

## Unit 314

## Setting gear grinding machines for production

<b>UAN:</b>	M/600/5398
<b>Level:</b>	3
<b>Credit value:</b>	91
<b>GLH:</b>	210
<b>Relationship to NOS:</b>	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 14: Setting Gear Grinding Machines for Production (Level 3).
<b>Assessment requirements specified by a sector or regulatory body:</b>	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
<b>Aim:</b>	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up gear grinding machines, which cover gear grinding using formed wheels and gear grinding using generation methods, and will include the grinding of spur gears, helical, bevel gears and splines, in accordance with approved procedures. This involves selecting the appropriate workholding devices, and mounting and positioning them to the machine in the correct location for the type of operation being carried out. The learner will also be expected to select the appropriate grinding wheels to use, check them for defects, balance them when appropriate, and mount and secure them to the machine spindle. The learner will also be expected to mount the gears to be ground, and to check that they are running true and concentric before starting the grinding operations.</p> <p>The learner will be expected to prepare the grinding wheels for operation, by mounting the correct templates and dressing the wheels to the correct form, or mounting the correct crushing rolls and forming the wheels to the correct profiles. The learner must set up the appropriate mechanisms and controls for indexing, selecting and fitting appropriate change gears or roll gears</p>

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for generation, workspeed, setting the angle of the wheelhead and workhead, feeds and speeds, as applicable for the particular gears and gear grinding methods being used. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role.

The learner's responsibilities will require them to comply with organisational policy and procedures for the machine setting activities undertaken, and to report any problems with the grinding machines, equipment or setting up activities that they cannot resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to the setting up procedures used. The learner will understand the gear grinding machines used, and their application, and will know about the workholding devices, grinding wheels, wheel forming and setting up procedures, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the work produced is to the required specification.

The learner will understand the safety precautions required when working with the machines and their 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.

<b>Learning outcome</b>
The learner will: 1. set gear grinding machines for production
<b>Assessment criteria</b>
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 carry out all of the following activities during setting up: <ul style="list-style-type: none"><li>• obtain and use the appropriate documentation (such as job</li></ul>

- instructions, drawings, quality control documentation)
- adhere to procedures or systems in place for risk assessment, COSHH, Personal Protective Equipment and other relevant safety regulations and procedures to realise a safe system of work
  - follow safe practice/approved setting up procedures at all times
  - ensure that correctly adjusted machine guards are in place
  - check that grinding wheels are in a safe and usable condition
  - hold components securely without distortion
  - leave the work area and machine in a safe and appropriate condition on completion of the activities
- 1.3 follow the correct specifications for the component to be produced
- 1.4 set the machine to produce components within all of the following quality and accuracy standards, as applicable to the operations performed:
- dimensional tolerance equivalent to BS 4500 Grade 5 or BS1916
  - surface texture 8  $\mu\text{in}$  or 0.2 $\mu\text{m}$
  - components to be free from false grinding cuts, burrs and sharp edges
- 1.5 determine what has to be done and how the machine will be set to achieve this
- 1.6 prepare one of the following gear grinding machines in readiness for production:
- gear grinding using formed wheels
  - gear grinding using generation
- 1.7 mount and set the required workholding devices, workpiece and cutting tools
- 1.8 position and secure workpieces using two of the following workholding arrangements:
- mandrels
  - arbors
  - pots
  - centres
  - chucks
  - collets
  - clamps
  - face plates
  - jigs/fixtures
- 1.9 select and mount grinding wheels to include all of the following:
- selecting gear grinding wheels for specific materials and gear pitch (grain size, grade, structure, bond) mounting wheels (paper washers, flanges, locking pressure)
  - testing wheels for cracks
  - balancing wheels, where appropriate
- 1.10 set the machine tool operating parameters to achieve the component specification
- 1.11 set up gear grinding machines, to include four of the following as appropriate to machine type:

<ul style="list-style-type: none"> <li>• setting up diamond tools for use in pantograph and wheel dressing units</li> <li>• selecting and mounting correct templates for the specific gear tooth form</li> <li>• selecting and mounting correct crushing rolls for the specific gear tooth form</li> <li>• dressing and 'trueing up' single and multi-ribbed grinding wheels</li> <li>• setting index plates or change gears for number of teeth to be ground</li> <li>• selecting and fitting of pitch block and tapes for diameter of pitch circle to be ground</li> <li>• selecting and fitting workspeed gears</li> <li>• setting wheelhead and workhead angle for helical gears</li> </ul> <p>1.12 set up a machine to grind two of the following gear forms applicable to the machine type:</p> <ul style="list-style-type: none"> <li>• external spur gear</li> <li>• internal spur gear</li> <li>• single helical gear</li> <li>• double helical gear</li> <li>• bevel gears</li> <li>• straight splines</li> <li>• involute splines</li> <li>• tip and root relief</li> </ul> <p>1.13 grind gears made from one of the following types of material:</p> <ul style="list-style-type: none"> <li>• ferrous</li> <li>• non-ferrous</li> <li>• non-metallic</li> </ul> <p>1.14 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations</p> <p>1.15 deal promptly and effectively with problems within their control and report those that cannot be solved.</p>
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<b>Learning outcome</b>
The learner will: 2. know how to set gear grinding machines for production
<b>Assessment criteria</b>
The learner can: 2.1 describe the specific safety precautions to be taken when setting up workholding devices and grinding wheels on gear grinding machines 2.2 describe their duties and responsibilities under The Abrasive Wheels Regulations, with particular reference to the mounting of abrasive wheels 2.3 describe the hazards associated with setting gear grinding machines (such as moving parts of machinery, sparks/airborne particles, bursting grinding wheels) and how to minimise them and reduce any risks 2.4 explain how to start and stop the machine in normal and

- emergency situations
- 2.5 describe the importance of ensuring that the machine is isolated from the power supply before mounting grinding wheels and workholding devices
  - 2.6 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
  - 2.7 explain how to handle and store gear grinding wheels safely and correctly
  - 2.8 explain how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken
  - 2.9 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
  - 2.10 describe the terminology used in gear grinding in relation to the activities undertaken
  - 2.11 describe the range of workholding methods and devices that are used on gear grinding machines
  - 2.12 describe the methods of mounting and setting the workpiece in/on the workholding devices, and the tools and equipment that can be used
  - 2.13 describe the various gear grinding operations that are used to produce the required gear forms, and the types of wheels that are used
  - 2.14 explain how to check that the grinding wheels are in a safe and serviceable condition (such as free from damage, cracks, correctly balanced)
  - 2.15 describe the methods of mounting and securing the grinding wheels to the machine spindles
  - 2.16 describe the methods of forming the wheels to the required gear profile (such as use of pantograph and wheel dressing units, use of crushing rolls)
  - 2.17 describe the need for 'trueing up' and dressing of wheels to prevent glazing and burning of workpiece
  - 2.18 explain how to set up the various machines for the particular gears being ground
  - 2.19 explain how the various types of material will affect the feeds and speeds that can be used
  - 2.20 describe the application of cutting fluids with regard to a range of different materials
  - 2.21 describe the need to conduct trial runs, and to check that the machine is set up and running safely and correctly
  - 2.22 describe the problems that can occur with setting up of the grinding wheels, workholding devices and machine operating parameters, and what to do if problems occur
  - 2.23 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.