

QUALIFICATION HANDBOOK

QUALIFICATION

Level 3 NVQ Extended Diploma in Mechanical Manufacturing Engineering (Machine Tool Setting) (1712-32)

November 2022 Version 2.0



Qualification at a glance

Subject area	Mechanical Manufacturing Engineering
City & Guilds number	1712
Age group approved	16+
Entry requirements	None
Assessment	Portfolio of evidence
Automatic approval	Available
Support materials	Centre handbook
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	GLH	TQT	City & Guilds number	Accreditation number
Level 3 NVQ Extended Diploma in Mechanical Manufacturing Engineering – Machine Tool Setting	439	1060	1712-32	601/0081/3

Version and date	Change detail	Section
1.1 February 2018	Added TQT and GLH details Deleted QCF	Qualification at a Glance, Structure Throughout
2.0 November 2022	Adjusted document to only fit extended diploma requirements, as the original diploma has expired Adjusted TQT & GLH Added PEO Requirements Links updated throughout Changed seven main groups to nine on unit 201 AC 2.3	Structure GLH & TQT Throughout Unit 201 Assessment Criteria 2.3



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1 Introduction

This document tells you what you need to do to deliver the qualification:

Area	Description
Who is the qualification for?	It is for candidates who work or want to work as mechanical manufacturing engineers – machine tool setting in the mechanical manufacturing engineering sector
What does the qualification cover?	It allows candidates to learn, develop and practise the skills required for employment and/or career progression in the mechanical manufacturing engineering sector.
Is the qualification part of a framework or initiative?	It serves as a competence qualification, in the Engineering Apprenticeship framework.
What opportunities for progression are there?	It allows candidates to progress into employment or to the following City & Guilds qualifications: <ul style="list-style-type: none">• City & Guilds level 4 engineering qualifications• Foundation Degree or other higher education qualifications

Structure

To achieve the **level 3 Extended Diploma in Mechanical Manufacturing Engineering (Machine Tool Setting)**, learners must achieve the minimum requirements from the Performing Engineering Operations (PEO) units, which can be found on the “1712 L2 Unit pack” document on the mechanical manufacturing engineering (1712) page (cityandguilds.com):

- A minimum of **27 credits** and **3 units** from PEO pathway A (704-761, 765-773), or:
- A minimum of **51 credits** must be achieved from PEO pathway B: this must be achieved from:
 - **11 credits** and **1 unit** from group B1 (704, 731, 761)
 - **16 credits** and **2 units** from group B2 (762-764) and
 - **24 credits** and **2 units** from group B3 (765-768)
- If PEO pathway A is undertaken learners must note the following barred units
 - Only one unit from 704, 732 and 761 may be included in the learner’s choice of three units
 - If unit 765 is selected units 705, 706, 708, 711, 712, 715, 716, 717 cannot be included in the learner’s choice of three units
 - If unit 766 is selected units 710, 722, 723, 725, 726, 727, 728, 729, 730, 734 cannot be included in the learner’s choice of three units
 - If unit 767 is selected units 733, 735, 736, 740 cannot be included in the learner’s choice of three units
 - If unit 768 is selected units 719, 721, 737, 738, 739, 740, 758, 759 cannot be included in the learner’s choice of three units

Learners must also achieve **53** credits from the mandatory units and a minimum of **70** credits from the optional groups available

Unit accreditation number	City & Guilds unit number	Unit title	Credit value
Mandatory			
A/601/5013	Unit 201	Complying with statutory regulations and organisational safety requirements	5
Y/601/5102	Unit 202	Using and interpreting engineering data and documentation	5
K/601/5055	Unit 303	Working efficiently and effectively in engineering	5
A/600/5436	Unit 352	Handing over machine tools to production operators	38

Optional

J/600/5391	Unit 308	Setting milling machines for production	91
R/600/5393	Unit 310	Setting shaping, planing or slotting machines for production	78
D/600/5395	Unit 312	Setting gear cutting machines for production	91
M/600/5398	Unit 314	Setting gear grinding machines for production	91
H/600/5432	Unit 320	Setting electro-discharge machines for production	91
M/600/5448	Unit 322	Setting grinding machines for production	91

L/600/5473	Unit 324	Setting honing and lapping machines for production	78
L/600/5490	Unit 326	Setting broaching machines for production	78
H/600/5561	Unit 332	Setting CNC turning machines for production	70
R/600/5572	Unit 334	Setting CNC milling machines for production	70
J/600/5584	Unit 336	Setting CNC grinding machines for production	70
K/600/5643	Unit 338	Setting CNC Punching Machines for Production	70
R/600/5670	Unit 340	Setting CNC laser profiling machines for production	70
M/600/5921	Unit 342	Setting CNC electro-discharge machines for production	70
L/600/5974	Unit 348	Setting CNC gear cutting machines for production	70
L/600/5991	Unit 350	Setting CNC machining centres for production	70
Y/600/5444	Unit 353	Setting capstan and turret lathes for production	91
K/600/5450	Unit 354	Setting single-spindle automatic turning machines for production	91
T/600/5452	Unit 355	Setting multi-spindle automatic turning machines for production	77
J/600/5455	Unit 356	Setting single and multi-spindle drilling machines for production	77

Y/600/5461	Unit 357	Setting tool and cutter grinding machines for production	77
D/600/5462	Unit 358	Setting special-purpose machines for production	91
A/600/5467	Unit 359	Setting power presses for production	91

Total Qualification Time

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a Learner to achieve a qualification. It includes both guided learning hours (which are listed separately) and hours spent in preparation, study and assessment.

Title and level	GLH	TQT
Level 3 NVQ Extended Diploma in Mechanical Manufacturing Engineering - Machine Tool Setting	439	1060



2 Centre requirements

Approval

Centres currently offering the City & Guilds Level 3 NVQ in Mechanical Manufacturing Engineering (1682) will be automatically approved to run this new qualification.

To offer this qualification new centres will need to gain both centre and qualification approval. Please refer to the Centre Manual - Supporting Customer Excellence for further information.

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualification before designing a course programme.

Resource requirements

Centre staffing

Staff delivering this qualification must be able to demonstrate that they meet the following occupational expertise requirements. They should:

- ✓ be occupationally competent or technically knowledgeable in the areas for which they are delivering training and/or have experience of providing training. This knowledge must be to the same level as the training being delivered
- ✓ have recent relevant experience in the specific area they will be assessing
- ✓ have credible experience of providing training.

Centre staff may undertake more than one role, e.g. tutor and assessor or internal verifier, but cannot internally verify their own assessments.

Assessors and internal verifier

Assessor Requirements to Demonstrate Effective Assessment Practice

Assessment must be carried out by competent Assessors that as a minimum must hold the Level 3 Award in Assessing Competence in the Work Environment. Current and operational assessors that hold units D32 and/or D33 or A1 and/or A2 as appropriate for the assessment requirements set out in this Unit Assessment Strategy. However, they will be expected to regularly review their skills, knowledge and understanding and where applicable undertake continuing professional development to ensure that they are carrying out workplace assessment to the most up to date National Occupational Standards (NOS)

Assessor Technical Requirements

Assessors must be able to demonstrate that they have verifiable, relevant and sufficient technical competence to evaluate and judge performance

and knowledge evidence requirements as set out in the relevant unit learning outcomes and associated assessment criteria.

This will be demonstrated either by holding a relevant technical qualification or by proven industrial experience of the technical areas to be assessed. The assessor's competence must, at the very least, be at the same level as that required of the learner(s) in the units being assessed.

Assessors must also be fully conversant with the Awarding Organisation's assessment recording documentation used for the NVQ units against which the assessments and verification are to be carried out, other relevant documentation and system and procedures to support the QA process.

Verifier Requirements (internal and external)

Internal quality assurance (Internal Verification) must be carried out by competent Verifiers that as a minimum must hold the Level 4 Award in the Internal Quality Assurance of Assessment Processes and Practices. Current and operational Internal Verifiers that hold internal verification units V1 or D34 will not be required to achieve the Level 4 Award as they are still appropriate for the verification requirements set out in this Unit Assessment Strategy. Verifiers must be familiar with, and preferably hold, either the nationally recognised Assessor units D32 and/or D33 or A1 and/or A2 or the Level 3 Award in Assessing Competence in the Work Environment.

External quality assurance (**External Verification**) must be carried out by competent External Verifiers that as a minimum must hold the Level 4 Award in the External Quality Assurance of Assessment Processes and Practices. Current and operational External Verifiers that hold external verification units V2 or D35 will not be required to achieve the Level 4 Award as they are still appropriate for the verification requirements set out in this Unit Assessment Strategy. Verifiers must be familiar with, and preferably hold, either the nationally recognised Assessor units D32 and/or D33 or A1 and/or A2 or the Level 3 Award in Assessing Competence in the Work Environment

External and Internal Verifiers will be expected to regularly review their skills, knowledge and understanding and where applicable undertake continuing professional development to ensure that they are carrying out workplace Quality Assurance (verification) of Assessment Processes and Practices to the most up to date National Occupational Standards (NOS) Verifiers, both Internal and External, will also be expected to be fully conversant with the terminology used in the NVQ units against which the assessments and verification are to be carried out, the appropriate Regulatory Body's systems and procedures and the relevant Awarding Organisation's documentation.

Continuing Professional Development (CPD)

Centres must support their staff to ensure that they have current knowledge of the occupational area, that delivery, mentoring, training, assessment and verification is in line with best practice, and that it takes account of any national or legislative developments.

Candidate entry requirements

City & Guilds does not set entry requirements for this qualification. However, centres must ensure that candidates have the potential and opportunity to gain the qualification successfully so should have the opportunity to gather work based evidence.

The SEMTA Engineering Manufacture apprenticeship framework suggests that:

Employers would be interested in candidates that:

- ✓ Are keen and motivated to work in an engineering environment
- ✓ Are willing to undertake a course of training both on-the-job and off-the-job and apply this learning in the workplace
- ✓ Have previous work experience or employment in the sector
- ✓ Have completed a 14 to 19 Diploma in Engineering or Manufacturing
- ✓ Have completed a Young Apprenticeship in Engineering or other related area
- ✓ Have GCSEs in English, Maths and Science
- ✓ Have completed tests in basic numeracy, literacy and communication skills and have spatial awareness.

As a guide, the Engineering Manufacturing framework is suitable for applicants who have five GCSEs grades D to E in English, Maths and Science. The selection process on behalf of employers may include initial assessment where applicants will be asked if they have any qualifications or experience that can be accredited against the requirements of the apprenticeship. They may also be required to take tests in basic numeracy and literacy, communications skills and spatial awareness. There may also be an interview to ensure applicants have selected the right occupational sector and are motivated to become an apprentice, as undertaking an apprenticeship is a major commitment for both the individual and the employer.

Assessment Environment (extract from SEMTA QCF Unit Assessment Strategy 1 January 2011)

The evidence put forward for this qualification can only be regarded valid, reliable, sufficient and authentic if achieved and obtained in the working environment and be clearly attributable to the learner. However, in certain circumstances, simulation/replication of work activities may be acceptable.

The use of high quality, realistic simulations/replication, which impose pressures which are consistent with workplace expectations, should only be used in relation to the assessment of the following:

- ✓ rare or dangerous occurrences, such as those associated with health, safety and the environment issues, emergency scenarios and rare operations at work
- ✓ the response to faults and problems for which no opportunity has presented for the use of naturally occurring workplace evidence of learners competence

- ✓ aspects of working relationships and communications for which no opportunity has presented for the use of naturally occurring workplace evidence of learners competence.

Simulations/replications will require prior approval from centres City & Guilds external verifier/qualification consultant and should be designed in relation to the following parameters:

- ✓ the environment in which simulations take place must be designed to match the characteristics of the working environment
- ✓ competencies achieved via simulation/replication must be transferable to the working environment
- ✓ simulations which are designed to assess competence in dealing with emergencies, accidents and incidents must be verified as complying with relevant health, safety and environmental legislation by a competent health and safety/environmental control officer before being used
- ✓ simulated activities should place learners under the same pressures of time, access to resources and access to information as would be expected if the activity was real
- ✓ simulated activities should require learners to demonstrate their competence using plant and/or equipment used in the working environment
- ✓ simulated activities which require interaction with colleagues and contacts should require the learner to use the communication media that would be expected at the workplace
- ✓ for health and safety reason simulations need not involve the use of genuine substances/materials. Any simulations which require the learner to handle or otherwise deal with materials substances/should ensure that the substitute takes the same form as in the workplace.

Age restrictions

City & Guilds cannot accept any registrations for candidates under 16 as this qualification is not approved for under-16s.

Legal restrictions apply to candidates under the age of 18 working unsupervised with children. Centres and candidates should be fully aware of minimum age requirements in their home nation and any implications for completing assessments.



3 Delivering the qualification

Initial assessment and induction

An initial assessment of each candidate should be made before the start of their programme to identify:

- ✓ if the candidate has any specific training needs
- ✓ support and guidance they may need when working towards their qualification
- ✓ any units they have already completed, or credit they have accumulated which is relevant to the qualification
- ✓ the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the candidate fully understands the requirements of the qualification, their responsibilities as a candidate, and the responsibilities of the centre. This information can be recorded on a learning contract.

Recommended delivery strategies

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualifications before designing a course programme.

Centres may design course programmes of study in any way which:

- ✓ best meets the needs and capabilities of their candidates
- ✓ satisfies the requirements of the qualifications.

When designing and delivering the course programme, centres might wish to incorporate other teaching and learning that is not assessed as part of the qualifications. This might include the following:

- ✓ literacy, language and/or numeracy
- ✓ personal learning and thinking
- ✓ personal and social development
- ✓ employability.

Where applicable, this could involve enabling the candidate to access relevant qualifications covering these skills.

Recording documents

Candidates and centres may decide to use a paper-based or electronic method of recording evidence.

City & Guilds endorses several ePortfolio systems. Further details are available at: www.cityandguilds.com/eportfolios.

City & Guilds has developed a set of *Recording forms* including examples of completed forms, for new and existing centres to use as appropriate.

Recording forms are available on the City & Guilds website. Although

new centres are expected to use these forms, centres may devise or customise alternative forms, which must be approved for use by the external verifier, before they are used by candidates and assessors at the centre.

Amendable (MS Word) versions of the forms are available on the City & Guilds website.



4 Assessment

Assessment of the qualification

Candidates must have a completed portfolio of evidence for each unit chosen

Evidence requirements

Carrying Out Assessments

The NVQ units were specifically developed to cover a wide range of activities. The evidence produced for the units will, therefore, depend on the learners choice of “bulleted items” listed in the unit assessment criteria.

Where the assessment criteria gives a choice of bulleted items (for example ‘any three from five’), assessors should note that learners do not need to provide evidence of the other items to complete the unit (in this example, two) items, particularly where these additional items may relate to other activities or methods that are not part of the learners normal workplace activity or area of expertise.

Minimum Performance Evidence Requirements

Performance evidence must be the main form of evidence gathered. In order to demonstrate consistent, competent performance for a unit, a minimum of 3 different examples of performance must be provided, and must be sufficient to show that the assessment criteria have been achieved to the prescribed standards. It is possible that some of the bulleted items in the assessment criteria may be covered more than once. The assessor and learner need to devise an assessment plan to ensure that performance evidence is sufficient to cover all the specified assessment criteria and which maximises the opportunities to gather evidence. Where applicable, performance evidence may be used for more than one unit.

The most effective way of assessing competence, is through direct observation of the learner. Assessors must make sure that the evidence provided reflects the learner’s competence and not just the achievement of a training programme.

Evidence that has been produced from team activities, for example, maintenance or installation activities is only valid when it clearly relates to the learners specific and individual contribution to the activity, and not to the general outcome(s).

Each example of performance evidence will often contain features that apply to more than one unit, and can be used as evidence in any unit where appropriate.

Performance evidence must be a combination of:

- ✓ outputs of the learner's work, such as items that have been manufactured, installed, maintained, designed, planned or quality assured, and documents produced as part of a work activity
- ✓ evidence of the way the learner carried out the activities such as witness testimonies, assessor observations or authenticated learner reports, records or photographs of the work/activity carried out, etc.

Competent performance is more than just carrying out a series of individual set tasks. Many of the units contain statements that require the learner to provide evidence that proves they are capable of combining the various features and techniques. Where this is the case, separate fragments of evidence would not provide this combination of features and techniques and will not, therefore, be acceptable as demonstrating competent performance.

If there is any doubt as to what constitutes valid, authentic and reliable evidence, the internal and/or external verifier (qualifications consultant) should be consulted.

Assessing knowledge and understanding

Knowledge and understanding are key components of competent performance, but it is unlikely that performance evidence alone will provide enough evidence in this area. Where the learner's knowledge and understanding (and the handling of contingency situations) is not apparent from performance evidence, it must be assessed by other means and be supported by suitable evidence.

Knowledge and understanding can be demonstrated in a number of different ways. Semta (the Sector Skills Council) expects oral questioning and practical demonstrations to be used, as these are considered the most appropriate for these units. Assessors should ask enough questions to make sure that the learner has an appropriate level of knowledge and understanding, as required by the unit.

Evidence of knowledge and understanding will **not** be required for those bulleted items in the assessment criteria that have not been selected by the learner.

The achievement of the specific knowledge and understanding requirements of the units cannot simply be inferred by the results of tests or assignments from other units, qualifications or training programmes. Where evidence is submitted from these sources, the assessor must, as with any assessment, make sure the evidence is valid, reliable, authentic, directly attributable to the learner, and meets the full knowledge and understanding requirements of the unit. Where oral questioning is used the assessor must retain a record of the questions asked, together with the learner's answers.

Witness testimony

Where observation is used to obtain performance evidence, this must be carried out against the unit assessment criteria. Best practice would require that such observation is carried out by a qualified Assessor. If this is not practicable, then alternative sources of evidence may be used.

For example, the observation may be carried out against the assessment criteria by someone else that is in close contact with the learner. This could be a team leader, supervisor, mentor or line manager who may be regarded as a suitable witness to the learner's competency. However, the witness must be technically competent in the process or skills that they are providing testimony for, to at least the same level of expertise as that required of the learner. It will be the responsibility of the assessor to make sure that any witness testimonies accepted as evidence of the learner's competency are reliable, auditable and technically valid.

Recognition of Prior Learning (RPL)

Recognition of prior learning means using a person's previous experience or qualifications which have already been achieved to contribute to a new qualification. RPL is allowed and is also sector specific.



5 Units

Availability of units

The following units can also be obtained from The Register of Regulated Qualifications: [The Register of Regulated Qualifications: Home page \(ofqual.gov.uk\)](http://ofqual.gov.uk)

Structure of units

These units each have the following:

- ✓ City & Guilds unit number
- ✓ Title
- ✓ Unit Accreditation Number (UAN)
- ✓ Level
- ✓ Credit value
- ✓ Recommended Guided Learning Hours (GLH)
- ✓ Relationship to NOS, other qualifications and frameworks
- ✓ Endorsement by a sector or other appropriate body
- ✓ Unit aim(s)
- ✓ Learning outcomes which are comprised of a number of assessment criteria.

Unit 201

Complying with statutory regulations and organisational safety requirements

UAN:	A/601/5013
Level:	2
Credit value:	5
GLH:	35
Relationship to NOS:	This unit has been derived from Semta national occupational standard: Complying with statutory regulations and organisational safety requirements (Suite 2).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	This unit covers the skills and knowledge needed to prove the competences required to deal with statutory regulations and organisational safety requirements. It does not deal with specific safety regulations or detailed requirements, it does, however, cover the more general health and safety requirements that apply to working in an industrial environment.

The learner will be expected to comply with all relevant regulations that apply to their area of work, as well as their general responsibilities as defined in the Health and Safety at Work Act. The learner will need to be able to identify the relevant qualified first aiders and know the location of the first aid facilities. The learner will have a knowledge and understanding of the procedures to be adopted in the case of accidents involving injury and in situations where there are dangerous occurrences or hazardous malfunctions of equipment, processes or machinery. The learner will also need to be fully conversant with their organisation's procedures for fire alerts and the evacuation of premises.

The learner will also be required to identify the hazards and risks that are associated

equipment that they use, the materials and substances that they use, any working practices that do not follow laid-down procedures, and manual lifting and carrying techniques.

The learner's responsibilities will require them to comply with all relevant statutory and organisational policy and procedures for health and safety in the workplace. The learner must act in a responsible and safe manner at all times, and present themselves in the workplace suitably prepared for the activities to be undertaken. The learner will be expected to report any problems with health and safety issues, to the relevant authority.

The learner's knowledge will provide a good understanding of the relevant statutory regulations and organisational requirements associated with their work, and will provide an informed approach to the procedures used. The learner will need to understand their organisation's health and safety requirements and their application, in adequate depth to provide a sound basis for carrying out their activities in a safe and competent manner.

Learning outcome
The learner will: 1. comply with statutory regulations and organisational safety requirements
Assessment criteria
The learner can: 1.1 comply with their duties and obligations as defined in the Health and Safety at Work Act 1.2 demonstrate their understanding of their duties and obligations to health and safety by: <ul style="list-style-type: none">✓ applying in principle their duties and responsibilities as an individual under the Health and Safety at Work Act✓ identifying, within their organisation, appropriate sources of information and guidance on health and safety issues, such as:<ul style="list-style-type: none">- eye protection and personal protective equipment (PPE)- COSHH regulations- risk assessments✓ identifying the warning signs and labels of the main groups of hazardous or dangerous substances✓ complying with the appropriate statutory regulations at all times 1.3 present themselves in the workplace suitably prepared for the activities to be undertaken

- 1.4 follow organisational accident and emergency procedures
- 1.5 comply with emergency requirements, to include:
 - ✓ identifying the appropriate qualified first aiders and the location of first aid facilities
 - ✓ identifying the procedures to be followed in the event of injury to themselves or others
 - ✓ following organisational procedures in the event of fire and the evacuation of premises
 - ✓ identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions of equipment
- 1.6 recognise and control hazards in the workplace
- 1.7 identify the hazards and risks that are associated with the following:
 - ✓ their working environment
 - ✓ the equipment that they use
 - ✓ materials and substances (where appropriate) that they use
 - ✓ working practices that do not follow laid-down procedures
- 1.8 use correct manual lifting and carrying techniques
- 1.9 demonstrate one of the following methods of manual lifting and carrying:
 - ✓ lifting alone
 - ✓ with assistance of others
 - ✓ with mechanical assistance
- 1.10 apply safe working practices and procedures to include:
 - ✓ maintaining a tidy workplace, with exits and gangways free from obstruction
 - ✓ using equipment safely and only for the purpose intended
 - ✓ observing organisational safety rules, signs and hazard warnings
 - ✓ taking measures to protect others from any harm resulting from the work that they are carrying out.

