Qualification Specification:

OCN NI Level 2 Diploma in Engineering

- **Qualification No: 610/2947/6**

Version: 2.0

1. Specification Updates

Key changes have been listed below:

Section	Detail of change	Version and date of Issue
Specification	New format and scope	v2.0 – May 2025

2. Contents

3. Introduction to Open College Network Northern Ireland (OCN NI)

The Open College Network Northern Ireland (OCN NI) is a UK recognised awarding organisation based in Northern Ireland. We are regulated by CCEA Regulation to develop and award regulated professional and technical (vocational) qualifications from Entry Level up to and including Level 5 across all sector areas. In addition, OCN NI is also regulated by Ofqual to award qualifications in England.

OCN NI is also an educational charity that advances education by developing nationally recognised qualifications and recognising the achievements of learners. We work with centres such as Further Education Colleges, Private Training Organisations, Voluntary & Community Organisations, Schools, SME's and Public Sector bodies to provide learners with opportunities to progress into further learning and/or employment. OCN NI's Strategic Plan can be found on the OCN NI website www.ocnni.org.uk.

For further information on OCN NI qualifications or to contact us, you can visit our website at www.ocnni.org.uk. The website should provide you with details about our qualifications, courses, contact information, and any other relevant information you may need.

OCN NI Contact Details

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4. About this Specification

This specification details OCN NI's specific requirements for the delivery and assessment of the **OCN NI Level 2 Diploma in Engineering.**

This specification will provide guidelines for centres to ensure the effective and correct delivery of this qualification. OCN NI qualification specifications are based on research and engagement with the practitioner community to ensure they provide appropriate skills and knowledge for learners.

The qualification specification will detail the following aspects of the OCN NI Level 2 Diploma in Engineering.

- **Qualification Features:** this includes the key characteristics and features of this qualification, such as its intended audience, purpose, and credit value.

- **Centre Requirements:** this details the prerequisites and obligations that centres must fulfil to be eligible to deliver and assess this qualification. These includes guidelines on staff qualifications, resources, and required procedures.

- **Structure and Content:** this details the structure and content of the qualification including units, and any specific content that learners will be required to study.

- **Assessment Requirements:** this details assessment criteria and assessment methods for this qualification, ensuring that summative assessment approaches are clear.

- **Quality Assurance:** the quality and consistency of delivery and assessment of this qualification are of paramount importance to OCN NI. The mandatory quality assurance arrangements including processes for internal and external verification that all centres offering this qualification must adhere to are detailed.

- **Administration:** guidance on the administrative aspects of delivering this qualification, including registration, certification, and record-keeping.

- Reference to other handbooks and policies as appropriate to the qualification.

It is important to note that OCN NI will communicate any significant updates or changes to this specification in writing to our centres. Additionally, we will make these changes available on our official website at www.ocnni.org.uk.

To stay current, please refer to the online version of this specification as it is the most authoritative and up-to-date publication. Be aware that downloaded and printed copies may not reflect the latest revisions.

4.1 Additional Support

OCN NI offers a comprehensive range of support services designed to assist centres in meeting the delivery and quality assurance requirements of OCN NI qualifications. These services include:

- **Learner Assessment Booklets:** These booklets are created to assist learners in demonstrating the fulfilment of assessment criteria and organising the quality assurance prerequisites for each individual unit.

- **Specimen Assessment Materials:** These have been designed to work in conjunction with the learning content for each individual unit and assist learners to provide evidence which enables them to meet each assessment criteria.

- **Qualification Support Pack:** A support pack has been developed to support centres in the delivery of this qualification. The pack includes planning and assessment templates, guides to best practice, etc.

- **Professional Development for Educators:** OCN NI provides opportunities for professional development tailored to meet the various needs of practitioners and quality assurance staff. Centres can join our training sessions, available in both face-to-face and online formats, or explore a wealth of training materials by visiting www.ocnni.org.uk.

- **OCN NI Subject Advisors:** Our team of subject advisors offers vital information and support to centres. They provide guidance on specification details, non-exam assessment advice, updates on resource developments, and various training opportunities. They actively engage with subject communities through an array of networks to facilitate the exchange of ideas and expertise, to support practitioners to provide quality education programs to learners.

All centres can access information, support and guidance to support the delivery and quality assurance of this qualification by contacting their designated Business Development Advisor or by contacting us on Contact Us | OCN NI

5. About this Qualification

5.1 Qualification Regulation Information

OCN NI Level OCN NI Level 2 Diploma in Engineering
Qualification Number: 610/2947/6

Operational start date: 15 July 2023
Operational end date: 14 July 2028
Certification end date: 14 July 2030

The qualification's operational start and end dates define the regulated qualification's lifecycle. The operational end date is the final date for learner registration, while learners have until the certificate end date to complete the qualification and receive their certificates.

It is important to note that all OCN NI regulated qualifications are listed on the Register of Regulated Qualifications (RQF), which can be found at Ofqual Register. This register is maintained by Ofqual in England and CCEA Regulation in Northern Ireland. It contains information about qualifications that are regulated and accredited. It is a key resource for learners, employers, and educational institutions to verify the status and recognition of qualifications.

Centres must adhere to administrative guidelines diligently, with special attention to the fact that fees, registration, and certification end dates for the qualification may be subject to changes. It is a centre's responsibility to make itself aware of updates on any modifications to ensure compliance with the latest requirements. OCN NI provides centres with timely updates through various channels including website, newsletters and through this specification. Information on qualification fees can be found on the Centre Login section of the OCN NI website www.ocnni.org.uk .

5.2 Sector Subject Area

A subject sector area is a specific category used to classify academic and vocational qualifications. Subject sector areas are part of the educational and qualifications framework to organise and categorise qualifications. The sector subject for this qualification is:

4.1 Engineering

This qualification has been mapped to National Occupational Standards including the following:

SEMPEO205 - Producing Components Using Hand Fitting Techniques - National Occupational Standards (ukstandards.org.uk)

SEMPEO211 - Preparing and Using Lathes for Turning Operations - National Occupational Standards (ukstandards.org.uk)

SEMPEO223 - Producing Platework Components and Assemblies - National Occupational Standards (ukstandards.org.uk)

SEMPEO229 - Preparing and Using Semi-Automatic MIG, MAG and Flux Cored Arc Welding - National Occupational Standards (ukstandards.org.uk)

SEMPEO233 - Wiring and Testing Electrical Equipment and Circuits - National Occupational Standards (ukstandards.org.uk)

5.3 Grading

Grading for this qualification is pass/fail.

Qualification's Aim and Objectives

Qualification's Aim

The aim of the OCN NI Level 2 Diploma in Engineering is to enable learners to gain the skills and knowledge to undertake a broad range of engineering roles and/or progress to further engineering qualifications.

Qualification's Objectives

The objectives of the OCN NI Level 2 Diploma in Engineering are to enable learners to gain skills and knowledge to include the following:

- health and safety in an engineering and manufacturing environment
- mathematics and science for engineering
- practical engineering project
- engineering skills in a broad range of areas

5.4 Target Learners

The qualification is targeted at individuals who are interested in developing skills and knowledge in a broad range of engineering areas.

5.5 Entry Requirements

Learners must be at least 16 years of age.

5.6 Progression

The OCN NI Level 2 Diploma in Engineering qualification enables progression to further learning in this area or into employment.

