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Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering

Specification

Competence-based qualification

For first registration August 2010

Issue 2

Pearson

Edexcel, BTEC and LCCI qualifications

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This specification is Issue 2. Key changes are listed in the summary table on the next page. We will inform centres of any changes to this issue. The latest issue can be found on the Pearson website: qualifications.pearson.com

This qualification was previously known as:

Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering (QCF)

The QN remains the same.

References to third party material made in this specification are made in good faith. Pearson does not endorse, approve or accept responsibility for the content of materials, which may be subject to change, or any opinions expressed therein. (Material may include textbooks, journals, magazines and other publications and websites.)

All information in this specification is correct at time of going to publication.

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Summary of Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering specification Issue 2 changes

Summary of changes made between previous issue and this current issue	Page number
All references to QCF have been removed throughout the specification	
Definition of TQT added	1
Definition of sizes of qualifications aligned to TQT	2
TQT value added	7
Guided learning definition updated	14
QCF references removed from unit titles and unit levels in all units	15-445

Earlier issue(s) show(s) previous changes.
If you need further information on these changes or what they mean, contact us via our website at: qualifications.pearson.com/en/support/contact-us.html.

Contents

Introducing Pearson Edexcel NVQ/Competence-based qualifications

What are NVQ/Competence-based qualifications?

National Vocational Qualifications (NVQs)/Competence-based qualifications are work-based qualifications that give learners the opportunity to develop and demonstrate their competence in the area of work or job role to which the qualification relates.

NVQs/Competence-based qualifications are based on recognised occupational standards for the appropriate sector. Occupational standards define what employees, or potential employees, must be able to do and know, and how well they should undertake work tasks and work roles. These standards are written in broad terms to enable employers and providers to apply them to a wide range of related occupational areas.

NVQs/Competence-based qualifications are outcomes-based with no fixed learning programme, therefore allowing flexible delivery to meet the individual learner's needs. At Level 2 and above, these qualifications are recognised as approved training and development courses for employees that have been in the workplace for some time or as a way of inducting, training and developing new entrants into the workplace. Qualifications at Level 1 can be used in Traineeships, which enables progression to entry level employment or to Apprenticeship programmes.

Learners will work towards their qualification in the workplace or in settings that replicate the working environment as specified in the assessment requirements. Colleges, training centres and/or employers can offer these qualifications as long as they have access to appropriate physical and human resources and have the necessary quality assurance systems in place.

Sizes of NVQ/Competence-based qualifications

For all regulated qualifications, Pearson specify a total number of hours that it is estimated learners will require to complete and show achievement for the qualification – this is the Total Qualification Time (TQT). The TQT value indicates the size of a qualification.

Within the TQT, Pearson identifies the number of Guided Learning Hours (GLH) that we estimate a centre delivering the qualification might provide. Guided learning means activities, such as lessons, tutorials, online instruction, supervised study and giving feedback on performance, that directly involve tutors and assessors in teaching, supervising and invigilating learners. Guided learning includes the time required for learners to complete external assessment under examination or supervised conditions.

In addition to guided learning, other required learning directed by tutors or assessors will include private study, preparation for assessment and undertaking assessment when not under supervision, such as preparatory reading, revision and independent research.

As well as TQT and GLH, qualifications can also have a credit value – equal to one tenth of TQT, rounded to the nearest whole number.

TQT and credit values are assigned after consultation with users of the qualifications.

NVQ/Competence-based qualifications are available in the following sizes:

- Award – a qualification with a TQT value of 120 or less (equivalent to a range of 1–12 credits)
- Certificate – a qualification with a TQT value in the range of 121–369 (equivalent to a range of 13–36 credits)
- Diploma – a qualification with a TQT value of 370 or more (equivalent to 37 credits and above).

Qualification title covered by this specification

This specification gives you the information you need to offer the Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering:

Qualification title	Qualification Number (QN)	Accreditation start date
Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering	501/0739/2	01/08/2010

Qualifications eligible and funded for post-16-year-olds can be found on the funding Hub. The Skills Funding Agency also publishes a funding catalogue that lists the qualifications available for 19+ funding.

You should use the Qualification Number (QN), when you wish to seek public funding for your learners. Each unit within a qualification will also have a unique reference number, which is listed in this specification.

The qualification title and unit reference numbers will appear on the learners' final certification document. Learners need to be made aware of this when they are recruited by the centre and registered with Pearson.

Key features of the Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering

This qualification:

- is nationally recognised
- is based on the Semta National Occupational Standards (NOS). The NOS, assessment strategy and qualification structure are owned by Semta.

The Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering has been approved as a component for the Semta Apprenticeship framework.

What is the purpose of this qualification?

This qualification is appropriate for employees in the engineering sector working across a broad range of areas. It is designed to assess occupational competence in the workplace where learners are required to demonstrate skills and knowledge to a level required in the engineering industry.

Who is this qualification for?

This qualification is for all learners aged 16 and above who are capable of reaching the required standards.

Pearson's policy is that the qualification should:

- be free from any barriers that restrict access and progression
- ensure equality of opportunity for all wishing to access the qualification.

What are the benefits of this qualification to the learner and employer?

This qualification allows learners to demonstrate competence against National Occupational Standards which are based on the needs of the engineering industry as defined by Semta, the Sector Skills Council. As such it contributes to the development of skilled labour in the sector. The qualification may contribute towards the competence element of an Apprenticeship.

What are the potential job roles for those working towards this qualification?

- Engineering craft/CNC machinist
- Production engineer

What progression opportunities are available to learners who achieve this qualification?

This qualification allows learners to demonstrate competence in mechanical manufacturing engineering at a level required by the engineering industry. Learners can progress across the level and size of the engineering competence and knowledge qualifications and into other occupational areas such as team leading and management.

What is the qualification structure for the Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering?

The Total Qualification Time (TQT) for this qualification is 540.

The Guided Learning Hours (GLH) for this qualification is 387.

To achieve the **Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering**

Learners must complete a minimum of 54 credits. Learners must complete all mandatory units in Group M (15 credits) and then choose one of the following pathways:

Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering – Machine Operating

Learners must complete a minimum of one unit in Group AO (minimum 39 credits). Total of 54 credits (minimum).

Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering – CNC Machine Operating

Learners must complete a minimum of one unit in Group BO (minimum 39 credits). Total of 54 credits (minimum).

Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering – Production Assembly

Learners must complete a minimum of one unit in Group CO (minimum 49 credits). Total of 64 credits (minimum).

Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering – Composite Manufacture

Learners must complete a minimum of two units in Group DO (minimum 46 credits). Total of 61 credits (minimum).

Pearson Edexcel Level 2 NVQ Diploma in Mechanical Manufacturing Engineering – Optical Engineering

Learners must complete the unit in Group EM and must also complete a minimum of one unit in Group EO (minimum 74 credits). Total of 89 credits (minimum).

M – **Mandatory units (all pathways)**

Learners must complete all units in Group M.

Credit value required: minimum 15.

A/601/5013 – Complying with statutory regulations and organisational safety requirements

Y/601/5102 – Using and interpreting engineering data and documentation

Y/601/5052 – Working efficiently and effectively in engineering

A – **Machine Operating (pathway)**

Learners must complete a minimum of one unit in Group AO.

AO – Optional units (Machine Operating)

Credit value required: minimum 39.

R/600/5409 – Operating capstan or turret lathes

A/600/5419 – Operating centre lathes

R/600/5426 – Operating single spindle automatic turning machines

D/600/5431 – Operating multi-spindle automatic turning machines

T/600/5435 – Operating milling machines

L/600/5442 – Operating single and multi-spindle drilling machines

H/600/5446 – Operating grinding machines

A/600/5453 – Operating special-purpose machines

D/600/5459 – Operating gear cutting machines

K/600/5464 – Operating electro-discharge machines

M/600/5479 – Operating honing and lapping machines

L/600/6008 – Operating broaching machines

R/600/6012 – Operating shaping, planing or slotting machines

D/600/6014 – Operating gear grinding machines

K/600/6016 – Operating power presses

B – CNC Machine Operating (pathway)

Learners must complete a minimum of one unit in Group BO.

BO – Optional units (CNC Machine Operating)

Credit value required: minimum 39.

M/600/6020 – Operating CNC turning machines

D/600/6031 – Operating CNC milling machines

H/600/6032 – Operating CNC grinding machines

K/600/6033 – Operating CNC punching machines

M/600/6034 – Operating CNC laser profiling machines

F/600/6037 – Operating CNC electro-discharge machines

J/600/6038 – Operating CNC gear cutting machines

L/600/6039 – Operating CNC machining centres

C – Production Assembly (pathway)

Learners must complete a minimum of one unit in Group CO.

CO – Optional units (Production Assembly)

Credit value required: minimum 49.

F/600/6040 – Producing mechanical sub-assemblies/assemblies

L/600/6042 – Assembling fluid power components to mechanical equipment

R/600/6043 – Assembling electrical or electronic components to mechanical equipment

D/600/6045 – Assembling pipework components to mechanical equipment

D – Composite Manufacture (pathway)

Learners must complete a minimum of two units in Group DO.

DO – Optional units (Composite Manufacture)

Credit value required: minimum 46.

H/600/6046 – Producing composite mouldings using wet lay-up techniques

M/600/6048 – Producing composite mouldings using pre-preg laminating techniques

K/600/6050 – Producing components by acrylic moulding

M/600/6051 – Vacuum forming composite materials

T/600/6052 – Trimming composite mouldings using hand tools

F/600/6054 – Identifying defects in composite mouldings

J/600/6055 – Carrying out repairs to composite mouldings

L/600/6056 – Applying surface finishes to composite mouldings

Y/600/6058 – Bonding composite mouldings

D/600/6059 – Producing composite assemblies

E – Optical Engineering (pathway)

Learners must complete the unit in Group EM and must also complete a minimum of one unit in Group EO.

Credit value required: minimum 74.

EM – Mandatory units (Optical Engineering)

Credit value required: minimum 42.

R/600/6060 – Carrying out inspection activities on optical components

EO – Optional units (Optical Engineering)

Credit value required: minimum 32.

Y/600/6061 – Operating infra-red/special material lens process machines

D/600/6062 – Operating optical glass lens process machines

K/600/6064 – Operating optical prism and flat process machines

A/600/6067 – Operating CNC aspheric optical and diamond turning machines

J/600/6069 – Operating CNC optical grinding and polishing machines

F/600/6071 – Operating optical cylinder and dome process machines

R/600/6074 – Operating vacuum coating optical process machines

Y/600/6075 – Operating optical plastic process machines

How is the qualification graded and assessed?

The overall grade for the qualification is a 'pass'. The learner must achieve all the required units within the specified qualification structure.

To pass a unit the learner must:

- achieve **all** the specified learning outcomes
- satisfy **all** the assessment criteria by providing sufficient and valid evidence for each criterion
- show that the evidence is their own.

The qualification is designed to be assessed:

- in the workplace or
- in conditions resembling the workplace, as specified in the assessment strategy for the sector, or
- as part of a training programme.

Assessment Strategy

The Assessment Strategy for this qualification has been included in *Annexe D.* It has been developed by Semta in partnership with employers, training providers, awarding organisations and the regulatory authorities. The assessment strategy includes details on:

- criteria for defining realistic working environments
- roles and occupational competence of assessors, expert witnesses, internal verifiers and standards verifiers
- quality control of assessment
- evidence requirements.

Evidence of competence may come from:

- **current practice** where evidence is generated from a current job role
- a **programme of development** where evidence comes from assessment opportunities built into a learning/training programme whether at or away from the workplace
- the **Recognition of Prior Learning (RPL)** where a learner can demonstrate that they can meet the assessment criteria within a unit through knowledge, understanding or skills they already possess without undertaking a course of learning. They must submit sufficient, reliable and valid evidence for internal and standards verification purposes. RPL is acceptable for accrediting a unit, several units or a whole qualification
- a **combination** of these.

It is important that the evidence is:

Valid	relevant to the standards for which competence is claimed
Authentic	produced by the learner
Current	sufficiently recent to create confidence that the same skill, understanding or knowledge persist at the time of the claim
Reliable	indicates that the learner can consistently perform at this level
Sufficient	fully meets the requirements of the standards.

Types of evidence

To successfully achieve a unit the learner must gather evidence which shows that they have met the required standard in the assessment criteria. Evidence can take a variety of different forms including the following examples:

- direct observation of the learner's performance by their assessor
- outcomes from oral or written questioning
- products of the learner's work
- personal statements and/or reflective accounts
- outcomes from simulation, where permitted by the assessment strategy
- professional discussion
- assignment, project/case studies
- authentic statements/witness testimony
- expert witness testimony
- reflective accounts
- evidence of Recognition of Prior Learning.

Learners can use one piece of evidence to prove their knowledge, skills and understanding across different assessment criteria and/or across different units. It is, therefore, not necessary for learners to have each assessment criterion assessed separately. Learners should be encouraged to reference the assessment criteria to which the evidence relates.

Evidence must be made available to the assessor, internal verifier and Pearson standards verifier. A range of recording documents is available on the Pearson website qualifications.pearson.com. Alternatively, centres may develop their own.

Additional requirements

The Joint Awarding Body and the SSC Working Practices Group have identified additional requirements that are needed to assess and quality assure qualifications that use NVQ within their title. These requirements are shown in *Annexe C: Additional requirements for Qualifications that use the title NVQ*.

Centre recognition and approval

Centre recognition

Centres that have not previously offered Peasron qualifications need to apply for and be granted centre recognition as part of the process for approval to offer individual qualifications. New centres must complete both a centre recognition approval application and a qualification approval application.

Existing centres will be given 'automatic approval' for a new qualification if they are already approved for a qualification that is being replaced by the new qualification and the conditions for automatic approval are met. Centres already holding Pearson approval are able to gain qualification approval for a different level or different sector via Edexcel online.

Approvals agreement

All centres are required to enter into an approvals agreement which is a formal commitment by the head or principal of a centre to meet all the requirements of the specification and any linked codes or regulations. Pearson will act to protect the integrity of the awarding of qualifications, if centres do not comply with the agreement. This could result in the suspension of certification or withdrawal of approval.

Quality assurance

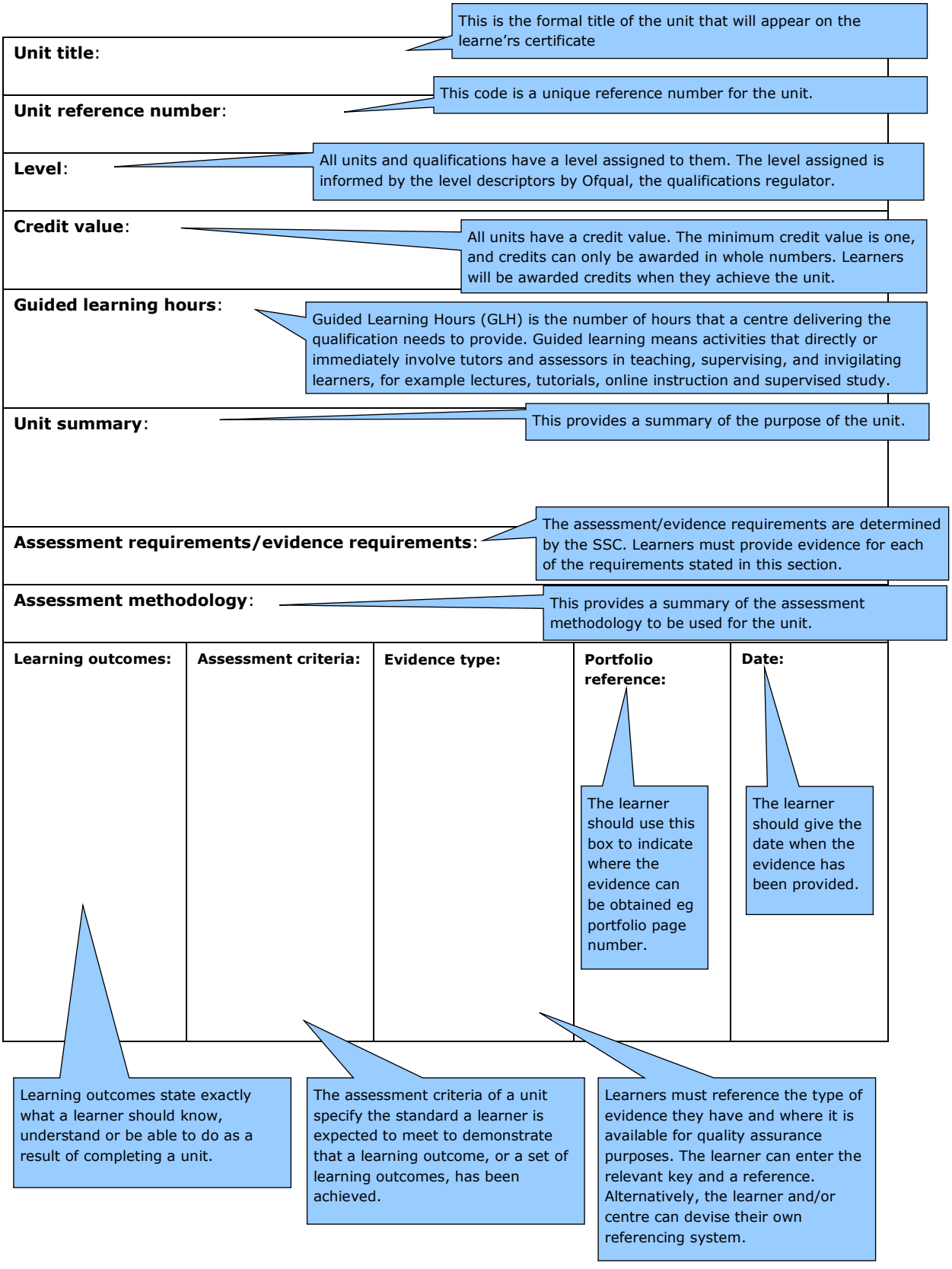
Detailed information on Pearson's quality assurance processes is given in *Annexe A*.

What resources are required?

Each qualification is designed to support learners working in the Engineering sector. Physical resources need to support the delivery of the qualification and the assessment of the learning outcomes and must be of industry standard. Centres must meet any specific resource requirements outlined in *Annexe D: Assessment Strategy*. Staff assessing the learner must meet the requirements within the overarching assessment strategy for the sector.

Unit format

Each unit in this specification contains the following sections.



Units

Unit 1: Complying with statutory regulations and organisational safety requirements

Unit reference number: A/601/5013

Level: 2

Credit value: 5

Guided learning hours: 35

Unit summary

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 with their job. Typically, these will focus on their working environment, the tools and 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.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1 Comply with statutory regulations and organisational safety requirements	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: • 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: – 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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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 outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2 Know how to comply with statutory regulations and organisational safety requirements	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 seven 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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 2: Using and interpreting engineering data and documentation

Unit reference number: Y/601/5102

Level: 2

Credit value: 5

Guided learning hours: 25

Unit summary

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.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1 Use and interpret engineering data and documentation	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: • 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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• 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: • materials or components required • dimensions • tolerances • build quality • installation requirements • customer requirements • timescales • financial information • operating parameters • surface texture requirements • location/orientation of parts • process or treatments required			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• 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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• 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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• 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) • 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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.8 deal promptly and effectively with any problems within their control and report those which cannot be solved 1.9 report any inaccuracies or discrepancies in documentation and specifications			
2 Know how to use and interpret engineering data and documentation	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 such as drawings, job instructions product data sheets, manufacturers' manuals, financial spreadsheets, production schedules, inspection and calibration requirements, customer information)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 3: Working efficiently and effectively in engineering

Unit reference number: Y/601/5052

Level: 2

Credit value: 5

Guided learning hours: 25

Unit summary

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 ensuring that any tools, equipment, materials and other resources required are available and in a safe and usable condition.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1 Work efficiently and effectively in engineering	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 prepare the work area to carry out the engineering activity 1.3 prepare to carry out the engineering activity, taking into consideration all of the following, as applicable to the work to be undertaken: • the work area is free from hazards and 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 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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• storage arrangements for work are appropriate • appropriate authorisation to carry out the work is obtained 1.4 check that there are sufficient supplies of materials and/or consumables and that they meet work requirements 1.5 ensure completed products or resources are stored in the appropriate location on completion of the activities 1.6 complete work activities, to include all of the following: • returning tools and equipment • returning drawings and work instructions • completing all necessary documentation accurately and legibly • identifying, where appropriate, any unusable tools, equipment and components • arranging for the safe disposal of waste materials 1.7 tidy up the work area on completion of the engineering activity 1.8 deal promptly and effectively with problems within their control and report those that cannot be resolved			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.9 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 1.10 contribute to organisational procedures for identifying opportunities for improvement to one of the following: • working practices • working methods • quality • safety • tools and equipment • supplier relationships • internal communication			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• customer service • training and development • teamwork • other 1.11 maintain effective working relationships with colleagues to include two of the following: • colleagues within their own working group • people outside their normal working group • line management • external contacts 1.12 review personal training and development as appropriate to the job role 1.13 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 outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2 Know how to work efficiently and effectively in engineering	2.1 describe the safe working practices and procedures to be followed while preparing and tidying up their work environment 2.2 describe the correct use of any equipment to protect the health and safety of themselves and their colleagues 2.3 describe the procedure for ensuring that all documentation relating to the work being carried out is available and current, prior to starting the activity 2.4 describe the action that should be taken if documentation received is incomplete and/or incorrect 2.5 describe the procedure for ensuring that all tools and equipment are available prior to undertaking the activity 2.6 describe the checks to be carried out to ensure that tools and equipment are in full working order, prior to undertaking the activity 2.7 describe the action that should be taken if tools and equipment are not in full working order 2.8 describe the checks to be carried out to ensure that all required materials are correct and complete, prior to undertaking the activity			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.9 describe the action that should be taken if materials do not meet the requirements of the activity 2.10 explain whom to inform when the work activity has been completed 2.11 describe the information and/or documentation that others will require to confirm that the activity has been completed 2.12 explain what materials, equipment and tools can be re-used 2.13 explain how any waste materials and/or products are transferred, stored and disposed of 2.14 explain where tools and equipment should be stored and located 2.15 describe the importance of maintaining effective working relationships within the workplace 2.16 describe the procedures for dealing with and reporting any problems that can affect working relationships 2.17 describe the importance of making a contribution to improving working practices 2.18 describe the procedure and format for making suggestions for improvements 2.19 describe the benefits for the work area if improvements can be identified			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.20 describe the difficulties that can occur in working relationships 2.21 describe the regulations that affect how they should be treated at work (such as Equal Opportunities Act, Race and Sex Discrimination, Working Time Directive) 2.22 describe the benefits of continuous personal development 2.23 describe the training opportunities that are available in the workplace 2.24 describe the importance of reviewing their training and development 2.25 explain with whom to discuss training and development issues 2.26 describe the extent of their own authority and to whom they should report if they have any problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 4: Operating capstan or turret lathes