Learning outcome
The learner will: 2. know how to comply with statutory regulations and organisational safety requirements
Assessment criteria
The learner can: 2.1 describe the roles and responsibilities of themselves and others under the Health and Safety at Work Act, and other current legislation (such as The Management of Health and Safety at Work Regulations, Workplace Health and Safety and Welfare Regulations, Personal Protective Equipment at Work Regulations, Manual Handling Operations Regulations, Provision and Use of Work Equipment Regulations, Display Screen at Work Regulations, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations) 2.2 describe the specific regulations and safe working practices and procedures that apply to their work activities

- 2.3 Describe the warning signs for the nine main groups of hazardous substances defined by Classification, Packaging and Labelling of Dangerous Substances Regulations
- 2.4 explain how to locate relevant health and safety information for their tasks, and the sources of expert assistance when help is needed
- 2.5 explain what constitutes a hazard in the workplace (such as moving parts of machinery, electricity, slippery and uneven surfaces, poorly placed equipment, dust and fumes, handling and transporting, contaminants and irritants, material ejection, fire, working at height, environment, pressure/stored energy systems, volatile, flammable or toxic materials, unshielded processes, working in confined spaces)
- 2.6 describe their responsibilities for identifying and dealing with hazards and reducing risks in the workplace
- 2.7 describe the risks associated with their working environment (such as the tools, materials and equipment that they use, spillages of oil, chemicals and other substances, not reporting accidental breakages of tools or equipment and not following laid-down working practices and procedures)
- 2.8 describe the processes and procedures that are used to identify and rate the level of risk (such as safety inspections, the use of hazard checklists, carrying out risk assessments, COSHH assessments)
- 2.9 describe the first aid facilities that exist within their work area and within the organisation in general; the procedures to be followed in the case of accidents involving injury
- 2.10 explain what constitute dangerous occurrences and hazardous malfunctions, and why these must be reported even if no-one is injured
- 2.11 describe the procedures for sounding the emergency alarms, evacuation procedures and escape routes to be used, and the need to report their presence at the appropriate assembly point
- 2.12 describe the organisational policy with regard to fire fighting procedures; the common causes of fire and what they can do to help prevent them
- 2.13 describe the protective clothing and equipment that is available for their areas of activity
- 2.14 explain how to safely lift and carry loads, and the manual and mechanical aids available
- 2.15 explain how to prepare and maintain safe working areas; the standards and procedures to ensure good housekeeping
- 2.16 describe the importance of safe storage of tools, equipment, materials and products
- 2.17 describe the extent of their own authority, and to whom they should report in the event of problems that they cannot resolve.

Unit 202

Using and interpreting engineering data and documentation

UAN:	Y/601/5102
Level:	2
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from Semta national occupational standard: Using and interpreting engineering data and documentation (Suite 2).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to make effective use of text, numeric and graphical information, by interpreting and using technical information extracted from documents such as engineering drawings, technical manuals, reference tables, specifications, technical sales/marketing documentation, charts or electronic displays, in accordance with approved procedures. The learner will be required to extract the necessary information from the various documents, in order to establish and carry out the work requirements, and to make valid decisions about the work activities based on the information extracted.</p> <p>The learner's responsibilities will require them to comply with organisational policy and procedures for obtaining and using the documentation applicable to the activity. They will be expected to report any problems with the use and interpretation of the documents that they cannot personally resolve, or are outside their permitted authority, to the relevant people. They will be expected to work to instructions if necessary, with an appropriate level of supervision or as a member of a team, and</p>

the work that they carry out.

The learner's underpinning knowledge will provide a good understanding of the types of documentation used, and will provide an informed approach to applying instructions and procedures. They will be able to read and interpret the documentation used and will know about the conventions, symbols and abbreviations, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

Learning outcome
The learner will: 1. use and interpret engineering data and documentation
Assessment criteria
The learner can: 1.1 use the approved source to obtain the required data and documentation 1.2 use the data and documentation and carry out all of the following: <ul style="list-style-type: none">✓ check the currency and validity of the data and documentation used✓ exercise care and control over the documents at all times✓ correctly extract all necessary data in order to carry out the required tasks✓ seek out additional information where there are gaps or deficiencies in the information obtained✓ deal with or report any problems found with the data and documentation✓ make valid decisions based on the evaluation of the engineering information extracted from the documents✓ return all documents to the approved location on completion of the work✓ complete all necessary work related documentation such as production documentation, installation documentation, maintenance documentation, planning documentation 1.3 correctly identify, interpret and extract the required information 1.4 extract information that includes three of the following: <ul style="list-style-type: none">✓ materials or components required✓ dimensions✓ tolerances✓ build quality✓ installation requirements✓ customer requirements✓ time scales✓ financial information✓ operating parameters✓ surface texture requirements

- ✓ location/orientation of parts
 - ✓ process or treatments required
 - ✓ dismantling/assembly sequence
 - ✓ inspection/testing requirements
 - ✓ number/volumes required
 - ✓ repair/service methods
 - ✓ method of manufacture
 - ✓ weld type and size
 - ✓ operations required
 - ✓ connections to be made
 - ✓ surface finish required
 - ✓ shape or profiles
 - ✓ fault finding procedures
 - ✓ safety/risk factors
 - ✓ environmental controls
 - ✓ specific data (such as component data, maintenance data, electrical data, fluid data)
 - ✓ resources (such as tools, equipment, personnel)
 - ✓ utility supply details (such as electricity, water, gas, air)
 - ✓ location of services, including standby and emergency backup systems
 - ✓ circuit characteristics (such as pressure, flow, current, voltage, speed)
 - ✓ protective arrangements and equipment (such as containment, environmental controls, warning and evacuation systems and equipment)
 - ✓ other specific related information
- 1.5 use the information obtained to ensure that work output meets the specification
- 1.6 use information extracted from documents to include one from the following:
- ✓ drawings (such as component drawings, assembly drawings, modification drawings, repair drawings, welding/fabrication drawings, distribution and installation drawings)
 - ✓ diagrams (such as schematic, fluid power diagrams, piping, wiring/circuit diagrams)
 - ✓ manufacturers manuals/drawings
 - ✓ approved sketches
 - ✓ technical illustrations
 - ✓ photographic representations
 - ✓ visual display screen information
 - ✓ technical sales/marketing documentation
 - ✓ contractual documentation
 - ✓ other specific drawings/documents
- 1.7 use information extracted from related documentation, to include two from the following:
- ✓ instructions (such as job instructions, drawing instructions, manufacturers instructions)

<ul style="list-style-type: none"> ✓ specifications (such as material, finish, process, contractual, calibration) ✓ reference materials (such as manuals, tables, charts, guides, notes) ✓ schedules ✓ operation sheets ✓ service/test information ✓ planning documentation ✓ quality control documents ✓ company specific technical instructions ✓ national, international and organisational standards ✓ health and safety standards relating to the activity (such as COSHH) ✓ other specific related documentation <p>1.8 deal promptly and effectively with any problems within their control and report those which cannot be solved</p> <p>1.9 report any inaccuracies or discrepancies in documentation and specifications.</p>
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Learning outcome
The learner will:
2. know how to use and interpret engineering data and documentation
Assessment criteria
The learner can:
2.1 explain what information sources are used for the data and documentation that they use in their work activities
2.2 explain how documents are obtained, and how to check that they are current and valid
2.3 explain the basic principles of confidentiality (including what information should be available and to whom)
2.4 describe the different ways/formats that data and documentation can be presented (such as drawings, job instructions product data sheets, manufacturers' manuals, financial spreadsheets, production schedules, inspection and calibration requirements, customer information)
2.5 explain how to use other sources of information to support the data (such as electronic component pin configuration specifications, reference charts, standards, bend allowances required for material thickness, electrical conditions required for specific welding rods, mixing ratios for bonding and finishing materials, metal specifications and inspection requirements, health and safety documentation)
2.6 describe the importance of differentiating fact from opinion when reviewing data and documentation
2.7 describe the importance of analysing all available data and documentation before decisions are made
2.8 describe the different ways of storing and organising data and documentation to ensure easy access
2.9 describe the procedures for reporting discrepancies in the data or documentation, and for reporting lost or damaged documents
2.10 describe the importance of keeping all data and documentation up

to date during the work activity, and the implications of this not being done

- 2.11 explain the care and control procedures for the documents, and how damage or graffiti on documents can lead to scrapped work
- 2.12 explain the importance of returning documents to the designated location on completion of the work activities
- 2.13 explain what basic drawing conventions are used and why there needs to be different types of drawings (such as isometric and orthographic, first and third angle, assembly drawings, circuit and wiring diagrams, block and schematic diagrams)
- 2.14 explain what types of documentation are used and how they interrelate (such as production drawings, assembly drawings, circuit and wiring diagrams, block and schematic diagrams)
- 2.15 explain the imperial and metric systems of measurement; tolerancing and fixed reference points
- 2.16 describe the meaning of the different symbols and abbreviations found on the documents that they use (such as surface finish, electronic components, weld symbols, linear and geometric tolerances, pressure and flow characteristics)
- 2.17 describe the extent of their own responsibility, when to act on their own initiative to find, clarify and evaluate information, and to whom they should report if they have problems that they cannot resolve.

Unit 303

Working efficiently and effectively in engineering

UAN:	K/601/5055
Level:	3
Credit value:	5
GLH:	25
Relationship to NOS:	This unit has been derived from Semta national occupational standard: Working efficiently and effectively in engineering (Suite 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to work efficiently and effectively in the workplace, in accordance with approved procedures and practices. Prior to undertaking the engineering activity, the learner will be required to carry out all necessary preparations within the scope of their responsibility. This may include preparing the work area and ensuring that it is in a safe condition to carry out the intended activities, ensuring they have the appropriate job specifications and instructions and that any tools, equipment, materials and other resources required are available and in a safe and usable condition.</p> <p>On completion of the engineering activity, the learner will be required to return their immediate work area to an acceptable condition before recommencing further work requirements. This may involve placing completed work in the correct location, returning and/or storing any tools and equipment in the correct area, identifying any waste and/or scrapped materials and arranging for their disposal, and reporting any defects or damage to tools and equipment used.</p> <p>In order to be efficient and effective in the workplace, the learner will also be required to</p>

colleagues and line management. The learner will also be expected to review objectives and targets for their personal development and make recommendations to, and communicate any opportunities for, improvements that could be made to working practices and procedures.

The learner's responsibilities will require them to comply with organisational policy and procedures for the engineering activities undertaken, and to report any problems with the activities, or the tools and equipment that are used that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to take 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 working efficiently and effectively in an engineering environment. The learner will understand the need to work efficiently and effectively, and will know about the areas they need to consider when preparing and tidying up the work area, how to contribute to improvements, deal with problems, maintain effective working relationships and agree their development objectives and targets, in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

Learning outcome
The learner will: 3. work efficiently and effectively in engineering
Assessment criteria
The learner can: 3.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 3.2 prepare the work area to carry out the engineering activity 3.3 prepare to carry out the engineering activity, taking into consideration all of the following, as applicable to the work to be undertaken: <ul style="list-style-type: none"> ✓ the work area is free from hazards and is suitably prepared for the activities to be undertaken ✓ any required safety procedures are implemented ✓ any necessary personal protection equipment is obtained and is in a usable condition

tools and equipment required are obtained and checked that
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- they are in a safe and useable condition
 - ✓ all necessary drawings, specifications and associated documentation is obtained
 - ✓ job instructions are obtained and understood
 - ✓ the correct materials or components are obtained
 - ✓ storage arrangements for work are appropriate
 - ✓ appropriate authorisation to carry out the work is obtained
- 3.4 check that there are sufficient supplies of materials and/or consumables and that they meet work requirements
- 3.5 ensure that completed products or resources are stored in the appropriate location on completion of the activities
- 3.6 complete work activities, to include all of the following:
- ✓ completing all necessary documentation accurately and legibly
 - ✓ returning tools and equipment
 - ✓ returning drawings and work instructions
 - ✓ identifying, where appropriate, any unusable tools, equipment or components
 - ✓ arranging for disposal of waste materials
- 3.7 tidy up the work area on completion of the engineering activity
- 3.8 deal promptly and effectively with problems within their control and report those that cannot be resolved
- 3.9 deal with problems affecting the engineering process, to include two of the following:
- ✓ materials
 - ✓ tools and equipment
 - ✓ drawings
 - ✓ job specification
 - ✓ quality
 - ✓ people
 - ✓ timescales
 - ✓ safety
 - ✓ activities or procedures
- 3.10 contribute to and communicate opportunities for improvement to working practices and procedures
- 3.11 make recommendations for improving to two of the following:
- ✓ working practices
 - ✓ working methods
 - ✓ quality
 - ✓ safety
 - ✓ tools and equipment
 - ✓ supplier relationships
 - ✓ internal communication
 - ✓ customer service
 - ✓ training and development
 - ✓ teamwork
 - ✓ other
- 3.12 maintain effective working relationships with colleagues to include

two of the following:

- ✓ colleagues within own working group
- ✓ colleagues outside normal working group
- ✓ line management
- ✓ external contacts

3.13 review personal training and development as appropriate to the job role

3.14 review personal development objectives and targets to include one of the following:

- ✓ dual or multi-skilling
- ✓ training on new equipment / technology
- ✓ increased responsibility
- ✓ understanding of company working practices, procedures, plans and policies
- ✓ other specific requirements.

Learning outcome
The learner will: 4. know how to work efficiently and effectively in engineering
Assessment criteria
The learner can: 4.1 describe the safe working practices and procedures to be followed whilst preparing and tidying up their work area 4.2 describe the correct use of any equipment used to protect the health and safety of themselves and their colleagues 4.3 describe the procedure for ensuring that all documentation relating to the work being carried out is available and current, prior to starting the activity 4.4 describe the action that should be taken if documentation received is incomplete and/or incorrect 4.5 describe the procedure for ensuring that all tools and equipment are available prior to undertaking the activity 4.6 describe the checks to be carried out to ensure that tools and equipment are in full working order, prior to undertaking the activity 4.7 describe the action that should be taken if tools and equipment are not in full working order 4.8 describe the checks to be carried out to ensure that all materials required are correct and complete, prior to undertaking the activity 4.9 describe the action that should be taken if materials do not meet the requirements of the activity 4.10 explain whom to inform when the work activity has been completed 4.11 describe the information and/or documentation required to confirm that the activity has been completed 4.12 explain what materials, equipment and tools can be reused 4.13 explain how any waste materials and/or products are transferred, stored and disposed of 4.14 explain where tools and equipment should be stored and located 4.15 describe the importance of making recommendations for improving working practices

- 4.16 describe the procedure and format for making suggestions for improvements
- 4.17 describe the benefits to organisations if improvements can be identified
- 4.18 describe the importance of maintaining effective working relationships within the workplace
- 4.19 describe the procedures to deal with and report any problems that can affect working relationships
- 4.20 describe the difficulties that can occur in working relationships
- 4.21 describe the regulations that affect how they should be treated at work (such as Equal Opportunities Act, Race and Sex Discrimination, Working Time Directive)
- 4.22 describe the benefits of continuous personal development
- 4.23 describe the training opportunities that are available in the workplace
- 4.24 describe the importance of reviewing their training and development
- 4.25 explain with whom to discuss training and development issues
- 4.26 describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve.

Unit 308

Setting milling machines for production

UAN:	J/600/5391
Level:	3
Credit value:	91
GLH:	210
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 8: <u>Setting milling machines for production (Level 3)</u> .
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up milling machines, such as horizontal, vertical, universal machines, planer/gantry milling machines and boring machines with milling attachments, 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.</p> <p>The learner will also be expected to select the appropriate milling cutters, check them for defects, and mount and secure them to the relevant tool holding devices and machine spindle. The learner will also be expected to set up and align the workpiece in the correct relationship to the machine spindle, and to set the machine operating parameters to produce the workpiece to the required specification. The learner must produce trial cuts, and prove the machine is working satisfactorily before declaring the installation ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role.</p> <p>The learner's responsibilities will require them to comply with organisational policy</p>

activities undertaken, and to report any problems with the machine, cutters, 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 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 milling machine used, and its application, and will know about the workholding devices, milling cutters, relevant materials, consumables and setting up procedures, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the work output is to the required specification.

The learner will understand the safety precautions required when working with the milling 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.

Learning outcome
The learner will: 1. set milling machines for production
Assessment criteria
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"> ✓ obtain and use the appropriate documentation (such as job 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 cutting tools are in a suitable 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:
 - ✓ components to be free from false tool cuts, burrs and sharp edges
 - ✓ dimensional tolerance equivalent to BS 4500 or BS 1916 Grade 7
 - ✓ flatness & squareness within 0.001" per inch or 0.025mm per 25mm
 - ✓ surface finish 63µin or 1.6µm
 - ✓ angles within +/- 0.5 degree
 - ✓ bored holes within H8
- 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 types of milling machine for production:
 - ✓ horizontal milling machine
 - ✓ universal milling machine
 - ✓ boring machines with milling attachments
 - ✓ vertical milling machine
 - ✓ planer /gantry milling machine
- 1.7 mount and set the required workholding devices, workpiece and cutting tools
- 1.8 position, align and secure the workpiece using three of the following:
 - ✓ clamping direct to machine table
 - ✓ pneumatic or magnetic table
 - ✓ machine vice (such as plain, swivel, universal)
 - ✓ angle plate
 - ✓ vee block and clamps
 - ✓ fixtures
 - ✓ chucks (such as 3, 4 jaw)
 - ✓ indexing head/device
 - ✓ rotary table
- 1.9 select and mount milling cutters to include six of the following:
 - ✓ face mills
 - ✓ slab mills/cylindrical cutters
 - ✓ side and face cutters
 - ✓ slotting cutters
 - ✓ slitting saws
 - ✓ profile cutters
 - ✓ twist drills
 - ✓ boring tools
 - ✓ end mills
 - ✓ slot drills
 - ✓ straddle milling
 - ✓ gang milling

- 1.10 set the machine tool operating parameters to achieve the component specification
- 1.11 set up the machine in accordance with instructions and specifications, to include all of the following:
 - ✓ alignment of workholding device
 - ✓ position of cutters in relationship to workpiece
 - ✓ milling cutter revs per minute
 - ✓ machine guards/safety mechanisms
 - ✓ linear/table feed rate
 - ✓ cutting fluid flow rate
 - ✓ depth of cut for roughing and finishing
- 1.12 set up the machine to produce internal and external profiles that include eight of the following:
 - ✓ flat faces
 - ✓ square faces
 - ✓ parallel faces
 - ✓ angular faces
 - ✓ steps/shoulders
 - ✓ open ended slots
 - ✓ enclosed slots
 - ✓ recesses
 - ✓ tee slots
 - ✓ drilled holes
 - ✓ bored holes
 - ✓ profile forms (vee, concave, convex, gear forms)
 - ✓ serrations
 - ✓ indexed or rotated forms
 - ✓ special forms
- 1.13 machine components made from one of the following types of material:
 - ✓ ferrous
 - ✓ non-metallic
 - ✓ non-ferrous
- 1.14 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
- 1.15 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome
The learner will: 2. know how to set milling machines for production
Assessment criteria
The learner can: 2.1 describe the specific safety precautions to be taken when setting up workholding devices and milling cutters on milling machines (such as horizontal, vertical, universal, planer/gantry, boring machines with milling attachments) 2.2 describe the hazards associated with setting milling machines (such

- as moving parts of machinery, handling milling cutters, handling cutting fluids, airborne particles, tool breakage, insecure components), and how to minimise them and reduce any risks
- 2.3 describe the operation of the machine controls in both hand and power modes, and how to stop the machine in an emergency
 - 2.4 describe the importance of ensuring that the machine is isolated from the power supply before mounting milling cutters and workholding devices
 - 2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
 - 2.6 describe the basic principles of operation of the various milling machines, and typical operations that they can perform
 - 2.7 explain how to handle and store milling cutters 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 milling in relation to the activities undertaken
 - 2.11 describe the range of workholding methods and devices that are used on machines (such as direct clamping, machine vice, pneumatic and magnetic tables, jigs and fixtures, chucks, indexing devices rotary tables, angle brackets, vee blocks and clamps)
 - 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 different types of milling cutters that are used, and how they are selected, prepared and mounted to the machine tool holding devices (such as long arbors, stub arbors, collet chucks, direct mounting to machine spindle)
 - 2.14 describe the factors which determine speeds and feeds to be used (such as material, type of cutter, depth of cut, workpiece rigidity, machine condition, tolerance and finish required)
 - 2.15 explain how the various types of material will affect the feeds and speeds that can be used
 - 2.16 describe the types of cutting fluid that are used, and precautions to be taken when handling and using them
 - 2.17 explain how to set up the various machines for the particular operations being performed
 - 2.18 describe the need to conduct trial runs, and to check that the machine is set up and running safely and correctly
 - 2.19 describe the problems that can occur with setting up the milling cutters, workholding devices and machine operating parameters, and what to do if problems occur
 - 2.20 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve.