5.7 Delivery Language

This qualification is exclusively available in English. If there is a desire to offer this qualification in Welsh or Irish (Gaeilge), we encourage you to get in touch with OCN NI. They will assess the demand for such provisions and, if feasible, provide the qualification in the requested language as appropriate.

6. Centre Requirements for Delivering this Qualification

6.1 Centre Recognition

New and existing OCN NI recognised centres must apply for and be granted approval to deliver this qualification prior to the commencement of delivery.

6.2 Qualification Approval

Once a centre has successfully undergone the Centre Recognition process, it becomes eligible to apply for qualification approval. The centre's capability to meet and sustain the qualification criteria will be assessed. Throughout the qualification approval process, OCN NI will aim to ensure that:

- centres possess suitable physical resources (e.g., equipment, IT, learning materials, teaching rooms) to support qualification delivery and assessment
- centre staff involved in the assessment process have relevant expertise and/or occupational experience
- robust systems are in place for ensuring ongoing professional development for staff delivering the qualification
- centres have appropriate health and safety policies concerning learner equipment use
- qualification delivery by centres complies with current equality and diversity legislation and regulations
- as a part of the assessment process for this qualification it is required that learners have access to a practical work setting

6.3 Centre Staffing

To offer this qualification centres are mandated to establish the following roles as a minimum, although a single staff member may serve in more than one capacity*:

- Centre contact
- Programme Co-ordinator
- Assessor
- Internal Quality Assurer (IQA)

*Note: An individual cannot serve as an IQA for their own assessments.

6.4 Tutor Requirements

Tutors responsible for delivering this qualification are expected to possess a high degree of occupational competency. They should meet the following criteria:

- **Occupational Competency:** Tutors should demonstrate a clear understanding of engineering including up-to-date knowledge. This competence should enable them to effectively impart knowledge and practical skills to learners.

- **Qualifications:** Tutors should hold qualifications at a level that is at least one level higher than the qualification they are teaching. This ensures that they have the necessary academic foundation to provide in-depth guidance and support to learners.

- **Relevant Industry Experience:** In addition to academic qualifications, tutors must have a minimum of three years of relevant, hands-on experience working in the engineering industry.

These requirements collectively ensure that learners receive instruction from highly qualified and experienced instructors, thereby enhancing the quality and effectiveness of their educational experience.

6.5 Assessor Requirements

The assessment of this qualification takes place within the centre and is subjected to OCN NI's rigorous quality assurance procedures. The achievement of individual units is based on the criteria defined in each unit.

Assessors play a pivotal role in ensuring the validity and fairness of assessments. They are required to meet the following criteria:

- **Occupational Competency:** Assessors should possess a high degree of occupational competency in the relevant subject matter. This expertise enables them to accurately evaluate and measure a learner's knowledge and skills. Additionally, they should hold qualifications at a level that is at least one level higher than the qualification they are assessing, ensuring their in-depth understanding of the subject matter.

- **Relevant Industry Experience:** A minimum of three years of practical experience in the engineering industry is a prerequisite. This practical background is essential for assessors to effectively evaluate a learner's capabilities in real-world contexts.

- **Assessment Expertise:** Assessors should have direct or related experience in the field of assessment. This includes knowledge of best practices in designing, conducting, and grading assessments. Their expertise ensures that assessments are both fair and valid.

- **Assessors Qualification:** Assessors should hold or be currently undertaking a recognised assessor's qualification; or must have attended the OCN NI Assessment Training.

- **Comprehensive Assessment Oversight:** Assessors are responsible for evaluating all assessment tasks and activities comprehensively. They must thoroughly review and assess each element to ensure a fair and accurate representation of a learner's skills and knowledge.

These rigorous requirements uphold the quality and integrity of the qualification's assessment process, ensuring that learners receive a fair and reliable evaluation of their competencies.

6.6 IQA Requirements

The IQA plays a crucial role in the centre's internal quality assurance processes. The centre must designate a skilled and trained IQA who assumes the role of an internal quality monitor responsible for verifying the delivery and assessment of the qualifications.

The IQA for this qualification must meet the following criteria:

- **Relevant Industry Experience:** A minimum of three years of practical experience in engineering is a prerequisite. This practical background is essential for assessors to effectively evaluate a learner's capabilities in real-world contexts.
- **IQA Expertise:** IQAs should have direct or related experience in the field of verification. This includes knowledge of best practices in designing, conducting, and grading assessments. Their expertise ensures that assessments are both fair and valid.
- **IQAs Qualification:** IQAs should hold or be currently undertaking a recognised IQAs qualification; or must have attended the OCN NI IQA Training.
- **Thorough Evaluation of Assessment Tasks and Activities:** IQAs are tasked with conducting in-depth reviews and assessments of all assessment tasks and activities. Their responsibility is to ensure a comprehensive and meticulous oversight of each element to guarantee a just and precise reflection of a learner's abilities and knowledge and to ensure that all assessment and quality assurance requirements are fulfilled.

7. Qualification Structure

7.1 Qualification Purpose

The OCN NI Level 2 Diploma in Engineering is a unitised qualification on a scale of pass or fail. Learners are expected to demonstrate a comprehensive understanding of the subject matter, ensuring a level of proficiency.

7.2 Qualification Level

In the context of the OCN NI Level 2 Diploma in Engineering it is essential to understand the significance of qualification levels, as they play a pivotal role in assessing the depth and complexity of knowledge and skills required for successful attainment. This qualification aligns with Level 2 which signifies a moderate level of difficulty and intricacy. It's important to note that qualification levels in the educational framework range from Level 1 to Level 8, complemented by three 'entry' levels, namely Entry 1 to Entry 3.

7.3 Qualification Size

Total Qualification Time (TQT)
This represents the total amount of time a learner is expected to spend to complete the qualification successfully. It includes both guided learning hours (GLH) and independent study or additional learning time.

Guided Learning Hours (GLH)
These are the hours of guided instruction and teaching provided to learners. This may include classroom instruction, tutorials, or other forms of structured learning.

OCN NI Level 2 Diploma in Engineering	
Total Qualification Time (TQT):	600 hours
Total Credits Required:	60 credits
Guided Learning Hours (GLH):	480 hours

7.4 How to Achieve the Qualification

To achieve the OCN NI Level 2 Diploma in Engineering learners must successfully complete 60 credits with 20 credits from the five mandatory units and the remaining 40 credits from any of the optional units.

8. Assessment Structure

This qualification is assessed through internal assessment and each unit is accompanied by specific assessment criteria that define the requirements for achievement.

8.1 Assessment Guidance: Portfolio

The portfolio for this qualification is designed to provide a comprehensive view of a learner's skills and knowledge. It is an holistic collection of evidence that may include a single piece of evidence that satisfies multiple assessment criteria. There is no requirement for learners to maintain separate evidence for each assessment criterion.

When learners are creating their portfolio they should refer to the assessment criteria to understand the evidence required.

It is essential that the evidence in the portfolio reflects the application of skills in real-world situations. Learners should ensure that they provide multiple examples or references whenever the assessment criteria require it.

8.2 Understanding the Units

The units outlined in this specification establish clear assessment expectations. They serve as a valuable guide for conducting assessments and ensuring quality assurance efficiently. Each unit within this specification follows a consistent structure. This section explains the operational framework of these units. It is imperative that all educators, assessors, IQAs, and other personnel overseeing the qualification review and familiarise themselves with this section to ensure a comprehensive understanding of how these units function.