Unit reference number: R/600/5409

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out turning operations on a capstan or turret lathe, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce a range of components that combine a number of different features, such as parallel, stepped and tapered diameters, drilled, bored and reamed holes, internal and external threads.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate capstan or turret lathes	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 produce machined components which combine different operations and cover six of the following: • flat faces • parallel diameters • stepped diameters • tapered diameters • drilled holes • bored holes • reamed holes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• profile forms • internal threads • external threads • eccentric features • parting off • chamfers and radii • knurls/special finishes • grooves/undercuts • counterbores			
1b Operate capstan or turret lathes (continued)	1.7 machine components made from one of the following types of material: • ferrous • non-ferrous • non-metallic 1.8 produce components with dimensional accuracy, form and surface texture within all of the following quality and accuracy standards, as is 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 9			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• surface finish 63µin or 1.6µm • reamed or bored holes within H8 • screw threads BS medium fit • angles within +/- 1 degree 1.9 carry out quality sampling checks at suitable intervals 1.10 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of four of the following: • diameters • hole size/fit • angle • surface finish • lengths • depths • thread fit • grooves/undercuts 1.11 deal promptly and effectively with problems within their control and report those that cannot be solved 1.12 shut down the equipment to a safe condition on conclusion of the machining activities			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to operate capstan or turret lathes	2.1 describe the safe working practices and procedures to be followed while operating capstan or turret lathes 2.2 describe the safety mechanisms on the machine and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both hand and power modes, including rapid power of the turret head 2.4 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the hazards associated with operating capstan lathes and carrying out the turning operations, and how to minimise them and reduce any risks 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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 use imperial and metric systems of measurement			
2b Know how to operate capstan or turret lathes (continued)	2.11 describe the main features of the capstan or turret lathe, and the accessories that can be used 2.12 describe the various turning operations that can be performed, and the methods and equipment used 2.13 describe the effects of backlash in machine slides and screws, and how this can be overcome 2.14 describe the application of roughing and finishing cuts and the effect on tool life, surface finish and dimensional accuracy 2.15 describe the application of cutting fluids with regard to a range of different materials 2.16 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components 2.17 explain how to recognise machining faults, and how to identify when tools need re-sharpening			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.18 describe the quality control procedures used and inspection checks to be carried out, and the equipment that will need to be used for these checks 2.19 describe the problems that can occur with the turning activities, and how they can be overcome 2.20 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 5: Operating centre lathes

Unit reference number: A/600/5419

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required for carrying out turning operations on a centre lathe, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components, materials and consumables are available. The learner will be expected to produce a range of components that combine a number of different features, such as parallel, stepped and tapered diameters, drilled, bored and reamed holes, internal and external threads.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate centre lathes	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 produce machined components which combine different operations and cover six of the following: • flat faces • parallel diameters • stepped diameters • tapered diameters • drilled holes • bored holes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• reamed holes • profile forms • internal threads • external threads • eccentric features • parting off • chamfers • knurls or special finishes • grooves • undercuts			
1b Operate centre lathes (continued)	1.7 machine components made from one of the following types of material: • ferrous • non-ferrous • non-metallic 1.8 produce components with dimensional accuracy, form and surface texture within all of the following quality and accuracy standards, as is applicable to the operations performed: • components to be free from false tool cuts, burrs and sharp edges			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• dimensional tolerance equivalent to BS 4500 or BS 1916 grade 7 • surface finish 63µin or 1.6µm • reamed or bored holes within H8 • screw threads BS medium fit • angles within +/- 1 degree 1.9 carry out quality sampling checks at suitable intervals 1.10 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of four of the following: • diameters • hole size/fit • surface finish • angle/taper • thread fit • lengths • depths • grooves/undercut			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.11 deal promptly and effectively with problems within their control and report those that cannot be solved 1.12 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate centre lathes	2.1 describe the safe working practices and procedures to be followed while operating centre lathes 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both hand and power modes 2.4 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the hazards associated with operating centre lathes and carrying out the turning operations, and how to minimise them and reduce any risks 2.7 describe the importance of keeping the work area clean and tidy			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 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 use imperial and metric systems of measurement			
2b Know how to operate centre lathes (continued)	2.11 describe the main features of the centre lathes and the accessories that can be used (such as saddle, compound slide, tailstock, taper turning attachments, profile attachments, fixed and travelling steadies) 2.12 describe the various turning operations that can be performed, and the methods and equipment used 2.13 describe the effects of backlash in machine slides and screws, and how this can be overcome 2.14 describe the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.15 describe the application of cutting fluids with regard to a range of different materials 2.16 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components 2.17 explain how to recognise machining faults and how to identify when tools need re-sharpening 2.18 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.19 describe the problems that can occur with the turning activities, and how these can be overcome 2.20 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 6: Operating single spindle automatic turning machines

Unit reference number: R/600/5426

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out turning operations on a single spindle automatic turning machine, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce a range of components that combine a number of different features, such as parallel, stepped and tapered diameters, drilled, bored and reamed holes, internal and external threads and profiles.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate single spindle automatic turning machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 produce machined components which combine different operations and cover six of the following: • flat faces • parallel diameters • stepped diameters • tapered diameters • drilled holes • bored holes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• reamed holes • profile forms • internal threads • external threads • eccentric features • parting off • chamfers and radii • knurls/special finishes • grooves/undercuts • counterbores			
1b Operate single spindle automatic turning machines (continued)	1.7 machine components made from one of the following types of material: • ferrous • non-ferrous • non-metallic 1.8 produce components with dimensional accuracy, form and surface texture within all of the following quality and accuracy standards, as is applicable to the operations performed: • components to be free from false tool cuts, burrs and sharp edges			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• dimensional tolerance equivalent to BS 4500 or BS 1916 grade 9 • surface finish 63µin or 1.6µm • reamed or bored holes within H8 • screw threads BS medium fit • angles within +/- 1 degree 1.9 carry out quality sampling checks at suitable intervals 1.10 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of four of the following: • diameters • hole size/fit • angle/taper • surface finish • lengths/depths • thread fit • grooves/undercuts 1.11 deal promptly and effectively with problems within their control and report those that cannot be solved 1.12 shut down the equipment to a safe condition on conclusion of the machining activities			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to operate single spindle automatic turning machines	2.1 describe the safe working practices and procedures to be followed while operating single spindle automatic turning machines 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both hand and power modes 2.4 how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the hazards associated with operating single spindle automatic turning operations and carrying out the turning operations, and how to minimise them and reduce any risks 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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 use imperial and metric systems of measurement			
2b Know how to operate single spindle automatic turning machines (continued)	2.11 describe the main features of the single spindle automatic turning machines, and the accessories that can be used 2.12 describe the various turning operations that can be performed, and the methods and equipment used 2.13 describe the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy 2.14 describe the application of cutting fluids with regard to a range of different materials 2.15 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components 2.16 explain how to recognise machining faults, and how to identify when tools need re-sharpening			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.17 describe the quality control procedures used, inspection checks to be carried out and the equipment that will need to be used 2.18 describe the problems that can occur with the turning activities, and how these can be overcome 2.19 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date:_____

Learner signature: _____ Date:_____

Assessor signature: _____ Date:_____

Internal verifier signature: _____ Date:_____
(*if sampled*)

Unit 7: Operating multi-spindle automatic turning machines

Unit reference number: D/600/5431

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out turning operations on a multi-spindle automatic turning machine, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce a range of components that combine a number of different features, such as parallel, stepped and tapered diameters, drilled and reamed holes, internal and external threads, and special profiles or forms.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate multi-spindle automatic turning machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 produce machined components which combine different operations and cover six of the following: • flat faces • parallel diameters • stepped diameters • tapered diameters • drilled holes • bored holes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• reamed holes • profile forms • internal threads • external threads • eccentric features • parting off • chamfers and radii • knurls/special finishes • grooves/undercuts • counterbores			
1b Operate multi-spindle automatic turning machines (continued)	1.7 machine components made from one of the following types of material: • ferrous • non-ferrous • non-metallic 1.8 produce components with dimensional accuracy, form and surface texture within all of the following quality and accuracy standards, as is applicable to the operations performed: • components to be free from false tool cuts, burrs and sharp edges			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• reamed holes • profile forms • internal threads • external threads • eccentric features • parting off • chamfers and radii • knurls/special finishes • grooves/undercuts • counterbores • dimensional tolerance equivalent to BS 4500 or BS 1916 grade 9 • surface finish 63µin or 1.6µm • reamed holes within H8 • screw threads BS medium fit • angles within +/- 1 degree 1.9 carry out quality sampling checks at suitable intervals			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.10 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of four of the following: • diameters • hole size/fit • angle • surface finish • lengths • depths • thread fit • grooves/recesses 1.11 deal promptly and effectively with problems within their control and report those that cannot be solved 1.12 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate multi-spindle automatic turning machines	2.1 describe the safe working practices and procedures to be followed while operating multi-spindle automatic turning machines 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.3 describe the operation of the machine controls in both hand and power modes 2.4 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the hazards associated with operating multi-spindle turning machines, and carrying out the turning operations and how to minimise them and reduce any risks 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 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 use imperial and metric systems of measurement			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2b Know how to operate multi-spindle automatic turning machines (continued)	2.11 describe the main features of the multi-spindle automatic turning machines, and the accessories that can be used 2.12 describe the various turning operations that can be performed, and the methods and equipment used 2.13 describe the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy 2.14 describe the application of cutting fluids with regard to a range of different materials 2.15 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components 2.16 explain how to recognise machining faults, and how to identify when tools need re-sharpening 2.17 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.18 describe the problems that can occur with the turning activities, and how these can be overcome 2.19 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 8: Operating milling machines

Unit reference number: T/600/5435

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out milling operations on a milling machine, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce a range of components that combine a number of different features, such as flat faces, parallel faces, faces that are flat and square to each other, angular faces, steps, slots and special forms.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate milling machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 operate one type of milling machine from the following: • horizontal milling machine • vertical milling machine • universal milling machine 1.7 produce machined components which combine different operations and cover six of the following: • flat faces • square faces			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• parallel faces • angular faces • steps/shoulders • open ended slots • enclosed slots • recesses • tee slots • drilled holes • bored holes • profile forms (such as vee, concave, convex, gear forms) • serrations • indexed or rotated forms • special forms			
1b Operate milling machines (continued)	1.8 machine components made from one of the following types of material: • ferrous • non-ferrous • non-metallic			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.9 produce components with dimensional accuracy, form and surface texture within all the following quality and accuracy standards, as is 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 9 • flatness and squareness within 0.005" per inch or 0.125 mm per 25 mm • surface finish 63µin or 1.6µm • angles within +/- 1 degree 1.10 carry out quality sampling checks at suitable intervals 1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of four of the following: • dimensions • squareness • hole size/fit • angles • flatness			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• surface finish • slots • recesses 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate milling machines	2.1 describe the safe working practices and procedures to be followed while operating milling machines 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 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 personal protective equipment to be worn, and where this can be obtained 2.5 describe the hazards associated with operating milling machines and carrying out the milling operations, and how to minimise them and reduce any risks 2.6 describe the importance of keeping the work area clean and tidy			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.7 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 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 use imperial and metric systems of measurement 2.10 describe the main features of the milling machine, and the accessories that can be used			
2b Know how to operate milling machines (continued)	2.11 describe the various milling operations that can be performed, and the methods and equipment used 2.12 describe the effects of backlash in machine slides and screws, and how this can be overcome 2.13 explain how to handle and store cutting tools safely and correctly 2.14 describe the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy 2.15 describe the application of cutting fluids with regard to a range of different materials			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.16 describe the effects of clamping the workpiece, and how this can cause distortion in the finished components 2.17 explain how to recognise machining faults, and how to identify when cutters need re-sharpening 2.18 describe the quality control procedures that are used, inspection checks to be carried out, and the equipment that will need to be used 2.19 describe the problems that can occur with the milling activities, and how these can be overcome 2.20 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 9: Operating single and multi-spindle drilling machines

Unit reference number: L/600/5442

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out drilling operations on single or multi-spindle drilling machines, such as bench drilling machines, pedestal machines, radial arm machines or special-purpose drilling machines, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce a range of components that combine a number of different features, such as drilled and reamed holes, counterbores, countersinks and internal threads.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate single and multi-spindle drilling machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 operate two of the following types of drilling machine: • single spindle pedestal drill • multi-spindle pedestal drill • special-purpose drilling machines • radial arm drill • bench drill			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.7 produce drilled components which combine different operations and cover five of the following: • drilling to depth • drilling through the work piece • drilling flat bottomed • counterboring • countersinking • spot facing • reaming • tapping			
1b Operate single and multi-spindle drilling machines (continued)	1.8 drill components made from one of the following types of material: • ferrous • non-ferrous • non-metallic 1.9 produce components with dimensional accuracy, form and surface texture within all of the following quality and accuracy standards, as is applicable to the operations performed: • components to be free from false tools cuts, burrs and sharp edges			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• dimensional tolerance equivalent to BS 4500 or BS 1916 grade 9 • surface finish 63µin or 1.6µm • reamed holes within H8 • screw threads BS medium fit 1.10 carry out quality sampling checks at suitable intervals 1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of all of the following: • hole size/fit • hole depths • thread fits 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate single and multi-spindle drilling machines	2.1 describe the safe working practices and procedures to be followed while operating single or multi-spindle drilling machines 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.3 describe the operation of the machine controls in both hand and power modes 2.4 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the hazards associated with operating multi-spindle drilling machines and carrying out the drilling operations, and how to minimise them and reduce any risks 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 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 use imperial and metric systems of measurement			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2b Know how to operate single and multi-spindle drilling machines (continued)	2.11 describe the main features of the single or multi-spindle drilling machine, and the accessories that can be used 2.12 describe the various drilling operations that can be performed, and the methods and equipment used 2.13 explain how to handle and store drills and tools safely and correctly 2.14 describe the application of cutting fluids with regard to a range of different materials 2.15 describe the effects of clamping the workpiece in a jig/workholding device, and how this can cause distortion in the finished components 2.16 explain how to recognise machining faults, and how to identify when drills and tools need re-sharpening 2.17 describe the quality control procedures that are used, inspection checks to be carried out, and the equipment that will need to be used 2.18 describe the problems that can occur with the drilling activities, and how these can be overcome 2.19 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 10: Operating grinding machines

Unit reference number: H/600/5446

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out grinding operations, using machines such as horizontal or vertical surface grinding, external cylindrical, internal cylindrical, centreless, profile or thread grinding machines, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to grind a range of components that combine a number of different features, such as parallel faces, flat faces, vertical faces, parallel, diameters, stepped diameters, tapered diameters, shoulders and faces, bores and counterbores, different thread forms and profiles.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate grinding machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that grinding wheels are maintained correctly dressed/formed and are in a usable condition • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 operate one of the following types of grinding machine: • horizontal surface • vertical surface • external cylindrical • internal cylindrical			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• universal • centreless • thread grinding • profile grinding 1.7 produce ground components which include three of the following features, as applicable to the type of machine used: • 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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• left hand threads • right hand threads • single start threads • multi-start threads • internal threads • external threads • angular faces			
1b Operate grinding machines (continued)	1.8 produce components with dimensional accuracy, form and surface texture within all the following standards as is applicable to the operations performed: • tolerance to BS 4500 or BS 1916 grade 5 • surface texture 8µin or 0.2µm • angles within +/- 0.5 degree • components to be free from false grinding cuts, burrs and sharp edges 1.9 grind components made from one of the following types of material: • ferrous • non-ferrous • non-metallic			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.10 carry out quality sampling checks at suitable intervals 1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • dimensions • parallelism • squareness • profile • concentricity • thread form • surface texture • angle/taper • ovality/lobbing 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to operate grinding machines	2.1 describe the safe working practices and procedures to be followed while operating grinding machines 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both hand and power modes 2.4 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the hazards associated with operating grinding machines and carrying out the grinding operations (such as moving machine parts, sparks/airborne particles, bursting grinding wheels, insecure workpiece), and how to minimise them and reduce any risks 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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 use imperial and metric systems of measurement 2.11 describe the main features of the grinding machine, and the accessories that can be used			
2b Know how to operate grinding machines (continued)	2.12 describe the various grinding operations that can be performed, and the methods and equipment used 2.13 describe the effects of backlash in machine slides and screws, and how this can be overcome 2.14 describe the application of roughing and finishing cuts, and the effect on wheel life, surface finish and dimensional accuracy 2.15 explain how to dress and reshape grinding wheels, and the equipment to be used 2.16 describe the application of cutting fluids with regard to a range of different materials 2.17 describe the effects of clamping the workpiece in/on a chuck/workholding device, and how this can cause distortion in the finished components			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.18 explain how to recognise machining faults and identify when wheels need dressing 2.19 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.20 describe the problems that can occur with the grinding activities, and how these can be overcome 2.21 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 11: Operating special-purpose machines

Unit reference number: A/600/5453

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out machining operations on special-purpose machines, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce components relevant to the special-purpose machine's capabilities and to the required specifications.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate special-purpose machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 produce machined components covering two of the following operations: • turning • drilling • milling • grinding • erosion • other special operations			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Operate special-purpose machines (continued)	1.7 produce components which combine different operations and cover six of the following: • flat faces • parallel faces • square faces • angular faces • slots • parallel diameters • tapered diameters • stepped diameters • bores • counterbores • drilled holes • tapped holes • reamed holes • profiles • special finishes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.8 machine components made from one of the following types of material: • ferrous • non-ferrous • non-metallic 1.9 produce components with dimensional accuracy, form and surface texture within all of the following quality and accuracy standards, as is 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 9 • surface finish 63µin or 1.6µm • bored or reamed holes within H8 • screw threads BS medium fit • angles within +/- 1 degree 1.10 carry out quality sampling checks at suitable intervals			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • diameters • lengths • depths • hole size/fit • thread fit • angles • surface finish • profile 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate special-purpose machines	2.1 describe the safe working practices and procedures to be followed while operating special-purpose machines 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.3 describe the operation of the machine controls in both hand and power modes (including rapid power, where appropriate) 2.4 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the hazards associated with operating special-purpose machinery and carrying out the machining operations, and how to minimise them and reduce any risks 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 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 use imperial and metric systems of measurement			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2b Know how to operate special-purpose machines (continued)	2.11 describe the main features of the special-purpose machine, and the accessories that are to be used 2.12 describe the various operations that can be performed on the machine, and the methods and equipment used 2.13 describe the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy 2.14 describe the application of cutting fluids with regard to a range of different materials 2.15 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components 2.16 explain how to recognise machining faults, and how to identify when tools need re-sharpening 2.17 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.18 describe the problems that can occur with special-purpose machining activities, and how these can be overcome 2.19 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

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Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 12: Operating gear cutting machines

Unit reference number: D/600/5459

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out gear cutting operations, in accordance with approved procedures, using machines such as gear hobbing, gear shaping, gear shaving, gear planing, bevel gear cutting. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce a range of components that combine a number of different features, such as spur gears, helical and double helical gears, bevel gears, chain sprockets, external splines and serrations.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate gear cutting machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 operate one type of gear cutting machine from the following: • gear hobbing • gear shaping • bevel gear cutting • gear planning • gear shaving			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.7 produce one of the following types of machined gears: • external spur gear • internal spur gear • single helical gear • double helical gear • chain sprockets • serrations • splines • straight bevel gears			
1b Operate gear cutting machines (continued)	1.8 machine gears made from one of the following types of material: • ferrous • non-ferrous • non-metallic 1.9 produce components with dimensional accuracy, form and surface texture within all of the following quality and accuracy standards, as is applicable to the operations performed: • components to be free from false tool cuts, burrs and sharp edges			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• straight splines and serrations to BS 2059 or BS 1953 class 1 • spur and helical gears to BS 436 Pt 1 or BS 1967 • involute splines to BS 3550 1963 class 1 • tolerance to BS 4500 or BS1916 grade 9 • surface texture 63µin or 1.6µm 1.10 carry out quality sampling checks at suitable intervals 1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • gear blanks • lead and helix angle • gear tooth thickness • involute form • composite error rolling test • surface texture • concentricit 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to operate gear cutting machines	2.1 describe the safe working practices and procedures to be followed while operating gear cutting machines 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both hand and power modes (including rapid power, where appropriate) 2.4 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the hazards associated with operating gear cutting machines and carrying out the gear cutting operations, and how to minimise them and reduce any risks 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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 use imperial and metric systems of measurement 2.11 describe the main features of the gear cutting machine, and the accessories that can be used			
2b Know how to operate gear cutting machines (continued)	2.12 describe the various gear cutting operations that can be performed, and the methods and equipment used 2.13 describe the effects of backlash in machine slides and screws, and how this can be overcome 2.14 explain how to handle and store tools safely and correctly 2.15 describe the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy 2.16 describe the application of cutting fluids with regard to a range of different materials 2.17 describe the effects of clamping the workpiece on a workholding device, and how this can cause distortion in the finished components			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.18 explain how to recognise machining faults, and how to identify when wheels need dressing 2.19 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.20 describe the problems that can occur with the gear cutting activities, and how these can be overcome 2.21 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 13: Operating electro-discharge machines

Unit reference number: K/600/5464

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out machining operations on an electro-discharge machine, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce a range of component shapes, such as internal and external profiles that have flat, square, parallel and tapered faces, square/rectangular forms, concave and convex forms, holes, slots, radii/arcs, cavities and special forms.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate electro-discharge machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 operate one of the following types of electro-discharge machine: • spark erosion • wire erosion 1.7 produce machined components which include four of the following features: • flat faces • square faces • parallel faces			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• threads • concave forms • convex forms • holes • engraving • profile forms • cavities • radii/arcs • slots • square/rectangular forms • angular faces • other special features			
1b Operate electro-discharge machines (continued)	1.8 produce components with dimensional accuracy, form and surface texture within all the relevant quality and accuracy standards as is applicable to the operations performed: • components to be free from false starts and sharp edges • tolerance to BS 4500 or BS 1916 grade 9 • surface texture 32µin or 0.8µm or 18VDI			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.9 machine components made from one of the following types of material: • ferrous • non-ferrous 1.10 carry out quality sampling checks at suitable intervals 1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • dimensions • parallelism • angle/taper • squareness • surface texture • profile 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to operate electro-discharge machines	2.1 describe the safe working practices and procedures to be followed while operating electro-discharge machines 2.2 describe the hazards associated with the operating electro-discharge machines and carrying out the machining operations (such as moving machine parts, electrical components, handling dielectrics, fumes), and how to minimise them and reduce any risks 2.3 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.4 describe the operation of the machine controls in both hand and power modes (including rapid power, where appropriate) 2.5 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.6 describe the personal protective equipment to be worn, and where this can be obtained 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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 use imperial and metric systems of measurement 2.11 describe the main features of the electro-discharge machine being used, and the accessories that can be used			
2b Know how to operate electro-discharge machines (continued)	2.12 describe the various erosion operations that can be performed, and the methods and equipment used 2.13 describe the effects of backlash in machine slides and screws, and how this can be overcome 2.14 explain how to handle and store electrodes and wires safely and correctly 2.15 describe the application of roughing and finishing cuts, and the effect on electrode life, surface finish and dimensional accuracy 2.16 describe the application of dielectric fluid with regard to a range of different materials 2.17 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.18 explain how to recognise machining faults, and how to identify when electrodes need changing 2.19 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.20 describe the problems that can occur with the electro-discharge machining activities, and how these can be overcome 2.21 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 14: Operating honing and lapping machines