Unit 310

Setting shaping, planing or slotting machines for production

UAN:	R/600/5393
Level:	3
Credit value:	78
GLH:	175
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 10: Setting Shaping, Planing or Slotting Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up shaping, planing or slotting machines for production, in accordance with approved procedures. This will involve selecting the appropriate workholding devices and securing them to the machine table, and mounting and setting the workpiece in correct relationship to the cutting tools. The learner will be expected to select the appropriate shaping/slotting tools, check that they are in a usable condition, and mount and secure them to the relevant tool holding devices.</p> <p>The learner will need to set the machine operating parameters to produce the workpiece to the required specification. This will involve setting the appropriate stroke length, stroke position, feeds and speeds, and determining suitable roughing and finishing cuts. The learner must produce trial cuts, and prove the machine is working satisfactorily before declaring the machine ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role.</p>

and procedures for the machine setting activities undertaken, and to report any problems with the machine, tooling, equipment or setting up activities that they cannot personally 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 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 machine used, and its application, and will know about the workholding devices, shaping/slotting tools, relevant materials, consumables and setting up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults and ensuring the work output meets the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set shaping, planing or slotting machines for production
Assessment criteria
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"> ✓ obtain and use the appropriate documentation (such as job 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 cutting tools are in a suitable 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:
 - ✓ components to be free from false tool cuts, burrs and sharp edges
 - ✓ dimensional tolerance equivalent to BS 4500 or BS 1916 Grade 7
 - ✓ flatness and squareness within 0.001" per inch or 0.025mm per 25mm
 - ✓ surface finish 63 µin or 1.6µm
 - ✓ angles within +/- 0.5 degree
- 1.5 determine what has to be done and how the machine will be set to achieve this
- 1.6 mount and set the required workholding devices, workpiece and cutting tools
- 1.7 select, mount and secure the workpiece using three of the following workholding devices:
 - ✓ clamping direct to machine table
 - ✓ pneumatic or magnetic table
 - ✓ machine vice (such as plain, swivel, universal)
 - ✓ angle plate
 - ✓ vee block and clamps
 - ✓ jigs/fixtures
 - ✓ chucks (such as 3 or 4 jaw)
 - ✓ indexing head/device
 - ✓ rotary table
- 1.8 select and mount tools to include three of the following types appropriate to the machine:
 - ✓ flat facing
 - ✓ vertical facing
 - ✓ forming/profiling
 - ✓ recessing
 - ✓ keyway slotting
 - ✓ spline slotting
 - ✓ serrating
 - ✓ special slotting
- 1.9 set the machine tool operating parameters to achieve the component specification
- 1.10 set up one of the following types of machine:
 - ✓ shaping
 - ✓ planing
 - ✓ slotting
 - ✓ milling machine with slotting attachment
- 1.11 set up the machine in accordance with instructions and specifications, to include all of the following:
 - ✓ position of workpiece

<ul style="list-style-type: none"> ✓ position of tools in relationship to workpiece ✓ stroke position and length mechanisms ✓ stroke speed ✓ linear feed rate ✓ depth of cut for roughing and finishing ✓ cutting fluid flow rate ✓ machine guards/safety mechanisms <p>1.12 set up the machine to produce internal and external profiles that includes six of the following:</p> <ul style="list-style-type: none"> ✓ flat faces ✓ parallel faces ✓ faces square to each other ✓ steps/shoulders ✓ angular faces ✓ slots/grooves ✓ key ways ✓ splines ✓ flat sided holes (e.g.. square, hexagonal) ✓ serrations ✓ other specific forms <p>1.13 machine components made from one of the following types of material:</p> <ul style="list-style-type: none"> ✓ ferrous ✓ non-metallic ✓ non-ferrous <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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Learning outcome
The learner will:
2. know how to set shaping, planing or slotting machines for production
Assessment criteria
The learner can:
2.1 describe the specific safety precautions to be taken when setting up workholding devices and accessories, workpiece and shaping/slotting tools
2.2 describe the hazards associated with setting shaping, planing and slotting machines (such as moving parts of machinery, handling cutting tools, handling cutting fluids, tool breakage, insecure components), and how to minimise them and reduce any risks
2.3 explain how to start and stop the machine in normal and emergency situations
2.4 describe the importance of ensuring that the machine is isolated from the power supply before mounting tools and workholding devices
2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and

tidy

- 2.6 describe the basic principles of operation of the shaping, planing or slotting machine and its accessories, and typical operations that they can perform
- 2.7 explain how to handle and store shaping, planing and slotting tools 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 shaping, planing or slotting in relation to the activities undertaken
- 2.11 describe the range of work holding methods and devices that are used on shaping, planing and slotting machines (such as plain, swivel and universal machine vice, three and four jaw chucks, jigs and fixtures, direct clamping to machine table, rotary and indexing devices)
- 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 different types of shaping, planing and slotting tools that are used, and how they are selected, prepared and mounted to the machine tool holding devices (such as clapper box, slotting or planing head)
- 2.14 describe the factors which determine stroke speeds and feeds to be used (such as material, type of tooling, depth of cut, workpiece rigidity, machine condition, tolerance and finish required)
- 2.15 explain how the various types of materials used will affect the feeds and speeds that can be used
- 2.16 describe the types of cutting fluid that are used, and precautions to be taken when handling and using them
- 2.17 explain how to set up the shaping, planing or slotting machine, and its accessories, for the particular operations being performed (such as setting stroke length, stroke position, angle of tool head)
- 2.18 describe the need to conduct trial runs, and to check that the machine is set up and producing the components correctly
- 2.19 describe the problems that can occur with setting up the workholding devices, tooling and machine operating parameters, and what to do if problems occur
- 2.20 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 312

Setting gear cutting machines for production

UAN:	D/600/5395
Level:	3
Credit value:	91
GLH:	210
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 12: Setting Gear Cutting Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up gear cutting machines, such as gear hobbing, gear shaping, gear shaving, gear planning and bevel gear cutting machines, 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 cutters to use, and to mount and secure them to the appropriate tool holding devices.</p> <p>The learner will be expected to check that the components and cutting tools are running true and concentric before starting the cutting operations. The learner will be expected to set up hob slides to the required angle, select and fit appropriate index change gears and differential gears, feed cams, determine and set parameters for axial or conventional shaving, tangential or underpass methods, diagonal or plunge methods, push or pull methods, and the appropriate feeds and speeds for the particular gears and gear cutting methods being used.</p>

The learner's responsibilities will require

and procedures for the machine setting activities undertaken, and to report any problems with the setting up activities that they cannot personally 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 machine used, and its application, and will know about the workholding devices, gear cutting tools, relevant materials, consumables and setting-up procedures, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the work output 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.

Learning outcome
The learner will: 1. set gear cutting machines for production
Assessment criteria
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"> ✓ obtain and use the appropriate documentation (such as job 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 cutting tools are in a suitable condition ✓ hold components securely without distortion

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:
 - ✓ components to be free from false tool cuts, burrs and sharp edges
 - ✓ straight splines and serrations to BS 2059 or BS1953 Class 1
 - ✓ spur and helical gears to BS 436 Pt 1 or BS1967
 - ✓ involute splines to BS 3550 1963 Class 1
 - ✓ tolerance to BS 4500 or BS1916 Grade 9
 - ✓ surface texture 63 μin or 1.6 μm
- 1.5 determine what has to be done and how the machine will be set to achieve this
- 1.6 set up two of the following types of machine:
 - ✓ gear hobbing
 - ✓ gear shaping
 - ✓ bevel gear cutting
 - ✓ gear planing
 - ✓ gear shaving
- 1.7 mount and set the required workholding devices, workpiece and cutting tools
- 1.8 select, mount and secure the workpiece using two of the following workholding devices:
 - ✓ arbors
 - ✓ mandrels
 - ✓ chucks
 - ✓ pots
 - ✓ collets
 - ✓ fixtures
 - ✓ centres
 - ✓ clamps
 - ✓ face plates
- 1.9 select and mount to the appropriate tool holding device, four of the following types of gear cutting tools:
 - ✓ shank type hobs
 - ✓ protuberance hobs
 - ✓ skiving hobs
 - ✓ inserted blade hobs
 - ✓ tapered hobs
 - ✓ single or multi-start straight hobs
 - ✓ bevel gear roughing cutters
 - ✓ bevel gear finishing cutters
 - ✓ disc type shaping/shaving cutters
 - ✓ shank type shaping/shaving cutters
 - ✓ extended hub type shaving cutters
 - ✓ screwed hub type shaping/shaving cutters

- ✓ special cutters
 - ✓ rack type gear planing roughing cutters
 - ✓ single tooth gear planing roughing cutters
 - ✓ rack type full fillet planing finishing cutters
 - ✓ single tooth full fillet planing finishing cutters
- 1.10 set the machine tool operating parameters to achieve the component specification
- 1.11 prepare the machine by carrying out all the following activities applicable to the machine type:
- ✓ set the slide angles
 - ✓ set the speed and feed rates
 - ✓ fitting differential/index change gears
 - ✓ select and set climb or conventional hobbing
 - ✓ set other machine operating parameters
 - ✓ select and fit appropriate index change gears and differential gears
 - ✓ select/set shaving method (axial or conventional, tangential or underpass, diagonal or plunge)
- 1.12 set up the machine to produce machined components that include two of the following:
- ✓ external spur gear
 - ✓ internal spur gear
 - ✓ single helical gear
 - ✓ double helical gear
 - ✓ chain sprockets
 - ✓ serrations
 - ✓ splines
 - ✓ straight bevel gears
- 1.13 machine components made from one of the following types of material:
- ✓ ferrous
 - ✓ non-metallic
 - ✓ non-ferrous
- 1.14 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
- 1.15 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome
The learner will:
2. know how to set gear cutting machines for production
Assessment criteria
The learner can:
2.1 describe the specific safety precautions to be taken when setting up workholding devices and tooling on gear cutting machines
2.2 describe the hazards associated with setting gear cutting machines (such as moving parts of machinery, handling gear cutters, handling cutting fluids, airborne particles, tool breakage, insecure

- components) and how to minimise them and reduce any risks
- 2.3 explain how to start and stop the machine in normal and emergency situations
 - 2.4 describe the importance of ensuring that the machine is isolated from the power supply before mounting cutters and workholding devices
 - 2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
 - 2.6 explain how to handle and store gear cutting tools safely and correctly
 - 2.7 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
 - 2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
 - 2.9 describe the terminology used in gear cutting in relation to the activities undertaken
 - 2.10 describe the range of workholding methods and devices that are used on gear cutting machines
 - 2.11 describe the methods of mounting and setting the workpiece in/on the workholding devices, and the tools and equipment that can be used
 - 2.12 describe the various gear cutting operations that are used to produce the required gear forms, and the types of tooling used (such as straight hobs having single and multi start, tapered hobs, shank type hobs, protuberance hobs, inserted blade hobs, skiving hobs, disc and shank type gear shaping and shaving cutters, gear planing cutters and bevel gear cutters)
 - 2.13 explain how to check that the gear cutting tools are in a safe and serviceable condition
 - 2.14 describe the various tool holding devices that are used, and the methods of mounting and securing the gear cutting tools to the tool holders and machine spindles
 - 2.15 explain how to set up the various machines for the particular gears being machined
 - 2.16 explain how the various types of material will affect the feeds and speeds that can be used
 - 2.17 describe the application of cutting fluids with regard to a range of different materials, and why some materials do not require the use of cutting fluids
 - 2.18 describe the need to conduct trial runs, and to check that the machine is set up and running safely and correctly
 - 2.19 describe the problems that can occur with setting up of the tooling, workholding devices and machine operating parameters, and what to do if problems occur
 - 2.20 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 314

Setting gear grinding machines for production

UAN:	M/600/5398
Level:	3
Credit value:	91
GLH:	210
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 14: Setting Gear Grinding Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<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 for operation, workhead, setting the angle</p>

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.

Learning outcome
The learner will: 1. set gear grinding machines for production
Assessment criteria

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:
 - ✓ obtain and use the appropriate documentation (such as job 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 μin or 0.2 μm
 - ✓ 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:
- ✓ setting up diamond tools for use in pantograph and wheel

<ul style="list-style-type: none"> dressing units ✓ selecting and mounting correct templates for the specific gear tooth form ✓ selecting and mounting correct crushing rolls for the specific gear tooth form ✓ dressing and 'trueing up' single and multi-ribbed grinding wheels ✓ setting index plates or change gears for number of teeth to be ground ✓ selecting and fitting of pitch block and tapes for diameter of pitch circle to be ground ✓ selecting and fitting workspeed gears ✓ setting wheelhead and workhead angle for helical gears <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"> ✓ external spur gear ✓ internal spur gear ✓ single helical gear ✓ double helical gear ✓ bevel gears ✓ straight splines ✓ involute splines ✓ tip and root relief <p>1.13 grind gears made from one of the following types of material:</p> <ul style="list-style-type: none"> ✓ ferrous ✓ non-ferrous ✓ non-metallic <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>

Learning outcome
The learner will:
2. know how to set gear grinding machines for production
Assessment criteria
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

- 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.

Unit 320

Setting electro-discharge machines for production

UAN:	H/600/5432
Level:	3
Credit value:	91
GLH:	210
Relationship to NOS:	This unit has been derived from Sema National Occupational Standard Mechanical Manufacturing Engineering Unit 20: Setting Electro-Discharge Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Sema, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up electro-discharge machines, such as spark erosion or wire erosion machines, 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 electrodes or wires to use, check them for defects, and mount and secure them to the relevant parts of the machine.</p> <p>The learner will be expected to set the electrical conditions; wire or electrode feed rate, dielectric flow rate, filtration and fume extraction systems. The learner must produce trial cuts, and prove the machine is working satisfactorily before declaring the installation ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role.</p> <p>The learner's responsibilities will require them to comply with organisational policy and procedures for the machine setting</p>

setting up activities that they cannot personally 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 electro-discharge machine used, and its application, and will know about the workholding devices, electrodes, relevant materials, consumables and setting up procedures, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring that the work output 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.

Learning outcome
The learner will: 1. set electro-discharge machines for production
Assessment criteria
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"> ✓ obtain and use the appropriate documentation (such as job 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 cutting tools are in a suitable 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:

- ✓ components to be free from false starts and sharp edges
 - ✓ tolerance to BS 4500 or BS 1916 Grade 7
 - ✓ surface texture 32 μin or 0.8 μm or 18VDI
- 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 types of electro-discharge machine in readiness for production:
- ✓ spark erosion
 - ✓ wire erosion
- 1.7 mount and set the required workholding devices, workpiece and cutting tools
- 1.8 position and secure workpieces to machine table, to include all of the following:
- ✓ clamping direct to machine table
 - ✓ pneumatic or magnetic table
 - ✓ machine vice (such as plain, swivel, universal)
 - ✓ angle plate
 - ✓ vee block and clamps
 - ✓ fixtures
 - ✓ chucks (such as 3 or 4 jaw)
 - ✓ ancillary indexing device
- 1.9 select and mount electrodes for roughing and finishing, to include one of the following:
- ✓ plain electrodes
 - ✓ profile electrodes
 - ✓ hollow electrodes
 - ✓ wire
- 1.10 set the machine tool operating parameters to achieve the component specification
- 1.11 set up the machine in accordance with instructions and specifications, to include all of the following:
- ✓ electrical conditions (such as current density, spark frequency)
 - ✓ alignment of electrodes
 - ✓ wire tension
 - ✓ wire speeds
 - ✓ filtration equipment
 - ✓ linear feeds and speeds
 - ✓ dielectric flow rates
 - ✓ ventilation and fume extraction
 - ✓ correct threading of wire through wire guides and feed mechanisms
 - ✓ safety mechanisms/devices
- 1.12 set up the machine to produce internal and external profiles that include six of the following:
- ✓ flat faces
 - ✓ square faces

- ✓ convex forms
- ✓ profile forms
- ✓ radii/arcs
- ✓ slots
- ✓ square/rectangular forms
- ✓ angular faces
- ✓ parallel faces
- ✓ concave forms
- ✓ holes
- ✓ cavities
- ✓ threads
- ✓ engraving
- ✓ other special activities

1.13 machine components made from one of the following types of material:

- ✓ ferrous
- ✓ non-ferrous

1.14 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations

1.15 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome

The learner will:

2. know how to set electro-discharge machines for production

Assessment criteria

The learner can:

- 2.1 describe the specific safety precautions to be taken when setting up workholding devices and electrodes or wires on electro-discharge machines
- 2.2 describe the hazards associated with setting electro-discharge machines (such as moving parts of machinery, electrical components, handling dielectrics, fumes), and how to minimise them and reduce any risks
- 2.3 explain how to start and stop the machine in normal and emergency situations
- 2.4 describe the importance of ensuring that the machine is isolated from the power supply before mounting electrodes, wires and workholding devices
- 2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
- 2.6 describe the basic principles of operation of the various electro-discharge machines, and typical operations that they can perform
- 2.7 explain how to handle and store electrodes and wires 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 electro-discharge machining in relation to the activities undertaken
- 2.11 describe the range of eroded features that are produced on the electro-discharge machines
- 2.12 describe the range of workholding methods and devices that are used on electro-discharge machines
- 2.13 describe the methods of mounting and setting the workpiece in/on the workholding devices, and the tools and equipment that can be used
- 2.14 describe the different types of electrodes and wires that are used, and how they are selected, prepared and mounted to the machine tool holding devices
- 2.15 describe the factors that determine current density, spark frequency, wire speeds and feeds, or linear feeds and speeds
- 2.16 explain how the various types of material will affect the feeds and speeds that can be used
- 2.17 describe the type of dielectrics that are used; filtration requirements; and precautions to be taken when handling and using them
- 2.18 explain how to set up the various machines for the particular operations being performed
- 2.19 describe the need to conduct trial runs, and to check that the machine is set up and running safely and correctly
- 2.20 describe the problems that can occur with setting up the electrodes or wires, workholding devices, and machine operating parameters, and what to do if problems occur
- 2.21 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 322

Setting grinding machines for production

UAN:	M/600/5448
Level:	3
Credit value:	91
GLH:	210
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 22: <u>Setting Grinding Machines for Production (Level 3)</u> .
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up grinding machines, such as surface grinding, external cylindrical grinding, internal cylindrical, universal, centreless, profile and thread grinding machines, in accordance with approved procedures. The learner will be expected to set up the machines 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. 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.</p> <p>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 be expected to prepare the grinding wheels for operation by 'trueing up' and dressing the wheels, and creating any necessary relief or form as applicable to the operation to be performed. The learner must set up the appropriate mechanisms, stops and controls for feeds and speeds, as applicable for the particular operations and machine type.</p>

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 personally 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 grinding machine used, and its application, and will know about the workholding devices, grinding wheels, wheel forming, relevant materials, consumables and setting up procedures, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the work output 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.

Learning outcome
The learner will: 1. set grinding machines for production
Assessment criteria
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">✓ obtain and use the appropriate documentation (such as job 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 prepare one of the following types of grinding machine in readiness for production:
- ✓ horizontal surface
 - ✓ vertical surface
 - ✓ external cylindrical
 - ✓ internal cylindrical
 - ✓ universal
 - ✓ centreless
 - ✓ thread grinding
- 1.5 determine what has to be done and how the machine will be set to achieve this
- 1.6 prepare gear grinding wheels to include carrying out two of the following:
- ✓ dressing and 'trueing up' grinding wheels
 - ✓ wheel forming (such as chamfers, radii, angular forms, profiles)
 - ✓ relieving the wheel sides
 - ✓ dressing and 'trueing up' control wheels
- 1.7 mount and set the required workholding devices, workpiece and cutting tools
- 1.8 position and secure workpieces using four of the following workholding methods and devices:
- ✓ chucks
 - ✓ collets
 - ✓ centres
 - ✓ face plate
 - ✓ machine vices
 - ✓ power chucks
 - ✓ clamps
 - ✓ angle plates
 - ✓ vee blocks
 - ✓ work rests
 - ✓ control stops
 - ✓ fixtures
 - ✓ injector mechanisms
 - ✓ magnetic blocks
 - ✓ pots
- 1.9 select and mount grinding wheels, to include all of the following:
- ✓ selecting grinding wheels for specific materials and applications (such as grain size, grade, structure, bond)
 - ✓ mounting wheels (such as 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 grinding machines to grind six of the following forms, as applicable to the machine type:
- ✓ flat faces
 - ✓ vertical faces
 - ✓ parallel faces
 - ✓ faces square to each other
 - ✓ shoulders and faces
 - ✓ slots
 - ✓ parallel diameters
 - ✓ tapered diameters
 - ✓ counterbores
 - ✓ tapered bores
 - ✓ parallel bores
 - ✓ profile forms
 - ✓ other thread forms
 - ✓ vee form threads
 - ✓ left hand threads
 - ✓ right hand threads
 - ✓ single start threads
 - ✓ multi-start threads
 - ✓ internal threads
 - ✓ external threads
 - ✓ angular faces
- 1.12 grind components made from one of the following types of material:
- ✓ ferrous
 - ✓ non-ferrous
 - ✓ non-metallic
- 1.13 set the machine to produce components within all of the following quality and accuracy standards, as applicable to the operations performed:
- ✓ tolerance to BS 4500 or BS 1916 Grade 5
 - ✓ surface texture 8 μin or 0.2 μm
 - ✓ components to be free from false grinding cuts, burrs and sharp edges
- 1.14 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
- 1.15 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome

The learner will:

2. know how to set grinding machines for production

Assessment criteria

The learner can:

- 2.1 describe the specific safety precautions to be taken when setting up workholding devices and grinding wheels on grinding machines (such as cylindrical, internal, surface, centreless and thread grinding)
- 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 grinding machines (such as moving parts of machinery, sparks/airborne particles, bursting grinding wheels, insecure components), 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 describe the basic operation of the various grinding machines, and typical operations that they can perform
- 2.8 explain how to handle and store grinding wheels safely and correctly
- 2.9 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
- 2.10 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
- 2.11 describe the terminology used in grinding in relation to the activities undertaken
- 2.12 describe the range of workholding methods and devices that are used on grinding machines
- 2.13 describe the methods of mounting and setting the workpiece in/on the workholding devices, and the tools and equipment that can be used
- 2.14 describe the various grinding operations that are used to produce the required profiles, and the types of wheels that are used
- 2.15 explain how to check that the grinding wheels are in a safe and serviceable condition (such as free from damage, cracks, correctly balanced)
- 2.16 describe the methods of mounting and securing the grinding wheels to the machine spindles
- 2.17 describe the methods of forming the wheels to the required profile (such as use of pantograph, diamond dressing units, thread crushing rolls)
- 2.18 describe the need for 'trueing up' and dressing of wheels to prevent glazing and burning of workpiece

- 2.19 explain how to set up the various machines for the particular

operations being performed

- 2.20 explain how the various types of material will affect the feeds and speeds that can be used
- 2.21 describe the application of cutting fluids with regard to a range of different materials
- 2.22 describe the need to conduct trial runs, and to check that the machine is set up and running safely and correctly
- 2.23 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
- 2.24 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 324

Setting honing and lapping machines for production

UAN:	L/600/5473
Level:	3
Credit value:	78
GLH:	175
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 24: Setting Honing and Lapping Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up honing and lapping machines, such as horizontal, vertical honing machines, rotary and reciprocal lapping machines, 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 be expected to select the appropriate honing mandrels, stones, discs and grit to use, check them for defects and mount and secure them to the machine spindle. The learner will also be expected to mount the workpiece, and to check that it is correctly positioned and aligned before starting the honing or lapping operations.</p> <p>The learner must set up the appropriate mechanisms, stops and controls for stroke lengths, stroke over-run, speed of stroke, RPM, and stone pressure, as applicable for the particular operations and machine type used. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role.</p> <p>The learner's responsibilities will require</p>

activities undertaken, and to report any problems with the honing and lapping machines, equipment or setting up activities that they cannot personally 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 honing and lapping machines used, and their application, and will know about the workholding devices, honing stones, equipment, relevant materials, consumables and setting up procedures, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the work output 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.