Explanation

- **Title:** The title will reflect the content of the unit and should be clear and concise.
- **Level:** A unit can have one of six RQF levels: Entry, One, Two, Three, Four or Five. All units within this qualification are level 2.
- **Credit Value:** This describes the number of credits ascribed to a unit. It identifies the number of credits a learner is awarded upon successful achievement of the unit. One credit is awarded for the learning outcomes which a learner, on average, might reasonably be expected to achieve in a notional 10 hours of learning.
- **Learning Outcome:** A coherent set of measurable achievements.
- **Assessment Criteria:** These enable a judgement to be made about whether or not, and how well, the students have achieved the learning outcomes.
- **Assessment Guidance and Methods:** These detail the different assessment methods within the unit that may be used.
- **Possible Content:** This provides indicative content to assist in teaching and learning.
- **Scope:** This provides possible teaching content.

9. Qualification Summary by Unit

OCN NI Level 2 Diploma in Engineering
Total Qualification Time (TQT) for this qualification: 600 hours
Guided Learning Hours (GLH) for this qualification: 480 hours

To achieve the OCN NI Level 2 Diploma in Engineering learners must successfully complete 60 credits with 20 credits from the five mandatory units and the remaining 40 credits from any of the optional units.

Unit Reference Number	OCN Code	Unit Title	Credit Value	GLH	Level
Mandatory units					
R/650/7647	CBG236	Health and Safety in an Engineering and Manufacturing Environment	4	32	Two
M/650/7655	CBG237	Mathematics for Engineering	4	32	Two
R/650/7656	CBG238	Understand the Principles of Science Used within Engineering	4	32	Two
T/650/7657	CBG239	Engineering Materials	4	32	Two
Y/650/7658	CBG240	Practical Engineering Project	4	32	Two
Optional units					
A/650/7659	CBG241	Producing Electrical and Electronic Engineering Drawings Using CAD	10	80	Two
H/650/7660	CBG242	Computer Aided Design	10	80	Two
J/650/7661	CBG243	Hand Fitting	10	80	Two
K/650/7662	CBG244	Preparing and Using Lathes for Turning Operations	10	80	Two
L/650/7663	CBG245	Producing Plate Work Components and Assemblies	10	80	Two
M/650/7664	CBG246	Preparing and Using Manual Metal Arc Welding Equipment	10	80	Two

Unit Reference Number	OCN Code	Unit Title	Credit Value	GLH	Level
R/650/7665	CBG247	Using Semi-Automatic Metal Inert Gas, Metal Active Gas and Flux Cored Arc-Welding Equipment	10	80	Two
T/650/7666	CBG248	Forming and Installing Cable Enclosures	10	80	Two
Y/650/7667	CBG249	Wiring and Testing Electrical Circuits and Equipment	10	80	Two
A/650/7668	CBG250	Robotic Systems for Engineering	10	80	Two
D/650/7669	CBG251	Preparing and Using Manual TIG Welding Equipment	10	80	Two
J/650/7670	CBG252	Producing Sheet Metal Components and Assemblies	10	80	Two
K/650/7671	CBG253	Assembling and Testing Electronic Circuits	10	80	Two
L/650/7672	CBG254	Preparing and Using Milling Machines	10	80	Two
M/650/7673	CBG255	Wiring and Testing Programmable Controllers	10	80	Two
K/650/7680	CBG256	Fluid Power Systems	10	80	Two
L/650/7681	CBG257	Installing Aircraft Mechanical Fasteners	10	80	Two
M/650/7682	CBG258	Producing Aircraft Detail Assemblies	10	80	Two
R/650/7683	CBG259	Aircraft Detail Fitting	10	80	Two
T/650/7684	CBG260	Industrial Coatings Application	10	80	Two
K/651/0261	CBG538	Preparing and Using Computerised Numerical Control Mills for Milling Operations	10	80	Two
H/650/9669	CBG539	Producing Computer Aided Design Models	10	80	Two
L/650/9670	CBG540	Producing Components using Rapid Prototyping and Additive Manufacturing	10	80	Two

Unit Reference Number	OCN Code	Unit Title	Credit Value	GLH	Level
L/651/0262	CBG541	Producing Composite Mouldings Using Wet Lay-up Techniques	10	80	Two

10. Unit Content

Title	Health and Safety in an Engineering and Manufacturing Environment
Level	Two
Credit Value	4
Guided Learning Hours (GLH)	32
OCN NI Unit Code	CBG236
Unit Reference No	R/650/7647
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand health and safety regulations, policies and procedures and how to work safely in a manufacturing and engineering environment.	

Learning Outcomes	Assessment Criteria
1. Understand regulations, polices, procedures and roles and responsibilities relating to health and safety in engineering and manufacturing.	1.1. Describe key aspects of health and safety regulations, policies, and procedures applicable to engineering and manufacturing. 1.2. Summarise employer and employee responsibilities in relation to workplace health and safety. 1.3. Define the roles and responsibilities for health and safety personnel applicable to engineering and manufacturing.
2. Understand safe working practices in an engineering and manufacturing environment.	2.1. Identify safe working practices that must be adhered to in the workplace. 2.2. Identify different types and classifications of health and safety signs that are used in engineering and manufacturing environments. 2.3. Summarise the purpose and use of different types of personal protective equipment (PPE) to minimise risk. 2.4. Describe how to carry out a risk assessment in an engineering and manufacturing environment including identification of potential hazards. 2.5. Describe the following in relation to health and safety in engineering and manufacturing environments: a) methods of fire prevention and control b) how to ensure hazardous areas are safe prior to work commencing. c) emergency procedures to be followed in response to different incidents. d) procedures to be followed when carrying out manual handling activities safely

Assessment Guidance		
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.		
Assessment Method	**Definition**	**Possible Content**
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Health and Safety in an Engineering and Manufacturing Environment
1. Understand regulations, polices, procedures and roles and responsibilities relating to health and safety in engineering and manufacturing.	**Scope** **Teaching will cover:** • **Health and Safety Legislation**: Health and Safety at Work Act 1974, Health and Safety at Work order 1978 • **Health and safety regulations:** Health and Safety at Work etc. Act NI, Control of Substances Hazardous to Health Regulations, Personal Protective Equipment at Work Regulations, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations, Manual Handling Operations Regulations, Lifting Operations and Lifting Equipment Regulations, The Control of Noise at Work Regulations. • **Employers' responsibilities:** A safe place of work, a safe working environment, safe plant and equipment, safe methods of handling, storing and transporting goods and materials, reporting of accidents, information, instruction, training and supervision of employees. • **Roles and responsibilities:** Health and safety advisors, health and safety representatives, health and safety executive inspectors. Human and environmental conditions, causes of accidents, accident prevention measures.