Unit reference number: M/600/5479

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out machining operations on a honing or lapping machine, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to hone/lap a range of components, which will include through holes, blind holes and flat surfaces.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate honing and lapping machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 operate one of the following types of honing or lapping machine: • horizontal honing • vertical honing • rotary disc lapping • reciprocating machines			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.7 either – rough, finish and polish components which includes two of the following for honing machines: • through holes • blind holes • tapered holes or - rough, finish and polish components which includes two of the following for lapping machines: • flat faces • parallel faces • angular faces			
1b Operate honing and lapping machines (continued)	1.8 produce components with dimensional accuracy, form and surface texture within all of the following standards: • tolerance to BS 4500 or BS 1916 grade 5 • surface texture 8µin or 0.2µm • components to be free from stone/disc marks, burrs and sharp edges 1.9 hone and lap components made from one of the following types of material: • ferrous • non-ferrous			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.10 carry out quality sampling checks at suitable intervals 1.11 either – carry out all of the following checks, during production, for accuracy when using honing machines: • dimensions • parallelism • surface texture • ovality/lobbing or – carry out all of the following checks, during production, for accuracy when using lapping machines: • dimensions • parallelism • surface texture • flatness 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to operate honing and lapping machines	2.1 describe the safe working practices and procedures to be followed while operating honing and lapping machines 2.2 describe the hazards associated with the operating honing and lapping machines and carrying out the honing and lapping operations (such as moving machine parts, airborne particles, insecure workpiece), and how to minimise them and reduce any risks 2.3 describe the safety mechanisms on the machine and the procedure for checking that they function correctly 2.4 describe the operation of the machine controls in both hand and power modes (including rapid power, where appropriate) 2.5 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.6 describe the personal protective equipment to be worn, and where this can be obtained 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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 use imperial and metric systems of measurement 2.11 describe the main features of the honing and lapping machine used, and the accessories that can be used			
2b Know how to operate honing and lapping machines (continued)	2.12 describe the various honing or lapping operations that can be performed, and the methods and equipment used 2.13 describe the effects of backlash in machine slides and screws, and how this can be overcome 2.14 explain how to handle and store honing and lapping stones and equipment safely and correctly 2.15 describe the application of roughing and finishing cuts, and the effect on stone life, surface finish and dimensional accuracy 2.16 explain how to adjust the equipment, to correct taper in bores and achieve workpiece tolerances 2.17 describe the application of cutting fluids with regard to a range of different materials			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.18 describe the effects of clamping the workpiece, and how this can cause distortion in the finished components 2.19 explain how to recognise honing and lapping faults, and how to identify when the stones need replacing 2.20 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.21 describe the problems that can occur with the honing and lapping activities, and how these can be overcome 2.22 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 15: Operating broaching machines

Unit reference number: L/600/6008

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out machining operations on a broaching machine, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce a range of components that cover a number of different features, such as keyways, square holes, hexagonal and octagonal holes, holes with a single flat-side, splines, serrations and special forms.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate broaching machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 operate one type of broaching machine from the following: • horizontal broaching machine • vertical broaching machine 1.7 produce machined components which cover three of the following: • keyways • flat-sided holes • square holes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• hexagonal holes • octagonal holes • splines • serrations • other/special forms			
1b Operate broaching machines (continued)	1.8 machine components made from one type of material from the following: • ferrous • non-ferrous • non-metallic 1.9 produce components with dimensional accuracy, form and surface texture within all of the following quality and accuracy standards: • dimensional tolerance equivalent to BS 4500 or BS 1916 grade 9 • surface finish 63 µin or 1.6 µm • components to be free from false tool cuts, burrs and sharp edges 1.10 carry out quality sampling checks at suitable intervals			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • dimensions • squareness • spline/serration fit • surface finish • keyway width • keyway position 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate broaching machines	2.1 describe the safe working practices and procedures to be followed while operating broaching machines 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 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 personal protective equipment to be worn, and where this can be obtained			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.5 describe the hazards associated with the broaching operations (such as moving parts of machines, handling broaches, handling cutting oils, insecure components, breakages of broaches), and how to minimise them and reduce any risk 2.6 describe the importance of keeping the work area clean and tidy 2.7 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 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 use imperial and metric systems of measurement			
2b Know how to operate broaching machines (continued)	2.10 describe the various broaching techniques that can be used to produce the required shapes, and the types of broaches used (roughing and finishing broaches, high speed steel and tipped broaches) 2.11 explain how to handle and store broaches safely and correctly 2.12 describe the application of cutting fluids with regard to a range of different materials			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.13 describe the effects of clamping the workpiece, and how this can cause distortion in the finished components 2.14 explain how to recognise broaching faults, and how to identify when tools need re-sharpening 2.15 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.16 describe the problems that can occur with the broaching activities, and how these can be overcome 2.17 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 16: Operating shaping, planing or slotting machines

Unit reference number: R/600/6012

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out machining operations on a shaping, planing or slotting machine, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce a range of components that cover a number of different features, such as parallel faces, flat faces, faces that are square to each other, angular faces, steps, slots, keyways, flat sided holes, splines and serrations, as applicable to the machine used.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate shaping, planing or slotting machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 operate one type of machine from the following: • shaping • planing • slotting • milling machine with slotting attachment 1.7 produce machined components which combine different operations and cover four of the following: • flat faces • faces that are square to each other			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• parallel faces • steps/shoulders • angular faces • slots/grooves • special forms • keyways • flat-sided holes (such as square, hexagonal) • splines • serrations			
1b Operate shaping, planing or slotting machines (continued)	1.8 machine components made from one type of material from the following: • ferrous • non-ferrous • non-metallic 1.9 produce components with dimensional accuracy, form and surface within all the relevant quality and accuracy standards as is 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 9			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• flatness and squareness within 0.005” per inch or 0.125 mm per 25 mm • surface finish 63 µin or 1.6 µm • angles within +/- 1 degree 1.10 carry out quality sampling checks at suitable intervals 1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • dimensions • squareness • angles • flatness • spline or serration fit • surface finish • slot or recess width and position • keyway position 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to operate shaping, planing or slotting machines	2.1 describe the safe working practices and procedures to be followed while operating shaping, planing or slotting machines 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both hand and power modes (including rapid power, where appropriate) 2.4 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the hazards associated with operating shaping, planing or slotting machines and with the operations carried out, and how to minimise them and reduce any risks 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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 use imperial and metric systems of measurement 2.11 describe the main features of the shaping, planing or slotting machine used, and the accessories that can be used			
2b Know how to operate shaping, planing or slotting machines (continued)	2.12 describe the various operations that can be performed on the machine, and the methods and equipment used 2.13 describe the effects of backlash in machine slides and screws, and how this can be overcome 2.14 explain how to handle and store tools safely and correctly 2.15 describe the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy 2.16 describe the application of cutting fluids with regard to a range of different materials 2.17 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.18 explain how to recognise machining faults, and how to identify when tools need re-sharpening 2.19 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.20 describe the problems that can occur with the machining activities, and how these can be overcome 2.21 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 17: Operating gear grinding machines

Unit reference number: D/600/6014

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out gear grinding operations, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to grind a range of components that cover a number of different features, such as spur gears, helical and double helical gears, bevel gears and splines.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate gear grinding machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 operate one of the following types of gear grinding machine: • gear grinding using formed wheels • gear grinding by generation 1.7 finish grind two of the following types of gears, as applicable to the machine type: • external spur gear • internal spur gear • single helical gear			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• double helical gear • bevel gears • straight splines • involute splines • tip and root relief			
1b Operate gear grinding machines (continued)	1.8 grind gears made from one of the following types of material: • ferrous • non-ferrous • non-metallic 1.9 produce components with dimensional accuracy, form and surface texture within all the relevant quality and accuracy standards: • dimensional tolerance equivalent to BS 4500 grade 5 or BS 1916 • surface texture 16 µin or 0.4 µm • components to be free from false grinding cuts, burrs and sharp edges 1.10 carry out quality sampling checks at suitable intervals			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.11 carry out the necessary checks, during production, for accuracy of three of the following: • gear tooth profile • lead and pitch • gear tooth thickness • involute form • concentricity • surface texture 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate gear grinding machines	2.1 describe the safe working practices and procedures to be followed while operating gear grinding machines 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both hand and power modes (including rapid power, where appropriate)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.4 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the hazards associated with operating gear grinding machines and the gear grinding operations, and how to minimise them and reduce any risks 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 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 use imperial and metric systems of measurement			

2b	Know how to operate gear grinding machines (continued)	2.11	describe the main features of the gear grinding machines, and the accessories that can be used		
		2.12	describe the various gear grinding operations that can be performed, and the methods and equipment used		
		2.13	describe the effects of backlash in machine slides and screws, and how this can be overcome		
		2.14	describe the application of roughing and finishing cuts, and the effect on wheel life, surface finish and dimensional accuracy		
		2.15	describe the application of cutting fluids with regard to a range of different materials		
		2.16	describe the effects of clamping the workpiece in a workholding device, and how this can cause distortion in the finished components		
		2.17	explain how to recognise machining faults, and how to identify when wheels need dressing		
		2.18	describe the quality control procedures that are used, inspection checks to be carried out, and the equipment that will need to be used		
		2.19	describe the problems that can occur with the gear grinding activities, and how these can be overcome		
		2.20	describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve		

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 18: Operating power presses

Unit reference number: K/600/6016

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out press operations on a power press, in accordance with approved procedures. The learner will confirm with the press setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce a range of components that cover a number of different features, such as blanking, piercing, cropping, shearing, bending, forming, cupping, rolling, planishing, flattening, coining and notching, as applicable to the power press being used.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate power presses	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 manipulate the machine tool controls safely and correctly in line with operational procedures 1.4 produce components to the required quality and within the specified dimensional accuracy 1.5 apply all of the following during the machining 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 • confirm with the press setter that the press is ready for production • where appropriate, seek any necessary instruction/training on the operation of the press			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that the power press guards are in place and are correctly adjusted • ensure that materials are correctly located and positioned • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that press settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 operate one of the following types of power press: • single action • multiple action 1.7 produce pressed components which cover four of the following operations: • blanking • piercing • cropping/shearing			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• bending • cupping • rolling • planishing/flattening • embossing • coining • notching • forming • assembling • other operations			
1b Operate power presses (continued)	1.8 produce components made from one type of material from the following: • ferrous • non-ferrous • non-metallic 1.9 produce components within all the relevant quality and accuracy standards: • components meet drawing, specification, template or job requirements • components meet customer requirements			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• components have the required dimensional accuracy within specified tolerances • components are free from false tool marks, excessive burrs and sharp edges • components are free from surface damage and deformity and have an acceptable appearance 1.10 carry out quality sampling checks at suitable intervals 1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of two of the following: • dimensions • squareness • flatness • form/profile • security of assembled parts 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to operate power presses	2.1 describe the safe working practices and procedures to be followed while operating power presses 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both hand and power modes (including rapid power, where appropriate) 2.4 explain how to stop the machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the hazards associated with operating power presses and with the operations carried out, and how to minimise them and reduce any risks 2.7 describe the importance of keeping the work area clean and tidy 2.8 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be pressed			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	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 use imperial and metric systems of measurement			
2b Know how to operate power presses (continued)	2.11 describe the main features of the power press being used, and the accessories that can be used 2.12 describe the various operations that can be performed on the press, and the methods and equipment used 2.13 explain how to handle and store tools safely and correctly 2.14 describe the application of lubricants to assist pressing operations 2.15 describe the effects of clamping the workpiece in a workholding device, and how this can cause distortion in the material being pressed 2.16 explain how to handle and store a components safely and correctly 2.17 explain how to recognise machining faults, and how to identify when tools need re-sharpening			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.18 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.19 describe the problems that can occur with the power press activities, and how these can be overcome 2.20 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 19: Operating CNC turning machines

Unit reference number: M/600/6020

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out turning operations, in accordance with approved procedures, using Computer Numerical Control (CNC) machines, or CNC machining centres. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. In operating the machine, the learner will be expected to follow the correct procedures for calling up the operating program, dealing with any error messages and executing the program activities safely and correctly.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate CNC turning machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up and ready for operation 1.3 check all of the following to confirm that the machine is ready for operation: • 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• check that the operating program is at the correct start point and the workpiece is clear of the machine spindle • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.4 follow the defined procedures for starting and running the operating system 1.5 operate one of the following CNC turning machines: • CNC lathe • CNC machining centre 1.6 produce machined components which combine different operations and cover six of the following features: • parallel diameters • stepped diameters			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• 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			
1b Operate CNC turning machines (continued)	1.7 machine one of the following types of material: • ferrous • non-ferrous • non-metallic			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.8 produce components with dimensional accuracy, form and surface texture within all the relevant quality and accuracy standards, as applicable to the operations performed: • dimensional tolerance equivalent to BS 4500 or BS 1916 grade 9 • surface finish 63 µin or 1.6 µm • reamed and bored holes within H8 • angles within +/- 0.5 degree • screw threads BS medium fit 1.9 deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved 1.10 monitor the computer process and ensure that the production output is to the required specification 1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • diameters • hole size/fit • angle/taper • lengths/depths			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• surface finish • thread fit 1.12 shut down the equipment to a safe condition on conclusion of the activities			
2a Know how to operate CNC turning machines	2.1 describe the safe working practices and procedures to be followed while operating CNC lathes 2.2 describe the safety mechanisms on the CNC turning machine, and the procedure for checking that they function correctly 2.3 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 and reduce any risks 2.4 describe the personal protective equipment to be worn, and where this can be obtained 2.5 describe the importance of keeping the work area clean and tidy 2.6 describe the main features of the CNC turning machine, and the accessories that can be used 2.7 describe the various CNC turning operations that can be performed, and the methods and equipment used			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.8 describe the operation of the various hand and automatic modes of machine control (such as hand wheels, joysticks, program operating and control buttons) 2.9 explain how to stop the CNC lathe in both normal and emergency situations, and the procedure for restarting after an emergency 2.10 explain how to use the visual display and understand the various messages displayed 2.11 describe the function of error messages, and what to do when an error message is displayed			
2b Know how to operate CNC turning machines (continued)	2.12 explain how to find the correct restart point in the program when the machine has been stopped before completion of the program 2.13 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 2.14 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 2.15 explain how to use imperial and metric systems of measurement			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.16 describe the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy 2.17 describe the application of cutting fluids with regard to a range of different materials 2.18 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components 2.19 explain how to recognise CNC turning faults, and how to identify when tools need re-sharpening/replacing 2.20 describe the quality control procedures that are used, inspection checks to be carried out, and the equipment that will need to be used 2.21 describe the problems that can occur with the CNC turning activities, and how these can be overcome 2.22 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 20: Operating CNC milling machines

Unit reference number: D/600/6031

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to operate Computer Numerical Control (CNC) three-axis or multi-axis machines, or CNC machining centres, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. In operating the machine, the learner will be expected to follow the correct procedures for calling up the operating program, dealing with any error messages and executing the program activities safely and correctly. The learner will be expected to produce a range of components that combine a number of different features, such as flat faces, angled faces, internal and external profiles, slots, steps, holes which are linearly or radially pitched, and special profiles such as convex or concave.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate CNC milling machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up and ready for operation 1.3 confirm that the machine is ready for operation by checking all of the following: • 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• check that the operating program is at the correct start point and the workpiece is clear of the machine spindle • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.4 follow the defined procedures for starting and running the operating system 1.5 operate one of the following CNC milling machines: • CNC three-axis milling machine • CNC multi-axis milling machine • CNC machining centre 1.6 produce machined components which combine different operations and cover six of the following: • flat faces • steps/shoulders			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• enclosed slots/recesses • internal profiles • holes on pitched circles • parallel faces • angular faces • open ended slots • external profiles • holes linearly pitched • circular/curved profiles • tapped holes • special forms (such as concave, convex) • faces that are square to each other			
1b Operate CNC milling machines (continued)	1.7 machine components made from one of the following types of material: • ferrous • non-ferrous • non-metallic			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.8 produce components with dimensional accuracy, form and surface texture within all the relevant quality and accuracy standards as is applicable to the operations performed: • dimensional tolerance equivalent to BS 4500 or BS 1916 grade 9 • surface finish 63 µin or 1.6 µm • reamed and bored holes within H 8 • flatness and squareness within 0.001" per inch or 0.025 mm per 25 mm • angles within +/- 0.5 degree 1.9 deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved 1.10 monitor the computer process and ensure that the production output is to the required specification 1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • dimensions • squareness • hole size/fit • surface finish			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• angles • flatness • slots • recesses 1.12 shut down the equipment to a safe condition on conclusion of the activities			
2a Know how to operate CNC milling machines	2.1 describe the specific safety precautions to be taken when working with CNC milling machines and equipment 2.2 describe the safety mechanisms on the machine, and the procedures for checking that they are operating correctly 2.3 explain how to start and stop the machine in both normal and emergency situations and the procedure for restarting after an emergency 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, hot and airborne metal particles), and how to minimise them and reduce any risks 2.5 describe the importance of wearing the appropriate protective clothing and equipment, and of keeping the work area clean and tidy			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.6 describe the personal protective equipment to be worn, and where this can be obtained 2.7 describe the main features of the CNC milling machine, and the accessories that can be used 2.8 describe the various CNC milling operations that can be performed, and the methods and equipment used 2.9 describe the operation of the various hand and automatic modes of machine control (such as hand wheels, joysticks, program operating and control buttons) 2.10 explain how to use the visual display and understand the various messages displayed 2.11 describe the function of error messages, and what to do when an error message is displayed			
2b Know how to operate CNC milling machines (continued)	2.12 explain how to find the correct restart point in the program when the machine has been stopped before completion of the program 2.13 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 2.14 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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.15 explain how to use imperial and metric systems of measurement 2.16 describe the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy 2.17 describe the application of cutting fluids with regard to a range of different materials 2.18 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components 2.19 explain how to recognise CNC milling faults, and how to identify when tools need re-sharpening/replacing 2.20 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.21 describe the problems that can occur with the CNC milling activities, and how these can be overcome 2.22 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 21: Operating CNC grinding machines

Unit reference number: H/600/6032

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out grinding operations, in accordance with approved procedures, using Computer Numerical Control (CNC) machines, such as universal grinding machines, gear grinding machines, thread grinding machines, ring grinding machines and grinding machining centres. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. In operating the machine, the learner will be expected to follow the correct procedures for calling up the operating program, dealing with any error messages and executing the program activities safely and correctly.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate CNC grinding machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up and ready for operation 1.3 confirm that the machine is ready for operation by checking all of the following: • 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• check that the operating program is at the correct start point and the workpiece is clear of the machine spindle • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.4 follow the defined procedures for starting and running the operating system 1.5 operate one of the following CNC grinding machines: • CNC universal grinder • CNC gear grinder • CNC grinding machining centre • CNC thread grinder • other specific CNC grinding machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.6 produce ground components which cover four of the following, as applicable to the machine type used: • 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			
1b Operate CNC grinding machines (continued)	1.7 machine one type of material from the following: • ferrous • non-ferrous • non-metallic			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.8 produce component with dimensional accuracy, form and surface texture within all of the following quality and accuracy standards as is applicable to the operations performed: • dimensional tolerance equivalent to BS 4500 or BS 1916 grade 7 • flatness and squareness within 0.0005” per inch or 0.0125 mm per 25 mm • angles within +/- 0.5 degree • surface finish 16 µin or 0.8 µm • ground bores/holes within H8 • screw threads BS medium fit 1.9 deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved 1.10 monitor the computer process and ensure that the production output is to the required specification 1.11 use appropriate gauges or instruments to carry out the necessary checks for accuracy, during production, of three of the following: • dimensions • parallelism • squareness			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• profile • concentricity • thread form • surface texture • angle/taper • ovality/lobbing • hole size 1.12 shut down the equipment to a safe condition on conclusion of the activities			
2a Know how to operate CNC grinding machines	2.1 describe the safe working practices and procedures to be followed while operating CNC grinding machines 2.2 describe the safety mechanisms on the CNC grinding machine, and the procedure for checking that they function correctly 2.3 explain how to stop the CNC grinding machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.4 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 risk			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the importance of keeping the work area clean and tidy 2.7 describe the operation of the various hand and automatic modes of machine control (such as hand wheels, joysticks, program operating and control buttons) 2.8 explain how to use the visual display and understand the various messages displayed 2.9 describe the function of error messages, and what to do when an error message is displayed 2.10 explain how to find the correct restart point in the program when the machine has been stopped before completion of the program 2.11 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 2.12 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			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2b Know how to operate CNC grinding machines (continued)	2.13 explain how to use imperial and metric systems of measurement 2.14 describe the main features of the CNC grinding machine, and the accessories that can be used 2.15 describe the various CNC grinding operations that can be performed, and the methods and equipment used 2.16 explain how to handle and store grinding wheels safely and correctly 2.17 describe the application of roughing and finishing cuts, and the effect on wheel life, surface finish and dimensional accuracy 2.18 describe the application of cutting fluids with regard to a range of different materials 2.19 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components 2.20 explain how to recognise CNC grinding machining faults, and identify when adjustments need to be made 2.21 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.22 describe the problems that can occur with the CNC grinding activities, and how these can be overcome 2.23 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 22: Operating CNC punching machines

Unit reference number: K/600/6033

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out pressing and punching operations, in accordance with approved procedures, using Computer Numerical Control (CNC) machines. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. In operating the machine, the learner will be expected to follow the correct procedures for calling up the operating program, dealing with any error messages and executing the program activities safely and correctly. The learner will be expected to produce a range of components that cover a number of different features, such as linearly pitched holes, radially pitched holes, internal square/rectangular profiles, curved/circular profiles, swages, louvres, forms and profiles.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate CNC punching machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up and ready for operation 1.3 confirm that the machine is ready for operation by checking all of the following: • 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• check that the operating program is at the correct start point and the workpiece is clear of the machine spindle • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.4 follow the defined procedures for starting and running the operating system 1.5 operate one of the following CNC punching machines: • CNC punching machine • CNC fabrication machining centre for punching operations 1.6 produce components which cover four of the following features: • holes linearly pitched			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• holes radially pitched • square/rectangular profiles • curved profiles • swages • louvers • other applications			
1b Operate CNC punching machines (continued)	1.7 machine one of the following types of material: • ferrous • non-ferrous • special alloys 1.8 produce components within all of the following quality and accuracy standards: • dimensional tolerance equivalent to BS 4500 or BS 1916 grade 9 • components to be free from deformity, burrs and sharp edges 1.9 deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved 1.10 monitor the computer process and ensure that the production output is to the required specification			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • dimensions of punched features • position of features • hole positions linearly pitched • hole positions radially pitched • accuracy of profiles • flatness/freedom from excessive distortion • accuracy of louvres and swages 1.12 shut down the equipment to a safe condition on conclusion of the activities			
2a Know how to operate CNC punching machines	2.1 describe the safe working practices and procedures to be followed while operating CNC pressing/punching machines 2.2 describe the safety mechanisms on the CNC pressing/punching machine, and the procedure for checking that they function correctly 2.3 describe the hazards associated with working on CNC punching machines (such as moving machinery, automatic machine operation, lifting and handling sheet materials), and how to minimise them and reduce any risks			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.4 explain how to stop the CNC pressing/punching machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the importance of keeping the work area clean and tidy 2.7 describe the operation of the various hand and automatic modes of machine control (such as hand wheels, joysticks, program operating and control buttons) 2.8 explain how to use the visual display and understand the various messages displayed 2.9 describe the function of error messages, and what to do when an error message is displayed 2.10 explain how to find the correct restart point in the program when the machine has been stopped before completion of the program			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2b Know how to operate CNC punching machines (continued)	2.11 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 2.12 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 2.13 explain how to use imperial and metric systems of measurement 2.14 describe the main features of the CNC pressing/punching machine, and the accessories that can be used 2.15 describe the various CNC pressing/punching operations that can be performed, and the methods and equipment used 2.16 describe the effects of clamping the workpiece in a workholding device, and how this can cause distortion in the finished components 2.17 explain how to recognise CNC pressing/punching faults, and how to identify when tools need re-sharpening, replacing or adjustments are required 2.18 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.19 describe the problems that can occur with the CNC pressing/punching activities, and how these can be overcome 2.20 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 23: Operating CNC laser profiling machines