Learning outcome
The learner will: 1. set honing and lapping machines for production
Assessment criteria
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">✓ obtain and use the appropriate documentation (such as job 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 the honing stones or discs are in a 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 determine what has to be done and how the machine will be set to achieve this
- 1.5 prepare one of the following types of honing or lapping machine in readiness for production:
 - ✓ horizontal honing
 - ✓ vertical honing
 - ✓ rotary disc lapping
 - ✓ reciprocating machines
- 1.6 prepare honing or lapping machines, to include all the following, as applicable to the machine type:
 - ✓ RPM or reciprocating speed
 - ✓ stroke length
 - ✓ stroke over-run length
 - ✓ stroke speed
 - ✓ stone or disc pressure
- 1.7 mount and set the required workholding devices, workpiece and cutting tools
- 1.8 position and secure workpieces, using four of the following workholding methods and devices:
 - ✓ chucks
 - ✓ collets
 - ✓ pots
 - ✓ vee-blocks
 - ✓ magnetic chucks
 - ✓ magnetic blocks
 - ✓ face plate
 - ✓ clamps
 - ✓ jigs/fixtures
 - ✓ angle plates
- 1.9 select, prepare and mount all the following for honing machines:
 - ✓ selecting mandrels and wedges to suit bore size and through or blind hole
 - ✓ selecting honing stones for specific materials and applications (roughing, finishing, polishing)
 - ✓ checking stones for damage

or: select, prepare and mount all the following for lapping machines:

 - ✓ selecting discs/pads for specific materials and applications (roughing, finishing, polishing)
 - ✓ selecting appropriate grits for specific materials and applications (roughing, finishing, polishing)
 - ✓ checking discs for damage
- 1.10 set the machine tool operating parameters to achieve the component specification
- 1.11 set up honing machines to finish two of the following features:
 - ✓ through holes

<ul style="list-style-type: none"> ✓ blind holes ✓ tapered holes <p>or: set up lapping machines to finish all of the following features:</p> <ul style="list-style-type: none"> ✓ flat faces ✓ parallel faces ✓ angular faces <p>1.12 hone or lap components made from one of the following types of material:</p> <ul style="list-style-type: none"> ✓ ferrous ✓ non-ferrous <p>1.13 set the machine to produce components within all of the following quality and accuracy standards, as applicable to the operations performed:</p> <ul style="list-style-type: none"> ✓ tolerance to BS 4500 or BS 1916 Grade 5 ✓ surface texture 8 µin or 0.2µm ✓ components to be free from stone marks, burrs and sharp edges <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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Learning outcome
The learner will:
2. know how to set honing and lapping machines for production
Assessment criteria
The learner can:
2.1 describe the specific safety precautions to be taken when setting up workholding devices and honing/lapping equipment on machines (such as horizontal, vertical, rotary disc and reciprocating honing and lapping machines)
2.2 describe the hazards associated with setting honing and lapping (such as moving parts of machinery, airborne particles, insecure components), and how to minimise them and reduce any risks
2.3 explain how to start and stop the machine in normal and emergency situations
2.4 describe the importance of ensuring that the machine is isolated from the power supply before mounting honing mandrels, stones and workholding devices
2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
2.6 describe the basic operation of the various honing and lapping machines, and typical operations that they can perform
2.7 explain how to handle and store honing and lapping equipment and stones 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

metric systems of measurement, workpiece reference points and system of tolerancing

- 2.10 describe the terminology used in honing and lapping in relation to the activities undertaken
- 2.11 describe the range of workholding methods and devices that are used on honing and lapping 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 honing and lapping operations that are used to produce the required profiles, and the types of stones, discs and grits that are used
- 2.14 explain how to check that the honing mandrels, wedges and stones are in a safe and serviceable condition (such as free from damage, correct type, correctly fitted and secured)
- 2.15 describe the methods of mounting and securing the mandrels and discs to the machine spindles
- 2.16 explain how to set up the various machines for the particular operations being performed (such as stroke length, stroke speed, rpm, stone pressure)
- 2.17 explain how the various types of material will affect the feeds and speeds that can be used
- 2.18 describe the application of cutting fluids with regard to a range of different materials
- 2.19 describe the filtration requirements, and how to recognise when filters require changing/cleaning
- 2.20 describe the need to conduct trial runs, and to check that the machine is set up and running safely and correctly
- 2.21 describe the problems that can occur with setting up of the honing and lapping equipment, workholding devices and machine operating parameters, and what to do if problems occur
- 2.22 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 326

Setting broaching machines for production

UAN:	L/600/5490
Level:	3
Credit value:	78
GLH:	175
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 26: <u>Setting Broaching Machines for Production (Level 3).</u>
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up horizontal and/or vertical broaching machines for production, in accordance with approved procedures. This will involve selecting the appropriate workholding devices and securing them to the machine, and mounting and setting the workpiece in correct relationship to the broaching tool. The learner will be expected to select the appropriate broaching tools, check that they are in a usable condition, and mount and secure them to the relevant tool holding devices.</p> <p>The learner will also need to set the machine operating parameters to produce the workpiece to the required specification. This will involve setting the appropriate stroke length, pulling pressure and feed required. The learner must produce trial cuts and prove that the machine is working satisfactorily before declaring the machine ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role.</p> <p>The learner's responsibilities will require them to comply with organisational policy and procedures for the machine setting activities undertaken. and to report any</p>

cannot personally 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 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 broaching machine used and its application, and will know about the workholding devices, broaching tools, relevant materials, consumables and setting up procedures, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set broaching machines for production
Assessment criteria
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"> ✓ obtain and use the appropriate documentation (such as job 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 broaching tools 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 or BS 1916 Grade 7
 - ✓ surface finish 63 μin or 1.6 μm
 - ✓ components to be free from false tool 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 set up one of the following types of machine:
 - ✓ horizontal broaching machine
 - ✓ vertical broaching machine
- 1.7 mount and set the required workholding devices, workpiece and cutting tools
- 1.8 set up the workpiece and broach, to include all of the following:
 - ✓ selecting and setting the appropriate work holding device
 - ✓ locating and, where appropriate, securing the workpiece in the holding device
 - ✓ fitting and aligning the appropriate broach
 - ✓ aligning the workpiece in relationship to machine axis
- 1.9 set the machine tool operating parameters to achieve the component specification
- 1.10 set up machine in accordance with instructions and specifications, to include setting all of the following:
 - ✓ stroke position and length mechanisms
 - ✓ machine guards/safety mechanisms
 - ✓ broach pulling pressure
 - ✓ cutting fluid flow rate
 - ✓ stroke speed/feed
- 1.11 set up the machine to produce internal and external profiles that include four of the following:
 - ✓ keyways
 - ✓ flat sided holes
 - ✓ square holes
 - ✓ hexagonal holes
 - ✓ octagonal holes
 - ✓ splines
 - ✓ serrations
 - ✓ other/special forms
- 1.12 machine components made from one type of material from the following:
 - ✓ ferrous
 - ✓ non-ferrous
 - ✓ non-metallic
- 1.13 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
- 1.14 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome
The learner will: 2. know how to set broaching machines for production
Assessment criteria
The learner can: 2.1 describe the specific safety precautions to be taken when setting up workholding devices and accessories, workpiece and broaching tools 2.2 describe the hazards associated with setting broaching machines (such as moving parts of machinery, handling broaching tools, handling cutting fluids, tool breakage, insecure components), and how to minimise them and reduce any risks 2.3 explain how to start and stop the machine in normal and emergency situations 2.4 describe the importance of ensuring that the machine is isolated from the power supply before mounting broaching tools and workholding devices 2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy 2.6 describe the basic principles of operation of the broaching machine and its accessories, and typical operations that they can perform 2.7 explain how to handle and store broaching tools 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 broaching in relation to the activities undertaken 2.11 describe the range of workholding methods and devices that are used on broaching machines (jigs and fixtures, direct clamping to machine table) 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 different types of broaching tools that are used, and how they are selected, prepared and mounted to the machine tool holding devices 2.14 describe the factors which determine pulling pressure and feeds to be used (such as material, type of tooling, machine condition, tolerance and finish required) 2.15 explain how the various types of materials will affect the feeds that can be used 2.16 describe the types of cutting fluid that are used, and precautions to be taken when handling and using them 2.17 explain how to set up the broaching machine and its accessories for the particular operations being performed (such as setting stroke length, stroke position, pulling pressure and feed required)

- 2.18 describe the need to conduct trial runs, and to check that the machine is set up and producing the components correctly
- 2.19 describe the problems that can occur with setting up the workholding devices, tooling and machine operating parameters, and what to do if problems occur
- 2.20 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 332

Setting CNC turning machines for production

UAN:	H/600/5561
Level:	3
Credit value:	70
GLH:	140
Relationship to NOS:	This unit has been derived from Sema National Occupational Standard Mechanical Manufacturing Engineering Unit 32: Setting CNC Turning Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Sema, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up Computer Numerical Control (CNC) machines or CNC machining centres, in accordance with approved procedures. The learner will be expected to select the appropriate workholding devices, and to mount and secure them to the machine spindle. The learner will also be required to select the appropriate cutting tools, mount and secure them to the appropriate tool holding devices, and place the cutting tools in the relevant positions within the tool posts, turrets, slides or tool change magazine/carousel, where this is applicable.</p> <p>The learner will need to ensure that all the tools have been allocated a relevant tool number, and that the relevant data on their co-ordinates and datum positions are entered into the operating program and machine. This will involve loading and proving component programs, checking for errors/faults, editing and saving program changes.</p> <p>The learner must produce trial components and prove the machine is working satisfactorily before declaring the machine ready for production. Making adjustments to</p>

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 equipment, tooling, programs or setting-up activities that they cannot personally 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 CNC turning machine used, and its application, and will know about the workholding devices, tooling, machine operating programmes and setting-up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults, and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set CNC turning machines for production
Assessment criteria
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 during the setting-up activities: <ul style="list-style-type: none">✓ obtain and use the appropriate documentation (such as job 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
 - ✓ confirm that the correct operating program has been loaded
 - ✓ check that the tooling is in a usable condition
 - ✓ ensure that the workpiece is correctly positioned and secured without distortion
 - ✓ update the program tool data, as applicable
 - ✓ ensure that correctly adjusted machine guards are in place
 - ✓ 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 determine what has to be done and how the machine will be set to achieve this
- 1.5 prepare one of the following CNC turning machines in readiness for production:
 - ✓ CNC lathe
 - ✓ CNC machining centre
- 1.6 prepare the tooling for operation, by carrying out all the following activities, as applicable to the machine type:
 - ✓ positioning tools in the correct position in the tool posts, turrets, magazine or carousel
 - ✓ checking tools have a specific tool number in relation to the operating program
 - ✓ entering all relevant tool data to the operating program (tool lengths, tool offsets, radius compensation)
 - ✓ pre-setting tooling using setting jigs/fixtures
 - ✓ setting tool datum
 - ✓ saving changes to the program
- 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 methods and devices:
 - ✓ chucks with hard jaws
 - ✓ chucks with soft jaws
 - ✓ fixtures
 - ✓ drive centres
 - ✓ collet chucks
 - ✓ faceplates
 - ✓ magnetic/pneumatic devices
 - ✓ other workholding devices
- 1.9 select and mount the appropriate tool holding device and eight of the following types of cutting tool:
 - ✓ roughing tool
 - ✓ finishing tool
 - ✓ parting-off tool
 - ✓ screw-thread tool
 - ✓ profiling tools
 - ✓ form tools
 - ✓ centre drills

- ✓ twist/core drills
 - ✓ boring tools
 - ✓ reamers
 - ✓ maxi-tipped drills
- 1.10 set the machine tool operating parameters to achieve the component specification
- 1.11 set up the machine to produce components combining several different operations, covering ten from:
- ✓ parallel diameters
 - ✓ stepped diameters
 - ✓ tapered diameters
 - ✓ flat faces
 - ✓ internal undercuts
 - ✓ external undercuts
 - ✓ internal profiles
 - ✓ external profiles
 - ✓ reamed holes
 - ✓ tapped holes
 - ✓ drilled holes
 - ✓ parting-off
 - ✓ eccentric diameters
 - ✓ external screw threads
 - ✓ internal screw threads
 - ✓ chamfers and radii
 - ✓ bored holes
 - ✓ grooves
- 1.12 machine one of the following types of material:
- ✓ ferrous
 - ✓ non-ferrous
 - ✓ stainless
 - ✓ non-metallic
- 1.13 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 BS4500 or BS 1916 Grade 7
 - ✓ surface finish 63µin or 1.6µm
 - ✓ reamed and bored holes within H8
 - ✓ angles within +/- 0.5 degree
 - ✓ screw threads BS medium fit
- 1.14 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
- 1.15 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome

The learner will:

2. know how to set CNC turning machines for production

Assessment criteria

The learner can:

- 2.1 describe the specific safety precautions to be taken when setting up workholding devices and tooling on CNC lathes
- 2.2 explain how to start and stop the machine in normal and emergency situations
- 2.3 describe the importance of ensuring that the machine is isolated from the power supply before mounting cutting tools and workholding devices
- 2.4 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
- 2.5 describe the hazards associated with working on CNC lathes (such as use of power operated chucks, moving machinery, automatic machine operation, handling cutting tools, lifting and handling workholding devices, hot and airborne metal particles), and how to minimise them
- 2.6 explain how to handle and store cutting tools and verified tapes and programs, safely and correctly
- 2.7 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
- 2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
- 2.9 describe the range of workholding methods and devices that are used on CNC lathes
- 2.10 explain why it is important to set the workholding device in relationship to the machine datum's and reference points
- 2.11 describe the methods of setting the workholding devices, and the tools and equipment that can be used
- 2.12 describe the range of cutting tools that are used on CNC lathes, and typical applications
- 2.13 explain how to check that the cutting tools are in a safe and serviceable condition
- 2.14 describe the use of tungsten carbide, ceramic and diamond indexable tips, and the factors which will determine their selection and use (such as the condition of material supplied, hardness of the material, the cutting characteristics of the material, tolerances to be achieved, component surface finish and specifications)
- 2.15 describe the various tool holding devices that are used, and the methods of correctly mounting and securing the cutting tools to the tool holders
- 2.16 describe the advantages of using pre-set tooling, and how to set the tooling using setting jigs/fixtures
- 2.17 describe the use of tool posts, magazines and carousels, and how to position and identify the tools in relationship to the operating program
- 2.18 explain how to place the machine into the correct operating mode, and how to access the program edit facility in order to enter tooling data, such as tool datums, positions, lengths, offsets and radius

compensation

- 2.19 explain how to conduct trial runs using single block run, dry run and feed and speed override controls
- 2.20 describe the things that they need to check before allowing the machine to operate in full program run mode
- 2.21 explain how the various types of materials used will affect the feeds and speeds that can be used
- 2.22 describe the application of cutting fluids with regard to a range of different materials, and why some materials do not require the use of cutting fluids
- 2.23 describe the typical problems that can occur with the setting up of the tooling and workholding devices, and what to do if they occur
- 2.24 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 334

Setting CNC milling machines for production

UAN:	R/600/5572
Level:	3
Credit value:	70
GLH:	140
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 34: Setting CNC Milling Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up Computer Numerical Control (CNC) three axis or five axis machines or CNC machining centres, in accordance with approved procedures. This involves selecting the appropriate workholding devices, and mounting and positioning them to the machine table in the designated or appropriate position, as required by the machine-operating program. The learner will also be required to select the appropriate milling cutters to use, and to mount and secure them to the appropriate tool holding devices. The learner will be expected to place the tools in the relevant positions within the tool change magazine or carousel, where this is applicable.</p> <p>The learner will need to ensure that all the tools have been allocated a relevant tool number and that the relevant data on their co-ordinates and datum positions are entered into the operating program and machine. This will involve loading and proving the component program, checking for errors/faults, editing and saving program changes. The learner must produce trial components and prove the machine is working satisfactorily before declaring the machine ready for production. Making</p>

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 equipment, tooling, programs or setting-up activities that they cannot personally 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 CNC milling machine used, and its application, and will know about the workholding devices, tooling, materials, machine operating program and setting-up procedures, in adequate depth to provide a sound basis for setting-up the equipment, correcting faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set CNC milling machines for production
Assessment criteria
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 during the setting-up activities: <ul style="list-style-type: none">✓ obtain and use the appropriate documentation (such as job 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
 - ✓ confirm that the correct operating program has been loaded
 - ✓ check that the tooling is in a usable condition
 - ✓ ensure that the workpiece is correctly positioned and secured without distortion
 - ✓ update the program tool data, as applicable
 - ✓ ensure that correctly adjusted machine guards are in place
 - ✓ 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 BS4500 or BS 1916 Grade 7
 - ✓ surface finish 63µm or 1.6µm
 - ✓ reamed and bored holes within H8
 - ✓ flat and square 0.001" per inch or 0.025mm per 25mm
 - ✓ angles within +/- 0.5 degree
- 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 CNC milling machines in readiness for production:
- ✓ CNC three axis milling machine
 - ✓ CNC five axis milling machine
 - ✓ CNC machining centre
- 1.7 prepare tooling for operation by carrying out all the following activities, as applicable to the machine type:
- ✓ positioning tools in the correct position in the tool magazine or carousel
 - ✓ checking tools have specific tool number in relation to the operating program
 - ✓ entering all relevant tool data to the operating program (tool lengths, tool offsets, radius compensation)
 - ✓ presetting tooling using setting jigs/fixtures
 - ✓ setting tool datum
 - ✓ saving changes to program
- 1.8 mount and set the required workholding devices, workpiece and cutting tools
- 1.9 position and secure workpieces using two of the following workholding methods and devices:
- ✓ machine vices
 - ✓ fixtures
 - ✓ chucks
 - ✓ pneumatic or magnetic table
 - ✓ direct clamping to machine table
 - ✓ ancillary indexing devices
 - ✓ angle plate

- 1.10 select and mount four of the following types of milling cutters to the appropriate tool holding device:
- ✓ face mills
 - ✓ end mills
 - ✓ twist/core drills
 - ✓ boring tools
 - ✓ reamers
 - ✓ slot drills
 - ✓ special profile cutters
- 1.11 set the machine tool operating parameters to achieve the component specification
- 1.12 set up the machine to produce components, combining different operations, covering eight from:
- ✓ flat faces
 - ✓ steps/shoulders
 - ✓ enclosed slots/recesses
 - ✓ internal profiles
 - ✓ holes on pitch circles
 - ✓ parallel faces
 - ✓ angular faces
 - ✓ open ended slots
 - ✓ external profiles
 - ✓ holes linearly pitched
 - ✓ circular/curved profiles
 - ✓ special forms (such as concave, convex)
 - ✓ faces that are square to each other
- 1.13 machine components made from one of the following types of material:
- ✓ ferrous
 - ✓ non-ferrous
 - ✓ stainless
 - ✓ non-metallic
- 1.14 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
- 1.15 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome
The learner will: 2. know how to set CNC milling machines for production
Assessment criteria
The learner can: 2.1 describe the specific safety precautions to be taken when setting up workholding devices and tooling on CNC milling machines 2.2 explain how to start and stop the machine in normal and emergency situations 2.3 describe the importance of ensuring that the machine is isolated from the power supply before mounting cutters and workholding

devices

- 2.4 describe the hazards associated with working on CNC milling machines (such as use of power operated workholding devices, moving machinery, automatic machine operation, handling cutting tools, lifting and handling workholding devices, hot and airborne metal particles), and how to minimise them and reduce any risk
- 2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
- 2.6 explain how to handle and store milling cutters safely and correctly
- 2.7 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
- 2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
- 2.9 explain how to read and interpret CNC drawings and extract the relevant information
- 2.10 describe the range of workholding methods and devices that are used on CNC milling machines
- 2.11 explain why it is important to set the workholding device in relation to the machine axis and reference points
- 2.12 describe the methods of setting the workholding devices, and the tools and equipment that can be used
- 2.13 describe the range of cutting tools that are used on CNC milling machines, and typical applications
- 2.14 describe the use of tungsten carbide, ceramic and diamond indexable tips, and the factors which will determine their selection and use (such as condition of material supplied, hardness of the material, cutting characteristics of the material, tolerances to be achieved, component surface finish and specifications)
- 2.15 explain how to check that the cutting tools are in a safe and serviceable condition
- 2.16 describe the various tool holding devices that are used, and the methods of mounting and securing the cutting tools to the tool holders
- 2.17 describe the advantages of using pre-set tooling, and how to set the tooling using setting jigs
- 2.18 describe the use of tool magazines and carousels, and how to position and identify the tools in relation to the operating program
- 2.19 explain how to place the machine into the correct operating mode, and how to access the program edit facility in order to enter tooling data (such as tool lengths, tool offsets, radius compensation)
- 2.20 explain how to conduct trial runs using single block run, dry run, and feed and speed override controls
- 2.21 describe the things that they need to check before allowing the machine to operate in full program run mode
- 2.22 explain how the various types of materials used will affect the feeds and speeds that can be used
- 2.23 describe the application of cutting fluids with regard to a range of different materials, and why some materials do not require the use of cutting fluids
- 2.24 describe the typical problems that can occur with the setting up of

the tooling and workholding devices, and what to do if they occur
2.25 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 336