2. Understand safe working practices in an engineering and manufacturing environment.	**Scope**
	
	Teaching will cover:
	• **Safe working practices** be alert, maintain personal hygiene, protect yourself and other people, emergency procedures, report all hazards. Implementation:
	  ○ safety policies
	  ○ codes of practice
	  ○ safe systems of work
	• **Signs:** Warning, prohibition, mandatory, information, fire.
	• **Protection of operators and bystanders:** Personal Protective Equipment (PPE), Respiratory Protective Equipment (RPE), designated safe areas, first aid treatment:
	  ○ location of facilities
	  ○ location of qualified first aiders
	• **Risk assessments:** Understand the 5 step Risk assessment process. Develop an understanding for a range of risks to include slippery or uneven surfaces, spillages, scrap or waste material, flammable materials, faulty or missing machine guards, faulty electrical connections or damaged cables, dust and fumes, contaminants and irritants, materials handling, and transportation.
	• **Fire:** Conditions required for extinction, fire prevention, (fire procedures, fire drills, firefighting equipment for different types of fires extinguishers, automatic systems, e.g. sprinklers). Hazardous area: using barriers and/or tapes, placing warning signs in appropriate positions, informing any persons who may be affected, isolating power or pressure sources, obtaining official clearance, safety.
	  a) how to ensure hazardous areas are safe prior to work commencing.
	  b) emergency procedures to be followed in response to different incidents.
	  c) procedures to be followed when carrying out manual handling activities safely.

Title	Mathematics for Engineering
Level	Two
Credit Value	4
Guided Learning Hours (GLH)	32
OCN NI Unit Code	CBG237
Unit Reference No	M/650/7655
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to apply basic mathematics to solve engineering problems.	

Learning Outcomes	Assessment Criteria
1. Be able to use basic arithmetic, algebraic and graphical methods to solve engineering problems.	1.1. Use basic arithmetic methods to solve engineering problems including: a) addition, subtraction, multiplication, and division of whole and decimal numbers b) fractions, ratios, and percentages c) powers and roots d) standard form and scientific notation e) approximations, significant figures and decimal places 1.2. Use algebraic methods to transpose two simple formulae. 1.3. Use graphical methods to plot and analyse linear and non-linear relationships for given engineering data.
2. Be able to use and apply trigonometric functions.	2.1. Apply the following to solve basic mathematical problems involving right-angled triangles: a) Pythagoras' theorem b) sine, cosine, tangent functions
3. Be able to measure and calculate the area and volume of objects and apply trigonometric functions.	3.1. Determine the area of at least three of the following regular shapes: a) squares b) rectangles c) triangles d) circles e) compound shapes. 3.2. Determine the volume of at least three of the following regular solid bodies: a) cylinders b) cones c) right rectangular prisms d) compound solid bodies

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion

	the learner's progression through the course	
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Mathematics for Engineering
1. Be able to use basic arithmetic, algebraic and graphical methods to solve engineering problems.	**Scope** **Teaching will cover:** • **Degree of accuracy:** decimals places, significant figures. • **Quantity:** fractions as a decimal, fractions to percentages to decimals, percentage of an amount • **Standard Form Conversion:** expressing numbers using standard form and scientific notation, e.g. 5.6 x 105, 12 x 103 W and 12kW. • Understanding the application of a number raised to the power, Roots. • **Algebraic Formulae:** simplify equations, factorising, expanding brackets. • **Transpositions:** involving addition, subtraction, multiplication, and division in any combination using a maximum of three terms, for example solve problems: substitution of known values • **Algebraic expressions:** represent numerical quantities using symbols, apply laws of precedence in the use of precedence (BODMAS) • **Straight line graphs:** determining suitable scales from given data, defining and correctly labelling axes, determine the gradient, determine the intercept, prove the law of the straight-line graph is y = mx • Plot linear relationships, e.g. determining gradient, intercept, distance travelled, linear acceleration, work done. • Plot and use non-linear relationships, e.g. inverse relationships, exponential growth, and decay.
2. Be able to use and apply trigonometric functions.	**Scope** **Teaching will cover:** • **Angles in a triangle:** right-angled, isosceles, equilateral • **Sine, Cosine and Tangent:** state their ratios for angles up to 90°, determine their values for given angles up to 90°, solve simple problems. • Apply Pythagoras Theorem to a given Engineering problem.
3. Be able to measure and calculate the area and volume of objects and apply trigonometric functions.	**Scope** **Teaching will cover:** • **Areas of basic shapes:** square, rectangle, triangle, circle • **Compound shapes:** involving: squares, rectangles, triangles, circles, semi-circles, quadrants of a circle • **Surface areas:** cube, rectangular prism, cylinder (curved surface area only) • **Volumes:** cube, rectangular prism, cylinder

Title	Understand the Principles of Science Used within Engineering
Level	Two
Credit Value	4
Guided Learning Hours (GLH)	32
OCN NI Unit Code	CBG238
Unit Reference No	R/650/7656
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to apply scientific principles to solve engineering problems.	

Learning Outcomes	Assessment Criteria
1. Be able to apply concepts and principles relating to electrical science.	1.1. Summarise what is meant by the following electrical terms including units of measurement: a) voltage b) current c) resistance d) electro-motive force e) electrical power 1.2. Summarise what is meant by electrical terms: a) direct current b) alternating current c) electrostatic discharge d) conductors e) insulators f) earthing 1.3. Identify electrical and electronic components of using industry forms of classifications of components. 1.4. Summarise what is meant by the following terms relating to magnetic fields including units of measurement: a) magnetic fields b) magnetic flux c) flux density. 1.5. Determine the following for both series and parallel circuits: a) total resistance b) potential difference between two given points c) current at given points
2. Be able to apply concepts and principles relating to mechanical science.	2.1. Summarise what is meant by following terms relating to static and dynamic systems including units of measurement: a) mass b) weight c) force d) moment of a force e) density f) relative density g) displacement h) velocity i) acceleration j) work

	2.2. Use appropriate physical laws to calculate from given data: a) the resultant and equilibrant of a system of concurrent coplanar forces from given data. b) uniform acceleration and deceleration retardation of a body c) pressure at a given depth in a fluid

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Understand the Principles of Science Used within Engineering
1. Be able to apply concepts and principles relating to electrical science.	**Scope** **Teaching will cover:** • Ohms Law (Voltage/Current/Resistance) • Definition of Electro-motive force and application within electrical circuits. • **Electrical quantities (SI units):** Resistance, Resistivity, Power, Frequency, Current, Voltage, Energy, direct current, alternating current, electrostatic discharge, conductors, insulators, earthing. • Capacitance • **Power factor:** Electrical quantities (measurement): Resistance, Power, Current, Voltage, Energy. • Describe the basic principles of electron theory. • Explain the relationship between current, voltage and resistance in parallel and series D.C. circuits. • Calculate the values of current, voltage and resistance in parallel and series D.C. circuits. • Calculate values of power in parallel and series D.C. circuits • State what is meant by the term voltage drop in relation to electrical circuits. • Describe what is meant by resistance and resistivity in relation to electrical circuit. • Explain the relationship between current, voltage and resistance in parallel and series D.C. circuits. • Calculate the values of current, voltage and resistance in parallel and series D.C. circuits. • Calculate values of power in parallel and series D.C. circuits • State what is meant by the term voltage drop in relation to electrical circuits. • Describe the effects of magnetism in terms of attraction and repulsion. • State the difference between magnetic flux and flux density. • Describe the magnetic effects of electrical currents in terms of: production of a magnetic field, force on a current-carrying conductor in a magnetic field, electromagnetism d. electromotive force. • Describe the basic principles of generating an A.C. supply in terms of: a. a single-loop generator b. sine-wave c. frequency d. EMF e. magnetic flux. • Understand the application of electrical and electronic components to include: resistor, LDR, LED, switch, capacitor, battery, variable resistors.