Unit reference number: M/600/6034

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out cutting and profiling operations using Computer Numerical Control (CNC) laser profiling machines, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. In operating the machine, the learner will be expected to follow the correct procedures for calling up the machine-operating program, dealing with any error messages and executing the program activities safely and correctly. The learner will be expected to produce a range of components that cover a number of different features, such as square and rectangular profiles, angular profiles, curved profiles, circles, holes linearly positioned, holes radially positioned, slots and grooves.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate CNC laser profiling machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up and ready for operation 1.3 confirm that the machine is ready for operation by checking all of the following: • 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • check that the laser lens is clean and in a suitable condition			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• check that the operating program is at the correct start point • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.4 follow the defined procedures for starting and running the operating system 1.5 produce machined components which cover four of the following features: • square/rectangular profiles • angular profiles • curved profiles • circles • ellipses • holes linearly positioned			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• holes radially positioned • slots and apertures • other features 1.6 machine one of the following types of material: • ferrous • non-ferrous • stainless/alloy steel • non-metallic			
1b Operate CNC laser profiling machines (continued)	1.7 produce component within all of the following quality and accuracy standards: • dimensional tolerance equivalent to BS 4500 or BS 1916 grade 7 • angles within +/- 0.5 degree • surface texture within 63 µin or 1.6 µm 1.8 deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved 1.9 monitor the computer process and ensure that the production output is to the required specification			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.10 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • dimensions • position of features • holes positioned linearly • holes positioned radially • angles • profiles • flatness/freedom from distortion 1.11 shut down the equipment to a safe condition on conclusion of the activities			
2a Know how to operate CNC laser profiling machines	2.1 describe the safe working practices and procedures to be observed when 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 stop the CNC laser cutting machines in both normal and emergency situations, and the procedure for restarting after an emergency			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.3 describe the hazards associated with laser profiling machines (dangers from the high-power laser beam; live electrical components; moving parts of machinery), and how to minimise them and reduce any risks 2.4 describe the personal protective equipment to be worn, and where this can be obtained 2.5 describe the importance of keeping the work area clean and tidy 2.6 describe the main features of the CNC laser cutting, and the accessories that can be used 2.7 describe the various CNC machining operations that can be performed, and the methods and equipment used 2.8 describe the operation of the various hand and automatic modes of machine control (such as hand wheels, joysticks, program operating and control buttons) 2.9 explain how to use the visual display and understand the various messages displayed 2.10 describe the function of error messages, and what to do when an error message is displayed			
2b Know how to operate CNC laser profiling machines (continued)	2.11 explain how to find the correct restart point in the program when the machine has been stopped before completion of the program			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.12 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 2.13 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 2.14 explain how to use imperial and metric systems of measurement 2.15 describe the effects of clamping the workpiece in a workholding device, and how this can cause distortion in the finished components 2.16 explain how to recognise CNC laser cutting faults, and how to identify when actions need to be taken 2.17 describe the quality control procedures that are used, inspection checks to be carried out, and the equipment that will need to be used 2.18 describe the problems that can occur with the CNC laser cutting activities, and how these can be overcome 2.19 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 24: Operating CNC electro-discharge machines

Unit reference number: F/600/6037

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to operate Computer Numerical Control (CNC) electro-discharge machines, such as spark erosion and wire erosion machines, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be expected to produce a range of components that cover a number of different features, such as flat, tapered and angled faces, internal and external profiles, parallel and tapered slots and steps, parallel and tapered holes which are linearly or radially pitched.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate CNC electro-discharge machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up and ready for operation 1.3 confirm that the machine is ready for operation by checking all of the following: • 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion • ensure that the dielectric fluid is at an appropriate level			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• check that the operating program is at the correct start point • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.4 follow the defined procedures for starting and running the operating system 1.5 operate one of the following CNC electro-discharge machines: • CNC spark erosion machine • CNC wire erosion machine • CNC electro-discharge machining centre 1.6 produce machined components which cover six of the following: • flat faces			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• 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 pitched circles • linear holes (rows, angles) • special profiles (eg, concave, convex) • parallel and tapered steps/slots/shoulders • circular/curved profiles (internal and external) • other special forms or features			
1b Operate CNC electro-discharge machines (continued)	1.7 machine components made from one of the following types of material: • ferrous based • non-ferrous based			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.8 produce components with dimensional accuracy, form and surface texture within all of the following quality and accuracy standards as is applicable to the operations performed: • dimensional tolerance equivalent to BS 4500 or BS 1916 grade 7 • flatness and squareness within 0.001” per inch or 0.025mm per 25mm • components to be free from false starts, and sharp edges • angles within +/- 0.5 degree • machined holes within H 8 • surface finish 32 µin; 0.8 µm; 18 VDI 1.9 deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved 1.10 monitor the computer process and ensure that the production output is to the required specification 1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • dimensions • position			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• parallelism • angle/taper • squareness • surface texture • profile 1.12 shut down the equipment to a safe condition on conclusion of the activities			
2a Know how to operate CNC electro-discharge machines	2.1 describe the safe working practices and procedures to be followed while operating CNC electro-discharge machines 2.2 describe the safety mechanisms on the CNC electro-discharge machine, and the procedure for checking that they function correctly 2.3 explain how to stop the CNC electro-discharge machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.4 describe the hazards associated with the electro-discharge machining operations (such as moving machine parts, electrical components, handling dielectrics, fumes), and how to minimise them and reduce any risks 2.5 describe the personal protective equipment to be worn, and where this can be obtained			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.6 describe the importance of keeping the work area clean and tidy 2.7 describe the main features of the CNC electro-discharge machines, and the accessories that can be used 2.8 describe the various CNC electro-discharge operations that can be performed, and the methods and equipment used 2.9 describe the operation of the various hand and automatic modes of machine control (such as hand wheels, joysticks, program operating and control buttons) 2.10 explain how to use the visual display and understand the various messages displayed 2.11 describe the function of error messages, and what to do when an error message is displayed			
2b Know how to operate CNC electro-discharge machines (continued)	2.12 explain how to find the correct restart point in the program when the machine has been stopped before completion of the program 2.13 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.14 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 2.15 explain how to use imperial and metric systems of measurement 2.16 describe the application of dielectric and ionised fluids with regard to a range of different materials 2.17 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components 2.18 explain how to recognise CNC electro-discharge machining faults, and when actions need to be taken 2.19 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.20 describe the problems that can occur with the CNC electro-discharge machining activities, and how these can be overcome 2.21 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 25: Operating CNC gear cutting machines

Unit reference number: J/600/6038

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out gear cutting operations, in accordance with approved procedures, using Computer Numerical Control (CNC) machines. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. In operating the machine, the learner will be expected to follow the correct procedures for calling up the operating program, dealing with any error messages and executing the program activities safely and correctly. The learner will be expected to produce a range of components that combine a number of different features, such as internal and external spur gears, helical gears, involute splines, straight splines, serrations, racks and bevel gears.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate CNC gear cutting machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up and ready for operation 1.3 confirm that the machine is ready for operation by checking all of the following: • 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• check that the operating program is at the correct start point and the workpiece is clear of the machine spindle • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.4 follow the defined procedures for starting and running the operating system 1.5 operate one of the following CNC gear cutting machines: • CNC gear cutting machine • CNC gear hobbing machine • CNC gear shaving machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.6 produce machined components which cover four of the following, as applicable to the machine type used: • external spur gears • internal spur gears • external helical gears • internal helical gears • straight splines • involute splines • serrations • bevel gears • racks			
1b Operate CNC gear cutting machines (continued)	1.7 machine one of the following types of material: • ferrous • non-ferrous • non-metallic 1.8 produce components with dimensional accuracy, form and surface texture within all the relevant quality and accuracy standards as is applicable to the operations performed: • components to be free from false tool cuts, burrs and sharp edges			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• straight splines and serrations to BS 2059 or BS1953 class 1 • spur and helical gears to BS 436 Pt 1 or BS 1967 • involute splines to BS 35501963 class 1 • tolerance to BS 4500 or BS 1916 grade 9 • surface texture 63 µin or 1.6 µm 1.9 deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved 1.10 monitor the computer process and ensure that the production output is to the required specification 1.11 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of three of the following: • gear blanks • lead and helix angle • gear tooth thickness • involute form • composite error rolling test • surface texture			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.12 shut down the equipment to a safe condition on conclusion of the activities			
2a Know how to operate CNC gear cutting machines	2.1 describe the safe working practices and procedures to be followed while operating CNC gear cutting machines 2.2 describe the safety mechanisms on the machine, and the procedures for checking that they are operating correctly 2.3 explain how to stop the CNC gear cutting machine in both normal and emergency situations, and the procedure for restarting after an emergency 2.4 describe the hazards associated with working on CNC gear cutting machines (such as using moving machinery, automatic machine operation, handling cutting tools, hot and airborne metal particles), and how to minimise them and reduce any risks 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the importance of keeping the work area clean and tidy 2.7 describe the main features of the CNC gear cutting machine, and the accessories that can be used 2.8 describe the various CNC gear cutting operations that can be performed, and the methods and equipment used			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.9 describe the operation of the various hand and automatic modes of machine control (such as hand wheels, joysticks, program operating and control buttons) 2.10 explain how to use the visual display and understand the various messages displayed 2.11 describe the function of error messages, and what to do when an error message is displayed			
2b Know how to operate CNC gear cutting machines (continued)	2.12 explain how to find the correct restart point in the program when the machine has been stopped before completion of the program 2.13 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 2.14 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 2.15 explain how to use imperial and metric systems of measurement 2.16 describe the application of roughing and finishing cuts, and the effect on cutter life, surface finish and dimensional accuracy			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.17 describe the application of cutting fluids with regard to a range of different materials 2.18 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components 2.19 explain how to recognise CNC gear cutting faults, and how to identify when tools need re-sharpening/replacing 2.20 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used 2.21 describe the problems that can occur with the CNC gear cutting activities, and how these can be overcome 2.22 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 26: Operating CNC machining centres

Unit reference number: L/600/6039

Level: 2

Credit value: 39

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out machining operations, in accordance with approved procedures, using Computer Numerical Control (CNC) machining centres. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. In operating the machine, the learner will be expected to follow the correct procedures for calling up the operating program, dealing with any error messages and executing the program activities safely and correctly. The learner will be expected to produce a range of components that cover a number of different features, such as bored holes, tapered holes, external diameters, flat faces, square and parallel faces, angular faces, slots, indexed and rotated forms, internal and external forms, grooves, drilled, reamed and tapped holes.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate CNC machining centres	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up and ready for operation 1.3 confirm that the machine is ready for operation by checking all of the following: • 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without distortion			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• check that the operating program is at the correct start point and the workpiece is clear of the machine spindle • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.4 follow the defined procedures for starting and running the operating system 1.5 produce components which cover six of the following: • external diameters • tapered diameters • shoulders and steps • bored holes • tapered holes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• flat faces • tapped holes • square and parallel faces • angular faces • slots • indexed or rotated forms • internal profiles • external profiles • internal threads • external threads • grooves • undercuts • drilled holes • reamed holes			
1b Operate CNC machining centres (continued)	1.6 machine one of the following types of material: • ferrous • non-ferrous • non-metallic			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.7 produce component with dimensional accuracy, form and surface texture within all of the following quality and accuracy standards as is applicable to the operations performed: • dimensional tolerance equivalent to BS 4500 or BS 1916 grade 9 • components to be free from false tool cuts, burrs and sharp edges • flatness and squareness within 0.001" per inch or 0.025 mm per 25 mm • reamed/bored holes within H 8 • angles within +/- 0.5 degree • screw threads BS medium fit • surface finish 63 µin or 1.6 µm 1.8 deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved 1.9 monitor the computer process and ensure that the production output is to the required specification			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.10 use appropriate gauges or instruments to carry out the necessary checks, during production, for accuracy of four of the following: • external diameters • internal diameters • lengths/depths • reamed hole size/fit • taper/angles • thread fit • slot or recess width and position • surface finish • flatness of faces • squareness of faces 1.11 shut down the equipment to a safe condition on conclusion of the activities			
2a Know how to operate CNC machining centres	2.1 describe the safe working practices and procedures to be followed while operating CNC machining centres 2.2 describe the safety mechanisms on the machine, and the procedures for checking that they are operating correctly 2.3 explain how to stop the CNC machining centre in both normal and emergency situations, and the procedure for restarting after an emergency			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.4 describe the hazards associated with working on CNC machining centres (such as use of moving machinery, automatic machine operation, handling cutting tools, hot and airborne metal particles), and how to minimise them and reduce any risk 2.5 describe the personal protective equipment to be worn, and where this can be obtained 2.6 describe the importance of keeping the work area clean and tidy 2.7 describe the main features of the CNC machining centre, and the accessories that can be used 2.8 describe the various CNC machining operations that can be performed, and the methods and equipment used 2.9 describe the operation of the various hand and automatic modes of machine control (such as hand wheels, joysticks, program operating and control buttons) 2.10 explain how to use the visual display and understand the various messages displayed 2.11 describe the function of error messages, and what to do when an error message is displayed 2.12 explain how to find the correct restart point in the program when the machine has been stopped before completion of the program			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2b Know how to operate CNC machining centres (continued)	2.13 explain where to obtain the component drawings, specifications and/or job instructions required for the components to be machined 2.14 explain how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken 2.15 explain how to use imperial and metric systems of measurement 2.16 explain how to handle and store tools and cutters safely and correctly 2.17 describe the application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy 2.18 describe the application of cutting fluids with regard to a range of different materials 2.19 describe the effects of clamping the workpiece in a chuck/workholding device, and how this can cause distortion in the finished components 2.20 explain how to recognise CNC machining faults, and how to identify when tools need re-sharpening/ replacing 2.21 describe the quality control procedures used, inspection checks to be carried out, and the equipment that will need to be used			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.22 describe the problems that can occur with the CNC machining activities, and how these can be overcome 2.23 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 27: Producing mechanical sub-assemblies/assemblies

Unit reference number: F/600/6040

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out assembly operations to produce mechanical assemblies, in accordance with approved procedures. The learner will be required to check that specified components are available and fit for purpose, to obtain all relevant and current documentation, to obtain the tools and equipment required for the assembly operations, and to check that they are in a safe and usable condition. In carrying out the assembly operations, the learner will be required to follow company procedures and specified assembly techniques, in order to produce the assembly.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Produce mechanical sub-assemblies/assemblies	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 assembly 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 • check that tools and measuring instruments to be used are fit for service • use lifting and slinging equipment (where appropriate) in accordance with health and safety guidelines and procedures • use appropriate and approved assembly techniques at all times • ensure that the components used are free from damage, foreign objects, dirt or other contamination • leave the work area in a safe and appropriate condition on completion of the activities			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.3 follow the relevant instructions, assembly drawings and any other specifications 1.4 ensure that the specified components are available and that they are in a usable condition 1.5 use the appropriate methods and techniques to assemble the components in their correct positions 1.6 produce assemblies using four of the following methods and techniques: • assembly of components by expansion/contraction • fitting (such as filing, scraping, lapping or polishing) • securing using mechanical fasteners/threaded devices • applying sealants/adhesives • electrical bonding of components • assembly of products by pressure • setting working clearances • drilling • reaming • balancing components • applying bolt locking methods			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• shimming and packing • blue-bedding of components • aligning components • riveting • torque setting • soldering/brazing 1.7 produce assemblies constructed from two of the following • sub-assemblies • support framework • component kits • fastener kits • casings, panels • single components			
1b Produce mechanical sub-assemblies/assemblies (continued)	1.8 assemble products using one of the following assembly aids and equipment: • workholding devices • lifting and moving equipment • specialised assembly tools/equipment • jigs and fixtures • shims and packing			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• rollers or wedges • supporting equipment 1.9 secure the components using the specified connectors and securing devices 1.10 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification 1.11 carry out quality checks using appropriate equipment, to include four of the following: • positional accuracy • freedom of movement • component security • completeness • dimensions • orientation • alignment • function • bearing end float • operating/working clearances • free from damage or foreign objects			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.12 produce mechanical assemblies which comply with one of the following quality and accuracy standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific system requirements 1.13 deal promptly and effectively with problems within their control and report those that cannot be solved			
2a Know how to produce mechanical sub-assemblies/assemblies	2.1 describe the specific safety precautions to be taken while carrying out the mechanical assembly (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials) 2.2 describe the health and safety requirements of the work area in which they are carrying out the assembly activities, and the responsibility they place on them 2.3 describe the COSHH regulations with regard to the substances used in the assembly process 2.4 describe the hazards associated with producing mechanical assemblies, and how to minimise them and reduce any risks			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.5 describe the personal protective equipment and clothing to be worn during the assembly activities 2.6 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 2.7 describe the general principles of mechanical assembly, and the purpose and function of the components and materials used, including component identification systems (such as codes and component orientation indicators) 2.8 describe the preparations that need to be undertaken on the components prior to fitting them into the assembly 2.9 describe the assembly/joining methods, techniques and procedures to be used, and the importance of adhering to these 2.10 explain how the components are to be aligned, adjusted and positioned prior to securing, and the tools and equipment that is used			
2b Know how to produce mechanical sub-assemblies/assemblies (continued)	2.11 describe the importance of using the specified components and joining devices for the assembly, and why they must not use substitutes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.12 explain where appropriate, the application of sealants and adhesives within the assembly activities, and the precautions that must be taken when working with them 2.13 describe the quality control procedures to be followed during the assembly operations 2.14 explain how to conduct any necessary checks to ensure the accuracy, position, security, function and completeness of the assembly 2.15 describe the methods and equipment used to transport, lift and handle components and assemblies 2.16 explain how to check that the tools and equipment to be used are in a safe and serviceable condition 2.17 describe the importance of ensuring that all tools are used correctly and within their permitted operating range 2.18 describe the things that can go wrong with the assembly operations, and what to do if they occur 2.19 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 28: Assembling fluid power components to mechanical equipment

Unit reference number: L/600/6042

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to assemble and fit fluid power components (such as pneumatic, hydraulic, or vacuum) to mechanical equipment, in accordance with approved procedures. The learner will be required to check the specified components are available and fit for purpose, to obtain all relevant and current documentation, to obtain the tools and equipment required for the assembly operations and to check that they are in a safe and usable condition. In carrying out the fitting and assembly operations, they will be required to follow company procedures and specified assembly techniques, in order to assemble the required components.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Assemble fluid power components to mechanical equipment	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 assembly 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 • check that tools and measuring instruments to be used are fit for service • ensure that components and pipes used are free from damage, foreign objects, dirt or other contamination • use appropriate and approved fitting and assembly techniques at all times • leave the work area in a safe and appropriate condition on completion of the activities 1.3 follow the relevant instructions, assembly drawings and any other specifications			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.4 ensure that the specified components are available and that they are in a usable condition 1.5 use the appropriate methods and techniques to assemble the components in their correct positions 1.6 assemble and fit components for one of the following types of fluid power systems: • pneumatic • hydraulic • vacuum • electro-fluid power systems			
1b Assemble fluid power components to mechanical equipment (continued)	1.7 prepare and fit four of the following fluid power components and materials to mechanical equipment: • power generation components (such as motors, pumps, compressors, intensifiers) • fluid conditioning components (such as filters, lubricators, separation units, heaters/driers, cooler units) • storage devices (such as reservoirs, accumulators) • monitoring components (such as sensors, meters, gauges and indicators)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• pipework (such as rigid pipe, flexible pipe, hoses) • connection devices (such as manifolds, couplings, cables and wires) • control components (such as valves, actuators/cylinders, regulators) 1.8 secure the components using the specified connectors and securing devices 1.9 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification 1.10 carry out the quality checks using appropriate equipment, to include four of the following: • dimensions • positional accuracy • alignment • correct direction and flow • leak or pressure tests • component security • electrical continuity • completeness • function			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• pipework (free from ripple and creases) 1.11 produce fluid power assemblies which comply with one of the following quality and accuracy standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific system requirements 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved			
2a Know how to assemble fluid power components to mechanical equipment	2.1 describe the specific safety precautions to be taken while carrying out the fluid power assembly (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials) 2.2 describe the health and safety requirements of the work area in which they are carrying out the assembly activities, and the responsibility these requirements place on them 2.3 describe the COSHH regulations with regard to the substances used in the fluid power assembly process			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.4 describe the hazards associated with assembling fluid power system components, and how to minimise them and reduce any risks 2.5 describe the personal protective equipment and clothing to be worn during the assembly activities 2.6 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 2.7 describe the general principles of fluid power, and the purpose and function of the components and materials used 2.8 describe the preparations to be undertaken on the components prior to fitting them onto the assembly 2.9 describe the fitting and assembly methods and procedures to be used, and the importance of adhering to these procedures			
2b Know how to assemble fluid power components to mechanical equipment (continued)	2.10 explain how the components are to be aligned, adjusted and positioned prior to securing, and the tools and equipment that are used 2.11 describe the importance of using the specified components for the assembly, and why they must not use substitutes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.12 describe the quality control procedures to be followed during the assembly operations 2.13 explain how to detect assembly defects/faults (such as ineffective joining techniques, foreign objects, component damage), and what to do to rectify them 2.14 describe the methods and equipment used to transport, lift and handle components and assemblies 2.15 explain how to check that the tools and equipment to be used are in a safe and serviceable condition 2.16 describe the importance of ensuring that all tools are used correctly and within their permitted operating range 2.17 describe the things that can go wrong with the assembly operations, and what to do if they occur 2.18 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 29: Assembling electrical or electronic components to mechanical equipment

Unit reference number: R/600/6043

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to assemble electrical or electronic components to mechanical equipment, in accordance with approved procedures. The learner will be required to check that specified components are available and fit for purpose, to obtain all relevant and current documentation, to obtain the tools and equipment required for the assembly operations and to check that they are in a safe and usable condition. In carrying out the assembly operations, the learner will be required to follow company procedures and specified assembly techniques, in order to fit the electrical or electronic components to the mechanical assembly.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Assemble electrical or electronic components to mechanical equipment	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 assembly 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 • use lifting and slinging equipment (where appropriate) in accordance with health and safety guidelines and procedures • check that tools and measuring instruments to be used are fit for service • use appropriate and approved fitting and assembly techniques at all times • ensure that the components used are free from damage, foreign objects, dirt or other contamination • leave the work area in a safe and appropriate condition on completion of the activities			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.3 follow the relevant instructions, assembly drawings and any other specifications 1.4 ensure that the specified components are available and that they are in a usable condition 1.5 use the appropriate methods and techniques to assemble the components in their correct positions 1.6 fit electrical or electronic components using all of the following techniques: • routeing cables and wires • mounting/securing components • cable fixings and fasteners 1.7 terminate and join cables/wires to components using two of the following: • screwed connections • clamped connections • soldering • crimping • cable protection devices (such as sleeving or grommets)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Assemble electrical or electronic components to mechanical equipment (continued)	1.8 fit four of the following electrical components on the mechanical equipment: • cable enclosures (such as conduit, trunking, tray work) • circuit connection devices (such as plugs, sockets) • monitoring components (such as sensors) • power generation components (such as motors, transformers) • control components (such as relays, solenoids, switches) • cables and wires • lamps/lighting • electronic modules • instrumentation units • circuit protection devices • other specific components 1.9 secure the components using the specified connectors and securing devices 1.10 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.11 carry out the required checks using the correct tools and equipment, to include four of the following: • position • alignment • completeness • free from damage or foreign objects • electrical continuity • component security 1.12 produce mechanical assemblies which comply with one of the following standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific system requirements 1.13 deal promptly and effectively with problems within their control and report those that cannot be solved			
2a Know how to assemble electrical or electronic components to mechanical equipment	2.1 describe the specific safety precautions to be taken while carrying out the assembly (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.2 describe the health and safety requirements of the work area in which they are carrying out the assembly activities, and the responsibility these requirements place on them 2.3 describe the COSHH regulations with regard to the substances used in the assembly process 2.4 describe the hazards associated with assembling electrical or electronic components to mechanical equipment, and how to minimise them and reduce any risks 2.5 describe the personal protective equipment and clothing to be worn during the assembly activities 2.6 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 2.7 describe the general principles of electrical and electronic fitting techniques; the purpose and function of the components, including identification systems (such as colour codes, manufacture's specification) 2.8 describe the preparations to be undertaken on the electrical or electronic components prior to fitting them into the assembly			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.9 describe the correct component handling procedures, including any relevant handling equipment 2.10 describe the assembly and securing methods and procedures to be used, and the importance of adhering to these			
2b Know how to assemble electrical or electronic components to mechanical equipment (continued)	2.11 explain how the components are to be positioned, aligned and secured, and the tools and equipment that are used 2.12 describe the importance of using the specified electrical or electronic components and securing devices for the assembly, and why they must not use substitutes 2.13 describe the quality control procedures to be followed during the assembly operations 2.14 explain how to conduct any necessary checks to ensure the accuracy, position, security, function, completeness and electrical continuity of the assembly 2.15 explain how to detect assembly defects (such as ineffective joining techniques, component damage), and what to do to rectify them 2.16 explain how to check that the tools and equipment to be used are in a safe and serviceable condition			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.17 describe the importance of ensuring that all tools are used correctly and within their permitted operating range 2.18 describe the importance of ensuring all tools, equipment and components are accounted for and returned to their correct location on completion of the assembly activities 2.19 describe the things that can go wrong with the assembly operations, and what to do if they occur 2.20 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 30: Assembling pipework components to mechanical equipment