Setting CNC grinding machines for production

UAN:	J/600/5584
Level:	3
Credit value:	70
GLH:	140
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 36: Setting CNC Grinding Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up Computer Numerically Control (CNC) grinding machines, such as CNC universal grinding machines, CNC gear grinding machines, CNC ring grinding machines, and CNC grinding machining centre, in accordance with approved procedures. The learner will be expected to select the appropriate workholding devices, and to mount and secure them to the machine table or spindle in the designated or appropriate position, as required by the machine operating program. The learner will also be expected to select the appropriate grinding wheels, and to balance, dress, mount and secure them to the appropriate machine spindles and/or tool change magazine/carousel, where this is applicable.</p> <p>The learner will need to ensure that all grinding wheels have been allocated a relevant tool number, and that the relevant data on their co-ordinates and datum positions are entered into the operating program and machine controller. This will involve loading and proving component programs, checking for errors/faults, editing and saving program changes. Making adjustments to settings to achieve specification. and solving machine-related</p>

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 equipment, grinding wheels, programs or setting up activities that they cannot personally 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 CNC grinding machine used, and its application, and will know about the workholding devices, grinding wheels, machine operating programs and setting-up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set CNC grinding machines for production
Assessment criteria

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 during the setting-up activities:
 - ✓ obtain and use the appropriate documentation (such as job 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

- ✓ confirm that the correct operating program has been loaded
 - ✓ check that the grinding wheels are in a safe and usable condition
 - ✓ ensure that the workpiece is correctly positioned and secured without distortion
 - ✓ update the program tool data as applicable
 - ✓ ensure that correctly adjusted machine guards are in place
 - ✓ 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 BS4500 or BS 1916 Grade 7
 - ✓ flat and square 0.0005" per inch or 0.005mm per 25mm
 - ✓ angles within +/- 0.5 degree
 - ✓ surface finish 32µin or 0.8µm
 - ✓ ground bores/holes within H8
 - ✓ screw threads BS medium fit
- 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 NC/CNC grinding machines in readiness for production:
- ✓ CNC universal grinder
 - ✓ CNC gear grinder
 - ✓ CNC grinding machining centre
 - ✓ CNC thread grinder
 - ✓ CNC ring grinder
- 1.7 prepare the tooling by carrying out all of the following activities, as applicable to the machine type:
- ✓ pre-setting grinding wheels/spindles using balancing units and setting jigs/fixtures
 - ✓ setting tool datum
 - ✓ positioning grinding wheels/spindles in the correct position in the machine spindle, magazine or carousel
 - ✓ checking wheels/spindles have a specific tool number in relation to the operating program
 - ✓ entering all relevant tooling data to the operating program (wheel/spindle position offsets)
 - ✓ saving changes to programme
- 1.8 mount and set the required workholding devices, workpiece and cutting tools
- 1.9 position and secure workpieces using four of the following workholding methods and devices:
- ✓ chucks
 - ✓ collets
 - ✓ clamps
 - ✓ machine vices

- ✓ faceplates
 - ✓ vee-blocks
 - ✓ centers
 - ✓ fixtures
 - ✓ angle plates
 - ✓ mandrels/arbours
 - ✓ power chucks/blocks
 - ✓ other workholding arrangements
- 1.10 select/mount grinding wheels and dress six of the following types of feature on the grinding wheel:
- ✓ rough grinding
 - ✓ male radius
 - ✓ finish grinding
 - ✓ angles
 - ✓ for thread grinding
 - ✓ component form profile
 - ✓ for gear grinding
 - ✓ female radius
- 1.11 set the machine tool operating parameters to achieve the component specification
- 1.12 set up to produce ground components, which combine different operations and cover six of the following:
- ✓ plain diameters
 - ✓ stepped diameters
 - ✓ tapered diameters
 - ✓ flat faces and shoulders
 - ✓ internal and external profiles
 - ✓ eccentric diameters
 - ✓ external screw threads
 - ✓ chamfers and radii
 - ✓ parallel bores
 - ✓ tapered bores
 - ✓ involute and helical forms
 - ✓ curvic couplings
 - ✓ special forms (such as concave, convex)
 - ✓ internal/external undercuts/bearing tracks
- 1.13 machine one different type of material from:
- ✓ ferrous
 - ✓ non-ferrous
 - ✓ stainless
 - ✓ non-metallic
- 1.14 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
- 1.15 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome

The learner will:

2. know how to set CNC grinding machines for production

Assessment criteria

The learner can:

- 2.1 describe the specific safety precautions to be taken when setting up workholding devices and tooling on CNC grinding machines
- 2.2 explain how to start and stop the machine in normal and emergency situations
- 2.3 describe the hazards associated with working on CNC grinding machines (such as moving machinery, automatic machine operation, sparks/airborne particles, bursting grinding wheels), and how to minimise them and reduce any risks
- 2.4 describe the Grinding Wheel Regulations covering the use and operation of grinding wheels and equipment
- 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 grinding wheels, spindles, verified tapes and programs, 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 range of workholding methods and devices that are used on CNC grinding machines
- 2.11 explain why it is important to set the workholding device in relation to the machine datum's and reference points
- 2.12 describe the methods of setting the workholding devices, and the tools and equipment that can be used
- 2.13 describe the range of grinding wheels that are used on CNC lathes, and typical applications
- 2.14 explain how to check that the grinding wheels are in a safe and serviceable condition
- 2.15 describe the use of silicon carbide, aluminium oxide and diamond wheels, and the material conditions determining their use
- 2.16 explain how to select the correct grade and type of grinding wheel for the materials being machined
- 2.17 describe the various grinding tool holding devices that are used, and the methods of correctly mounting and securing the grinding wheels to the machine spindle and tool holders
- 2.18 describe the advantages of using pre-set tooling, and how to set the tooling using setting jigs/fixtures
- 2.19 describe the use of magazines and carousels, and how to position and identify the tools in relation to the operating program
- 2.20 explain how to place the machine into the correct operating mode, and how to access the program edit facility in order to enter tooling data (such as tool datums, positions, lengths and offsets)

- 2.21 explain how to conduct trial runs, using single block run, dry run and feed/speed override controls
- 2.22 describe the things that they need to check before allowing the machine to operate in full program run mode
- 2.23 explain how the various materials will affect the feeds and speeds that can be used
- 2.24 describe the application of cutting fluids with regard to a range of different materials, and why some materials do not require the use of cutting fluids
- 2.25 describe the typical problems that can occur when setting-up of grinding wheels and workholding devices, and what to do if they occur
- 2.26 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 338

Setting CNC punching machines for production

UAN:	K/600/5643
Level:	3
Credit value:	70
GLH:	140
Relationship to NOS:	This unit has been derived from Sema National Occupational Standard Mechanical Manufacturing Engineering Unit 38: Setting CNC Punching Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Sema, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up Computer Numerical Control (CNC) punching machines, in accordance with approved procedures. The learner will be expected to select the appropriate workholding devices, and to mount and secure them to the machine spindle. The learner will also be required to select the appropriate cutting tools, mount and secure them to the appropriate tool holding devices, and place the cutting tools in the relevant positions within the tool posts, turrets, slides or tool change magazine/carousel, where this is applicable.</p> <p>The learner will need to ensure that all the tools have been allocated a relevant tool number and that the relevant data on their co-ordinates and datum positions are entered into the operating program and machine. This will involve loading and proving component programs, checking for errors/faults, editing and saving program changes.</p> <p>The learner must produce trial components and prove the machine is working satisfactorily before declaring the machine ready for production. Making adjustments to settings to achieve specification. and solving</p>

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 equipment, tooling, programs or setting up activities that they cannot personally 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 CNC punching machine used, and its application, and will know about the workholding devices, tooling, machine operating programs and setting-up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set CNC punching machines for production
Assessment criteria
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 during the setting-up activities: <ul style="list-style-type: none">✓ obtain and use the appropriate documentation (such as job 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

- ✓ confirm that the correct operating program has been loaded
 - ✓ check that the tooling is in a usable condition
 - ✓ ensure that the workpiece is correctly positioned and secured without distortion
 - ✓ update the program tool data as applicable
 - ✓ ensure that correctly adjusted machine guards are in place
 - ✓ 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 or BS 1916 Grade 9
 - ✓ components to be free from deformity, 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 CNC punching machines in readiness for production:
- ✓ CNC punching machine
 - ✓ CNC fabrication machining centre (for punching operations)
- 1.7 prepare the tooling by carrying out all of the following activities, as applicable to the machine type:
- ✓ pre-setting tooling using setting jigs/fixtures
 - ✓ setting tool datums
 - ✓ positioning tools in the correct position in the tool posts, turrets, magazine or carousel
 - ✓ checking tools have a specific tool number in relation to the operating program
 - ✓ entering all relevant tool data to the operating program (tool lengths, tool offsets, radius compensation)
 - ✓ saving changes to program
- 1.8 mount and set the required workholding devices, workpiece and cutting tools
- 1.9 position and secure workpieces using two of the following workholding methods and devices:
- ✓ direct clamping to machine table
 - ✓ magnetic chucks
 - ✓ pneumatic chucks
 - ✓ jigs and fixtures
 - ✓ other workholding devices
- 1.10 select and mount, in the appropriate holding device, two of the following types of punching/forming tool:
- ✓ hole punching tools
 - ✓ nibbling tools
 - ✓ forming tools
- 1.11 set the machine tool operating parameters to achieve the component specification
- 1.12 set up the machine to produce components, combining several different operations, and cover four from:

- ✓ holes linearly pitched
- ✓ holes radially pitched
- ✓ square/rectangular profiles
- ✓ curved profiles
- ✓ swages
- ✓ louvres
- ✓ other applications

1.13 machine one of the following types of material:

- ✓ ferrous
- ✓ non-ferrous
- ✓ stainless
- ✓ special alloys

1.14 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations

1.15 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome
The learner will:
2. know how to set CNC punching machines for production
Assessment criteria
The learner can:
2.1 describe the specific safety precautions to be taken when setting up workholding devices and tooling on CNC punching machines
2.2 explain how to start and stop the machine in normal and emergency situations
2.3 describe the importance of ensuring that the machine is isolated from the power supply before mounting punching tools and workholding devices
2.4 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
2.5 describe the hazards associated with working on CNC punching machines (such as moving machinery, automatic machine operation, handling punching tools, lifting and handling workholding devices, handling sheet materials), and how to minimise them and reduce any risks
2.6 explain how to handle and store punching tools and verified tapes and programs, safely and correctly
2.7 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
2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
2.9 describe the range of workholding methods and devices that are used on CNC punching machines
2.10 explain why it is important to set the workholding device/workpiece in relationship to the machine datum's and reference points

- devices/workpieces, and the tools and equipment that can be used
- 2.12 describe the range of punching tools that are used on CNC punching machines, and typical applications
 - 2.13 explain how to check that the punching tools are in a safe and serviceable condition
 - 2.14 describe the use of high-speed steel and tungsten carbide tooling, and the factors which will determine their selection and use (such as condition of material supplied, hardness of the material, cutting characteristics of the material, tolerances to be achieved, component surface finish and specifications)
 - 2.15 describe the various tool holding devices that are used, and the methods of correctly mounting and securing the punching tools to the tool holders
 - 2.16 describe the advantages of using pre-set tooling, and how to set the tooling using setting jigs/fixtures
 - 2.17 describe the use of tool posts, magazines and carousels, and how to position and identify the tools in relation to the operating program
 - 2.18 explain how to place the machine into the correct operating mode, and how to access the program edit facility in order to enter tooling data (such as tool datum's, positions, lengths, offsets and radius compensation)
 - 2.19 explain how to conduct trial runs using single block run, dry run and feed/speed override controls
 - 2.20 describe the things that they need to check before allowing the machine to operate in full program run mode
 - 2.21 explain how the various types of materials will affect the feeds and speeds that can be used
 - 2.22 describe the typical problems that can occur with the setting up of the tooling and workholding devices, and what to do if they occur
 - 2.23 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 340

Setting CNC laser profiling machines for production

UAN:	R/600/5670
Level:	3
Credit value:	70
GLH:	140
Relationship to NOS:	This unit has been derived from Sema National Occupational Standard Mechanical Manufacturing Engineering Unit 40: Setting CNC Laser Profiling Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Sema, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to set up CNC laser profiling machines and associated equipment, in accordance with approved procedures. The learner will be required to select the appropriate workholding devices, and to mount and secure them to the machine table in the correct relation to the operating program and machine parameters.</p> <p>The learner will need to set up the machine conditions and adjust/edit program parameters, controlling the setting of the optical system, laser characteristics, laser alignment, electrical parameters, and the laser cutting speed. This will involve loading and proving component programmes, checking for errors/faults, editing and saving program changes. The learner must produce trial components, and prove the machine is working correctly and producing the components to the required specification, before declaring the machine ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role.</p> <p>The learner's responsibilities will require them to comply with organisational policy</p>

problems with the equipment or setting activities that they cannot personally 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 CNC laser profiling machine used, and its application, and will know about the workholding devices, machine operating programmes and setting-up procedures, in adequate depth to provide a sound basis for setting-up the equipment, correcting faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working on the machine and its associated 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. set CNC laser profiling machines for production
Assessment criteria
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 during the setting-up activities: <ul style="list-style-type: none"> ✓ obtain and use the appropriate documentation (such as job 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 ✓ confirm that the correct operating program has been loaded ✓ ensure that the laser lens is in a clean and usable condition ensure that the material/workpiece is correctly positioned and secured without distortion ✓ update the program data as applicable ensure that correctly adjusted machine guards are in place

- ✓ 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 BS4500 or BS 1916 Grade 7
 - ✓ angles within +/- 0.5 degree
 - ✓ surface texture within 63µin or 1.6µm
- 1.5 determine what has to be done and how the machine will be set to achieve this
- 1.6 mount and set the required workholding devices, workpiece and cutting tools
- 1.7 position and secure materials/workpiece using three of the following workholding devices:
 - ✓ machine vices
 - ✓ chucks
 - ✓ fixtures
 - ✓ direct clamping to machine table
 - ✓ Indexing tables/devices
 - ✓ Other
- 1.8 set the machine tool operating parameters to achieve the component specification
- 1.9 set up, in accordance with work instructions and specifications, all of the following:
 - ✓ optical system
 - ✓ laser positioning
 - ✓ profiling parameters
 - ✓ saving changes to programme
 - ✓ laser alignment
 - ✓ cutting speed
- 1.10 set up the equipment to produce machined components which cover six of the following features:
 - ✓ square/rectangular profiles
 - ✓ angular profiles
 - ✓ curved profiles
 - ✓ circles
 - ✓ ellipses
 - ✓ holes linearly positioned
 - ✓ holes radially positioned
 - ✓ slots and apertures
 - ✓ other features
- 1.11 machine one of the following types of material:
 - ✓ ferrous
 - ✓ non-ferrous
 - ✓ stainless
 - ✓ non-metallic

- 1.12 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations
- 1.13 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome

The learner will:

- 2. know how to set CNC laser profiling machines for production

Assessment criteria

The learner can:

- 2.1 describe the safe working practices and procedures to be observed when setting and operating CNC laser profiling machines (care when working with high power laser beams machine guards; ventilation and fume extraction; machine safety devices)
- 2.2 explain how to start and stop the machine in normal and emergency situations, and how to close the machine down on completion of activities
- 2.3 describe the importance of ensuring that the machine is isolated from the power supply before working with machinery; and of taking particular care when working with high-power laser beams
- 2.4 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
- 2.5 describe the hazards associated with setting laser machines (such as dangers from high power laser beams; live electrical components; moving parts of machinery), and how to minimise them and reduce any risks
- 2.6 describe the basic principles of laser profiling (such as using a laser beam to cut metals; forming component profile; process principles; nature of the laser beam; methods of generating a laser beam; guiding and optical focussing laser optics; parameters; how variation in the parameters influences the component feature, quality and output; terminology used in laser machining)
- 2.7 describe the key components and features of the equipment (such as types of laser beam generator, beam characteristics, power ranges; beam guiding and focusing arrangements; power sources; materials and thickness capabilities; facilities for manipulating the components for machining; and safety features)
- 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 range of workholding methods and devices used on laser profiling machines
- 2.11 describe the methods of setting up the components in relation to the machine's datum's and operating parameters (such as to achieve correct laser alignment; manipulation of work holding equipment to present the component correctly relative to the laser).
- 2.12 describe the setting up the laser equipment to achieve the

focal distance; cutting speed)

- 2.13 explain how to place the machine in the correct operating mode, and how to access the program edit facility in order to make minor adjustments for production
- 2.14 explain how to conduct trial runs, using single block run, speed override controls, and checking that the machine functions to the required specification
- 2.15 explain how the various materials will affect the operating conditions used, and the cutting speed that can be applied
- 2.16 describe the problems that can occur with laser cutting activities, and how these can be overcome (such as causes of distortion and methods of control, cutting characteristics of parent materials; sources of component defects and methods of prevention)
- 2.17 describe the organisational quality systems (such as standards to be achieved; production records to be kept)
- 2.18 describe the extent of their responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 342

Setting CNC electro-discharge machines for production

UAN:	M/600/5921
Level:	3
Credit value:	70
GLH:	140
Relationship to NOS:	This unit has been derived from Sema National Occupational Standard Mechanical Manufacturing Engineering Unit 42: Setting CNC Electro-Discharge Machines for <u>Production (Level 3)</u> .
Endorsement by a sector or other appropriate body:	This unit is endorsed by Sema, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up Computer Numerical Control (CNC) electrical discharge machines, such as spark erosion and wire erosion machines, in accordance with approved procedures. The learner will be expected to select the appropriate workholding devices, and to mount and secure them to the machine table in the designated or appropriate position, as required by the machine-operating program. The learner will also be expected to select the appropriate electrode cartridge holders or wires, and to mount and secure these to the appropriate machine head/slide and/or tool change holder mechanism, where this is applicable.</p>

The learner will need to ensure that all electrode cartridges/holders and/or wires have been allocated a relevant tool number, and that the relevant data on their co-ordinates and datum positions are entered into the operating program of the machine. This will involve loading and proving component programs, checking for errors/faults, editing and saving program changes. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role.

them to comply with organisational policy and procedures for the machine setting activities undertaken, and to report any problems with the equipment, tooling programs or setting-up activities that they cannot personally 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 CNC electrical discharge machine used, and its application, and will know about the workholding devices, tooling, machine operating programs and setting-up procedures, in adequate depth to provide a sound basis for setting-up the equipment, correcting faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the CNC electro-discharge machine and 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. set CNC electro-discharge machines for production
Assessment criteria
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 during the setting-up activities: <ul style="list-style-type: none"> ✓ obtain and use the appropriate documentation (such as job 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 ✓ confirm that the correct operating program has been loaded ✓ check that the electrode or wire is of the correct type and in a

- usable condition
 - ✓ check that the dielectric fluid is at an appropriate level
 - ✓ ensure that the workpiece is correctly positioned and secured without distortion
 - ✓ update the program tool data as applicable
 - ✓ ensure that correctly adjusted machine guards are in place and safety devices are working
 - ✓ 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 BS4500 or BS 1916 Grade 7
 - ✓ flatness and squareness 0.001" per inch or 0.025mm per 25mm
 - ✓ components to be free from false starts and sharp edges
 - ✓ surface finish 32µin/0.8µm, 18VDI
 - ✓ machined holes within H8
 - ✓ angles within +/- 0.5 degree
- 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 electro-discharge machines for operation:
- ✓ CNC wire erosion machine
 - ✓ CNC spark erosion machine
 - ✓ CNC electrical discharge machining centre
- 1.7 prepare the tooling by carrying out all the following activities, as applicable to the machine type:
- ✓ pre-setting electrodes in tooling cartridges/holders manually or by using setting jigs/fixtures
 - ✓ loading and threading wire through wire feed mechanism and wire guides
 - ✓ positioning electrode cartridges/holders in correct position on machine head or magazine/docking station
 - ✓ checking electrode cartridges/holders/wire have a specific tool number or technology setting in relation to the operating program
 - ✓ entering all wire data to the operating program (such as wire type and size, material thickness, number of skims)
 - ✓ entering all relevant tooling data to the operating program (such as cartridge/holder position, offsets)
 - ✓ setting tool/wire datum point
 - ✓ saving changes to program
- 1.8 mount and set the required workholding devices, workpiece and cutting tools
- 1.9 position and secure workpieces using three of the following workholding methods and devices:
- ✓ clamping direct to machine table

<ul style="list-style-type: none"> ✓ pneumatic or magnetic table ✓ machine vice (such as plain, swivel, universal) ✓ angle plate ✓ vee block and clamps ✓ fixtures ✓ chucks (such as 3 jaw, 4 jaw) ✓ ancillary indexing device
<p>1.10 select, load and set in the appropriate tool holding device, one of the following electrode types:</p> <ul style="list-style-type: none"> ✓ plain electrodes ✓ profile electrodes ✓ hollow electrodes ✓ wires
<p>1.11 set the machine tool operating parameters to achieve the component specification</p>
<p>1.12 set up to produce machined components, which combine different operations and cover ten of the following:</p> <ul style="list-style-type: none"> ✓ flat faces ✓ parallel faces ✓ tapered faces ✓ angular faces ✓ open ended slots/recesses ✓ internal profiles ✓ external profiles ✓ faces square to each other ✓ enclosed slots/recesses ✓ tapered holes ✓ holes on pitch circles ✓ linear holes (rows, angles) ✓ special profiles (such as concave, convex) ✓ parallel and tapered steps/slots/shoulders ✓ circular/curved profiles (internal and external) ✓ other special forms or activities
<p>1.13 machine components from one of the following types of material:</p> <ul style="list-style-type: none"> ✓ ferrous ✓ non-ferrous
<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>

Learning outcome
The learner will:
2. know how to set CNC electro-discharge machines for production
Assessment criteria
The learner can:
2.1 describe the specific safety precautions to be taken when setting