2. Be able to apply concepts and principles relating to mechanical science.	**Scope**
	
	Teaching will cover:
	• Definitions of parameters of static and dynamic systems:
	  ○ mass
	  ○ Weight
	  ○ force
	  ○ moment of a force
	  ○ density
	  ○ relative density
	  ○ displacement
	  ○ velocity
	  ○ acceleration

	○ work ○ power • Properties and behaviour of fluids: ○ absolute and gauge pressure ○ pressure at depth in a fluid ○ data to determine pressure. ○ laws of motion ○ formula for calculating pressure: p=hpg (Pressure=height x density x gravity)

Title	Engineering Materials
Level	Two
Credit Value	4
Guided Learning Hours (GLH)	32
OCN NI Unit Code	CBG239
Unit Reference No	T/650/7657
Learn Direct Code	XA1

Unit purpose and aim(s): This unit will enable the learner to understand common engineering materials, their properties and use for different engineering applications. The learner will also understand how sustainability impacts on engineering and use of materials.

Learning Outcomes	Assessment Criteria
1. Understand the properties of engineering materials.	1.1. Describe the properties that are used to define the behaviour of common engineering materials. 1.2. Determine the properties of given materials commonly used in engineering applications from each of the following categories: a) ferrous metal b) non-ferrous metal c) organic d) thermoplastic e) thermosetting polymer f) smart material
2. Know how engineering materials are identified.	2.1. Identify material symbols and abbreviations used on given engineering documentation. 2.2. Describe the forms of supply available for different engineering materials.
3. Understand the importance of using sustainable materials within engineering manufacture.	3.1. Describe why sustainability is important in engineering and how engineering companies can be encouraged to become more sustainable and environmentally aware. 3.2. Describe the importance of recycling within engineering. 3.3. Describe what is meant by the term materials economy in relation to engineering.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log

Learning Outcome	Unit: Engineering Materials
1. Understand the properties of engineering materials.	**Scope** **Teaching will cover:** **Types of engineering materials** • **Ferrous metals**, e.g. low and medium carbon steels, high carbon steels, stainless steel and cast-iron o applications include – cutting tools, e.g. drills (carbon steel), cutlery and medical instruments (stainless steel), castings and manhole covers (cast iron). • **Non-ferrous metals,** e.g. aluminium, copper, zinc, brass, lead, titanium, tungsten carbide, superalloys (nickel-based and cobalt-based) and ceramics (boron carbide and cubic boron nitride) applications include – aircraft components and kitchenware (aluminium), electrical wiring, cables and pipes (copper), anti-corrosion coatings and batteries (zinc), locks, gears, valves and door knobs (brass), building and construction, weights and radiation shielding (lead), aerospace, military, mobile phones and sporting goods (titanium), industrial machinery, tools and abrasives (tungsten carbide), aerospace and automotive components (superalloys), high performance mechanical and industrial applications, e.g. abrasive cutting tools, nuclear reactor control rods, anti-oxidant refractory mixes and tank armour (boron carbide, cubic boron nitride). • **Composite materials,** e.g. plywood, glass reinforced plastic (GRP), medium density fibreboard (MDF) carbon fibre and Kevlar applications include – floors and roofing (plywood), boats, automobiles, hot tubs, water tanks, roofing, pipes and cladding (GRP), building material, e.g. furniture and kitchen cabinets (MDF), bicycle tyres, racing sails and body armour (Kevlar®). • **Thermoplastics,** e.g. acrylic, polyvinyl chloride (PVC), polythene (PET), polystyrene, nylon and polycarbonate o applications include – aquariums, aircraft windows and motorcycle helmet visors (acrylic), sewage pipes, plumbing pipes, clothing and upholstery, electrical cable insulation and inflatable products (PVC), packaging, e.g. plastic bags, plastic films and foam insulation (PET), disposable cutlery, plastic models, CD and DVD cases, disposable foam cups, smoke detector housings and insulation for packaging (polystyrene), bristles for toothbrushes, strings for musical instruments, threads, ropes, filaments, nets, hosiery and knitted garments (nylon), electrical and telecommunication components, domelights, flat/curved glazing, sound walls, sunglass/eyeglass lenses, lightweight luggage, computer cases and food/drink containers (polycarbonate). • **Thermosetting polymers**, e.g. formica, melamine, epoxy resin and polyester resin o applications include – kitchen worktops (formica), kitchen utensils and plates (melamine), moulds, laminates, casting, fixtures, coating and adhesives (epoxy resin), marine construction materials, automotive and aircraft components, luggage, furnishings, textiles and packaging (polyester resin). • **Smart materials,** e.g. shape memory alloys (SMAs), shape memory polymers, electrochromic, piezoelectric, quantum tunnelling composite (QTC) applications include – surgical equipment, dental braces, oil line pipes and eyeglass frames (SMAs), window frame seals, helmets, small scale surgical products (shape memory polymers), smart windows, information displays and eyewear (electrochromic), production and detection of sound, generation of high voltages, electronic frequency generation, ignition source for cigarette lighters and push-start propane barbecues (piezoelectric), electrically conductive clothing (QTC).

	Properties of materials • **Mechanical,** e.g. density, tensile strength, shear strength, hardness, toughness/brittleness, malleability/ductility, elasticity, and plasticity. • **Electromagnetic,** e.g. electrical conductivity, electrical resistance, paramagnetism/diamagnetism/ferromagnetism. • **Chemical,** e.g. resistance to corrosion and environmental degradation, reactivity. • **Thermal,** e.g. melting point, thermal conductivity, and thermal expansion.
2. Know how engineering materials are identified.	**Scope** **Teaching will cover:** • **Symbols, abbreviations, and identification coding,** e.g. International Organisation for Standardisation (ISO), British Standards Institution (BSI) materials coding system, suppliers' and organisations' colour codes. • **Material selection,** e.g. bright drawn mild steel bar, solid diameters, pipe/tube diameters and wire gauges. • **Metal forms,** e.g. bar stock, sheet materials, pipe/tube, wire, plate, rolled steel sections, pressings, castings, ingots, forgings and extrusions. • **Polymers/composite forms,** e.g. sheet, pipe/tube, mouldings, powders, granules, resins and film. • **Size,** e.g. diameters, thickness and gauge. • **Surface finish,** e.g. bright drawn, cold drawn, plated, painted and plastic coated.
3. Understand the importance of using sustainable materials within engineering manufacture.	**Scope** **Teaching will cover:** • The importance of Sustainability within Engineering setting • Recycling within an Engineering Setting • How Engineering companies can recycle within their setting • Raw materials extraction and processing • Lower volatile organic compounds • Reducing material use • Reusing materials and products where applicable • Recycling materials or using recycled materials • Waste management • Material Economy and how this is applicable to Engineering Manufacture

Title	Practical Engineering Project
Level	Two
Credit Value	4
Guided Learning Hours (GLH)	32
OCN NI Unit Code	CBG240
Unit Reference No	Y/650/7658
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to be able to undertake a timebound engineering project demonstrating appropriate industry skills and knowledge.	