Unit reference number: D/600/6045

Level: 2

Credit value: 49

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to assemble and fit pipework components to mechanical equipment, in accordance with approved procedures. The learner will be required to check that specified components are available and fit for purpose, to obtain all relevant and current documentation, to obtain the tools and equipment required for the assembly operations and to check that they are in a safe and usable condition. In carrying out the assembly operations, the learner will be required to follow company procedures and specified assembly techniques, in order to assemble the pipework and components and to fit them to the mechanical equipment.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Assemble pipework components to mechanical equipment	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 assembly 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 • check that tools and measuring instruments to be used are fit for service • ensure that components and pipes used are free from damage, foreign objects, dirt or other contamination • use appropriate and approved fitting and assembly techniques at all times • use lifting and slinging equipment (where appropriate) in accordance with health and safety guidelines and procedures • leave the work area in a safe and appropriate condition on completion of the activities			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.3 follow the relevant instructions, assembly drawings and any other specifications 1.4 ensure that the specified components are available and that they are in a usable condition 1.5 use the appropriate methods and techniques to assemble the components in their correct positions 1.6 use appropriate techniques to assemble two of the following types of pipework to the mechanical equipment: • steel pipe • copper pipe • plastic pipe • flexible hoses 1.7 connect pipework using two of the following methods: • compression • bolting • screwing • brazing • push fit • soldering • cementing/bonding			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Assemble pipework components to mechanical equipment (continued)	1.8 fit five of the following pipework components: • straight connectors • reduction pieces • straight sections • tee pieces • flanges • elbows • curved/profiled sections • couplings • angular sections plus one more from the following: • control components (such as valves, taps, regulators) • storage devices (such as tanks, reservoirs) • monitoring components (such as sensors, meters, gauges) • fluid distribution components (such as motors, pumps) 1.9 secure the components using the specified connectors and securing devices			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.10 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification 1.11 carry out all of the following quality checks using appropriate equipment, to include: • alignment • completeness • positional accuracy • correct direction and flow • component security • component quality (such as free from ripple, creases, foreign objects) 1.12 produce pipework assemblies which comply with one of the following quality and accuracy standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific system requirements 1.13 deal promptly and effectively with problems within their control and report those that cannot be solved			

Learning outcomes		Assessment criteria		Evidence type	Portfolio reference	Date
2a	Know how to assemble pipework components to mechanical equipment	2.1	describe the specific safety precautions to be taken while carrying out the fitting of pipework systems to mechanical assemblies (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)			
		2.2	describe the health and safety requirements of the work area in which they are carrying out the assembly activities, and the responsibility these requirements place on them			
		2.3	describe the COSHH regulations with regard to the substances used in the assembly process			
		2.4	describe the hazards associated with assembling pipework and pipe components to mechanical equipment, and how to minimise them and reduce any risks			
		2.5	describe the personal protective equipment and clothing to be worn during the assembly activities			
		2.6	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			
		2.7	describe the general principles of producing pipework assemblies, and the purpose and function of the components and materials used, including identification systems (such as colour codes)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.8 describe the application of different pipework assembly methods and techniques 2.9 describe the preparations to be undertaken on the pipework prior to fitting them to the assembly			
2b Know how to assemble pipework components to mechanical equipment (continued)	2.10 describe the pipework assembly/joining methods and procedures to be used, and the importance of adhering to these 2.11 describe the importance of using the specified pipework and fittings for the assembly, and why they must not use substitutes 2.12 describe the quality control procedures to be followed during the assembly operations 2.13 explain how to conduct any necessary checks to ensure the safety, accuracy, position, security, function and completeness of the pipework assembly 2.14 explain how to identify pipework assembly defects (such as ineffective joining techniques, component damage), and what to do to rectify them 2.15 explain how to check that the tools and equipment to be used are in a safe and serviceable condition 2.16 describe the importance of ensuring that all tools are used correctly and within their permitted operating range			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.17 describe the things that can go wrong with the pipework assembly activities, and what to do if these occur 2.18 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 31: Producing composite mouldings using wet lay-up techniques

Unit reference number: H/600/6046

Level: 2

Credit value: 42

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to produce composite mouldings using wet lay-up techniques, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings, specifications and documentation to produce the composite mouldings, using the correct wet lay-up production techniques.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Produce composite mouldings using wet lay-up techniques	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the correct component drawing or any other related specifications for the component to be produced 1.3 determine what has to be done and how this will be achieved 1.4 obtain and prepare the appropriate tools, equipment and materials 1.5 prepare moulds and materials for production activities, to include all of the following: • cleaning of tooling and removal of resin build-ups • checking of tooling for surface defects • correctly applying sealants/release agents • dispensing and applying the correct measure and mix of resin/catalyst 1.6 carry out the moulding or laying-up activities using the correct methods and techniques			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.7 carry out all of the following during the moulding activities: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets) • 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 • obtain the correct tools and equipment for the activity and ensure they are safe to use • use the correct materials and consumables, as specified in the production documentation • apply safe and appropriate wet lay-up working practices and procedures at all times • keep the work area in a safe and suitable condition 1.8 produce components to the required specification			
1b Produce composite mouldings using wet lay-up techniques (continued)	1.9 produce a range of mouldings, using two of the following application techniques: • spray application of fibre/resin • application of a gel coat • brush application of fibre/resin			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• roller application of fibre/resin • removal of voids and air pockets • use of vacuum bagging • use of bleed plies 1.10 produce a range of mouldings incorporating one of the following in the lay-up: • feathered joins • overlap joins • orientated plies • inserts • fixtures • butt joins 1.11 produce a range of mouldings, incorporating two of the following shape features: • internal corner • external corner • double curvature • concave surface • convex surface • vertical surface			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.12 produce a range of mouldings using all the following: • resin (such as polyester, epoxy, phenolic, vinyl ester) • fibre (such as glass, carbon, polyethylene, aramid) • reinforcement (such as braids, roving, tapes, chopped strand, continuous filament, woven) • core material (such as wood, coremat, structural foam, honeycomb) 1.13 check that all the required operations have been completed to specification 1.14 produce a range of mouldings which comply with one of the following standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific material/moulding requirements 1.15 deal promptly and effectively with problems within their control and report those that cannot be solved			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to produce composite mouldings using wet lay-up techniques	2.1 describe the health and safety precautions to be taken, and procedures used in the specific work area, when working with composite materials, consumables, tools and equipment 2.2 describe the hazards associated with working with composite materials, consumables, tools and equipment, and how to minimise these and reduce any risks in the work area 2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others 2.4 describe the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables 2.5 explain how to extract and use information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standard) in relation to work undertaken 2.6 explain how to interpret and use imperial and metric systems of measurement 2.7 describe the quality procedures used in the workplace to ensure production control (such as in relation to currency, issue, meeting specification)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.8 describe the conventions and terminology used for wet lay-up techniques (such as resin and fibre weights/volumes, material orientation, material identification, material tailoring, mixing ratios, gel times, exotherm, bleed plies) 2.9 describe the type of resin, fibres and reinforcement used, and their applications 2.10 describe the visual identification of both raw and finished composite materials			
2b Know how to produce composite mouldings using wet lay-up techniques (continued)	2.11 describe the methods of preparation for patterns, moulds and tooling (including the correct use of surface sealers and release agents) 2.12 describe the mixing ratios for gel coats, resins and catalysts, and their associated working times 2.13 describe the methods used in the application of the resin/fibre during the lay-up activity 2.14 describe the tools and equipment used in the lay-up activities, and their care, preparation and control procedures 2.15 explain how to recognise faults that can occur during the lay-up process 2.16 describe the procedures and methods used for removing mouldings from production tooling			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.17 describe the identification of defects in the composite moulding (such as de-lamination, voids, contaminants) 2.18 describe the care and safe handling of production tooling and composite mouldings throughout the production cycle 2.19 describe the production controls used in the work area, and actions to be taken for unaccounted items 2.20 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 32: Producing composite mouldings using pre-preg laminating techniques

Unit reference number: M/600/6048

Level: 2

Credit value: 42

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to produce composite mouldings using pre-preg laminating techniques, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings, specifications and documentation to produce the various mouldings, using the correct pre-preg laminating production techniques.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Produce composite mouldings using pre-preg laminating techniques	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the correct component drawing or any other related specifications for the component to be produced 1.3 determine what has to be done and how this will be achieved 1.4 obtain and prepare the appropriate tools, equipment and materials 1.5 prepare moulds and materials for production activities, to include carrying out all of the following: • cleaning of tooling and removal of resin build-ups • checking of tooling for surface defects • correctly applying sealants/release agents • cutting materials to correct shape and orientation (where applicable) 1.6 carry out the moulding or laying-up activities using the correct methods and techniques			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.7 carry out all of the following during the moulding activities: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets) • 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 • obtain the correct tools and equipment for the activity and ensure they are safe to use • use the correct materials and consumables, as specified in the production documentation • apply safe and appropriate pre-preg laminating working practices and procedures at all times • keep the work area in a safe and suitable condition 1.8 produce a range of mouldings, using techniques for two of the following types of production tools: • metal • wet lay-up • glass pre-preg • tooling block			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• carbon pre-preg • female tooling • male tooling • multi-part tools • matched tooling • closed tooling 1.9 produce composite mouldings incorporating one of the following in the lay-up: • butt joins • overlap joins • staggered joins • orientated plies • inverted plies • inserts			
1b Produce composite mouldings using pre-preg laminating techniques (continued)	1.10 produce composite mouldings incorporating three of the following features: • internal corners • external corners • double curvature • concave surface			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• convex surfaces • return surfaces • joggle details • nett edges 1.11 use all of the following in the lay-up activities: • resin (such as epoxy, phenolic, bismaleimide, cyanate ester) • fibre (such as glass, polyethylene, aramid, carbon) • reinforcement (such as continuous, unidirectional, braids, woven, multi-axis, tapes) • core materials (such as wood, syntactic core, expanding core, foam, honeycomb) 1.12 use one of the following for applying temperature during the cure cycle: • oven • heated tools/moulds • autoclave • heated press			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.13 use one of the following for applying pressure during the cure cycle: • pressure bags • vacuum bags • thermal mould expansion • fibre tensioning 1.14 produce components to the required specification 1.15 produce a range of mouldings which comply with one of the following standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific material/moulding requirements 1.16 check that all the required operations have been completed to specification 1.17 deal promptly and effectively with problems within their control and report those that cannot be solved			
2a Know how to produce composite mouldings using pre-preg laminating techniques	2.1 describe the health and safety precautions to be taken, and procedures used in the specific work area, when working with composite materials, consumables, tools and equipment			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.2 describe the hazards associated with working with composite materials, consumables, tools and equipment, and how to minimise these and reduce any risks in the work area 2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others 2.4 describe the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables 2.5 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 2.6 explain how to interpret imperial and metric systems of measurement 2.7 describe the quality procedures used in the workplace to ensure production control (such as in relation to currency, issue, meeting specification) 2.8 describe the conventions and terminology used for pre-preg laminating techniques (such as material orientation, material identification, material templates, ply lay-up, pressure plates, vacuum bagging, cure cycles, exotherm)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.9 describe the type of resin systems, fibres and reinforcements used, and their applications 2.10 describe the core, insert and filler materials used, and their applications			
2b Know how to produce composite mouldings using pre-preg laminating techniques (continued)	2.11 describe the visual identification of both raw and finished composite materials 2.12 describe the methods used in the application of pre-preg materials to tooling surfaces (including methods of tailoring and cutting) 2.13 describe the correct methods of storage and handling of ancillary and consumable materials 2.14 describe the tools and equipment used in the pre-preg laminating activities, and their care, preparation and control procedures 2.15 explain how to recognise faults that can occur during the moulding process 2.16 describe the importance of adhering to the cure cycle 2.17 describe the procedures and methods used for removing mouldings from production tooling 2.18 describe the care and safe handling of production tooling and composite mouldings throughout the production cycle			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.19 describe the production controls used in the work area, and actions to be taken for unaccounted items 2.20 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 33: Producing components by acrylic moulding

Unit reference number: K/600/6050

Level: 2

Credit value: 32

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to produce components by acrylic moulding, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings, specifications and documentation to produce the various types of components. The learner will be expected to produce the acrylic components using the specified moulding process and techniques. This will involve using equipment such as air circulating ovens, presses, trimming and automated cutting equipment. The products produced will include deep drawn, double curvature, convex and concave shapes.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Produce components by acrylic moulding	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the correct component drawing or any other related specifications for the component to be produced 1.3 determine what has to be done and how this will be achieved 1.4 obtain and prepare the appropriate tools, equipment and materials 1.5 carry out the moulding or laying-up activities using the correct methods and techniques 1.6 carry out all of the following during the moulding activities: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets) • 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 • obtain the correct tools and equipment for the activity and ensure they are safe to use			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• use the correct materials and consumables, as specified in the production documentation • apply safe and appropriate acrylic moulding practices and procedures at all times • keep the work area in a safe and suitable condition 1.7 carry out one of the following moulding methods and techniques: • vacuum moulding • deep drawing • shape clamping • positive pressure shaping • stress relieving			
1b Produce components by acrylic moulding (continued)	1.8 carry out four of the following operations during the moulding process: • tool/equipment preparation • sheet preparation • trimming • setting and controlling temperatures • stress relieving • sheet forming			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• de-moulding 1.9 produce a range of components with two of the following features: • box sections • cylindrical section • convex shapes • concave shapes • single curvatures • double curvatures 1.10 produce components to the required specification 1.11 produce a range of mouldings which comply with one of the following standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific material/moulding requirements 1.12 check that all the required operations have been completed to specification 1.13 deal promptly and effectively with problems within their control and report those that cannot be solved			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2a Know how to produce components by acrylic moulding	2.1 describe the specific safety practices and procedures that they need to observe when working with acrylics (including any specific legislation, regulations/codes of practice for the activities, equipment or materials used) 2.2 describe the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.3 describe the protective equipment that they need to use for both personal protection and, where appropriate, protection of others 2.4 describe the hazards associated with moulding acrylic materials, and with the tools and equipment used, and how to minimise them and reduce any risks in the workplace 2.5 describe the interpretation of drawings, standards, quality control procedures and specifications used for the moulding activity, and the currency/issue checks of the documents they are working with 2.6 describe the principles of deep drawing, concave/convex moulding, positive pressure moulding and stress relieving 2.7 describe the different methods of heating materials, and the temperature control methods			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.8 describe the sheet profiling procedures, and material trimming methods/procedures 2.9 describe the supply of acrylic sheet (such as colour, thickness, sheet size, surface texture, material protection) 2.10 describe the use of forming aids			
2b Know how to produce components by acrylic moulding (continued)	2.11 describe the methods of sheet trimming and sheet cleaning prior to moulding 2.12 describe the preparation methods and procedures applied to the moulding surface 2.13 describe the material cleaning methods and procedures to be applied 2.14 describe the quality control procedures to be followed during the moulding operations 2.15 describe the methods and techniques for lifting, handling and supporting the components/equipment/ materials during the moulding activities 2.16 describe the recognition of moulding defects (such as misalignment, distortion, damage, contamination and surface defects) 2.17 describe the tools and equipment used in the moulding activities, and their calibration, care, preparation and control procedures			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.18 describe the problems that can occur with the moulding operations, and how these can be overcome 2.19 describe the recording documentation to be completed for the moulding activities undertaken 2.20 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date:_____

Learner signature: _____ Date:_____

Assessor signature: _____ Date:_____

Internal verifier signature: _____ Date:_____
(*if sampled*)

Unit 34: Vacuum forming composite materials

Unit reference number: M/600/6051

Level: 2

Credit value: 32

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to vacuum form components, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings and specifications, to produce the various types of components from thermoplastic sheet, fibre-reinforced thermoplastic sheet and structural foam. This will require the learner to use a range of air circulating ovens, vacuum forming machines, trimming equipment and various types of tooling. The components produced will have a range of features, including male shapes, female shapes, double curvatures and stiffened mouldings.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Vacuum form composite materials	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up correctly and is ready for use 1.3 use two of the following types of equipment: • air circulating ovens • vacuum forming machines • Tufnol® tooling • metal tooling • wood tooling • trimming equipment • composite tooling 1.4 manipulate the machine controls safely and correctly in line with operational procedures 1.5 produce components to the required specification 1.6 carry out all of the following during the vacuum forming activities: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• 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 • obtain the correct tools and equipment for the activity and ensure they are safe to use • use the correct materials and consumables, as specified in the production documentation (such as colour, size, composition) • apply safe and appropriate vacuum forming techniques and working practices at all times • keep the work area in a safe and suitable condition 1.7 carry out three of the following operations: • bubble blowing to minimise webbing • positioning of robbers • cleaning tooling • temperature control • trimming techniques • drying of sheet • use of intensifiers • sheet cleaning			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Vacuum form composite materials (continued)	1.8 produce a range of components with two of the following features: • double curvatures • male shapes • female shapes • stiffened mouldings 1.9 produce a range of components using one the following materials: • thermoplastic sheet (such as polycarbonate, polysulphone, acrylic, polyvinyl chloride, ABS) • fibre-reinforced thermoplastic sheet • structural foams (such as polyvinyl chloride (PVC), polymethate (Rohacell®, etc) 1.10 carry out quality sampling checks at suitable intervals 1.11 produce components which comply with one of the following standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific material/vacuum forming requirements			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to vacuum form composite materials	2.1 describe the specific safety practices and procedures that they need to observe when working with vacuum forming equipment (including any specific legislation, regulations/codes of practice for the activities, equipment or materials) 2.2 describe the health and safety requirements of the work area where they are carrying out the activities, and the responsibility these requirements place on them 2.3 describe the protective equipment that they need to use for both personal protection and, where appropriate, protection of others 2.4 describe the hazards associated with carrying out vacuum forming activities, and with the tools and equipment used, and how to minimise these and reduce any risks in the work area 2.5 describe the application of COSHH regulations in relation to the storage, use and disposal of materials and consumables used in the vacuum forming process			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.6 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 the work undertaken 2.7 explain how to interpret imperial and metric systems of measurement 2.8 describe the methods of sheet trimming and sheet cleaning, prior to forming 2.9 describe the preparation methods and procedures applied to the moulding surface 2.10 describe the identification of the correct male/female mould tooling			
2b Know how to vacuum form composite materials (continued)	2.11 describe the methods and techniques of loading and aligning materials into the mould tooling 2.12 describe the methods and techniques for carrying out the de-moulding procedures 2.13 explain how to recognise vacuum forming defects (such as misalignment, distortion, damage, contamination and surface defects) 2.14 describe the importance of adhering to the vacuum forming cycle 2.15 describe the quality control procedures to be followed during the vacuum forming operations			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.16 describe the tools and equipment used in the vacuum forming activities, and their care, preparation and control procedures 2.17 describe the problems that can occur with the vacuum forming operations, and how these can be overcome 2.18 describe the production documentation to be completed for the vacuum forming activities undertaken 2.19 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 35: Trimming composite mouldings using hand tools

Unit reference number: T/600/6052

Level: 2

Credit value: 32

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to trim composite mouldings using hand tools, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings, specifications and documentation to trim various composite mouldings, using the correct trimming techniques.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Trim composite mouldings using hand tools	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow relevant specifications for the component to be produced 1.3 carry out all of the following during the trimming activities: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets) • 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 • obtain the correct tools and equipment for the activity and ensure they are safe to use • apply safe and appropriate trimming techniques and working practices at all times • keep the work area in a safe and suitable condition 1.4 obtain the appropriate tools and equipment for the shaping operations and check they are in a safe and usable condition			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.5 shape the materials using appropriate methods and techniques 1.6 carry out all of the following when preparing for the trimming activity: • check the moulding is correct and complete • check for any defects in the moulding • identify and protect the moulding in the work area 1.7 mark out the mouldings using four of the following methods: • scriber • height gauge • moulded scribe lines • centre punch • trimming templates 1.8 cut mouldings using one the following methods: • cutting wheels/discs • saws • routers • trim jigs			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Trim composite mouldings using hand tools (continued)	1.9 sand mouldings using two of the following methods: • rubbing blocks • diamond files • pencil grinders • disc sanders • belt sanders 1.10 use a hand drill or pedestal drill to drill mouldings using two of the following methods: • drill jigs • hole saws • counterbores • countersinks • drill bits 1.11 polish mouldings using three of the following methods: • wet sanding • cutting compound • polishing compound • rubbing block • orbital sander			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• polisher 1.12 trim mouldings using appropriate techniques for both of the following: • resins (such as polyester, vinyl ester, epoxy, phenolic, bismaleimide, cyanate ester) • fibres (such as polyethylene, glass, aramid, carbon) 1.13 trim mouldings that require, or incorporate five of the following features: • straight edges • curved edges • flat surfaces • polished surfaces • shaped surfaces • radius corners • returns • nett edges • joggle details • removal of join lines • holes • multiple hole sizes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• countersinks • counterbores • further lay-up stages • inserts to be drilled • inserts to be tapped • solid cores • honeycomb cores • edge filling 1.14 check that all the required shaping operations have been completed to the required specification 1.15 trim a range of mouldings in compliance with one of the following standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific material/moulding requirements 1.16 deal promptly and effectively with problems within their control and report those that cannot be solved			
2a Know how to trim composite mouldings using hand tools	2.1 describe the health and safety precautions to be taken and procedures used when working with composite materials, consumables, tools and equipment in the specific work area			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.2 describe the hazards associated with trimming composite materials, consumables, tools and equipment, and how to minimise these and reduce any risks in the work area 2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others 2.4 describe the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables 2.5 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 2.6 explain how to interpret drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.7 explain how to prepare for the trimming activities, and how to mark out the mouldings for the material that needs to be removed 2.8 describe the quality procedures used in the workplace to ensure production control (such as in relation to currency, issue, meeting specification, etc)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
2b Know how to trim composite mouldings using hand tools (continued)	2.9 describe the conventions and terminology used for trimming activities (such as scribe lines, sanding grades, types of cutting tools, speeds) 2.10 describe the different types of manual and power tools used in composite trimming operations 2.11 describe the different types of cutting tools and abrasives used in trimming composite materials, and their application 2.12 describe the visual identification of cured composite materials 2.13 describe the identification of defects in composite mouldings 2.14 describe the methods used in the trimming of composite mouldings 2.15 describe the care and safe handling of composite mouldings throughout the trimming cycle 2.16 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 36: Identifying defects in composite mouldings