- up workholding devices and tooling on CNC electrical discharge machinery
- 2.2 explain how to start and stop the machine in normal and emergency situations
 - 2.3 describe the importance of ensuring that the machine is isolated from the power supply before mounting electrodes, cartridges/holders and workholding devices
 - 2.4 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
 - 2.5 describe the hazards associated with CNC electro-discharge operations (such as moving parts of machinery, electrical components, handling dielectrics, fumes), and how to minimise them and reduce any risks
 - 2.6 explain how to handle and store electrodes or wire, electrode cartridges/holders, verified tapes and programs, safely and correctly
 - 2.7 explain how to extract and use information from engineering drawings or other data supplied and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken
 - 2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
 - 2.9 describe the range of work holding methods and devices that are used on CNC electrical discharge machines
 - 2.10 explain why it is important to set the workholding device in relation to the machine datums and reference points
 - 2.11 describe the methods of setting the workholding devices, and the tools and equipment that can be used
 - 2.12 describe the range of eroded features that are produced on CNC electrical discharge machines
 - 2.13 explain how to check that the electrodes or wires are in a good and serviceable condition
 - 2.14 describe the different types of electrodes/wire, and the material conditions determining their use
 - 2.15 explain how to select the correct grade and type of electrode/wire for the materials and profiles being machined
 - 2.16 describe the various electrode tool holding devices that are used, and the methods of correctly loading, securing and setting the electrodes/wire in the electrode cartridge/holder/feed mechanism and the machine head/wire guides
 - 2.17 describe the use of tooling magazines or technology settings, and how to position and identify the tools in relation to the operating program
 - 2.18 explain how to place the machine into the correct operating mode, and how to access the program edit facility, in order to enter tooling data (such as tool datum's, positions, height, lengths and offsets, and number of skims)
 - 2.19 explain how to conduct trial runs using single block run, dry run and feed/speed override controls
 - 2.20 describe the typical faults that occur when electrical discharge machining and die sinking
 - 2.21 describe the things that they need to check before allowing the

machine to operate in full program run mode

- 2.22 explain how the various types of materials will affect the feeds and voltage that can be used
- 2.23 describe the application of dielectric fluids with regard to a range of different materials
- 2.24 describe the typical problems that can occur when setting-up electrodes/wires in cartridges/holders/feed mechanisms and with using workholding devices, and what to do if problems occur
- 2.25 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 348

Setting CNC gear cutting machines for production

UAN:	L/600/5974
Level:	3
Credit value:	70
GLH:	140
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 48: Setting CNC Gear Cutting Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up Computer Numerical Control (CNC) gear cutting machines, in accordance with approved procedures. The learner will be expected to select the appropriate workholding devices to be used, and to mount and position them to the machine in the correct location for the type of operation being carried out. The learner will also be required to select the appropriate tools and cutters, check them for defects, and mount and secure them to the relevant tool holding devices and machine spindle.</p> <p>The learner will need to ensure that all the tools have been allocated a relevant tool number, and that the relevant data on their co-ordinates and datum positions are entered into the operating program and machine. This will involve loading and proving component programmes, checking for errors/faults, editing and saving program changes.</p> <p>The learner must produce trial components and prove the machine is working satisfactorily before declaring the machine ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production,</p>

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 equipment, tooling, programs or setting up activities that they cannot personally 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 CNC gear cutting machine used, and its application, and will know about the workholding devices, tooling, machine operating programmes and setting-up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set CNC gear cutting machines for production
Assessment criteria
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 during the setting-up activities: <ul style="list-style-type: none"> ✓ obtain and use the appropriate documentation (such as job 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

- ✓ confirm that the correct operating program has been loaded
 - ✓ check that the tooling is in a usable condition
 - ✓ ensure that the workpiece is correctly positioned and secured without distortion
 - ✓ update the program tool data as applicable
 - ✓ ensure that correctly adjusted machine guards are in place
 - ✓ 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:
- ✓ components to be free from false tool cuts, burrs and sharp edges
 - ✓ straight splines and serrations to BS 2059 or BS1953 Class 1
 - ✓ spur and helical gears to BS 436 Pt 1 or BS1967
 - ✓ involute splines to BS 3550 1963 Class 1
 - ✓ tolerance to BS 4500 or BS1916 Grade 9
 - ✓ surface texture 63 μin or 1.6 μm
- 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 CNC gear cutting machines in readiness for production:
- ✓ CNC gear cutting machine
 - ✓ CNC gear hobbing machine
 - ✓ CNC gear shaving machine
- 1.7 prepare the tooling by carrying out all of the following activities, as applicable to the machine type:
- ✓ positioning tools in the correct position in the turrets, magazine or carousel
 - ✓ checking tools have a specific tool number in relation to the operating program
 - ✓ entering all relevant tool data to the operating program (such as tool lengths, tool offsets)
 - ✓ setting tool datum's
 - ✓ pre-setting tooling using setting jigs/fixtures
 - ✓ saving changes to program
- 1.8 mount and set the required workholding devices, workpiece and cutting tools
- 1.9 position and secure workpieces using four of the following workholding methods and devices:
- ✓ arbors
 - ✓ mandrels
 - ✓ chucks
 - ✓ pots
 - ✓ collets
 - ✓ fixtures
 - ✓ centres
 - ✓ clamps

<ul style="list-style-type: none"> ✓ face plates
<p>1.10 select and mount, in the appropriate tool holding device, three of the following types of cutting tool:</p> <ul style="list-style-type: none"> ✓ hobs ✓ shaving tools ✓ bevel gear cutting tools ✓ rack cutting tools ✓ spline/serration cutting tools ✓ other cutting tools
<p>1.11 set the machine tool operating parameters to achieve the component specification</p>
<p>1.12 set up the machine to produce components combining several different operations, and cover four from:</p> <ul style="list-style-type: none"> ✓ external spur gears ✓ internal spur gears ✓ external helical gears ✓ internal helical gears ✓ straight splines ✓ involute splines ✓ serrations ✓ bevel gears ✓ racks
<p>1.13 machine one of the following types of material:</p> <ul style="list-style-type: none"> ✓ ferrous ✓ non-ferrous ✓ stainless ✓ non-metallic
<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>

<p>Learning outcome</p>
<p>The learner will:</p> <p>2. know how to set CNC gear cutting machines for production</p>
<p>Assessment criteria</p>
<p>The learner can:</p> <p>2.1 describe the specific safety precautions to be taken when setting up workholding devices and tooling on CNC gear cutting machines</p> <p>2.2 explain how to start and stop the machine in normal and emergency situations</p> <p>2.3 describe the importance of ensuring that the machine is isolated from the power supply before mounting cutting tools and workholding devices</p> <p>2.4 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy</p> <p>2.5 describe the hazards associated with working on CNC gear cutting machines (such as use of moving machinery, automatic machine</p>

- operation, handling cutting tools, lifting and handling workholding devices, hot and airborne metal particles), and how to minimise them and reduce any risks
- 2.6 explain how to handle and store cutting tools and verified tapes and programs, safely and correctly
 - 2.7 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
 - 2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
 - 2.9 describe the range of workholding methods and devices that are used on CNC gear cutting machines
 - 2.10 explain why it is important to set the workholding device in relationship to the machine datums and reference points
 - 2.11 describe the methods of setting the workholding devices, and the tools and equipment that can be used
 - 2.12 describe the range of cutting tools used on CNC gear cutting machines, and typical applications
 - 2.13 describe the different types of gears and their application
 - 2.14 explain how to check that the cutting tools are in a safe and serviceable condition
 - 2.15 describe the use of tungsten carbide, ceramic and diamond indexable tips, and the factors which will determine their selection and use (such as condition of material supplied, hardness of the material, cutting characteristics of the material, tolerances to be achieved, component surface finish and specifications)
 - 2.16 describe the various tool holding devices that are used, and the methods of correctly mounting and securing the cutting tools to the tool holders
 - 2.17 describe the advantages of using pre-set tooling, and how to set the tooling using setting jigs/fixtures
 - 2.18 describe the use of magazines and carousels, and how to position and identify the tools in relation to the operating program
 - 2.19 explain how to place the machine into the correct operating mode, and how to access the program edit facility in order to enter tooling data (such as tool datums, positions, lengths, offsets and radius compensation)
 - 2.20 explain how to conduct trial runs, using single block run, dry run and feed/speed override controls
 - 2.21 describe the things that they need to check before allowing the machine to operate in full program run mode
 - 2.22 explain how the various types of materials will affect the feeds and speeds that can be used
 - 2.23 describe the application of cutting fluids with regard to a range of different materials, and why some materials do not require the use of cutting fluids
 - 2.24 describe the typical problems that can occur with the setting-up of the tooling and workholding devices, and what to do if they occur
 - 2.25 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 350

Setting CNC machining centres for production

UAN:	L/600/5991
Level:	3
Credit value:	70
GLH:	140
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 50: Setting CNC Machining Centres for Production (Level 3)
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up Computer Numerical Control (CNC) machining centres, in accordance with approved procedures. The learner will be expected to select the appropriate workholding devices to be used, and to mount and position them to the machine in the correct location for the type of operation being carried out. The learner will also be required to select the appropriate tools and cutters, check them for defects, and mount and secure them to the relevant tool holding devices and machine spindle.</p> <p>The learner will need to ensure that all the tools have been allocated a relevant tool number, and that the relevant data on their co-ordinates and datum positions are entered into the operating program and machine. This will involve loading and proving component programs, checking for errors/faults, editing and saving program changes. The learner must produce trial components and prove the machine is working satisfactorily before declaring the machine ready for production. Making adjustments to settings to achieve specification, and solving machine-related</p>

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 equipment, tooling, programs or setting up activities that they cannot personally 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 CNC machining centre used, and its application, and will know about the workholding devices, tooling, machine operating programs and setting-up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set CNC machining centres for production
Assessment criteria
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 during the setting-up activities: <ul style="list-style-type: none"> ✓ obtain and use the appropriate documentation (such as job 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 ✓ confirm that the correct operating program has been loaded

- ✓ check that the tooling is in a usable condition
 - ✓ ensure that the workpiece is correctly positioned and secured without distortion
 - ✓ update the program tool data as applicable
 - ✓ ensure that correctly adjusted machine guards are in place
 - ✓ 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 BS4500 or BS 1916 Grade 7
 - ✓ components to be free from false tool cuts, burrs and sharp edges
 - ✓ flatness and squareness 0.001" per inch or 0.025mm per 25mm
 - ✓ reamed/bored holes within H8
 - ✓ angles within +/- 0.5 degree
 - ✓ screw threads BS medium fit
 - ✓ surface finish 63 μin or 1.6 μm
- 1.5 determine what has to be done and how the machine will be set to achieve this
- 1.6 prepare the tooling for operation by carrying out all of the following activities, as applicable to the machine type:
- ✓ positioning tools in the correct position in the turrets, magazine or carousel
 - ✓ checking tools have a specific tool number in relationship to the operating program
 - ✓ entering all relevant tool data to the operating program (such as tool lengths, tool offsets, radius compensation)
 - ✓ setting tool datums
 - ✓ pre-setting tooling using setting jigs/fixtures
 - ✓ saving changes to program
- 1.7 mount and set the required workholding devices, workpiece and cutting tools
- 1.8 position and secure workpieces using four of the following workholding methods and devices:
- ✓ clamping direct to machine table
 - ✓ vee blocks and clamps
 - ✓ machine vice
 - ✓ chucks with hard jaws
 - ✓ chucks with soft jaws
 - ✓ collet chucks
 - ✓ jigs and fixtures
 - ✓ angle plate
 - ✓ indexing/rotating device
 - ✓ magnetic or pneumatic tables
 - ✓ other work holding devices

1.9 select and mount in the appropriate tool holding device, eight of the following types of cutting tool:

- ✓ turning tools
- ✓ boring tools
- ✓ facing
- ✓ thread cutting tools
- ✓ twist/core drills
- ✓ reamers
- ✓ recessing/undercutting tools
- ✓ face mills
- ✓ slotting cutters
- ✓ slitting saws
- ✓ end mills
- ✓ slot drills
- ✓ grinding wheels
- ✓ taps

1.10 set the machine tool operating parameters to achieve the component specification

1.11 set up the machine to produce components combining several different operations and cover ten from:

- ✓ external diameters
- ✓ tapered diameters
- ✓ shoulders and steps
- ✓ bored holes
- ✓ square and parallel faces
- ✓ angular faces
- ✓ indexed or rotated forms
- ✓ internal and external profiles
- ✓ grooves/undercuts
- ✓ drilled holes
- ✓ flat faces
- ✓ reamed holes
- ✓ tapped holes
- ✓ slots
- ✓ tapered holes

1.12 machine one of the following types of material:

- ✓ ferrous
- ✓ non-ferrous
- ✓ stainless
- ✓ non-metallic

1.13 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations

1.14 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome

The learner will:

2. know how to set CNC machining centres for production

Assessment criteria

The learner can:

- 2.1 describe the specific safety precautions to be taken when setting up workholding devices and tooling on CNC machining centres
- 2.2 explain how to start and stop the machine in normal and emergency situations
- 2.3 describe the importance of ensuring that the machine is isolated from the power supply before mounting cutting tools and workholding devices
- 2.4 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
- 2.5 describe the hazards associated with working on CNC machining centres (such as use of moving machinery, automatic machine operation, handling cutting tools, lifting and handling workholding devices, hot and airborne metal particles), and how to minimise them and reduce any risks
- 2.6 explain how to handle and store cutting tools and verified tapes and programs safely and correctly
- 2.7 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
- 2.8 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
- 2.9 describe the range of workholding methods and devices that are used on CNC machining centres
- 2.10 explain why it is important to set the workholding device in relation to the machine datum's and reference points
- 2.11 describe the methods of setting the workholding devices, and the tools and equipment that can be used
- 2.12 describe the range of cutting tools used on CNC machining centres, and typical applications
- 2.13 explain how to check that the cutting tools are in a safe and serviceable condition
- 2.14 describe the use of tungsten carbide, ceramic and diamond indexable tips, and the factors which will determine their selection and use (such as condition of material supplied, hardness of the material, cutting characteristics of the material, tolerances to be achieved, component surface finish and specifications)
- 2.15 describe the various tool holding devices that are used, and the methods of correctly mounting and securing the cutting tools to the tool holders
- 2.16 describe the advantages of using pre-set tooling, and how to set the tooling using setting jigs/fixtures
- 2.17 describe the use of magazines and carousels, and how to position and identify the tools in relation to the operating program
- 2.18 explain how to place the machine into the correct operating mode, and how to access the program edit facility in order to enter tooling data (such as tool datums, positions, lengths, offsets and radius

compensation)

- 2.19 explain how to conduct trial runs, using single block run, dry run and feed/speed override controls
- 2.20 describe the things that they need to check before allowing the machine to operate in full program run mode
- 2.21 explain how the various types of materials will affect the feeds and speeds that can be used
- 2.22 describe the application of cutting fluids with regard to a range of different materials, and why some materials do not require the use of cutting fluids
- 2.23 describe the typical problems that can occur with the setting up of the tooling and workholding devices, and what to do if they occur
- 2.24 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 352

Handing over machine tools to production operators

UAN:	A/600/5436
Level:	3
Credit value:	38
GLH:	98
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 52: Handing Over Machine Tools to Production Operators (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to hand over a prepared machine tool to production operators, in accordance with approved procedures. The learner will have either set up the machine themselves and are now handing it over to a machine operator to complete the required production operations, or are responsible for ensuring that a prepared machine already in production is handed over to a new shift operator. This will involve checking that the machine functions safely and correctly, that there are sufficient materials and consumables available for the work to be carried out, that all the required quality control instruments and gauges are available and correctly set/calibrated, and that the machine is producing the components to the required specification.</p> <p>The learner must then demonstrate the operation of the machine to the operator, highlighting all the necessary key stages of performance, specific techniques to be used, and aspects of safety that require particular attention. The learner will be required to ensure that the operator is operating the machine safely and correctly before leaving him/her to perform the tasks unsupervised. Periodic checking of the finished components,</p>

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 coaching and handover activities undertaken, and to report any problems with the handing over that they cannot personally 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 is produced.

The learner's knowledge will provide a good understanding of their work, and will provide an informed approach to applying coaching and handover procedures. The learner will understand the equipment being handed over, and its application, and will know about the operating procedures, potential problems and operating training requirements, in adequate depth to provide a sound basis for enabling the operators to carry out the activities to the required specification.

The learner will understand the safety precautions required when working with the machine and its associated equipment. The learner will be required to ensure that the production operator demonstrates safe working practices throughout, and that they understand the responsibility they owe to themselves and others in the workplace.

Learning outcome
The learner will: 1. hand over machine tools to production operators
Assessment criteria
The learner can: 1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 check the machine and equipment is in a safe and usable condition to hand over 1.3 confirm that the installation is ready for production operations, to include checking all of the following: <ul style="list-style-type: none">✓ the machine is correctly set up and ready for the required production operations✓ supplies of components and consumables are adequate and correctly prepared

- ✓ all safety equipment is in place and functioning correctly
 - ✓ all machine functions operate correctly
 - ✓ appropriate quality control instruments and gauges are available and correctly calibrated
- 1.4 ensure that the prepared machine is producing the components to the required specification
- 1.5 demonstrate the correct operation of the machine to the production operator
- 1.6 carry out correct handover procedures for one type of machine tool from the following:
- ✓ manual machines
 - ✓ semi-automatic machines
 - ✓ fully automatic machines
 - ✓ computer controlled machines
 - ✓ power presses
- 1.7 carry out handover procedures which include all of the following:
- ✓ demonstrating the operation of the machine to the production operator
 - ✓ explaining all the key stages and specific operation techniques required
 - ✓ highlighting critical areas to be observed (such as safety, specific tolerances or finish)
 - ✓ observing the operator in action and correcting any errors or inappropriate working practices
 - ✓ ensuring the operator is working safely and competently before leaving them to carry on with production
 - ✓ making periodic checks of performance and production quality
- 1.8 ensure that the production operator understands the operation of the machine and the production requirements
- 1.9 carry out handover procedures on two of the following categories of production operators:
- ✓ experienced operators on the particular type of equipment being used
 - ✓ experienced operators on machines but not the equipment being used
 - ✓ new or inexperienced operators
- 1.10 make periodic checks of the production and, where appropriate, adjust machine settings to maintain the required output quality
- 1.11 deal promptly and effectively with problems within their control and report those that they cannot solve
- 1.12 maintain appropriate records of the hand over, in accordance with organisational procedures.

Learning outcome
The learner will: 2. know how to hand over machine tools to production operators
Assessment criteria
The learner can: 2.1 describe the specific safety precautions to be taken when working with machine tools and when handing over machine tools to

production operators

- 2.2 describe the hazards associated with the particular machine and its operation, and how this needs to be communicated to the operator
- 2.3 describe the specific personal protective clothing and equipment to be worn for the particular activities, and how this is obtained
- 2.4 explain the need to be extra vigilant when training new and inexperienced machine operators to carry out the tasks
- 2.5 describe the things that they need to check before handing over the machine to the production operator (the machine is in a fit and safe condition, the tooling is sharp and undamaged, the machine produces components to specification)
- 2.6 explain the need to give the operator a practical demonstration of the machine operation, and how this is best achieved
- 2.7 describe the practical training techniques, including questioning and reinforcement techniques, to ensure the required operations are understood
- 2.8 explain how to vary their approach with the training, depending on the experience of the production operator
- 2.9 explain the need to ensure that the production operators are working safely and competently before leaving them to complete the production operations
- 2.10 explain how to create and maintain effective working relationships with the operators (encouraging, helping, politeness, open discussions both ways)
- 2.11 describe the organisational documentation and procedures for training and handover activities
- 2.12 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 353

Setting capstan and turret lathes for production

UAN:	Y/600/5444
Level:	3
Credit value:	91
GLH:	210
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 53: Setting Capstan and Turret Lathes for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up capstan and turret lathes, in accordance with approved procedures. This will involve selecting the appropriate workholding devices, securing them to the machine spindle, selecting and setting suitable chuck jaws and collet chucks, boring out soft jaws, and mounting workpieces in jigs or fixtures. The learner will be expected to select the appropriate turning tools, check that they are in a usable condition, and mount and secure them to the relevant tool holding devices, in front and rear tool posts and on the capstan/turret head.</p> <p>The learner will need to set the machine operating parameters to produce the workpiece to the required specification. This will involve setting up capstan/turret and saddle feed stops, setting appropriate depths of cut for roughing and finishing operations, selecting and setting feeds and speeds, and setting up multiple cutting arrangements between capstan/turret and saddle. The learner must produce trial cuts and prove the machine is working satisfactorily before declaring the machine ready for production. Making adjustments to settings to achieve specification, and solving machine-related</p>

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 machine, tooling, 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 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 machine used, and its application, and will know about the workholding devices, turning tools, relevant materials, consumables and setting-up procedures, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the work output is to the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set capstan and turret lathes for production
Assessment criteria
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 during the setting up activities: <ul style="list-style-type: none"> ✓ obtain and use the appropriate documentation (such as job 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 cutting tools are in a suitable 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 up machine in accordance with instructions and specifications, to include setting all of the following:
- ✓ position of workpiece in work holding device
 - ✓ position of turning tools in relationship to workpiece
 - ✓ screw threading devices
 - ✓ workpiece speed and feed
 - ✓ depth of cut for roughing and finishing
 - ✓ turret and saddle feed stops and indicators
 - ✓ cutting fluid flow rate
 - ✓ machine guards/safety mechanisms
- 1.5 determine what has to be done and how the machine will be set to achieve this
- 1.6 mount and set the required workholding devices, workpiece and cutting tools
- 1.7 select, mount and secure the workpiece using four of the following workholding devices:
- ✓ hand chucks with hard jaws
 - ✓ hand chucks with soft jaws
 - ✓ power chucks with hard jaws
 - ✓ power chucks with soft jaws
 - ✓ jigs/fixtures
 - ✓ collet chucks
- 1.8 use two of the following groups of turning tools:
- ✓ solid high-speed steel
 - ✓ brazed tungsten carbide
 - ✓ indexable tips (carbide, ceramic, diamond)
- 1.9 select and mount roughing and finishing tools, to include eight of the following types of tools:
- ✓ turning tools
 - ✓ facing tools
 - ✓ form tools
 - ✓ chamfer/radius
 - ✓ parting off tools
 - ✓ thread chaser
 - ✓ single point threading
 - ✓ boring bars
 - ✓ recessing tools
 - ✓ centre drills
 - ✓ twist/core drills
 - ✓ solid reamers
 - ✓ expanding reamers
 - ✓ taps