Learning Outcomes	Assessment Criteria
1. Be able to research and select approaches to provide a solution to an engineering challenge.	1.1. Research a minimum of two approaches to provide solutions to a given engineering challenge taking into account the following: a) types of material to be used b) material costs c) health and safety d) engineering techniques and skills required 1.2. Use a decision-making matrix to select with justification a preferred approach from those identified in AC 1.1 taking into account: a) costs b) difficulty of execution c) timeframe d) resources required
2. Be able to present a solution to an engineering challenge.	2.1. Present findings of research undertaken above using an appropriate medium to a given audience to include: a) explanation of why each approach was considered. b) justification for approach selected
3. Be able to design and implement a solution to an engineering challenge.	3.1. Design a solution specification based on selection of approach in AC 1.2. 3.2. Select the appropriate tools and equipment to implement the solution developed in AC 3.1. 3.3. Carry out a risk assessment. 3.4. Select and use personal protective equipment correctly where appropriate. 3.5. Implement the solution in the timeframe identified in AC 1.2.
4. Be able to evaluate a solution to an engineering challenge and present findings.	4.1. Evaluate the solution implemented in AC 3.5 including how it addresses the specification and identifying possible areas for improvement. 4.2. Present findings of evaluation undertaken in AC 4.1 using an appropriate medium to a given audience responding to technical and other questions as required.

Delivery Guidance

This unit must be delivered last and may either simulate an 'on the job' activity or be completed on site. Representatives from industry are encouraged to attend this presentation

Sizes and materials are to be determined by the individual centre to maximise the appropriate training to deem the candidate competent.

The use of extension activities is at the discretion of the centre and will have no impact on the overall achievement.

Assessment Guidance		
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.		
Assessment Method	**Definition**	**Possible Content**
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log

Learning Outcome	Unit: Practical Engineering Project
1. Be able to research and select approaches to provide a solution to an engineering challenge.	**Scope** Approach to the delivery of Engineering solutions to meet the requirements of a stated client brief that would typically be encountered in industry. Learner will then develop approach to enable decision-making to select optimal solutions with clear justifications. **Teaching will cover:** **Learners will evidence an understanding of appropriate Engineering solutions** based upon research for client brief that would typically be encountered in industry. For example: • **Types of Materials:** Discuss how to select materials based on properties like strength, durability, and suitability for the application. • **Material Costs:** Teach students how to estimate and compare material costs while considering long-term financial implications. • **Health and Safety Considerations:** Cover the health and safety regulations relevant to the proposed solutions. Discuss how to identify and mitigate risks in the design and execution stages. • **Engineering Techniques and Skills Required:** Guide students on assessing the complexity of the techniques and skills needed to execute each solution. Discuss whether these skills are readily available and the potential need for specialised training. **Understanding Decision-Making Tools:** Teach students what a decision-making matrix is and how it helps in selecting the best solution based on weighted criteria. Discuss the principles behind scoring and ranking different options. **Setting Up the Matrix:** Provide guidance on setting up a matrix that includes criteria such as: • Costs • Difficulty of Execution • Timeframe • Resources Required (e.g., equipment, materials, personnel) **Weighting and Scoring Criteria:** Teach students how to assign weights to each criterion based on its importance to the project. Provide examples of how to score different options objectively.
2. Be able to present a solution to an engineering challenge.	**Scope** **Teaching will cover:** **Understanding the Audience and Medium:** • **Identifying the Target Audience:** Teach students how to identify and analyse their audience (e.g., technical peers, managers, or clients). Discuss how the audience's level of technical knowledge and interests will influence the presentation's content and style. • **Selecting the Appropriate Presentation Medium:** Cover the various presentation formats available, such as PowerPoint slides, posters, written reports, or verbal presentations. Discuss how to choose the most effective medium based on the audience, setting, and type of information being presented. • **Organising Content for Clarity:** Teach students how to structure their presentation logically, ensuring that key points are highlighted, and the content flows smoothly. Emphasise the importance of starting with an introduction, followed by the main body and a clear conclusion. **Explaining and Justifying the Considered Approaches:** • **Explaining Each Approach:** Guide students on how to clearly explain why each researched approach was considered. Discuss the

	importance of providing relevant background information, technical details, and data to support the evaluation of each approach. • **Using Visual Aids:** Teach students how to use visual aids like diagrams, charts, and graphs to effectively communicate technical information. Provide examples of how these aids can make complex data more understandable and engaging. • **Comparing Approaches:** Cover techniques for comparing the different approaches side-by-side, highlighting their strengths and weaknesses. Encourage students to use objective data and criteria from their research when making comparisons. **Justifying the Selected Approach:** • **Presenting the Decision-Making Process:** Teach students how to present the outcome of their decision-making matrix, showing how the selected approach meets the key criteria (e.g., cost, feasibility, timeframe). Discuss the importance of backing up claims with evidence from the research. • **Addressing Counterarguments:** Train students to anticipate and address potential counterarguments or questions from the audience. Discuss strategies for defending their choice and providing additional context when needed. **Delivering a Professional Presentation:** • **Presentation Skills and Techniques:** Provide training on effective verbal communication skills, including clear articulation, appropriate pacing, and audience engagement. Discuss how body language, eye contact, and tone of voice contribute to a confident and convincing presentation. • **Practising the Presentation:** Encourage students to practice their presentation multiple times, both individually and in front of peers. Provide feedback on content delivery, timing, and the use of visual aids to help students refine their performance. **Engaging with the Audience:** • **Handling Questions and Feedback:** Teach students how to handle questions from the audience confidently and professionally. Discuss techniques for active listening, clarifying questions, and providing clear, concise responses. • **Closing the Presentation:** Emphasise the importance of summarising key points and leaving the audience with a clear understanding of the research findings and the justification for the selected approach.
3. Be able to design and manufacture a solution to an engineering challenge.	**Scope** **Teaching will cover:** **Understanding Solution Specifications:** • **Introduction to Solution Specifications:** Teach students what a solution specification is, focusing on how it serves as a detailed plan that outlines the key design requirements, materials, and processes needed to achieve the selected approach. • **Writing a Clear Specification:** Discuss the components of a well-written specification, including: o Design requirements (e.g., dimensions, performance criteria) o Material selection o Safety and regulatory compliance o Process steps for implementation • **Aligning the Specification with the Selected Approach:** Guide students in ensuring that the solution specification aligns with the decision-making process they used earlier (e.g., considering costs, feasibility, resources). Encourage them to be detailed yet concise in their specifications.