Unit reference number: F/600/6054

Level: 2

Credit value: 23

Guided learning hours: 95

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to identify and deal with defects in composite mouldings (moulds, panels, components, jigs), in accordance with approved procedures. The learner will be required to follow appropriate drawings, specifications and documentation to identify and deal with defects in composites mouldings.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Identify defects in composite mouldings	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 inspect mouldings to one of the following standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific material/moulding requirements 1.3 identify defects with regard to the product or asset specification 1.4 carry out all of the following during the inspection activities: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets) • 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 • obtain the correct tools and equipment for the activity and ensure they are safe to use			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• apply safe and appropriate inspection techniques and procedures at all times • keep the work area in a safe and suitable condition 1.5 identify defects in composite mouldings using four of the following methods: • touch • sound • visual • measurement • mechanical tests • co-ordinate measuring machines (CMM) • non-destructive testing (NDT) • stage inspection 1.6 identify defects in six of the following types of composite mouldings: • trim • closing panels • housings • body panels • tubes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• sections • sandwich panels • structural • aerodynamic • moulds • jigs			
1b Identify defects in composite mouldings (continued)	1.7 identify defects applicable to two of the following resin types: • polyester • vinyl ester • epoxy • phenolic • bismaleimide • cyanate ester 1.8 identify defects applicable to two of the following fibre types: • polyethylene • glass • aramid • carbon			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.9 identify eight of the following types of defect in composite mouldings: • incomplete curing • dimensional • tolerances • ply orientation • wrong join type • surface finish • distortion • blisters • bridging • de-lamination • wrinkles • broken fibres • splintering • voids • dents or 'dings' • dis-bonds • resin-rich areas • incorrect material			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• excessive adhesive • damaged cores • wrong inserts • insert positions • impact damage 1.10 assess the defects and determine action required to return the products and assets to specified condition 1.11 report recommendations for action to the appropriate people promptly and in accordance with organisational procedures 1.12 record details of defects in accordance with quality assurance and control systems and procedures			
2a Know how to identify defects in composite mouldings	2.1 describe the health and safety precautions to be taken and procedures used when working with composite materials, consumables, tools and equipment in the specific work area 2.2 describe the hazards associated with working with composite materials, consumables, tools and equipment, and how to minimise these and reduce any risks in the work area 2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.4 describe the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables 2.5 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 2.6 explain how to use imperial and metric systems of measurement, workpiece reference points and system of tolerancing			
2b Know how to identify defects in composite mouldings (continued)	2.7 describe the quality procedures used in the workplace to ensure production control (such as in relation to currency, issue, meeting specification), and the completion of appropriate documents 2.8 describe the conventions and terminology used when identifying and rectifying defects (such as dis-bonds, de-lamination, resin injection, resin voids, core potting, repair patches) 2.9 describe the failure modes for various composite mouldings, and what can contribute to these 2.10 describe the correct methods of storage and handling of composite materials 2.11 describe the tools and equipment used for checking the various composite mouldings			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.12 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 37: Carrying out repairs to composite mouldings

Unit reference number: J/600/6055

Level: 2

Credit value: 42

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out repairs to composite mouldings (cured panels, moulds, components and jigs), in accordance with approved procedures. The learner will be required to use appropriate specifications and documentation to bond composite materials, using the correct techniques.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Carry out repairs to composite mouldings	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 repair a range of composite mouldings which comply with one of the following standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific material/moulding requirements 1.3 follow the relevant specifications for the component to be repaired 1.4 prepare the component for repair 1.5 carry out the repairs within agreed timescale using approved materials and components and methods and procedures 1.6 carry out all of the following during the repair activities: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets, repair procedures)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• 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 • obtain the correct tools and equipment for the activity and ensure they are safe to use • identify what needs to be repaired and the method of repair to be used • use the correct materials and consumables, as specified in the repair/production documentation • apply appropriate and safe repair techniques and procedures at all times • keep the work area in a safe and suitable condition			
1b Carry out repairs to composite mouldings (continued)	1.7 repair defects in three of the following types of composite moulding: • trim • closing panels • housings • body panels • tubes • sections			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• sandwich panels • structural • aerodynamic • moulds • jigs 1.8 repair defects in composite mouldings using three of the following methods: • localised curing • fettling • surface filling • relieving distortion • separation of bonds • bonding • resin injection • wet-lay patching • pre-preg patching • core patching • insert/core potting • repair patches/kits			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.9 repair defects in composite mouldings using techniques and materials applicable to both of the following: • resins (such as polyester, vinyl ester, epoxy, phenolic, bismaleimide, cyanate ester) • fibres (such as polyethylene, glass, aramid, carbon) 1.10 repair five of the following types of defect in composite mouldings: • incomplete curing • dimensional • surface finish • distortion • blisters • bridging • de-lamination • broken fibres • voids • dis-bonds • dents or 'dings' • excessive adhesive			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• damaged cores • wrong inserts • insert positions • impact damage 1.11 ensure that the repaired component meets the specified operating conditions 1.12 produce accurate and complete records of all repair work carried out			
2a Know how to carry out repairs to composite mouldings	2.1 describe the health and safety precautions to be taken and procedures used when working with composite materials, consumables, tools and equipment in the specific work area 2.2 describe the hazards associated with carrying out repairs to composite materials, consumables, tools and equipment, and how to minimise these and reduce any risks in the work area 2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others 2.4 describe the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.5 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 2.6 describe the quality procedures used in the workplace to ensure that repairs are carried out satisfactorily			
2b Know how to carry out repairs to composite mouldings (continued)	2.7 describe the conventions and terminology used when repairing composite mouldings (such as dis-bonds, de-lamination, resin injection, resin voids, core potting, repair patches) 2.8 describe the different types of composite resin systems, fibres and reinforcements, and the repair techniques that can be used 2.9 describe the various bonding agents and methods used 2.10 describe the correct methods of storage and handling of composite materials 2.11 describe the tools and equipment used for the various activities associated with repairing composite mouldings 2.12 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 38: Applying surface finishes to composite mouldings

Unit reference number: L/600/6056

Level: 2

Credit value: 32

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to apply finishes to composite mouldings (moulds, panels and components), in accordance with approved procedures. The learner will be required to use appropriate drawings, specifications and documentation to apply finishes, using the correct techniques.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Apply surface finishes to composite mouldings	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 finishing activities: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets) • 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 • obtain the correct tools and equipment for the activity and ensure they are safe to use • use the correct materials and consumables, as specified in the finishing documentation • apply safe and appropriate finishing techniques and procedures at all times • keep the work area in a safe and suitable condition 1.3 ensure the material surfaces to be treated are suitably prepared for the finishing operations to be carried out			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.4 carry out all of the following activities when preparing for the finishing activity: • check that mouldings are correct and complete • check for any defects in the mouldings • check availability of ancillary materials required • select correct equipment for the activity • check that equipment is suitable for use • identify and protect the moulding in the work area 1.5 prepare surfaces of composite mouldings, using two of the following methods: • abrading • bead blasting • water cleaning • solvent cleaning • priming 1.6 check that the finishing equipment and treatment solutions are set up and maintained at satisfactory operating conditions and levels 1.7 carry out the treatment process in accordance with operating procedures and the component specification requirements			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.8 apply finishes to composite mouldings, using two of the following techniques: • cloth application • brush • spray • laying films • roller 1.9 apply two types of finish to composite mouldings from the following: • surface sealers • primers • top coats • adhesive films • UV coatings • heatproof coatings • speciality coatings • flexible coatings			
1b Apply surface finishes to composite mouldings (continued)	1.10 apply finishes to composite mouldings, using three of the following: • one-part finishes • two-part finishes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• multiple coatings • combination coats • solvent based • adhesive based • water based • single coatings 1.11 use four of the following consumable materials during the finishing operations: • abrasives • masking tapes • masking films • polishes • thinners • solvents • stoppers • fillers • sealers • primers • cutting compounds • cleaning agents			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.12 apply finishes to composite mouldings which are suitable for two of the following resin types: • polyester • vinyl ester • epoxy • phenolic • • bismaleimide • cyanate ester 1.13 ensure that the treated workpiece achieves the required characteristics and meets the finishing specification 1.14 apply finishes to composite mouldings suitable for two of the following fibre types: • polyethylene • glass • aramid • carbon 1.15 apply finishes to a range of mouldings, which comply with one of the following standards: • meet company standards and procedures • meet customer standards and requirements			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• have an appropriate surface finish and are free from • defects or surface blemishes 1.16 deal promptly and effectively with problems within their control and report those that cannot be solved 1.17 dispose of waste and excess materials in line with agreed organisational procedures 1.18 shut down the finishing equipment to a safe condition on completion of the processing activities			
2a Know how to apply surface finishes to composite mouldings	2.1 describe the health and safety precautions to be taken and procedures used when working with composite materials, consumables, tools and equipment in the specific work area 2.2 describe the hazards associated with composite materials, consumables, tools and equipment, and how to minimise these and reduce any risks in the work area 2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others 2.4 describe the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.5 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 2.6 describe the quality procedures used in the workplace to ensure production control (such as in relation to currency, issue, meeting specification), and the completion of appropriate documents 2.7 describe the conventions and terminology used for applying finishes (such as surface keying, finish thickness, matt finish, gloss finish, treatment reactions) 2.8 describe the different types of composite resin systems, fibres and reinforcements, and their merits			
2b Know how to apply surface finishes to composite mouldings (continued)	2.9 describe the different finishes applied to composites, and their merits 2.10 describe the correct methods of storage, handling and disposal of finishing materials 2.11 describe the methods of preparation for applying different finishes 2.12 describe the mixing ratios for two-part finishes, and the associated working times			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.13 describe the methods of application for different finishes 2.14 describe the problems that can occur during the finishing process, including defects such as contamination 2.15 explain how defects can be overcome during the finishing activity 2.16 describe the tools and equipment used in finishing activities, and their care, preparation and control procedures 2.17 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____

(*if sampled*)

Unit 39: Bonding composite mouldings

Unit reference number: Y/600/6058

Level: 2

Credit value: 23

Guided learning hours: 95

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to bond composite mouldings, in accordance with approved procedures. The learner will be required to follow the appropriate instructions, drawings, specifications and documentation to bond composite materials, using the correct production techniques.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Bond composite mouldings	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant bonding procedure specification and job instructions 1.3 check that the materials to be bonded and bonding agents comply with the specification 1.4 correctly prepare the parent materials and bonding agents in line with the bonding specification 1.5 carry out all of the following when preparing for the bonding activity: • check that mouldings are correct and complete • check for any defects in the mouldings • identify and protect the moulding and bonding materials in the work area • check that bonding materials are correct and complete 1.6 prepare bonding surfaces, using three of the following methods: • peel plies • templates • abrading			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• bead blasting • water cleaning • solvent cleaning • dry fitting • acid etching • priming • surface masks 1.7 carry out the bonding operations using the specified processes and techniques to position and bond the materials in their correct locations 1.8 carry out all of the following during the bonding activities: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets) • 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 • obtain the correct tools and equipment for the activity and ensure they are safe to use • use the correct materials and consumables, as specified in the production documentation			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• apply safe and appropriate bonding techniques at all times • keep the work area in a safe and suitable condition 1.9 bond composite mouldings, using techniques for one of the following: • one-part pastes • two-part pastes • film adhesives • syntactic films 1.10 use two of the following methods when bonding the composite mouldings: • dry fitting • bonding sequences • shimming materials • mixing adhesives • wetting-out by brush • applicator gun • laying film adhesives • oven curing • heated press			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Bond composite mouldings (continued)	1.11 bond composite mouldings using techniques for one of the following: • sandwich panels • butt joins • overlap joins • joggle joins • return joins 1.12 bond composite mouldings using techniques for two of the following: • flat surfaces • shaped surfaces • internal surfaces • external surfaces 1.13 use appropriate techniques for bonding one of the following materials to the composite moulding: • other composites • metals • ceramics • plastics • wood-based materials			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.14 bond composite mouldings using adhesives suitable for both of the following: • resins (such as polyester, epoxy, phenolic, bismaleimide, cyanate ester, vinyl ester) • fibres (such as polyethylene, glass, aramid, carbon, other specific types) 1.15 ensure that any equipment used to maintain surface contact during the bonding activities is set up and used correctly 1.16 use one of the following to retain the bond during the curing process: • weighting down • bonding jigs • pinning joins • clamping • press • vacuum bagging 1.17 achieve bonds of the required quality and within the specified dimensional accuracy			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.18 bond a range of mouldings which comply with one of the following standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific material/moulding requirements 1.19 deal promptly and effectively with problems within their control and report those that cannot be solved			
2a Know how to bond composite mouldings	2.1 describe the health and safety precautions to be taken and procedures used when working with composite materials, consumables, tools and equipment in the specific work area 2.2 describe the hazards associated with bonding composite materials, consumables, tools and equipment, and how to minimise these and reduce any risks in the work area 2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others 2.4 describe the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.5 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 2.6 explain how to use imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.7 describe the quality procedures used in the workplace to ensure production control (such as in relation to currency, issue, meeting specification) 2.8 describe the conventions and terminology used for bonding (such as gel points, cure times, bond thickness, bond strength, peel strength)			
2b Know how to bond composite mouldings (continued)	2.9 describe the correct methods of storage and handling of bonding agents 2.10 describe the methods of preparation for bonding different materials 2.11 describe the methods of application for different bonding agents 2.12 describe the methods of retaining the bond during the curing process, and their merits 2.13 describe the tools and equipment used in bonding activities, and their care, preparation and control procedures			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.14 describe the identification of bonding defects 2.15 describe the problems that can occur during the bonding process 2.16 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 40: Producing composite assemblies

Unit reference number: D/600/6059

Level: 2

Credit value: 42

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to produce composite assemblies from composite components and non-composite components, in accordance with approved procedures. The learner will be required to work to instructions, specifications and documentation to produce the composite assemblies, using the correct techniques. The learner will produce a variety of composite assemblies, incorporating a range of features and using a number of techniques and processes.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Produce composite assemblies	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the relevant instructions, assembly drawings and any other specifications 1.3 carry out all of the following during the assembly activities: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets) • 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 • obtain the correct tools and equipment for the activity and ensure they are safe to use • ensure that components to be used are of the correct type, and that all mouldings are free from defects • apply safe and appropriate assembly techniques and procedures at all times • keep the work area in a safe and suitable condition			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.4 ensure that the specified components are available and that they are in a usable condition 1.5 use the appropriate methods and techniques to assemble the components in their correct positions 1.6 produce one of the following types of composite assembly: • one-off assemblies • batch assemblies • assembly line 1.7 produce assemblies that incorporate two of the following features: • loose fit tolerances • close fit tolerances • non-permanent fixing • shape location • joggle joins • permanent fixing • return joins • overlap joins			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.8 produce composite assemblies that require two of the following methods to be used: • fettling • pinning • clamping • trial fitting • aligning • assembly jigs			
1b Produce composite assemblies (continued)	1.9 produce composite assemblies that use one of the following joining methods: • thread inserts • quick-release fasteners • rivets • mechanical fasteners • anchor nuts 1.10 assemble composite components which include two of the following: • trim • closing panels • body panels • tubes			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• structural • aerodynamic • core materials • sections • inserts • housings 1.11 produce assemblies which include one of the following non-composite components: • brackets • fixtures • fittings • trim • tapes • memory foam • films 1.12 secure the components using the specified connectors and securing devices 1.13 check the completed assembly to ensure that all operations have been completed and the finished assembly meets the required specification			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.14 produce assemblies which comply with one of the following standards: • BS, ISO or BSEN standards and procedures • customer standards and requirements • company standards and procedures • specific material/moulding assembly requirements 1.15 deal promptly and effectively with problems within their control and report those that cannot be solved			
2a Know how to produce composite assemblies	2.1 describe the health and safety precautions to be taken and procedures used in the specific work area, when working with composite materials, consumables, tools and equipment 2.2 describe the hazards associated with assembling composite materials, and with the consumables, tools and equipment used, and how to minimise these and reduce any risks in the work area 2.3 describe the protective equipment that is needed for personal protection and, where required, the protection of others 2.4 describe the application of COSHH regulations in relation to the storage, use and disposal of composite materials and consumables			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.5 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 2.6 explain how to use imperial and metric systems of measurement, workpiece reference points and system of tolerancing			
2b Know how to produce composite assemblies (continued)	2.7 describe the quality procedures used in the workplace to ensure production control 2.8 describe the methods of assembling composite components using mechanical methods (such as screw fasteners, rivets, special purpose fittings) 2.9 describe the methods for handling composite assemblies throughout the assembly activities 2.10 describe the tools and equipment used in assembly activities, and their care, preparation and control procedures 2.11 describe the things that can go wrong with the assembly activities, and how they can be avoided 2.12 describe the extent of their own authority and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 41: Carrying out inspection activities on optical components

Unit reference number: R/600/6060

Level: 2

Credit value: 42

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out optical inspection operations, in accordance with approved procedures, using optical inspection techniques and equipment. The learner will be expected to check components made from a range of optical materials, using a mixture of inspection equipment, as appropriate. The learner will be required to inspect a range of components that combine a number of different features, such as centre-thickness, diameters, generated blanks, optical lens form and power, angles, profiles, and with cosmetic defects.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Carry out inspection activities on optical components	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 follow the correct specification for the product or equipment being inspected 1.3 inspect optical components to one of the following: • BS, ISO or BSEN standards and procedures • other accepted international standards • customer (contractual) standards and requirements • company standards and procedures 1.4 use the correct equipment to carry out the inspection 1.5 operate four types of optical inspection equipment from the following: • lens centring rig • centre thickness gauge • microscopes • micrometers • optical measuring equipment • focometer test equipment			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• auto collimators • optical spheres • optical flats • dial test indicators • slip gauges • Vernier equipment • interferometry and phase analysis equipment • shadowgraph test equipment 1.6 identify and confirm the inspection checks to be made and acceptance criteria to be used 1.7 carry out all required inspections as specified			
1b Carry out inspection activities on optical components (continued)	1.8 carry out all of the following during the inspection activity: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets) • 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 • obtain and check that the required inspection equipment is within current calibration dates			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• use appropriate inspection techniques to check the components • determine any out-of-specification components • complete all relevant inspection documentation, accurately and legibly • apply safe working practices at all times 1.9 inspect three types of optical component from the following: • infra-red lens • combiners • infra-red glass flats • infra-red glass domes • cylinders • glass prisms • infra-red prisms • plastic lens components • glass lens • optical mirrors • profiled optical components			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.10 inspect six features of machined optical components from the following: • prism angles • concentricity • profiles • focal length • flats power error • lens diameter • lens form error • sag depth • lens centring • cosmetic defect • cap height • flats form error • centre thickness • refractive index • other features • truncation • lens wedge • flat/parallelism • lens power (radius)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.11 use inspection methods and techniques suitable for components made from three different types of material: • germanium • barium crowns • dense flints • flints/light flints • infra-red glass 4,5,6 • barium dense flints • zinc selenide • zinc sulphide • silicon • plastics • lanthanum crowns • anomalous dispersion flour crowns • optical neutral density glass • optical orange filter glass • optical blue filter glass • thallium ideobromide • borosilicate crowns • other			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.12 identify any defects or variations from the specification 1.13 record the results of the inspection in the appropriate format 1.14 deal promptly and effectively with problems within their control and report those that cannot be solved			
2a Know how to carry out inspection activities on optical components	2.1 describe the safe working practices and procedures to be followed while using optical inspection equipment 2.2 describe the safety mechanisms on the equipment, and the procedure for checking that they function correctly 2.3 describe the personal protective equipment to be worn, and where this can be obtained 2.4 describe the hazards associated with carrying out optical inspection operations, and how to minimise them and reduce any risks 2.5 describe the importance of keeping the work area clean and tidy 2.6 explain how to extract and use information from optical engineering drawings and related specifications (to include symbols and conventions to appropriate BS, ISO or BSEN standards) in relation to work undertaken			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.7 explain how to use imperial and metric systems of measurement, workpiece reference points and system of tolerancing 2.8 describe the various optical inspection operations to be performed, and types of equipment used 2.9 explain how to set or check the calibration of the equipment before inspection operations are carried out			
2b Know how to carry out inspection activities on optical components (continued)	2.10 explain how to recognise the various cosmetic defects 2.11 explain how to handle and store all inspection equipment, safely and correctly 2.12 explain how the various types of material will affect the way the inspection operation is performed 2.13 describe the effect of clamping the workpiece, and how this can cause distortion in the finished component 2.14 explain how to recognise inspection equipment faults, and identify when inspection equipment needs refurbishment 2.15 describe the problems that can occur with optical inspection activities, and how they can be overcome			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.16 describe the quality control procedures used, inspection checks to be carried out, and the equipment used 2.17 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 42: Operating infra-red/special material lens process machines

Unit reference number: Y/600/6061

Level: 2

Credit value: 42

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out machining operations on optical infra-red and special materials, in accordance with approved procedures, using optical infra-red process machines. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components, materials and consumables are available. The learner will be required to operate a range of machines, in order to produce the components that combine a mixture of processes identified for infra-red and special materials, using a selection of specified optical lens and flat materials. The learner will be expected to produce a range of components that combine a number of different features, such as centre thickness, diameters, generated blanks, optical lens form and power.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate infra-red/special material lens process machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 apply all of the following during the machine 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without damage or distortion • follow the defined operating procedures and apply safe working practices and procedures at all times			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.3 confirm that the machine is set up and ready for the machining activities to be carried out 1.4 manipulate the machine tool controls safely and correctly in line with operational procedures 1.5 produce components to the required quality and within the specified dimensional accuracy 1.6 operate two types of optical lens process machines from the following: • conventional pitch • lens silk polishing • flat silk polishing • special materials • automated • generating • lens edging			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.7 produce machined optical components that combine different operations and cover four of the following: • centre thickness • lens diameter • lens concentricity • flat parallelism • lens form analysis • lens power analysis • lens surface generation • lens cosmetic defects • lens truncation and cap height			
1b Operate infra-red/special material lens process machines (continued)	1.8 machine two different types of materials from the following: • zinc selenide • zinc sulphide • optical silicon • other optical grade • optical infra-red glass 4 • optical infra-red glass 5 • optical infra-red glass 6			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• optical cleartran • optical grade germanium • optical thallium ideobromide • other appropriate optical material 1.9 carry out quality sampling checks at suitable intervals 1.10 produce components with dimensional accuracy, form and surface quality, which comply to one of the following standards: • BS, ISO or BSEN standards and procedures • other accepted international standards • customer (contractual) standards and requirements • company standards and procedures 1.11 carry out the necessary checks for accuracy during production of three of the following: • optical bevels • lens chamfers • lens diameters • lens surface finish • lens cap height			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• optical parallelism • optical truncations • lens centre thickness • lens surface form error • lens surface power error 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate infra-red/special material lens process machines	2.1 describe the safe working practices and procedures to be followed while operating optical lens generating, smoothing and polishing equipment 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both set-up and run modes, and how to stop the machine in an emergency 2.4 describe the personal protective equipment to be worn, and where this can be obtained 2.5 describe the hazards associated with carrying out optical lens process operations, and how to minimise them and reduce any risks			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.6 describe the importance of keeping the work area clean and tidy 2.7 explain where to obtain the component drawing, specifications and/or job instructions required for the components to be machined 2.8 explain how to interpret optical 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 use imperial and metric systems of measurement 2.10 describe the various optical lens operations that can be performed 2.11 describe the effects of backlash in machine slides, dials and screws, and how this can be overcome			
2b Know how to operate infra-red/special material lens process machines (continued)	2.12 explain how to handle and store all cutting tools and kit required, safely and correctly 2.13 describe the application of roughing and finishing cuts and the effect on tool life, surface finish and dimensional accuracy 2.14 explain how tool wear affects surface finish and dimensional accuracy 2.15 explain how the various types of material will affect the way the operation is performed			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.16 describe the application of cutting fluids with regard to the range of material being produced 2.17 describe the effect of clamping the workpiece, and how this can cause distortion in the finished component 2.18 explain how to recognise machine faults and identify when tooling needs refurbishment 2.19 describe the problems that can occur with optical lens infra-red and special material machining activities, and how they can be overcome 2.20 describe the quality control procedures used, inspection checks to be carried out, and the equipment used 2.21 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 43: Operating optical glass lens process machines

