
- Vernier/digital/dial callipers
- Dial Test Indicators (DTI)
- surface finish equipment (such as comparison plates, machines)

Plus four more of the following:

- rules
- internal micrometers
- depth micrometers
- depth Verniers
- slip gauges
- bore/hole gauges
- thread gauges (such as ring, plug, profile)
- plug gauges
- radius/profile gauges
- protractors

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

- components to be free from false tool cuts, burrs and sharp edges
- general dimensional tolerance +/- 0.25mm or +/- 0.010”
- there must be one or more specific dimensional tolerances within +/- 0.1mm or +/- 0.004”
- surface finish 63 µin or 1.6µm
- reamed holes within H8
- screw threads BS medium fit
- angles within +/- 0.5 degree

1.16 Deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve

1.17 Shut down the equipment to a safe condition on completion of the machining activities

Learning outcome
The learner will: 2. Know how to prepare and use lathes for turning operations
Assessment criteria
The learner can: 2.1 Describe 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)

2.2 Describe 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

2.3 Describe the Personal Protective Equipment (PPE) to be worn for the turning activities (such as correctly fitting overalls and safety glasses; ensuring that, if they have long hair, it is tied back or netted; and removing any jewellery or other items that can become entangled in the machinery)

2.4 Describe the safety mechanisms on the machine (such as emergency stop buttons, emergency treadle brakes), and the procedure for checking that they function correctly

2.5 Describe 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

2.6 Explain how to plan and prepare 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)

2.7 Explain 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)

2.8 Describe 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)

2.9 Explain 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)

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

2.11 Describe 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)

2.12 Explain 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)

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

2.14 Describe the effects of backlash in machine slides and screws, and how this can be overcome

2.15 Describe 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
2.16	Describe the factors that affect the selection of cutting feeds and speeds, and the depth of cut that can be taken (such as type of material, size of material, operations being performed, workholding method/security of workpiece, condition of machine, finish and tolerance required)
2.17	Describe 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
2.18	Describe 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)
2.19	Explain 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)
2.20	Describe 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
2.21	Explain when to act on their own initiative and when to seek help and advice from others
2.22	Describe the importance of leaving the work area and machine in a safe condition on completion of the turning activities