	Tool and Equipment Selection: • **Identifying Required Tools and Equipment:** Teach students how to identify the tools and equipment necessary to manufacture their designed solution. Discuss factors to consider when selecting tools, such as precision, ease of use, and suitability for the task. • **Equipment and Tool Maintenance:** Cover the importance of maintaining tools and equipment to ensure accuracy and safety during the manufacturing process. Discuss basic maintenance tasks, such as checking calibration and inspecting for damage. **Matching Tools to the Specification:** • Provide practical exercises where students must select the appropriate tools and equipment based on the specifications they developed. For example, they might choose cutting tools, measuring instruments, or assembly equipment suitable for their project. **Time Management in Manufacturing:** • **Planning the Manufacturing Process:** Teach students how to break down the manufacturing process into manageable steps, assigning time estimates to each stage. Discuss techniques for staying on schedule, such as setting milestones and monitoring progress. • **Efficient Workflow Practices:** Cover best practices for maintaining efficiency during manufacturing, such as organising workspaces, reducing downtime, and anticipating potential delays. **Hands-On Manufacturing:** • **Implementing the Solution:** Provide workshop sessions where students can apply their skills and produce the solution according to their specifications. Emphasise the importance of following the planned timeline while maintaining quality and safety. • **Quality Control:** Teach students how to inspect their work during and after manufacturing to ensure it meets the required specifications. **Conducting a Risk Assessment:** Provide training on how to carry out risk assessments for specific project activities. Teach students to identify hazards, assess risks, and implement control measures that are appropriate for an aircraft environment.
4. Be able to evaluate a solution to an engineering challenge and present findings.	**Scope** **Teaching will cover:** **Evaluation Criteria:** Teach students how to establish clear criteria for evaluating the manufactured solution, focusing on how well it meets the original specification. Criteria should include: • Functional performance: Does the solution perform as intended? • Compliance with design specifications: Does it meet the dimensions, tolerances, and material requirements? • Quality of workmanship: Are there any defects or areas where quality could be improved? • Safety and reliability: Is the solution safe to use and reliable over time? **Evaluating Against the Specification:** Guide students in systematically comparing the final product against the solution specification created in the earlier stages. Teach them how to use measurement tools, testing equipment, and visual inspection techniques to assess whether the product meets the required standards. **Presentation:** Discuss the various formats available for presenting evaluation findings, such as PowerPoint presentations, technical reports, posters, or verbal presentations. Guide students on selecting the most appropriate medium based on the audience and context.

Title	Producing Electrical and Electronic Engineering Drawings Using CAD
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG241
Unit Reference No	A/650/7659
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to set up and operate a computer aided drawing (CAD) system to produce detailed drawings of electrical or electronic engineering systems.	

Learning Outcomes	Assessment Criteria
1. Be able to use sources of data and design features to produce electrical and electronic engineering drawings.	1.1. Use at least three of the following to obtain the necessary data to inform the production of electrical and electronic engineering drawings: a) drawing brief b) drawing change or modification request c) manuals d) calculations e) sketches f) specifications g) electrical regulations h) standards i) existing drawings and designs j) other available data k) standard reference documents l) notes from meetings or discussions 1.2. Incorporate at least four of the following design features to inform the production of electrical and electronic engineering drawings: a) function b) operating voltages c) ergonomics d) operating environment e) cost f) lifetime of the product g) tolerances h) interfaces i) aesthetics j) physical space and dimensions of circuit k) power supplies. l) safety m) component orientation n) connectors and test point access o) types of components available to be used. p) method of installation q) position of circuit components r) type of cable to be used. s) connections between components t) type of circuit; digital, analogue, hybrid u) technology of circuit design including single sided, double sided, multi-layer, flexi-rigid v) meets signal integrity parameters.

	w) meets specified operating conditions x) assembly or manufacturing schedule constraints
2. Be able to produce electrical and electronic engineering drawings.	2.1. Evaluate data and information obtained above to inform the production of electrical and electronic engineering drawings in terms of: a) completeness and accuracy b) determination of potential problems arising and how they may be addressed 2.2. Produce three of the following types of electrical or electronic engineering drawings informed by evaluations carried out in AC 2.1: a) circuit diagrams b) general assembly drawings c) installation and / or commissioning d) wiring diagrams e) panel assembly f) manufacture of cable looms g) block diagrams. h) cable and routing i) fault diagnostics j) schematics k) circuit board assembly l) system drawings m) circuit board layout n) modifications to equipment or systems
3. Be able to produce engineering drawings complying with British Standards (BS) and International Organization for Standardization (ISO) and other standards.	3.1. Produce electrical or electronic drawings which include at least ten of the following features: a) straight lines b) curved or contour lines. c) dimensions d) circles or ellipses e) angled lines f) hidden detail g) text h) parts lists i) insertion of standard electrical or electronic components j) test points. k) type and size of cables l) colour and component coding m) connection/termination details n) parts lists o) electrical/electronic symbols and abbreviations p) fault diagnosis 3.2. Produce an electrical or electronic drawing which complies with BS and ISO standards and procedures. 3.3. Produce an engineering drawing which complies with one of the following: a) organisational guidelines b) statutory regulations and codes of practice c) CAD software standards d) other international standards

Additional Assessment Guidance
Re: AC 3.1 – the electrical or electronic produced, must be of a significant nature, and have a minimum of seven of the features identified in AC 3.1.
Assessment Guidance
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Producing Electrical and Electronic Engineering Drawings Using CAD
1. Be able to use sources of data and design features to produce electrical and electronic engineering drawings.	**Scope** **Teaching will cover:** **Data Collection and Interpretation:** • **Sources of Data:** Teach students how to obtain data from a range of sources to inform the production of drawings. These include: o Drawing briefs o Drawing change or modification requests o Manuals and technical guides o Calculations and engineering sketches o Specifications and electrical regulations o Standards and existing drawings o Notes from meetings or discussions o Standard reference documents • **Practical Exercises:** Provide scenarios where students must gather data from at least three of these sources to create a complete set of information for producing a drawing. For instance, students could be given a drawing brief along with technical specifications and existing designs to analyse and extract the needed information. **Incorporating Design Features:** • **Key Design Considerations**: Teach students how to incorporate various design features into their drawings, ensuring that the drawings align with engineering requirements. Cover at least four of the following design elements: o Function and operating voltages o Ergonomics and operating environment o Cost, product lifetime, and tolerances o Interfaces, aesthetics, and physical dimensions o Power supplies and safety considerations o Component orientation and method of installation o Circuit types (digital, analogue, hybrid) and technology (single-sided, double-sided, multi-layer, flexi-rigid) o Signal integrity parameters and other relevant design considerations **Hands-On Drawing Projects:** Assign practical drawing tasks where students must incorporate these features. For example, students can design a circuit layout considering operating environment, safety, and connection requirements, ensuring their designs meet the necessary regulations. **Drawing Tools and Techniques:** • **CAD Software Training:** Teach the use of CAD tools and techniques to produce professional electrical and electronic drawings. Focus on ensuring that students understand how to implement design features using appropriate drawing software. • **Adhering to Standards and Regulations:** Cover the importance of following industry standards (e.g., BS, IEC) and electrical regulations in the production of drawings. Provide guidance on maintaining consistency and accuracy according to these standards. **Production and Verification:** • **Practical Drawing Assignments:** Assign tasks where students produce complete electrical and electronic drawings, integrating the data and design features discussed. This may include circuit layouts, wiring diagrams, and component placement plans. • **Quality Control:** Teach students how to verify the accuracy and completeness of their drawings, focusing on checking for errors, ensuring compliance with standards, and validating that all required design features are included.