Unit reference number: D/600/6062

Level: 2

Credit value: 42

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out machining operations on optical glass lens material, in accordance with approved procedures, using optical glass lens process machines. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be required to operate a range of machines, in order to produce components that combine a mixture of processes identified for optical glass lens machining, using a selection of specified optical glass materials. The learner will be expected to produce a range of components that combine a number of different features such as centre thickness, diameters, generated blanks, optical lens form and power.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate optical glass lens process machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 apply all of the following during the machine 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without damage or distortion			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.4 manipulate the machine tool controls safely and correctly in line with operational procedures 1.5 produce components to the required quality and within the specified dimensional accuracy 1.6 operate two types of optical lens process machine from the following: • lens edging • automated small lens • conventional large lens pitch • generating • automated large lens • conventional small lens pitch			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.7 produce optical machined components which combine different operations and cover four of the following: • centre thickness • lens diameter • lens concentricity • lens wedge • lens form analysis • lens power analysis • lens surface generation • lens cosmetic defects • lens truncation and cap height			
1b Operate optical glass lens process machines (continued)	1.8 machine two different types of material from the following: • barium crowns • borosilicate crowns • flints/light flints • optical orange filter glass • optical blue filter glass • optical neutral density glass • anomalous dispersion flour crowns			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• other optical grades • dense flints • barium dense flints • lanthanum crowns 1.9 carry out quality sampling checks at suitable intervals 1.10 produce components with dimensional accuracy, form and surface quality which complies to one of the following standards: • BS, ISO or BSEN standards and procedures • other accepted international standards • customer (contractual) standards and requirements • company standards and procedures 1.11 carry out the necessary checks for accuracy during production of three of the following: • optical bevels • optical lens wedge • optical parallelism • optical truncations • lens cap height			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• lens chamfers • lens diameters • lens surface finish • lens surface power error • lens centre thickness • lens surface form error 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate optical glass lens process machines	2.1 describe the safe working practices and procedures to be followed while operating optical lens generating, smoothing and polishing equipment 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both set-up and run modes, and how to stop the machine in an emergency 2.4 describe the personal protective equipment to be worn, and where this can be obtained 2.5 describe the hazards associated with carrying out optical lens process operations, and how to minimise them and reduce any risks			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.6 describe the importance of keeping the work area clean and tidy 2.7 explain where to obtain the component drawing, specifications and/or job instructions required for the components to be machined 2.8 explain how to extract and use information from optical 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 use imperial and metric systems of measurement 2.10 describe the various optical lens operations that can be performed 2.11 describe the effect of backlash in machines slides, dials and screws, and how this can be overcome			
2b Know how to operate optical glass lens process machines (continued)	2.12 explain how to handle and store all cutting tools and kit required, safely and correctly 2.13 describe the application of roughing and finishing cuts and pressures, and the effects on tool life, surface finish and dimensional accuracy 2.14 explain how tool wear affects surface finish and dimensional accuracy			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.15 explain how the various types of material will affect the way the operation is performed 2.16 describe the application of cutting fluids/rouges, with regard to the range of material being produced 2.17 describe the effect of clamping the workpiece, and how this can cause distortion in the finished component 2.18 explain how to recognise machine faults, and how to identify when tooling needs refurbishment 2.19 describe the problems that can occur with optical lens glass machining activities, and how they can be overcome 2.20 describe the quality control procedures used, inspection checks to be carried out, and the equipment used 2.21 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 44: Operating optical prism and flat process machines

Unit reference number: K/600/6064

Level: 2

Credit value: 42

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out machining operations on optical prisms and flat components, in accordance with approved procedures, using a range of optical prism and flat process machines. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components, materials and consumables are available. In operating the machine, the learner will be expected to produce a range of components that combine a number of different features such as angles, flats, parallelism, wedge shapes, chamfers and bevels, using a selection of specified optical prism and flat materials. The learner will also be required to check the finished components for accuracy and quality.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate optical prism and flat process machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without damage or distortion			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.4 manipulate the machine tool controls safely and correctly in line with operational procedures 1.5 produce components to the required quality and within the specified dimensional accuracy 1.6 operate two of the following types of optical prism and flat process machine: • preparation and smoothing • twin lap flat polishing • lap-master flat and prism • hard lap flat and prism polishing			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.7 produce machined optical components which combine different operations and cover four of the following: • flat centre thickness • angular tolerances • flatness tolerances • parallelism tolerances • cosmetic tolerances • transmission tolerances • finished size tolerances • prism chamfers/bevels tolerances			
1b Operate optical prism and flat process machines (continued)	1.8 machine two different types of materials from the following: • optical grade germanium • zinc selenide prisms and flats • zinc sulphide prisms and flats • borosilicate crowns • barium crowns • dense flints • optical orange filter glass • optical blue filter glass			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• optical neutral density glass • flint/light flints • barium dense flints • lanthanum crowns • anomalous dispersion flour crowns • other appropriate optical material 1.9 carry out quality sampling checks at suitable intervals 1.10 produce components with dimensional accuracy, form and surface quality, which comply to one of the following standards: • BS, ISO or BSEN standards and procedures • other accepted international standards • customer (contractual) standards and requirements • company standards and procedures 1.11 carry out the necessary checks for optical accuracy during production of four of the following: • flatness • prism chamfers and bevels • flat centre thickness			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• prism surface cosmetics • prism flatness measurement • flat surface cosmetics • flat chamfers and bevels • prism angular measurement • flat parallelism • prism balk height measurement • flatness transmission 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate optical prism and flat process machines	2.1 describe the safe working practices and procedures to be followed while operating optical prism preparation, smoothing and polishing equipment 2.2 describe the safety mechanisms on the machines, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both set-up and run modes, and how to stop the machine in an emergency 2.4 describe the personal protective equipment to be worn, and where this can be obtained			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.5 describe the hazards associated with carrying out optical prism process operations, and how to minimise them and reduce any risks 2.6 describe the importance of keeping the work area clean and tidy 2.7 explain how to extract and use information from optical 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 use imperial and metric systems of measurement 2.9 describe the various optical prism operations that can be performed 2.10 describe the effects of backlash in machine slides, dials and screws, and how this can be overcome			
2b Know how to operate optical prism and flat process machines (continued)	2.11 describe the methods that can be used to set up the workpiece prior to the operation, to minimise optical wedge and parallelism in relation to the cutting tool (such as alloy jigs, plaster blocks, pitch pads) 2.12 explain how to handle and store all tools and kit required, safely and correctly			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.13 The application of roughing and finishing cuts and pressures, and their effects on tool life, surface finish and dimensional accuracy 2.14 explain how tool wear affects surface finish and dimensional accuracy 2.15 explain how the various types of material will affect the way the operation is performed 2.16 describe the application of cutting fluids with regard to the range of material being produced 2.17 describe the effect of clamping the workpiece, and how this can cause distortion in the finished component 2.18 describe the problems that can occur with optical prism machining activities, and how they can be overcome 2.19 describe the quality control procedures used, inspection checks to be carried out, and the equipment used to achieve required component 2.20 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 45: Operating CNC aspheric optical and diamond turning machines

Unit reference number: A/600/6067

Level: 2

Credit value: 32

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out the machining of aspheric glass and diamond turned components, using Computer Numerical Control (CNC) machines or CNC machining centres, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components, materials and consumables are available. The learner will be required to produce a range of aspheric components of various infra-red and/or visible materials, which combine a range of different features, such as aspheric form, power, surface roughness, cap height, etc. The learner will also be required to check and verify the finished components, using a variety of equipment, to ensure they meet the required specifications.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate CNC aspheric optical and diamond turning machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up and ready for operation 1.3 follow the defined procedures for starting and running the operating system 1.4 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• hold components securely, without damage or distortion • maintain the cutting tools in a suitable condition • ensure that the operating program is at the correct start point before starting the machine • ensure that the workpiece is clear of the machine spindle • ensure that safe working practices and start-up procedures are observed • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.5 operate one of the following aspheric lens processes: • glass aspheric generating process • glass aspheric polishing process • diamond turning aspheric process • diamond turning diffractive/hybrid process			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.6 produce machined optical components that combine different operations and cover four of the following: • centre thickness • lens cosmetic defects • lens concentricity • lens cap height • lens diameter/step feature, angle • lens aspheric form analysis • lens surface roughness • lens power analysis/radius • lens diffractive step height			
1b Operate CNC aspheric optical and diamond turning machines (continued)	1.7 machine three different types of material from the following: • zinc selenide • zinc sulphide • optical silicon • optical cleartran • optical infra-red glass 4 • optical infra-red glass 5 • optical infra-red glass 6			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• gallium arsenide • acrylic • optical glass • optical grade germanium • optical thallium ideobromide • aluminium • other appropriate optical material 1.8 deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved 1.9 monitor the computer process and ensure that the production output is to the required specification 1.10 produce components with dimensional accuracy, form and surface quality, which comply to one of the following standards: • BS, ISO or BSEN standards and procedures • other accepted international standards • customer (contractual) standards and requirements • company standards and procedures			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.11 carry out the necessary checks for accuracy during production of four of the following: • lens chamfers • lens surface finish • lens diameter • lens cap height • lens centre thickness • lens power error lens surface power error 1.12 shut down the equipment to a safe condition on conclusion of the activities			
2a Know how to operate CNC aspheric optical and diamond turning machines	2.1 describe the safe working practices and procedures to be followed while operating CNC aspheric lens generating, and polishing equipment and diamond turning equipment 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both set-up and run modes, and how to stop the machine in an emergency 2.4 describe the personal protective equipment to be worn, and where this can be obtained			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.5 describe the hazards associated with carrying out aspheric lens process operations, and how to minimise them and reduce any risk 2.6 describe the importance of keeping the work area clean and tidy 2.7 explain how to extract and use information from optical 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 use imperial and metric systems of measurement and system of tolerancing 2.9 describe the process methods of aspheric manufacture, and the use of a variety of tools (such as diamond tip tools, diamond abrasive wheels and polishing tools) 2.10 describe the lens mounting methods used to set up the workpiece prior to operation, to minimise wedge error, concentricity and astigmatism			
2b Know how to operate CNC aspheric optical and diamond turning machines (continued)	2.11 explain how to handle and store all cutting tools and kit required, safe and correctly 2.12 describe the factors which affect the selection of cutting feeds, pressures and speeds required, and the depth of cut that can be taken (such as workpiece rigidity, machine condition, types of tooling, material, finish and tolerance required)			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.13 explain how tool wear affects surface finish and dimensional accuracy 2.14 explain how the various types of material will affect the way the operation is performed 2.15 describe the application of cutting fluids with regard to the range of material being produced 2.16 explain how to recognise machine faults, and how to identify when tooling needs refurbishment 2.17 describe the problems that can occur with CNC optical lens infra-red and special material machining activities, and how they can be overcome 2.18 describe the quality control procedures used, inspection checks to be carried out, and the equipment used 2.19 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 46: Operating CNC optical grinding and polishing machines

Unit reference number: J/600/6069

Level: 2

Credit value: 32

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to machine glass and infra-red/special material components, using Computer Numerical Control (CNC) optical grinding and polishing machines, in accordance with approved procedures. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components, materials and consumables are available.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate CNC optical grinding and polishing machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the equipment is set up and ready for operation 1.3 operate one of the following CNC optical process machines: • CNC 3 axis machine • CNC generating machine • CNC optical edging machine • CNC 4 axis machine • CNC smoothing machine • CNC optical grinding machine • CNC polishing machine • CNC special purpose machines • other CNC machines 1.4 follow the defined procedures for starting and running the operating system			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.5 apply all of the following during the machine 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without damage or distortion • maintain the cutting tools in a suitable condition • ensure that the operating program is at the correct start point before starting the machine • ensure that the workpiece is clear of the machine spindle			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that safe working practices and start-up procedures are observed • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.6 produce optical machined components which combine different operations and cover four of the following: • centre thickness • bevels • optical form analysis • surface finish • component profile • optical power (radius of curvature) • cap height • concentricity • diameter/step feature, angles			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Operate CNC optical grinding and polishing machines (continued)	1.7 machine three different types of materials from the following: • germanium • silicon • zinc selenide • zinc sulphide • cleartran • lanthanum crowns • dense flints • flints/light flints • barium crowns • borosilicate crowns • barium dense flints • anomalous dispersion flour crowns • other appropriate optical material 1.8 deal promptly and effectively with error messages or equipment faults that are within their control and report those that cannot be solved 1.9 control the computer process and ensure that the production output is to the required specification			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.10 produce components with dimensional accuracy, form and surface quality, which complies to one of the following standards applicable to the operations: • BS, ISO or BSEN standards and procedures • other accepted international standards • customer (contractual) standards and requirements • company standards and procedures 1.11 carry out the necessary checks for accuracy, during production, of four of the following: • centre thickness • component surface finish • component cosmetic defects • component profiles • bevels/chamfers • lens diameter • surface power error • surface form error • angles • cap height			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.12 shut down the equipment to a safe condition on conclusion of the activities			
2a Know how to operate CNC optical grinding and polishing machines	2.1 describe the safe working practices and procedures to be followed while operating CNC optical grinding and polishing machines/machining centres 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both set-up and run modes, and how to stop the machine in an emergency 2.4 describe the personal protective equipment to be worn, and where this can be obtained 2.5 describe the hazards associated with carrying out CNC process operations, and how to minimise them and reduce any risks 2.6 describe the importance of keeping the work area clean and tidy 2.7 explain how to extract and use information from optical 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 use imperial and metric systems of measurement and system of tolerancing			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.9 describe the process methods of CNC optical manufacture, and the use of a variety of grinding and polishing tools (such as diamond abrasive wheels and polishing tools) 2.10 describe the optical component mounting methods used to set up the workpiece prior to operation			
2b Know how to operate CNC optical grinding and polishing machines (continued)	2.11 explain how to handle and store all cutting tools and kit required, safely and correctly 2.12 describe the factors that affect the selection of cutting feeds, pressures and speeds and the depth of cut 2.13 explain how tool wear affects surface finish and dimensional accuracy 2.14 explain how the various types of material will affect the way the operation is performed 2.15 describe the application of cutting fluids with regard to the range of material being produced 2.16 explain how to recognise machine faults, and how to identify when grinding wheels need refurbishment 2.17 describe the problems that can occur with optical grinding and polishing machines, and how they can be overcome			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.18 describe the quality control procedures used, inspection checks to be carried out, and the equipment used 2.19 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 47: Operating optical cylinder and dome process machines

Unit reference number: F/600/6071

Level: 2

Credit value: 42

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out machining and finishing operations on optical cylinders and/or domes, in accordance with approved procedures, using optical process machines. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate optical cylinder and dome process machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 either – operate two of the following types of optical cylinder processes: • cylinder preparation process • cylinder pitch polishing process • cylinder hand lapping to axis/angle process • cylinder silk polishing process or – operate two of the following types of optical dome processes: • dome preparation process • dome silk polishing process • dome surface generation process • dome pitch polishing process • dome polyurethane process 1.4 manipulate the machine tool controls safely and correctly in line with operational procedures 1.5 produce components to the required quality and within the specified dimensional accuracy			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.6 apply all of the following during the machining 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without damage or distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.7 produce machined optical components that combine different operations and cover four of the following: • cylinder/dome centre thickness • cylinder/dome concentricity • cylinder/dome cosmetic defects • cylinder/dome diameter • cylinder/dome truncation • dome preparation/smoothing process • cylinder/dome surface generation • cylinder/dome power analysis (radius) • cylinder/dome form error analysis • cylinder parallelism • cylinder hand lapping process • dome transmitted wave-front analysis • dome transmission analysis			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Operate optical cylinder and dome process machines (continued)	1.8 either – machine three different types of cylinder material from the following: • germanium • barium crowns • dense flints • flints/light flints • lanthanum crowns • barium dense flints • optical neutral density cut glass • anomalous dispersion flour crowns • optical orange filter glass • optical blue filter glass • borosilicate crowns • magnesium fluoride • other appropriate cylinder material or – machine two different types of dome material from the following: • germanium • zinc selenide • zinc sulphide			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.9 carry out quality sampling checks at suitable intervals 1.10 produce components with dimensional accuracy, form and surface quality, which comply to one of the following standards: • BS, ISO or BSEN standards and procedures • other accepted international standards • customer (contractual) standards and requirements • company standards and procedures 1.11 carry out the necessary checks for accuracy during production of four of the following: • dome diameter • cylinder parallelism • cylinder/dome truncation • cylinder/dome centre thickness • cylinder/dome cosmetic surface finishes • cylinder/dome bevels • cylinder/dome chamfers • cylinder/dome cap height • cylinder/dome surface power error • cylinder/dome surface form error			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• magnesium fluoride • other appropriate dome material 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate optical cylinder and dome process machines	2.1 describe the safe working practices and procedures to be followed while operating optical cylinder/dome generating, hand lapping, smoothing and polishing equipment 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both set-up and run modes, and how to stop the machine in an emergency 2.4 describe the personal protective equipment to be worn, and where this can be obtained 2.5 describe the hazards associated with carrying out optical cylinder/dome process operations, and how to minimise them and reduce any risks 2.6 describe the importance of keeping the work area clean and tidy			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.7 explain where to obtain the component drawing, specifications and/or job instructions required for the components to be machined 2.8 explain how to extract and use information from optical 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 use imperial and metric systems of measurement 2.10 describe the various optical cylinder/dome operations that can be performed 2.11 describe the effect of backlash in machines slides, dials and screws, and how this can be overcome			
2b Know how to operate optical cylinder and dome process machines (continued)	2.12 explain how to handle and store all cutting tools and kit required, safely and correctly 2.13 describe the application of roughing and finishing cuts, cylinder/dome pressures used, and the effects on tool life, surface finish and dimensional accuracy 2.14 explain how tool wear affects surface finish and dimensional accuracy 2.15 explain how the various types of material will affect the way the operation is performed			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.16 describe the application of cutting fluids and polishing mediums with regard to the range of material being produced 2.17 describe the effect of clamping the workpiece, and how this can cause distortion in the finished component 2.18 explain how to recognise machine faults, and how to identify when tooling needs refurbishment 2.19 describe the problems that can occur with optical cylinder/dome machining activities, and how they can be overcome 2.20 describe the quality control procedures used, inspection checks to be carried out, and the equipment used 2.21 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 48: Operating vacuum coating optical process machines

Unit reference number: R/600/6074

Level: 2

Credit value: 32

Guided learning hours: 130

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out optical thin-film coating operations, in accordance with approved procedures, using optical thin-film coating process machines. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components, materials and consumables are available. The learner will be required to operate a range of equipment, in order to produce components that combine a mixture of processes identified for optical thin-film coating, using a selection of specified optical materials. The learner will be expected to produce a range of components that combine a number of different features, such as optical transmission, flatness, surface defects and transmitted wavelength.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate vacuum coating optical process machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 ensure that material surfaces to be treated are suitably prepared for the finishing operations to be carried out 1.3 check that the finishing equipment and treatment solutions are set up and maintained at satisfactory operating conditions and levels 1.4 carry out all of the following during the setting up and operating activities: • obtain and use the appropriate documentation (such as job instructions, drawings, quality control documentation, material data sheets) • 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• ensure that machine guards and safety mechanisms are in place and are correctly adjusted • hold components securely, without damage or distortion • follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required quality • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.5 carry out the treatment process in accordance with operating procedures and the component specification requirements 1.6 operate one of the following types of optical thin-film coating process machine from the following: • infra-red/special material coating • other coating processes • polycarbonate material coating • basic anti-reflection coating			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.7 produce optical thin-film coated components that combine different operations and cover four of the following: • coated flatness tolerance • coated cosmetic defects • coating material sources • coated reflection and transmission • coated specifications tolerances • coating component preparation/cleaning • coating component loading/unloading			
1b Operate vacuum coating optical process machines (continued)	1.8 thin-film coat two different types of component materials from the following: • germanium • polycarbonate • barium crown • dense flints • optical blue filter glass • zinc selenide prisms and flats • borosilicate crown • flint/light flints			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• anomalous dispersion flour crown • optical neutral density glass • zinc sulphide prisms and flats • barium dense flints • lanthanum crowns • optical orange filter glass • other appropriate material 1.9 ensure that the treated workpiece achieves the required characteristics and meets the finishing specification 1.10 produce components which comply to one of the following standards: • BS, ISO or BSEN standards and procedures • other accepted international standards • customer (contractual) standards and requirements • company standards and procedures • optical coating specifications 1.11 carry out the necessary checks for accuracy, during production, of all of the following: • transmission measurement			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• surface defect measurement • flatness measurement • coating adhesion test 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 dispose of waste and excess materials in line with agreed organisational procedures 1.14 shut down the finishing equipment to a safe condition on completion of the processing activities			
2a Know how to operate vacuum coating optical process machines	2.1 describe the safe working practices and procedures to be followed while operating optical coating process machines 2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both set-up and run modes, and how to stop the machine in an emergency 2.4 describe the personal protective equipment to be worn, and were this can be obtained 2.5 describe the hazards associated with carrying out optical coating process operations, and how to minimise them and reduce any risks			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.6 describe the importance of keeping the work area clean and tidy 2.7 explain where to obtain the component drawings, specifications and/or job instructions, in order to produce the required components to be coated 2.8 explain how to extract the necessary information from the drawings and specifications, in order to produce the required optical coating component 2.9 describe the factors which affect the selection of machine set-up, in order to achieve correct coating specification			
2b Know how to operate vacuum coating optical process machines (continued)	2.10 describe the preparation of coating material sources 2.11 explain how to load and unload coating components correctly into coating jigs and fixtures 2.12 explain how to clean and store components prior to coating operations 2.13 explain how to prepare the coating plant prior to the coating process 2.14 explain how to correctly identify the component face to be coated 2.15 explain how to strip the coating plant after coating operations have been carried out			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.16 describe the problems that can occur with optical thin-film coating activities, and how they can be overcome 2.17 describe the quality control procedures used, inspection checks to be carried out, and the equipment used to achieve the required component 2.18 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Unit 49: Operating optical plastic process machines

Unit reference number: Y/600/6075

Level: 2

Credit value: 42

Guided learning hours: 151

Unit summary

This unit covers the skills and knowledge needed to prove the competences required to carry out machining operations on optical plastic materials, in accordance with approved procedures, using optical plastic process machines. The learner will confirm with the machine setter that the machine is ready for the operations to be performed and that all the required components/materials and consumables are available. The learner will be required to operate a range of machines, in order to produce components that combine a mixture of processes identified for plastic materials, using a selection of specified optical plastic lens and flat materials. The learner will be expected to produce a range of components that combine a number of different features, such as centre thickness, diameters, generated blanks, optical lens form, power, and stress and strain analysis.