- ✓ dies
 - ✓ knurling tools
- 1.10 mount, secure and position tools in all of the following:
- ✓ front tool box
 - ✓ rear tool post
 - ✓ ending boxes
 - ✓ die boxes
 - ✓ roller box
 - ✓ polygon/special profile boxes
 - ✓ turret/capstan knee box
 - ✓ boring bars (single / multiple)
 - ✓ chucks/floating arrangements
 - ✓ multiple cutting arrangements
- 1.11 set the machine tool operating parameters to achieve the component specification
- 1.12 set the machine to produce internal and external profiles that include ten of the following:
- ✓ flat faces
 - ✓ parallel diameters
 - ✓ stepped diameters
 - ✓ tapered diameters
 - ✓ drilled holes
 - ✓ bored holes
 - ✓ reamed holes
 - ✓ profile forms
 - ✓ internal threads
 - ✓ external threads
 - ✓ eccentric features
 - ✓ parting off
 - ✓ chamfers and radii
 - ✓ knurls/special finishes
 - ✓ grooves/undercuts
 - ✓ counterbores
- 1.13 machine components from one of the following types of material:
- ✓ ferrous
 - ✓ non-ferrous
 - ✓ non-metallic
- 1.14 set the machine to produce components within all of the following quality and accuracy standards, as applicable to the operations performed:
- ✓ components to be free from false tool cuts, burrs and sharp edges
 - ✓ dimensional tolerance equivalent to BS 4500 or BS 1916 Grade 7
 - ✓ reamed and bored holes within H8
 - ✓ screw threads BS medium fit
 - ✓ angles within +/- 0.5 degree

<ul style="list-style-type: none"> ✓ surface finish 63µm or 1.6µm <p>1.15 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations</p> <p>1.16 deal promptly and effectively with problems within their control and report those that cannot be solved.</p>

Learning outcome
The learner will:
2. know how to set capstan and turret lathes for production
Assessment criteria
The learner can:
2.1 describe the specific safety precautions to be taken when setting up workholding devices and accessories, workpiece and turning tools on capstan and turret lathes
2.2 describe the hazards associated with setting capstan and turret lathes (moving parts of machinery, handling turning tools, handling cutting fluids, airborne particles, tool breakage, power chucks and power bar feed arrangements, insecure components), and how they can be minimised and reduce any risks
2.3 explain how to start and stop the machine in normal and emergency situations
2.4 describe the importance of ensuring that the machine is isolated from the power supply before mounting turning tools and workholding devices
2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
2.6 describe the basic principles of operation of the capstan or turret lathe and its accessories, and typical operations that they can perform
2.7 explain how to handle and store turning tools 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 capstan and turret lathe turning in relation to the activities undertaken
2.11 describe the range of workholding methods and devices that are used on capstan and turret lathes (such as two three and four jaw chucks, hand and power operated chucks, power bar feed arrangements, collet chucks, jigs and fixtures)
2.12 describe the use of hard and soft jaws in chucks, and the methods of boring out soft jaws to suit the workpiece
2.13 describe the different types of turning tools that are used, and how they are selected, prepared and mounted to the machine tool holding devices (such as front tool box, rear tool box, capstan/turret head, roller boxes, ending boxes, special profiling boxes, die boxes)
2.14 describe the use of pilot bars and shoes for the capstan/turret, and why they need to be accurately aligned

- 2.15 explain the need to produce a balanced capstan/turret arrangement, with tools appropriately positioned around the turret stations
- 2.16 describe the factors which determine speeds and feeds to be used (such as material, type of tooling, depth of cut, workpiece rigidity, machine condition, multiple cutting arrangements between capstan/turret and saddle, tolerance and finish required)
- 2.17 explain how the various types of material will affect the feeds and speeds that can be used
- 2.18 describe the types of cutting fluid that are used, and precautions to be taken when handling and using them
- 2.19 explain how to set up the turret lathe and its accessories for the particular operations being performed
- 2.20 explain the need to conduct trial runs, and to check that the machine is set up and producing the components correctly
- 2.21 describe the problems that can occur with setting up the workholding devices, tooling and machine operating parameters, and what to do if they occur
- 2.22 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 354

Setting single-spindle automatic turning machines for production

UAN:	K/600/5450
Level:	3
Credit value:	91
GLH:	210
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 54: Setting Single-Spindle Automatic Turning Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up single-spindle automatic turning machines for production, in accordance with approved procedures. This will involve selecting the appropriate workholding devices, securing them to the machine spindle, selecting and setting suitable chuck jaws, boring out soft jaws, and mounting workpieces in jigs or fixtures. The learner will be expected to select the appropriate turning tools, check that they are in a usable condition, and mount and secure them to the relevant tool holding devices, in front and rear tool posts and turret head.</p> <p>The learner will need to set the machine operating parameters to produce the workpiece to the required specification. This will involve selecting, mounting and setting up turret and slide operating cams, cam timing, setting trip dogs, limit switches, stops, feed and speed mechanisms, setting appropriate depths of cut for roughing and finishing operations, and setting up multiple cutting arrangements between turret and slide. The learner must produce trial cuts and prove the machine is working satisfactorily before declaring the machine ready for production. Making adjustments to</p>

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 machine, tooling, 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 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 machine used, and its application, and will know about the workholding devices, turning tools, relevant materials, consumables and setting up procedures, in adequate depth to provide a sound basis for carrying out the activities, correcting faults and ensuring the work output 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.

Learning outcome
The learner will: 1. set single-spindle automatic turning machines for production
Assessment criteria

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 during the setting-up activities:
 - ✓ obtain and use the appropriate documentation (such as job 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 cutting tools are in a suitable 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 determine what has to be done and how the machine will be set to achieve this
- 1.5 mount and set the required workholding devices, workpiece and cutting tools
- 1.6 select, mount and secure the workpiece using four of the following workholding devices:
- ✓ hand chucks with hard jaws
 - ✓ hand chucks with soft jaws
 - ✓ power chucks with hard jaws
 - ✓ power chucks with soft jaws
 - ✓ jigs/fixtures
 - ✓ collet chucks
- 1.7 use two of the following groups of turning tools:
- ✓ solid high-speed steel
 - ✓ brazed tungsten carbide
 - ✓ indexable tips (such as carbide, ceramic, diamond)
- 1.8 select and mount roughing and finishing tools, to include eight of the following types of tools:
- ✓ turning tools
 - ✓ facing tools
 - ✓ form tools
 - ✓ chamfer/radius
 - ✓ parting off tools
 - ✓ thread chaser
 - ✓ single point threading
 - ✓ boring bars
 - ✓ recessing tools
 - ✓ center drills
 - ✓ twist/core drills
 - ✓ solid reamers
 - ✓ expanding reamers
 - ✓ taps
 - ✓ dies
 - ✓ knurling tools
- 1.9 mount, secure and position tools in seven of the following devices:
- ✓ front tool box
 - ✓ rear tool post
 - ✓ die boxes
 - ✓ roller boxes
 - ✓ vertically or tangentially in turret knee box
 - ✓ boring bars (single and multiple)

- ✓ chucks or floating arrangements
 - ✓ to produce multiple cutting arrangements
 - ✓ special purpose profiling boxes (such as square, hexagon)
- 1.10 set the machine tool operating parameters to achieve the component specification
- 1.11 set up the machine in accordance with instructions and specifications, to include setting all of the following:
- ✓ position of workpiece in workholding device
 - ✓ position of turning tools in relation to workpiece
 - ✓ selecting and setting appropriate cams
 - ✓ depth of cut for roughing and finishing
 - ✓ machine guards/safety mechanisms
 - ✓ setting trip dogs and limit switches
 - ✓ setting stops
 - ✓ setting spindle speeds
 - ✓ setting linear feed rate
 - ✓ cutting fluid flow rate
- 1.12 set up the machine to produce internal and external profiles that include ten of the following:
- ✓ flat faces
 - ✓ parallel diameters
 - ✓ stepped diameters
 - ✓ tapered diameters
 - ✓ drilled holes
 - ✓ bored holes
 - ✓ reamed holes
 - ✓ profile forms
 - ✓ internal threads
 - ✓ external threads
 - ✓ eccentric features
 - ✓ parting off
 - ✓ chamfers and radii
 - ✓ knurls/special finishes
 - ✓ grooves/undercuts
 - ✓ counterbores
- 1.13 machine components from one of the following types of material:
- ✓ ferrous
 - ✓ non-ferrous
 - ✓ non-metallic
- 1.14 set the machine to produce components within all of the following quality and accuracy standards, as applicable to the operations performed:
- ✓ components to be free from false tool cuts, burrs and sharp edges
 - ✓ dimensional tolerance equivalent to BS 4500 or BS 1916 Grade 7
 - ✓ reamed and bored holes within H8

- ✓ screw threads BS medium fit
- ✓ angles within +/- 0.5 degree
- ✓ surface finish 63µm or 1.6µm

1.15 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations

1.16 deal promptly and effectively with problems within their control and report those that cannot be solved.

Learning outcome

The learner will:

2. know how to set single-spindle automatic turning machines for production

Assessment criteria

The learner can:

- 2.1 describe the specific safety precautions to be taken when setting up workholding devices and accessories, workpiece and turning tools on single spindle automatic turning machines
- 2.2 describe the hazards associated with setting automatic turning machines (such as moving parts of machinery, handling turning tools, handling cutting fluids, airborne particles, tool breakage, power chucks, insecure components, automatic operations), and how they can be minimised and reduce any risks
- 2.3 explain how to start and stop the machine in normal and emergency situations
- 2.4 describe the importance of ensuring that the machine is isolated from the power supply before mounting turning tools and workholding devices
- 2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
- 2.6 describe the basic principles of operation of the single-spindle automatic turning machine and its accessories, and typical operations that they can perform
- 2.7 explain how to handle and store turning tools 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 explain the terminology used in single spindle automatic lathe turning in relation to the activities undertaken
- 2.11 describe the range of work holding methods and devices that are used on single-spindle automatic lathes (such as two, three and four jaw chucks, hand and power operated chucks, collet chucks, jigs and fixtures)
- 2.12 describe the use of hard and soft jaws in chucks, and the methods of boring out soft jaws to suit the workpiece
- 2.13 describe the different types of turning tools that are used, and how

- need to be accurately aligned
- 2.15 describe the need to produce a balanced turret arrangement, with tools appropriately positioned around the turret stations
 - 2.16 describe the various specialist devices that can be used (such as die boxes, roller boxes, special purpose forming boxes for flats, squares, hexagons etc)
 - 2.17 describe the selection of cams, and how they are set up and timed in order to produce the components to the required specification
 - 2.18 describe the factors which determine speeds and feeds to be used (such as material, type of tooling, depth of cut, workpiece rigidity, machine condition, multiple cutting arrangements between turret and slide, tolerance and finish required)
 - 2.19 explain how the various types of material will affect the feeds and speeds that can be used
 - 2.20 describe the types of cutting fluid that are used, and precautions to be taken when handling and using them
 - 2.21 explain how to set up the automatic lathe and its accessories for the particular operations being performed
 - 2.22 explain the need to conduct trial runs, and to check that the machine is set up and producing the components correctly
 - 2.23 describe the problems that can occur with setting up the workholding devices, tooling and machine operating parameters and what to do if they occur
 - 2.24 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 355

Setting multi-spindle automatic turning machines for production

UAN:	T/600/5452
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 55: Setting Multi-Spindle Automatic Turning Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up multi-spindle automatic turning machines for production, in accordance with approved procedures. This will involve selecting the appropriate workholding devices, securing them to the machine spindle, selecting and setting suitable collets or chuck jaws, boring out soft jaws (where applicable) and mounting workpieces in jigs or fixtures. The learner will be expected to select the appropriate turning tools, check that they are in a usable condition, and mount and secure them to the relevant tool holding devices, in front and rear tool posts, tangential slides and turret head.</p> <p>The learner will need to set the machine operating parameters to produce the workpiece to the required specification. This will involve selecting, mounting and setting up turret and slide operating cams, cam timing, setting trip dogs, limit switches, stops, feed and speed mechanisms, setting appropriate depths of cut for roughing and finishing operations, and setting up multiple cutting arrangements between turret and slides. The learner must produce trial cuts and prove the machine is working satisfactorily before</p>

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 machine, tooling, equipment or setting-up activities that they cannot personally 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 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 multi-spindle machine used, and its application, and will know about the workholding devices, turning tools, relevant materials, consumables and setting up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set multi-spindle automatic turning machines for production
Assessment criteria
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 during the setting-up activities: <ul style="list-style-type: none">✓ obtain and use the appropriate documentation (such as job 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 cutting tools are in a suitable 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 determine what has to be done and how the machine will be set to achieve this
- 1.5 mount and set the required workholding devices, workpiece and cutting tools
- 1.6 select, mount and secure the workpiece using two of the following workholding devices:
 - ✓ power chucks with hard or soft jaws
 - ✓ jigs/fixtures
 - ✓ collet chucks
- 1.7 use two of the following groups of turning tools:
 - ✓ solid high-speed steel
 - ✓ brazed tungsten carbide
 - ✓ indexible tips (such as carbide, ceramic, diamond)
- 1.8 select and mount roughing and finishing tools, to include eight of the following types of tools:
 - ✓ turning tools
 - ✓ facing tools
 - ✓ form tools
 - ✓ chamfer/radius
 - ✓ parting off tools
 - ✓ thread chaser
 - ✓ single point threading
 - ✓ boring bars
 - ✓ recessing tools
 - ✓ centre drills
 - ✓ twist/core drills
 - ✓ solid reamers
 - ✓ expanding reamers
 - ✓ taps
 - ✓ dies
 - ✓ knurling tools
- 1.9 mount, secure and position tools mounted in seven of the following devices:
 - ✓ front tool box
 - ✓ rear tool post
 - ✓ die boxes
 - ✓ roller boxes
 - ✓ vertically or tangentially in turret knee box

- ✓ boring bars (single and multiple)
 - ✓ chucks or floating arrangements
 - ✓ to produce multiple cutting arrangements
 - ✓ special purpose profiling boxes (square, hexagon)
 - ✓ tangential tool posts
- 1.10 set the machine tool operating parameters to achieve the component specification
- 1.11 set up the machine in accordance with instructions and specifications, to include setting all of the following:
- ✓ setting stops
 - ✓ setting spindle speeds
 - ✓ setting linear feed rate
 - ✓ cutting fluid flow rate
 - ✓ position of workpiece in work holding device
 - ✓ position of turning tools in relationship to workpiece
 - ✓ selecting and setting appropriate cams
 - ✓ bar feed and stop mechanisms
 - ✓ depth of cut for roughing and finishing
 - ✓ machine guards/safety mechanisms
 - ✓ setting trip dogs and limit switches
- 1.12 set up the machine to produce internal and external profiles that include ten of the following:
- ✓ flat faces
 - ✓ parallel diameters
 - ✓ stepped diameters
 - ✓ tapered diameters
 - ✓ drilled holes
 - ✓ bored holes
 - ✓ reamed holes
 - ✓ profile forms
 - ✓ internal threads
 - ✓ external threads
 - ✓ eccentric features
 - ✓ parting off
 - ✓ chamfers and radii
 - ✓ knurls/special finishes
 - ✓ grooves/undercuts
 - ✓ counterbores
- 1.13 machine components from one of the following types of material:
- ✓ ferrous
 - ✓ non-ferrous
 - ✓ non-metallic
- 1.14 set the machine to produce components within all of the following quality and accuracy standards, as applicable to the operations performed:
- ✓ components to be free from false tool cuts, burrs and sharp edges

<ul style="list-style-type: none"> ✓ dimensional tolerance equivalent to BS 4500 or BS 1916 Grade 7 ✓ reamed and bored holes within H8 ✓ screw threads BS medium fit ✓ angles within +/- 0.5 degree ✓ surface finish 63µin or 1.6µm <p>1.15 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations</p> <p>1.16 deal promptly and effectively with problems within their control and report those that cannot be solved.</p>

<p>Learning outcome</p> <p>The learner will:</p> <p>2. know how to set multi-spindle automatic turning machines for production</p>
<p>Assessment criteria</p> <p>The learner can:</p> <p>2.1 describe the specific safety precautions to be taken when setting up workholding devices and accessories, workpiece and turning tools on multi-spindle automatic turning machines</p> <p>2.2 describe the hazards associated with setting multi spindle automatic turning machines (such as moving parts of machinery, handling turning tools, handling cutting fluids, airborne particles, tool breakage, power chucks, insecure components, automatic operations), and how to minimise them and reduce any risks</p> <p>2.3 explain how to start and stop the machine in normal and emergency situations</p> <p>2.4 describe the importance of ensuring that the machine is isolated from the power supply before mounting turning tools and workholding devices</p> <p>2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy</p> <p>2.6 describe the basic principles of operation of the multi-spindle automatic turning machine and its accessories, and typical operations that they can perform</p> <p>2.7 explain how to handle and store turning tools safely and correctly</p> <p>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</p> <p>2.9 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing</p> <p>2.10 explain the terminology used in multi-spindle automatic lathe turning in relation to the activities undertaken</p> <p>2.11 describe the range of workholding methods and devices that are used on single spindle automatic lathes (such as two, three and four jaw chucks, hand and power operated chucks, collet chucks, jigs and fixtures)</p> <p>2.12 describe the use of hard and soft jaws in chucks, and the methods of boring out soft jaws to suit the workpiece</p>

- 2.13 describe the different types of turning tools that are used, and how they are selected, prepared and mounted to the machine tool holding devices (such as front tool box, rear tool box, tangential slides, turret head)
- 2.14 describe the use of pilot bars and shoes for the turret, and why they need to be accurately aligned
- 2.15 explain the need to produce a balanced turret arrangement, with tools appropriately positioned around the turret stations
- 2.16 describe the various specialist devices that can be used (such as die boxes, roller boxes, special purpose forming boxes for flats, squares, hexagons)
- 2.17 describe the selection of cams, and how they are set up and timed in order to produce the components to be required specification
- 2.18 describe the factors which determine speeds and feeds to be used (such as material, type of tooling, depth of cut, workpiece rigidity, machine condition, multiple cutting arrangements between turret and slide, tolerance and finish required)
- 2.19 explain how the various types of material will affect the feeds and speeds that can be used
- 2.20 describe the types of cutting fluid that are used, and precautions to be taken when handling and using them
- 2.21 explain how to set up the automatic lathe and its accessories for the particular operations being performed
- 2.22 explain the need to conduct trial runs, and to check that the machine is set up and producing the components correctly
- 2.23 describe the problems that can occur with setting up the workholding devices, tooling and machine operating parameters, and what to do if they occur
- 2.24 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 356

Setting single and multi- spindle drilling machines for production

UAN:	J/600/5455
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 56: Setting Single and Multi-Spindle Drilling Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up single and multi-spindle drilling machines and associated drilling equipment, 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 drills, reamers, counterbore and countersink tools, spot facing tools and taps, check them for defects, and mount and secure them to the relevant tool holding device.</p> <p>The learner will set up and align the workpiece in the correct relationship to the machine spindle and set the machine operating parameters to produce the workpiece to the required specification. The learner must produce trial cuts and prove the machine is working satisfactorily before declaring the installation ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role.</p> <p>The learner's responsibilities will require</p>

them to comply with organisational policy and procedures for the machine setting activities undertaken, and to report any problems with the machine, work holding device, tools, equipment or setting up activities that they cannot personally 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 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 single and multi-spindle drilling machine used, and their application, and will know about the workholding devices, tools, relevant materials, consumables and setting-up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults and ensuring work output is produced to the required specification.

Learning outcome
The learner will: 1. set single and multi-spindle drilling machines for production
Assessment criteria
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 during the setting up activities: <ul style="list-style-type: none"> ✓ obtain and use the appropriate documentation (such as job 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 cutting tools are in a suitable 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 determine what has to be done and how the machine will be set to achieve this 1.5 prepare a multi-spindle drilling machine and three of the following drilling machines:

- ✓ pedestal drill
 - ✓ bench drill
 - ✓ radial arm drill
 - ✓ special purpose drill
- 1.6 mount and set the required workholding devices, workpiece and cutting tools
- 1.7 select, prepare and mount work holding device and workpiece, to include three of the following:
- ✓ drill jigs
 - ✓ machine vice
 - ✓ chucks
 - ✓ angle bracket
 - ✓ vee block and clamps
 - ✓ clamping direct to machine table
 - ✓ indexing device
- 1.8 select and mount cutting tools, to include eight of the following:
- ✓ straight twist drills
 - ✓ straight core drills
 - ✓ taper drills
 - ✓ counterbore tools
 - ✓ countersink tools
 - ✓ centre drills
 - ✓ solid reamers
 - ✓ expanding reamers
 - ✓ taper reamers
 - ✓ spot facing tools
 - ✓ taps
 - ✓ special tools
- 1.9 set the machine tool operating parameters to achieve the component specification
- 1.10 set up the machine in accordance with instructions and specifications, to include setting all of the following:
- ✓ setting speeds and feeds
 - ✓ cutting fluids
 - ✓ tapping compounds
 - ✓ mounting workholding device and workpiece
 - ✓ setting workpiece in relation to machine spindle
 - ✓ positioning drills/cutting tools
 - ✓ setting drill/cutting tool depth
- 1.11 set up the machine to produce the required hole, that must include all of the following:
- ✓ drilling to depth
 - ✓ drilling through work piece
 - ✓ drilling flat bottomed
 - ✓ counter boring
 - ✓ countersinking
 - ✓ reaming

<ul style="list-style-type: none"> ✓ spot facing ✓ tapping <p>1.12 machine components made from one of the following types of material:</p> <ul style="list-style-type: none"> ✓ ferrous ✓ non-ferrous ✓ non-metallic <p>1.13 set the machine to produce components within all of the following quality and accuracy standards, as applicable to the operations performed:</p> <ul style="list-style-type: none"> ✓ components to be free from false tool cuts, burrs and sharp edges ✓ dimensional tolerance equivalent to BS 4500 or BS 1916 Grade 7 ✓ reamed and bored holes within H8 ✓ screw threads BS medium fit ✓ angles within +/- 0.5 degree ✓ surface finish 63µin or 1.6µm <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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Learning outcome
The learner will:
2. know how to set single and multi-spindle drilling machines for production
Assessment criteria
The learner can:
2.1 describe the specific safety precautions to be taken when setting up workholding devices, tools and cutters on single and multi-spindle drilling machines
2.2 describe the hazards associated with setting single and multi-spindle drilling machines (such as moving parts of machinery, handling tools and cutters, lifting and moving workpieces, flying swarf, tool breakage, insecure components), and how to minimise them and reduce any risks
2.3 explain how to start and stop the machine in normal and emergency situations
2.4 describe the importance of ensuring that the machine is isolated from the power supply before mounting tools, workpieces and workholding devices
2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
2.6 describe the basic principles of operation of the single and multi-spindle drilling machines, and typical operations that they can perform
2.7 explain how to handle and store drills and cutters safely and correctly

- 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 explain the terminology used in single and multi-spindle drilling in relation to the activities undertaken
 - 2.11 describe the range of workholding methods and devices that are used on machines (such as drill jigs, vice, chucks, clamps, vee blocks)
 - 2.12 describe the methods of mounting and setting the workpiece on/in the workholding device, and the tools and equipment that can be used
 - 2.13 describe the different types of drills and cutters that are used, and how they are selected, prepared and mounted to the machine tool holding devices
 - 2.14 describe the factors which determine speeds and feeds to be used (such as material, type of cutter/tool, workpiece rigidity, machine condition, tolerance and finish required)
 - 2.15 explain how the various types of material will affect the speeds and feeds that can be used
 - 2.16 describe the types of cutting fluid that are used, and precautions to be taken when handling and using them
 - 2.17 explain how to set up the machine for the particular operations being performed
 - 2.18 explain the need to conduct trial runs, and to check that the machine is set up and running safely and correctly
 - 2.19 describe the problems that can occur with setting up the single and multi-spindle drilling tools and cutters, work holding devices and machine operating parameters, and what to do if they occur
 - 2.20 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 357

Setting tool and cutter grinding machines for production

UAN:	Y/600/5461
Level:	3
Credit value:	77
GLH:	161
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 57: Setting Tool and Cutter Grinding Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up tool and cutter grinding machines, and associated tool and cutter grinding equipment, 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 and tools, check them for defects, and mount and secure them to the relevant holding device. The learner will set up and align the workpiece in the correct relationship to the grinding wheel, and set the machine operating parameters to grind the workpiece to the required specification.</p>

The tools to be ground will include such things as drills, milling cutters, turning tools, saws, shaping and slotting tools, hobs, gear cutting and shaving tools, and broaches. The learner must produce trial cuts and prove the machine is working satisfactorily before declaring the machine ready for operation. Making adjustments to settings to achieve specification, and solving machine-related

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 machine, grinding wheels, equipment or setting-up activities that they cannot personally 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 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 tool and cutter grinding machine used, and its application, and will know about the workholding devices, cutters, tools, relevant materials, consumables and setting up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults and ensuring the tools are ground to the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set tool and cutter grinding machines for production
Assessment criteria

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 during the setting-up activities:
 - ✓ obtain and use the appropriate documentation (such as job 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 cutting tools are in a suitable 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 determine what has to be done and how the machine will be set to achieve this
- 1.5 prepare one of the following tool and cutter grinding machines in readiness for production:
- ✓ universal tool and cutter grinder
 - ✓ purpose-built tool and cutter grinder
- 1.6 prepare and dress grinding wheels using two of the following, as applicable to the machine used:
- ✓ dressing and 'trueing up' grinding wheels
 - ✓ wheel forming (chamfers, radii, angular forms, profiles)
 - ✓ relieving the wheel sides
 - ✓ diamond dressing sticks
- 1.7 mount and set the required workholding devices, workpiece and cutting tools
- 1.8 select, prepare and mount workholding devices to include five of the following:
- ✓ arbors
 - ✓ centres
 - ✓ chucks
 - ✓ vices
 - ✓ collets
 - ✓ work heads
 - ✓ work rests
 - ✓ ancillary equipment
 - ✓ indexing mechanisms
- 1.9 select and mount diamond wheels and grit wheels, to include all of the following:
- ✓ selecting grinding wheels for specific materials (such as diamond grade, grit grade, grain size, structure, bond)
 - ✓ mounting wheels (paper washers, flanges, locking pressure)
 - ✓ testing wheels for cracks/damage
 - ✓ balancing wheels (where appropriate)
- 1.10 set the machine tool operating parameters to achieve the component specification
- 1.11 set up the machine in accordance with instructions and specifications, to include setting all of the following:
- ✓ centres for tapers
 - ✓ centres for parallelism
 - ✓ setting indexing devices
 - ✓ positioning wheels
 - ✓ workpiece position and alignment
 - ✓ setting dust extraction systems

<ul style="list-style-type: none"> ✓ setting grinding depth/cut required ✓ machine guards/safety mechanisms
<p>1.12 set up the machine to grind new and refurbished tools and cutters, to include ten the following:</p> <ul style="list-style-type: none"> ✓ twist drills ✓ core drills ✓ reamers ✓ end mills ✓ face mills ✓ hobs ✓ lathe tools ✓ form tools ✓ slot drills ✓ slotting tools ✓ broaches ✓ slab mills ✓ counterbore tools ✓ gear shaving ✓ machine saws ✓ side/face cutters
<p>1.13 grind tools and cutters made from both of the following types of material:</p> <ul style="list-style-type: none"> ✓ high-speed steel ✓ tungsten carbide
<p>1.14 set the machine to grind components within all of the following quality and accuracy standards:</p> <ul style="list-style-type: none"> ✓ all operations are carried out to the required specification ✓ ground cutting angles and clearance meet operational requirements ✓ where applicable, dimensional accuracy and surface texture are within the tooling requirements
<p>1.15 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations</p>
<p>1.16 deal promptly and effectively with problems within their control and report those that cannot be solved.</p>

Learning outcome
The learner will:
2. know how to set tool and cutter grinding machines for production
Assessment criteria
The learner can:
2.1 describe the specific safety precautions to be taken when setting up workholding devices, tools and cutters on a tool and cutter grinding machine
2.2 explain the legislation that governs the mounting, dressing and balancing of grinding wheels (e.g. abrasive wheels regulations), and how this applies to them
2.3 describe the hazards associated with setting tool and cutter

- grinding machines (such as moving parts of machinery, handling tools and cutters, lifting and moving workpieces, wheel breakage, insecure components, airborne particles, sparks and fire hazards), 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, workpieces and work holding 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 describe the basic principles of operation of the tool and cutter grinding machine, and typical operations that they can perform
 - 2.8 explain how to handle and store tools and cutters safely and correctly
 - 2.9 explain how to handle and store grinding wheels safely and correctly
 - 2.10 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
 - 2.11 explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing
 - 2.12 explain the terminology used in tool and cutter grinding in relation to the activities undertaken
 - 2.13 describe the range of workholding methods and devices that are used on tool and cutter grinding machines
 - 2.14 describe the methods of mounting and setting the workpiece on the workholding device, and the tools and equipment that can be used
 - 2.15 describe the different types of tool and cutter grinding wheels and grits that are used, and how they are selected, prepared and mounted to the machine tool holding devices
 - 2.16 explain how to check that the grinding wheels are in a safe and serviceable condition (such as free from damage, cracks, correctly balanced)
 - 2.17 describe the methods of forming the wheels to the required profile (such as use of diamond dressing units, wheel forming equipment)
 - 2.18 explain the need for 'trueing up' and dressing of wheels to prevent glazing and burning of the workpiece
 - 2.19 describe the factors which determine speeds to be used (such as material, type of grinding wheel, workpiece rigidity, machine condition, tolerance and finish required)
 - 2.20 explain how the various types of material will affect the speeds that can be used
 - 2.21 explain how to set up the machine for the particular operations being performed
 - 2.22 explain the need to conduct trial runs, and to check that the machine is set up and running safely and correctly
 - 2.23 describe the problems that can occur with setting up the tool and cutter grinding machine, workholding devices and machine operating parameters, and what to do if they occur.

2.24 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 358

Setting special-purpose machines for production

UAN:	D/600/5462
Level:	3
Credit value:	91
GLH:	210
Relationship to NOS:	This unit has been derived from Sema National Occupational Standard Mechanical Manufacturing Engineering Unit 58: Setting Special-Purpose Machines for Production (Level 3).
Endorsement by a sector or other appropriate body:	This unit is endorsed by Sema, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up special-purpose machines for production, in accordance with approved procedures. This will involve selecting the appropriate workholding devices, securing them to the machine spindle, selecting and setting suitable collets or chuck jaws, boring out soft jaws (where applicable) and mounting workpieces in jigs or fixtures. The learner will be expected to select the appropriate tooling, to check that it is in a usable condition, and to mount and secure it to the relevant tool holding devices.</p> <p>The learner will need to set the machine operating parameters to produce the workpiece to the required specification. This will involve selecting, mounting and setting up component loading mechanisms, operating cams, cam timing, and setting trip dogs, limit switches, stops, feed and speed mechanisms. The learner must produce trial runs and prove the machine is working satisfactorily before declaring the machine ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role.</p>

The learner's responsibilities will require

activities undertaken, and to report any problems with the machine, tooling, equipment or setting-up activities that they cannot personally 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 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 machine used, and its application, and will know about the workholding devices, tooling, relevant materials, consumables and setting up procedures, in adequate depth to provide a sound basis for setting-up the equipment, correcting faults and ensuring the work output is produced to the required specification.

The learner will understand the safety precautions required when working with the machine and 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. set special-purpose machines for production
Assessment criteria
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 during the setting up activities: <ul style="list-style-type: none">✓ obtain and use the appropriate documentation (such as job 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 cutting tools are in a suitable 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 determine what has to be done and how the machine will be set to achieve this
- 1.5 mount and set the required workholding devices, workpiece and cutting tools
- 1.6 select, mount and secure the workpiece using two of the following workholding devices:
 - ✓ hand chucks
 - ✓ power chucks
 - ✓ jigs/fixtures
 - ✓ collet chucks
 - ✓ mandrels/arbors
 - ✓ machine vices
 - ✓ clamping direct to machine table
 - ✓ ancillary devices (such as centres, vee blocks, pots, angle plates, face plates, indexing/rotary device)
- 1.7 use two of the following groups of tooling:
 - ✓ turning tools
 - ✓ drilling bits
 - ✓ milling cutters
 - ✓ grinding wheels
 - ✓ forming tools
 - ✓ other special-purpose tooling
- 1.8 set the machine tool operating parameters to achieve the component specification
- 1.9 set up special-purpose operating control systems, to include four of the following devices:
 - ✓ cams and mechanical actuators
 - ✓ pneumatic actuators
 - ✓ hydraulic actuators
 - ✓ electro-mechanical actuators
 - ✓ feed fingers
 - ✓ gravity feed mechanisms
 - ✓ air feed mechanisms
 - ✓ magazine component loading
- 1.10 set up the machine in accordance with instructions and specifications, to include all of the following as appropriate:
 - ✓ setting stops
 - ✓ setting spindle speeds
 - ✓ setting linear feed rate
 - ✓ selecting cutting fluid
 - ✓ position of workpiece in work holding device
 - ✓ component feed and stop mechanisms
 - ✓ position of tooling relation to workpiece
 - ✓ selecting and setting appropriate cams
 - ✓ setting trip dogs and limit switches

<ul style="list-style-type: none"> ✓ machine guards/safety mechanisms <p>1.11 machine components made of one type of material from the following:</p> <ul style="list-style-type: none"> ✓ ferrous ✓ non-ferrous ✓ non-metallic <p>1.12 set the machine to produce components within all of the following:</p> <ul style="list-style-type: none"> ✓ all operations are carried out to the specification ✓ speed and feed settings are suitable for operations performed ✓ dimensional accuracy is within the specification requirements <p>1.13 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations</p> <p>1.14 deal promptly and effectively with problems within their control and report those that cannot be solved.</p>

Learning outcome
The learner will:
2. know how to set special-purpose machines for production
Assessment criteria
The learner can:
2.1 describe the specific safety precautions to be taken when setting up workholding devices and accessories, workpiece and turning tools on special-purpose automatic machines
2.2 describe the hazards associated with setting special purpose machines (such as moving parts of machinery, handling tooling, handling cutting fluids, airborne particles, tool breakage, power chucks, insecure components, automatic operations), and how to minimise them and reduce any risks
2.3 explain how to start and stop the machine in normal and emergency situations
2.4 describe the importance of ensuring that the machine is isolated from the power supply before mounting tooling and workholding devices
2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy
2.6 describe the basic principles of operation of the special-purpose machine used and its accessories, and typical operations that it can perform
2.7 explain how to handle and store tooling 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 explain the terminology used in relationship to the special-purpose equipment used and the activities undertaken
2.11 describe the range of workholding methods and devices that are used on the machine (such as chucks, hand and power operated

collet chucks, jigs and fixtures)

- 2.12 describe the different types of tooling that is used, and how it is selected, prepared and mounted to the machine tool holding devices
- 2.13 describe the various specialist devices that can be used for component feeding (such as feed fingers, gravity feed mechanisms, air feed supplies and magazine loading arrangements)
- 2.14 describe the selection of cams, and how they are set up and timed in order to produce the components to the required specification
- 2.15 describe the factors which determine speeds and feeds to be used (such as material, type of tooling, operations performed, workpiece rigidity, machine condition, simultaneous multiple operations, tolerance and finish required)
- 2.16 explain how the various types of materials will affect the feeds and speeds that can be used
- 2.17 describe the types of cutting fluids that are used, and precautions to be taken when handling and using them
- 2.18 explain how to set up the special-purpose machine and its accessories for the particular operations being performed
- 2.19 explain the need to conduct trial runs, and to check that the machine is set up and producing the components correctly
- 2.20 describe the problems that can occur with setting-up the workholding devices, tooling and machine operating parameters, and what to do if they occur
- 2.21 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.

Unit 359

Setting power presses for production

UAN:	A/600/5467
Level:	3
Credit value:	91
GLH:	210
Relationship to NOS:	This unit has been derived from Semta National Occupational Standard Mechanical Manufacturing Engineering Unit 59: Setting Power Presses for Production (Level 3).
Endorsement by a sector or regulatory body:	This unit is endorsed by Semta, the Sector Skills Council for Science, Engineering and Manufacturing Technologies.
Aim:	<p>This unit covers the skills and knowledge needed to prove the competences required to prepare and set up single and multi-action power presses and associated equipment, in accordance with approved procedures. This involves selecting the appropriate press tools, 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 set up and align all associated equipment, which will include material positioning mechanisms, workpiece ejection mechanisms, and all machine safety devices and guards.</p> <p>The learner will need to set up the machine operating parameters to produce the workpiece to the required specification. The learner must produce trial pressings and prove the machine is working satisfactorily before declaring the installation ready for production. Making adjustments to settings to achieve specification, and solving machine-related problems during production, will also form part of their role.</p> <p>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 machine, press tools, equipment or setting-up activities that they</p>

people. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the quality 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 power press used, and its application, and will know about the workholding devices, press tools, relevant materials, consumables and setting-up procedures, in adequate depth to provide a sound basis for setting up the equipment, correcting faults and ensuring that the work produced meets the required specification.

The learner will understand the safety precautions required when working with power operated presses and their associated tools and equipment, and the safeguards necessary for undertaking the activities safely and correctly.

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. set power presses for production
Assessment criteria
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 during the setting up activities: <ul style="list-style-type: none">✓ obtain and use the appropriate documentation (such as job 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✓ check that the machine is appropriate for the operation being performed (such as tonnage, open height, stroke)✓ ensure that the power press tool setters safety clutch lock, brakes, and emergency stop facilities operate correctly✓ follow safe practice/approved setting up procedures at all times✓ ensure that correctly adjusted machine guards are in place✓ check that press tools are undamaged and in a serviceable

- condition
 - ✓ ensure that machine settings are suitable for the material thickness and operations to be performed
 - ✓ 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 component drawing and any other related specifications for the component to be produced
- 1.4 determine what has to be done and how the machine will be set to achieve this
- 1.5 prepare and set up one of the following types of power press:
 - ✓ single action
 - ✓ multiple action
- 1.6 mount and set the correct forming tools and devices for the component being produced
- 1.7 select, prepare, mount and position press tools to the machine, to cover all of the following:
 - ✓ preparing the press to receive the tooling
 - ✓ setting workpiece feed and ejection systems
 - ✓ positioning, aligning and securing press tools
 - ✓ ensuring correct clamping of materials
 - ✓ fitting and adjusting guards, interlocks and other safety mechanisms
 - ✓ setting up press operating parameters (stroke, stroke speed, material feed mechanisms)
 - ✓ carrying out tool tryouts of the complete cycle, using manual operation
- 1.8 set the machine operating parameters to achieve the required pressure shaping requirements and component specification
- 1.9 set up the press to carry out five of the following operations:
 - ✓ blanking
 - ✓ piercing
 - ✓ cropping/shearing
 - ✓ bending/forming
 - ✓ securing/assembling
 - ✓ notching
 - ✓ joggling
 - ✓ coiling/rolling
 - ✓ planishing/flattening
 - ✓ raising of first draw
 - ✓ forming of second draw
 - ✓ compound operations
 - ✓ progression tool
 - ✓ cupping
 - ✓ embossing
 - ✓ coining
 - ✓ other operations
- 1.10 produce components from one of the following types of material:

<ul style="list-style-type: none"> ✓ ferrous materials ✓ non-ferrous materials ✓ deep drawing steels <p>1.11 set the machine to produce components within all of the following quality and accuracy standards, as applicable to the operations performed:</p> <ul style="list-style-type: none"> ✓ dimensional accuracy is within the specification tolerances ✓ the form or sharpness of the profile conforms to best practice and/or specification, without deformation or cracking ✓ the components produced conform to specification without defects <p>1.12 check that all safety mechanisms are in place and that the equipment is set correctly for the required operations</p> <p>1.13 deal promptly and effectively with problems within their control and report those that cannot be solved.</p>

Learning outcome
The learner will:
2. know how to set power presses for production
Assessment criteria
The learner can:
2.1 describe the relevant parts of the power press regulations, and how they apply to them and the work they are undertaking
2.2 describe the specific safety precautions to be taken when working with single and multiple action power presses and press tooling
2.3 describe the hazards associated with working with power presses (such as moving parts of machinery, material handling, material ejection, automatic processes, lifting and handling press tooling, using faulty or badly maintained equipment), and how to minimise them and reduce any risks
2.4 describe the correct protective clothing and handling precautions to be taken when working with power presses and press materials
2.5 describe the correct methods of lifting and moving press tooling, and the types of equipment used
2.6 explain how to check that lifting equipment is within its current test dates
2.7 explain how to obtain the necessary drawings and forming specifications
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 various types of power press that are used, and their typical applications
2.11 explain how to prepare and set up the power press and its tooling for a range of different applications
2.12 describe the types of press tool that are used for the various operations, and how they are secured and set to the machine's tool

- 2.13 describe the preparations to be carried out on the materials prior to using them
- 2.14 describe the basic characteristics of the materials with regard to the pressing operations undertaken
- 2.15 explain the need to take care of the press tools and equipment; how to recognise faulty or damaged press tools; how bending and forming tools should be stored
- 2.16 describe the problems that can occur with the bending and forming activities, and how they can be avoided
- 2.17 describe the organisational quality control procedures that are used, and how to recognise defects in the components that are produced
- 2.18 explain how to make dimensional and forming inspection checks, and the tools and equipment that can be used
- 2.19 describe the accuracy and limitations of processes
- 2.20 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve.



Appendix 1 Relationships to other qualifications

Links to other qualifications

Mapping is provided as guidance and suggests areas of commonality between the qualifications. It does not imply that candidates completing units in one qualification have automatically covered all of the content of another.

Centres are responsible for checking the different requirements of all qualifications they are delivering and ensuring that candidates meet requirements of all units/qualifications.

This qualification has connections to the:

- ✓ Level 3 NVQ in Mechanical Manufacturing Engineering (1682)

Literacy, language, numeracy and ICT skills development

This qualification can develop skills that can be used in the following qualifications:

- ✓ Functional Skills (England) – see [Functional Skills | City & Guilds \(cityandguilds.com\)](https://www.cityandguilds.com)
- ✓ Essential Skills (Northern Ireland) – see [Essential Skills \(Northern Ireland\) qualifications and training courses | City & Guilds \(cityandguilds.com\)](https://www.cityandguilds.com)
- ✓ Essential Skills Wales – see [Skills for Wales - Wales | City & Guilds \(cityandguilds.com\)](https://www.cityandguilds.com)



Appendix 2 Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the **Centres and Training Providers homepage** on www.cityandguilds.com.

Centre Manual - Supporting Customer Excellence contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues. Specifically, the document includes sections on:

- ✓ The centre and qualification approval process
- ✓ Assessment, internal quality assurance and examination roles at the centre
- ✓ Registration and certification of candidates
- ✓ Non-compliance
- ✓ Complaints and appeals
- ✓ Equal opportunities
- ✓ Data protection
- ✓ Management systems
- ✓ Maintaining records
- ✓ Assessment
- ✓ Internal quality assurance
- ✓ External quality assurance

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- ✓ SQA Awarding Body Criteria (2007)
- ✓ NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information such on such things as:

- ✓ **Walled Garden:** how to register and certificate candidates on line
- ✓ **Events:** dates and information on the latest Centre events
- ✓ **Online assessment:** how to register for e-assessments.

Useful contacts

UK learners General qualification information	T: +44 (0)844 543 0033 E: learnersupport@cityandguilds.com
International learners General qualification information	T: +44 (0)844 543 0033 F: +44 (0)20 7294 2413 E: intcg@cityandguilds.com
Centres Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports. Results	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: centresupport@cityandguilds.com
Single subject qualifications Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) E: singlesubjects@cityandguilds.com
International awards Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: intops@cityandguilds.com
Walled Garden Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: walledgarden@cityandguilds.com
Employer Employer solutions, Mapping, Accreditation, Development Skills, Consultancy	T: +44 (0)121 503 8993 E: business@cityandguilds.com
Publications Logbooks, Centre documents, Forms, Free literature	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413

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About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group operates from three major hubs: London (servicing Europe, the Caribbean and Americas), Johannesburg (servicing Africa), and Singapore (servicing Asia, Australia and New Zealand). The Group also includes the Institute of Leadership & Management (management and leadership qualifications), City & Guilds Land Based Services (land-based qualifications), the Centre for Skills Development (CSD works to improve the policy and practice of vocational education and training worldwide) and Learning Assistant (an online e-portfolio).

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