Assessment requirements/evidence requirements

This unit must be assessed in a work environment and must be assessed in accordance with the 'Semta Assessment Strategy'. Detailed information is given in *Annexe D.*

Assessment methodology

Learners can enter the types of evidence they are presenting for assessment and the submission date against each assessment criterion. Alternatively, centre documentation should be used to record this information.

Learning outcomes and assessment criteria

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1a Operate optical plastic process machines	1.1 work safely at all times, complying with health and safety and other relevant regulations and guidelines 1.2 confirm that the machine is set up and ready for the machining activities to be carried out 1.3 apply all of the following during machine operation: • 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 • confirm with the machine setter that the machine is ready for production • where appropriate, seek any necessary instruction/training on the operation of the machine • ensure that machine guards are in place and are correctly adjusted • hold components securely, without damage or distortion			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• follow the defined operating procedures and apply safe working practices and procedures at all times • ensure that machine settings are adjusted as and when required (either by themselves or the setter) to maintain the required accuracy • ensure that the components produced meet the required specification for quality and accuracy • leave the work area and machine in a safe and appropriate condition on completion of the activities 1.4 manipulate the machine tool controls safely and correctly in line with operational procedures 1.5 produce components to the required quality and within the specified dimensional accuracy 1.6 operate three types of optical plastic process from the following: • automated process • lens generating process • lens edging process • lens smoothing process • prism/flat smoothing process • hand smooth process			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	• hand polish process • plastic stabilisation process • plastic diamond turning process • prism/flat polishing process • optical special materials process • special plastic cleaning process 1.7 produce machined optical components that combine different operations and cover four of the following: • centre thickness • flat parallelism • lens surface generation • angular collimating • lens diameter • lens concentricity • lens form analysis • lens power analysis • lens cosmetic defects • lens truncation and cap height			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
1b Operate optical plastic process machines (continued)	1.8 machine one of the following types of plastic material: • cyclic olefin • polyetherimide • acrylic • nylon • polyethyrene • sulfones • polycarbonate • other optical grade plastics 1.9 carry out quality sampling checks at suitable intervals 1.10 produce components with dimensional accuracy, form and surface quality, which comply to one of the following standards: • BS, ISO or BSEN standards and procedures • other accepted international standards • customer (contractual) standards and requirements • company standards and procedures			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	1.11 carry out the necessary checks for accuracy during production of at least three of the following: • lens chamfers • lens surface finish • lens diameter • lens cap height • lens centre thickness • prism angles • parallelism • truncations • lens surface form error • bevels • lens surface power/radius error 1.12 deal promptly and effectively with problems within their control and report those that cannot be solved 1.13 shut down the equipment to a safe condition on conclusion of the machining activities			
2a Know how to operate optical plastic process machines	2.1 describe the safe working practices and procedures to be followed while operating plastic lens generating, smoothing and polishing equipment			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.2 describe the safety mechanisms on the machine, and the procedure for checking that they function correctly 2.3 describe the operation of the machine controls in both set-up and run modes, and how to stop the machine in an emergency 2.4 describe the personal protective equipment to be worn, and where this can be obtained 2.5 describe the hazards associated with carrying out plastic lens process operations, and how to minimise them and reduce any risks 2.6 describe the importance of keeping the work area clean and tidy 2.7 explain how to extract and use information from optical 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 use imperial and metric systems of measurement 2.9 describe the various plastic prism/lens operations that can be performed 2.10 explain how to achieve the required level of finish using hand smoothing and polishing techniques			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.11 describe the effect of backlash in machines slides, dials and screws, and how this can be overcome			
2b Know how to operate optical plastic process machines (continued)	2.12 explain how to handle and store all cutting tools and kit required, safe and correctly 2.13 describe the application of roughing and finishing cuts and pressures used, and the effects on tool life, surface finish and dimensional accuracy 2.14 explain how tool wear affects surface finish and dimensional accuracy 2.15 explain how the various types of materials will affect the way the operation is performed 2.16 describe the application of cutting fluids with regard to the range of material being produced 2.17 describe the effect of clamping the workpiece, and how this can cause distortion in the finished component 2.18 explain how to recognise machine faults, and how to identify when tooling needs refurbishment 2.19 describe the problems that can occur with plastic lens/prism machining activities, and how they can be overcome 2.20 describe the quality control procedures used, inspection checks to be carried out, and the equipment used			

Learning outcomes	Assessment criteria	Evidence type	Portfolio reference	Date
	2.21 describe the extent of their own responsibility and to whom they should report if they have problems that they cannot resolve			

Learner name: _____ Date: _____

Learner signature: _____ Date: _____

Assessor signature: _____ Date: _____

Internal verifier signature: _____ Date: _____
(*if sampled*)

Further information

To get in touch with us visit our 'Contact us' pages:

- Edexcel, BTEC and Pearson Work Based Learning contact details: qualifications.pearson.com/en/support/contact-us.html
- books, software and online resources for UK schools and colleges: www.pearsonschoolsandfecolleges.co.uk

Key publications

- *Adjustments for candidates with disabilities and learning difficulties, Access and Arrangements and Reasonable Adjustments, General and Vocational qualifications* (Joint Council for Qualifications (JCQ))
- *Supplementary guidance for reasonable adjustments and special consideration in vocational internally assessed units* (Pearson)
- *General and Vocational qualifications, Suspected Malpractice in Examination and Assessments: Policies and Procedures* (JCQ)
- *Equality Policy* (Pearson)
- *Recognition of Prior Learning Policy and Process* (Pearson)
- *UK Information Manual* (Pearson)
- *Pearson Edexcel NVQs, SVQs and competence-based qualifications – Delivery Requirements and Quality Assurance Guidance* (Pearson)

All of these publications are available on our website: qualifications.pearson.com

Further information and publications on the delivery and quality assurance of NVQ/Competence-based qualifications are available at our website on the Delivering BTEC pages. Our publications catalogue lists all the material available to support our qualifications. To access the catalogue and order publications, please go to the resources page of our website.

How to obtain National Occupational Standards

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14 Upton Road
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WD18 0JT

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Fax: 01923 256086
Email: customerservices@semta.org.uk

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The training we provide:

- is active
- is designed to be supportive and thought-provoking
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Annexe A: Quality assurance

Key principles of quality assurance

- A centre delivering Pearson qualifications must be a Pearson recognised centre and must have approval for qualifications that it is offering.
- The centre agrees as part of gaining recognition to abide by specific terms and conditions around the effective delivery and quality assurance of assessment; the centre must abide by these conditions throughout the period of delivery.
- Pearson makes available to approved centres a range of materials and opportunities to exemplify the processes required for effective assessment and provide examples of effective standards. Approved centres must use the guidance on assessment to ensure that staff who are delivering Pearson qualifications are applying consistent standards.
- An approved centre must follow agreed protocols for: standardisation of assessors; planning, monitoring and recording of assessment processes; internal verification and recording of internal verification processes; and for dealing with special circumstances, appeals and malpractice.

Quality assurance processes

The approach to quality assured assessment is made through a partnership between a recognised centre and Pearson. Pearson is committed to ensuring that it follows best practice and employs appropriate technology to support quality assurance process where practicable. Therefore, the specific arrangements for working with centres will vary. Pearson seeks to ensure that the quality assurance processes that it uses do not place undue bureaucratic processes on centres and works to support centres in providing robust quality assurance processes.

The learning outcomes and assessment criteria in each unit within this specification set out the standard to be achieved by each learner in order to gain the qualification. Pearson operates a quality assurance process, which is designed to ensure that these standards are maintained by all assessors and verifiers.

For the purposes of quality assurance all individual qualifications and units are considered as a whole. Centres offering Pearson qualifications must be committed to ensuring the quality of the units and qualifications they offer, through effective standardisation of assessors and internal verification of assessor decisions. Centre quality assurance and assessment processes are monitored by Pearson.

The Peasron quality assurance processes will involve:

- gaining centre recognition and qualification approval if a centre is not currently approved to offer Pearson qualifications
- annual visits to centres by Pearson for quality review and development of overarching processes and quality standards. Quality review and development visits will be conducted by a Pearson quality development reviewer
- annual visits by occupationally competent and qualified Pearson Standards Verifiers for sampling of internal verification and assessor decisions for the occupational sector
- the provision of support, advice and guidance towards the achievement of National Occupational Standards.

Centres are required to declare their commitment to ensuring quality and appropriate opportunities for learners that lead to valid and accurate assessment outcomes. In addition, centres will commit to undertaking defined training and online standardisation activities.

Annexe B: Centre certification and registration

Pearson Standards Verifiers will provide support, advice and guidance to centres to achieve Direct Claims Status (DCS). Peasron will maintain the integrity of Pearson NVQs through ensuring that the awarding of these qualifications is secure. Where there are quality issues identified in the delivery of programmes, Pearson will exercise the right to:

- direct centres to take actions
- limit or suspend certification
- suspend registration.

The approach of Pearson in such circumstances is to work with the centre to overcome the problems identified. If additional training is required, Pearson will aim to secure the appropriate expertise to provide this.

What are the access arrangements and special considerations for the qualification in this specification?

Centres are required to recruit learners to Pearson qualifications with integrity.

Appropriate steps should be taken to assess each applicant's potential and a professional judgement made about their ability to successfully complete the programme of study and achieve the qualification. This assessment will need to take account of the support available to the learner within the centre during their programme of study and any specific support that might be necessary to allow the learner to access the assessment for the qualification. Centres should consult Pearson's policy on learners with particular requirements.

Pearson's policy on access arrangements and special considerations for Pearson qualifications aims to enhance access to the qualifications for learners with disabilities and other difficulties (as defined by the 2010 Equality Act) without compromising the assessment of skills, knowledge, understanding or competence. Please refer to *Access Arrangements and Special Considerations for BTEC and Pearson NVQ Qualifications* for further details. qualifications.pearson.com.

Annexe C: Additional requirements for Qualifications that use the title NVQ within the QCF

Contents

Purpose of document

1. The purpose of this document is to make clear what Additional requirements are needed to assess and quality assure qualifications that use the title NVQ within the QCF.
2. When an SSC/SSB and awarding organisation wants to use the title NVQ in the naming of a qualification within the QCF, the awarding organisation is required to make sure this qualification is assessed and quality assured in accordance with these Additional requirements and other requirements described in the SSC/SSB assessment strategy.
3. The aims of these Additional requirements are to
    - ensure that all competence based qualifications that use the title NVQ within the QCF are
        - assessed consistently
        - quality assured consistently
    - maintain the integrity of qualifications that use the title NVQ within the QCF
    - establish the NVQ brand within the QCF
    - keep bureaucracy associated with assessment and quality assurance of qualifications that use the title NVQ within the QCF to a minimum.

Background

4. [1] "At the heart of an NVQ is the concept of occupational competence; the ability to perform to the standards required in employment across a range of circumstances and to meet changing demands. NVQs are first and foremost about what people can do. They go beyond technical skills to include planning, problem solving, dealing with unexpected occurrences, working with other people and applying the knowledge and understanding that underpins overall competence".
5. NVQs are based entirely on National Occupational Standards (NOS) developed by an SSC/SSB, which describe the competence needed in an occupational role.
6. Qualifications that use the title NVQ within the QCF must comply with the rules of combination determined by the SSC/SSB. Awarding organisations are not allowed to develop another qualification that does not use the title NVQ within the QCF, if it uses the same rules of combination as a qualification that does use the title NVQ within the QCF.
7. The QCF offers increased flexibility in the way occupational competence can be assessed and demonstrated. Qualifications that use the title NVQ in the title within the QCF are just one way of assessing and demonstrating occupational competence. SSCs/SSBs are free to work with their awarding organisations to agree what qualifications will be used to assess occupational competence. Qualifications that use the title NVQ within the QCF, are not a preferred method for assessing occupational competence and all qualifications accredited through the QCF have equal status.
8. When developing a qualification for the QCF, including qualifications that use the title NVQ within the QCF, an awarding organisation must be a recognised awarding organisation and must meet the Qualification Requirements in the Regulatory Arrangements for the Qualifications and Credit Framework, published by The Office of the Qualifications and Examinations Regulator (Ofqual) in August 2008.
9. The qualification regulators confirmed that a group of SSCs and SSBs would be free to develop specific, Additional requirements about the way in which qualifications that use the title NVQ within the QCF will be assessed and quality assured. For those recognised awarding organisations that want to assess occupational competence through the use of qualifications that use the title NVQ within the QCF, it has been agreed by SSCs and SSBs that the following Additional requirements must be met.

[1] NCVQ's NVQ Criteria and Guidance 1995.

Additional requirements for qualifications that use the title NVQ within the QCF

Introduction

10. Qualifications that use the title NVQ within the QCF must be assessed and quality assured in accordance with the following Additional requirements.

Assessment Requirements

11. When a qualification uses the title NVQ within the QCF, awarding organisations are required to make sure their recognised assessment centres understand how learners are to be assessed.
12. Assessment methodologies must meet the assessment strategy developed in partnership between the relevant SSC or SSB and awarding organisations for the qualification. The assessment strategy must be published and made available separately and will include the requirements for assessment of qualifications that use the title NVQ within the QCF. The assessment criteria for each unit will be part of the units that make up the qualification.
13. Learners must complete real work activities in order to produce evidence to demonstrate they have met the NOS and are occupationally competent.
14. When a learner cannot complete a real work activity, simulation is allowed.
15. Simulation is allowed when
    - a learner is required to complete a work activity that does not occur on a regular basis and therefore opportunities to complete a particular work activity do not easily arise
    - a learner is required to respond to a situation that rarely occurs, such as responding to an emergency situation
    - the safety of a learner, other individuals and/or resources will be put at risk.
16. When simulation is used, assessors must be confident that the simulation replicates the workplace to such an extent that learners will be able to fully transfer their occupational competence to the workplace and real situations.
17. Units that must not be assessed by simulation must be identified by the SSC/SSB in the assessment strategy for the qualification or family of qualifications.

18. Learners must be assessed by assessors
    - who are occupationally competent in the occupational areas they are assessing where they have sufficient and relevant technical/occupational competence in the unit, at or above the level of the unit being assessed and as defined by the assessment strategy for that qualification
    - [2]who must hold or be working towards a suitable assessor qualification to confirm they understand assessment and how to assess learners
    - must be fully conversant with the unit(s) against which the assessments and verification are to be undertaken.
19. All assessors must carry out assessment to the standards specified in the A units.
20. All assessment decisions made by a trainee assessor must be checked by a qualified assessor or an assessor recognised by an awarding organisation.
21. Trainee assessors must have a plan, which is overseen by the recognised assessment centre, to achieve the relevant assessor qualification(s) within an agreed timescale.

[2] Currently an assessor could hold unit A1 and/or unit A2. Or from the past unit D32 and/or unit D33. SSCs also identify other suitable equivalent qualifications.

Quality assurance requirements

22. When a qualification uses the title NVQ within the QCF, awarding organisations are required to make sure their recognised assessment centres understand how the qualification will be quality assured.
23. Qualifications that use the title NVQ within the QCF, must be verified
    - internally by an internal verifier, who is accountable to the assessment centre
    - externally by an external verifier, who is accountable to the awarding organisation or an agent of the awarding organisation.
24. With reference to internal verification, internal verifiers must
    - [3]hold or be working towards a suitable internal verifier qualification to confirm they understand how to internally verify assessments
    - have sufficient and relevant technical/occupational familiarity in the unit(s) being verified
    - be fully conversant with the standards and assessment criteria in the units to be assessed
    - understand the awarding organisation's quality assurance systems and requirements for this qualification.
25. Trainee internal verifiers must have a plan, which is overseen by the recognised assessment centre, to achieve the internal verifier qualification within an agreed timescale.
26. With reference to external verification, external verifiers must
    - [4]hold or be working towards a suitable external verification qualification to confirm they understand and are able to carry out external verification
    - have no connections with the assessment centre, in order to maintain objectivity
    - have sufficient and relevant technical/occupational understanding in the unit(s) being verified
    - be fully conversant with the standards and performance criteria in the units to be assessed
    - understand the awarding organisation's quality assurance systems for this qualification.
27. Trainee external verifiers must have a plan, which is overseen by the awarding organisation, to achieve the external verifier qualification within an agreed timescale.

[3] Currently an internal verifier needs to hold unit V1. Or from the past unit D34. SSCs also identify other suitable equivalent qualifications.

[4] Currently an external verifier needs to hold unit V2. Or from the past unit D35.

Awarding organisations must decide the frequency of external monitoring activities. Any decision must be based on

- the risks associated with a qualification that is designed to help a learner demonstrate occupational competence
- an evaluation of the centre's performance and past record.

28. Awarding organisations will have in place suitably constituted audit processes, which are supported by naturally occurring quality assurance and monitoring systems that already exist in workplace assessment environments.

Annexe D: Assessment Strategy

Semta

Engineering

NVQ Level 2, 3 and 4

QCF Unit Assessment strategy

Version 1. 16th March 2010

Contents

Introduction

Semta, the Sector Skills Council for the Science Engineering Manufacturing Technologies Sector, has produced this QCF Unit Assessment strategy to:

- assist Assessors, Internal Verifiers and External Verifiers
- encourage and promote consistent assessment of NVQ units
- promote cost effective assessment plans.

This document also provides definitions for:

- the qualifications and experience required for Assessors and Verifiers
- the assessment environment and notes on simulation/replication.
- access to units.

and requirements relating to:

- carrying out assessments
- performance evidence
- assessing knowledge and understanding.

The importance and value in which employers and learners place on undertaking NVQ units will provide a key measure of [Semta's] success with this unit assessment strategy. Another key success factor will be [Semta's] partnership with the relevant Awarding Organisations.

Assessor Requirements to Demonstrate Effective Assessment Practice

Assessment must be carried out by competent Assessors who hold, or are working towards, the nationally recognised Assessor units A1 and/or A2 as appropriate to the assessment being carried out. Assessors that hold units D32 and/or D33 must demonstrate that they are applying the assessment principles and practices set down in A1 and/or A2 as appropriate to the assessment being carried out.

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 QCF 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 QCF 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 Verifiers must hold, or be working towards, the nationally recognised Internal Verifier unit V1 and would be expected to be familiar with, and preferably hold, the nationally recognised Assessor units. Internal Verifiers that hold unit D34 must demonstrate that they are applying the verification principles and practices set down in V1.

External Verifiers must hold, or be working towards, the nationally recognised External Verifier unit V2 and would be expected to be familiar with, and preferably hold, the nationally recognised Assessor units, and Internal Verifier unit. External Verifiers that hold unit D35 must demonstrate that they are applying the verification principles and practices set down in V2.

Verifiers, both Internal and External, will also be expected to be fully conversant with the terminology used in the QCF 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, systems and procedures within which the assessment and verification is taking place.

Specific technical requirements for internal and external verifiers

Internal and external verifiers of this qualification must be able to demonstrate that have verifiable, sufficient and relevant industrial experience, and must have a working knowledge of the processes, techniques and procedures that are used in the relevant sector/occupation.

The tables on the following page show the recommended levels of technical competence for assessors, internal verifiers, and external verifiers.

Technical Requirements for Assessors and Verifiers

Position	**Prime activity requirements**	**Support activity requirements**	**Technical requirements (see notes)**
Assessor	Assessment Skills	IV Systems	Technical *competence* in the areas covered by the QCF units being assessed
Internal Verifier	Verification Skills	Assessment Knowledge	Technical *understanding* of the areas covered by the qualifications
External Verifier	Verification skills	Assessment Understanding	Technical *awareness* of the areas covered by the qualifications

Notes

1. Technical *competence* is defined here as a combination of practical skills, knowledge, and the ability to apply both of these, in familiar and new situations, within a real working environment.
2. Technical *understanding* is defined here as having a good understanding of the technical activities being assessed, together with knowledge of relevant Health & Safety implications and requirements of the assessments.
3. Technical *awareness* is defined here as a general overview of the subject area, sufficient to ensure that assessment and portfolio evidence are reliable, and that relevant Health and Safety requirements have been complied with.
4. The competence required by the assessor, internal verifier and external verifier, in the occupational area being assessed, is likely to exist at three levels as indicated by the shaded zones in the following table.

Technical Competence / required by:	An ability to *discuss* the general principles of the competences being assessed	An ability to *describe* the practical aspects of the competence being assessed	An ability to *demonstrate* the practical competences being assessed
Assessor			
Internal Verifier			
External Verifier			

Assessment Environment

The evidence put forward for this unit 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 the specific Awarding Organisation 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 take the same form as in the workplace.

Access to Assessment

There are no entry qualifications or age limits required by learners to undertake the NVQ units unless this is a legal requirement of the process or the environment. Assessment is open to any learner who has the potential to achieve the assessment criteria set out in the units.

Aids or appliances, which are designed to alleviate disability, may be used during assessment, providing they do not compromise the standard required.

Carrying Out Assessment

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.

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 maybe 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.

together with:

- 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 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 learners 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 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. Awarding Organisations may choose other methods, which must be supported by a suitable rationale.

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.

Awarding Organisations may choose other methods, which must be supported by a suitable rationale.

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 learners 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.

Quality Control of Assessment

General

There are two major points where an Awarding Organisation interacts with the Centre in relation to the External Quality Control of Assessment for a qualification and these are:

- Approval - when a Centre take on new qualifications, the Awarding Organisation, normally through an External Verifier (EV) ensures that the Centre is suitably equipped and prepared to deliver the new qualification
- Monitoring - throughout the ongoing delivery of the qualification the Awarding Organisation, through EV monitoring and other mechanisms must maintain and the quality and consistency of assessment of the qualification.

Approval

In granting Approval, the Awarding Organisation, normally through its External Verifiers (EV) Must ensure that the prospective Centre:

- Meets any procedural requirements specified by the Awarding Organisation
- Has sufficient and appropriate physical and staff resources
- Meets relevant health and safety and/or equality and access requirements
- Has a robust plan for the delivery, assessment and QA for the qualifications.

Awarding Organisation's may decide to visit the Centre to view the evidence provided. The Awarding Organisation must have a clear rationale for the method(s) deployed

Monitoring

- The Awarding Organisation, through EV monitoring and other mechanisms must ensure:
- that a strategy is developed and deployed for the ongoing Awarding Organisation monitoring of the Centre. This strategy must be based on an active risk assessment of the Centre. In particular the strategy must identify the learner, assessor and IV sampling strategy to be deployed and the rationale behind this
- that the Centre's internal quality assurance processes are effective in learner assessment
- that sanctions are applied to a Centre where necessary and that corrective actions are taken by the Centre and monitored by the Awarding Organisation/EV
- that reviews of Awarding Organisation's external auditing arrangements are undertaken.

Awarding Organisations are required to provide to SEMTA, on request, details of the strategies, rationales and reviews detailed above.

Additional Notes:

It is recognised that some Awarding Organisations provide supplementary guidance and documentation to centres to support the quality of assessment and verification practice of N/SVQs.

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