2. Be able to produce electrical and electronic engineering drawings.	**Scope** **Teaching will cover:** **Evaluating Data for Completeness and Accuracy:** • **Importance of Data Evaluation:** Teach students how to critically evaluate the data and information they have gathered for completeness and accuracy. Discuss why accurate data is essential for producing reliable and safe engineering drawings. • **Techniques for Data Verification:** Cover methods for cross-referencing data from multiple sources, checking for consistency, and identifying any missing or incorrect information. Provide practical exercises where students assess the completeness and accuracy of data sets before proceeding with drawing production. **Identifying and Addressing Potential Problems:** • **Common Issues in Data Interpretation:** Discuss potential problems that may arise when using incomplete, outdated, or conflicting data. Examples include incorrect component specifications, mismatched tolerances, and ambiguous design requirements. • **Problem-Solving Strategies:** Teach problem-solving techniques for identifying and addressing issues in the early stages. This could include revising design specifications, seeking clarification from stakeholders, or adjusting drawing parameters to account for data inconsistencies. • **Case Studies and Scenarios:** Provide students with case studies or scenarios where they must identify potential problems in data and propose solutions. This allows them to practice real-world problem-solving in the context of engineering drawing production. **Types of Electrical and Electronic Engineering Drawings:** • **Introduction to Drawing Types:** Teach students about the different types of electrical and electronic engineering drawings, such as: o Circuit diagrams o General assembly drawings o Installation and commissioning diagrams o Wiring diagrams o Panel assembly drawings o Manufacture of cable looms o Block diagrams o Cable and routing drawings o Fault diagnostics diagrams o Schematics o Circuit board assembly drawings o System drawings o Circuit board layouts o Modifications to equipment or systems • **Practical Application:** Guide students through the process of selecting the appropriate drawing type for a given project based on their data evaluations. Discuss how the purpose and requirements of the project influence the choice of drawing. **Drawing Production and Quality Assurance:** • **Producing Accurate Drawings:** Provide hands-on training in producing three types of drawings from the list above. Emphasise attention to detail, correct application of design features, and adherence to industry standards. • **Incorporating Data Evaluations into Drawings:** Teach students how to incorporate the results of their data evaluations into their drawings. This includes ensuring that any identified problems have been addressed and that the drawing reflects accurate, complete, and up-to-date information.

3. Be able to produce engineering drawings complying with British Standards (BS) and International Organization for Standardization (ISO) and other standards.	**Scope**
	
	Teaching will cover:
	Understanding and Applying Key Drawing Features:
	• **Introduction to Core Drawing Features:** Teach students the essential features commonly found in electrical and electronic drawings, including:
	  ○ **Straight Lines and Curved/Contour Lines:** The basics of drawing lines and curves to represent different circuit paths.
	  ○ **Dimensions and Angled Lines:** Emphasise how to properly measure and label components within a drawing to ensure clarity and accuracy.
	  ○ **Circles, Ellipses, and Hidden Details:** Explain how to represent circular components, arcs, and hidden features that are not directly visible but crucial for the overall design.
	  ○ **Text, Parts Lists, and Electrical Symbols:** Teach the correct placement of text annotations, parts lists, and standard electrical symbols, focusing on consistency and readability.
	  ○ **Insertion of Components and Connection Details:** Guide students in accurately placing standard electrical or electronic components and specifying connection/termination details.
	  ○ **Test Points, Cables, and Colour Coding:** Discuss how to include test points for diagnostics, specify the type and size of cables, and apply appropriate colour coding for components and wiring.
	Industry Standards and Compliance:
	• **Introduction to BS and ISO Standards:** Provide an overview of British Standards (BS) and International Organization for Standardization (ISO) guidelines relevant to electrical and electronic drawings. Discuss the importance of these standards in ensuring safety, consistency, and interoperability.
	• **Applying Standards to Drawings:** Teach students how to apply these standards in their drawings, covering aspects like symbol usage, dimensioning practices, and labelling conventions. Emphasise how these standards contribute to creating clear, consistent, and universally understood diagrams.
	• **Review of Example Drawings:** Show examples of drawings that meet BS and ISO standards. Analyse these drawings with students to identify the key features that ensure compliance.
	Creating Standard-Compliant Drawings:
	• **Hands-On Practice:** Provide drawing tasks that require students to apply BS and ISO standards. For instance, students could create a panel assembly or wiring diagram that meets the specified criteria while incorporating at least seven of the design features taught in the previous learning outcome.
	• **Quality Assurance and Self-Assessment:** Teach students how to self-assess their drawings against a checklist of BS and ISO requirements to ensure compliance.
	Understanding Organisational and Regulatory Requirements:
	• **Organisational Guidelines and Codes of Practice:** Discuss the role of organisational guidelines in shaping drawing practices. Explain how companies set their own standards for drawing formats, labelling, and documentation.
	• **Statutory Regulations and International Standards:** Teach the relevant statutory regulations and codes of practice that apply to engineering drawings. Discuss how compliance with regulations ensures legal and industry acceptance.
	• **CAD Software Standards:** Introduce the specific CAD software standards that ensure consistency and compatibility across different platforms and industries.

	Applying Standards to Drawings: • **Practical Application:** Assign drawing tasks where students must produce a compliant engineering drawing. For example, a task might require students to create a circuit board layout that follows both organisational guidelines and CAD software standards.

Title	Computer Aided Design
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG242
Unit Reference No	H/650/7660
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to set up and operate a computer aided drawing (CAD) system to produce detailed mechanical engineering drawings.	

Learning Outcomes	Assessment Criteria
1. Be able to interpret information and produce drawings using a drawing template.	1.1. Illustrate how to set up drawing template parameters including: a) layers of drawings b) scale c) paper size. d) colour setup. e) line types. f) dimension system. g) text styles. 1.2. Interpret information in order produce drawings, using two of the following methods of projection: a) first angle orthographic projections b) isometric/oblique projections c) third angle orthographic projections 1.3. Illustrate how to set up a viewing screen to show multiple views of a drawing to assist with development of a drawing including isometric front and side elevations. 1.4. Produce at least two of the following: a) detail drawings. b) general arrangement drawings c) sub-assembly drawings d) installation drawings
2. Be able to produce mechanical drawings which comply with British Standards (BS) and International Organization for Standardization (ISO).	2.1. Illustrate the application and use of drawing tools to produce drawing features including: a) straight lines b) curves and circles c) adding dimensions and text d) layers of drawings 2.2. Produce mechanical drawings which comply with BS and ISO standards and procedures to include at least ten of the following features: a) straight lines b) dimensions c) angled lines d) text e) insertion of standard components f) symbols and abbreviations g) curved/contour lines. h) circles or ellipses i) geometrical tolerancing j) hidden detail k) sectional detail l) parts lists m) other specific detail

Additional Assessment Guidance
Re: AC 2.2 – at least one drawing must be of a significant nature and have a minimum of ten of the features identified in AC 2.2.
Assessment Guidance
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Computer Aided Design
1. Be able to interpret information and produce drawings using a drawing template.	**Scope** **Teaching will cover:** • **Setting Up Drawing Templates:** Teach how to configure drawing template parameters such as layers, scale, paper size, colour setup, line types, dimension systems, and text styles. Demonstrate the creation of customized templates for different drawing needs, ensuring consistency and alignment with project requirements. • **Understanding Projection Methods:** Explain the different methods of projection used in mechanical engineering drawings, including first-angle orthographic, isometric, oblique, and third-angle orthographic projections. Provide exercises where students create drawings using at least two of these methods. • **Setting Up Multiple Views:** Show how to set up viewing screens to display multiple views of a drawing simultaneously. Teach how to manage and navigate between isometric views, front elevations, and side elevations to enhance drawing development. • **Producing Different Types of Drawings:** Guide students in producing various types of drawings, such as: ○ **Detail Drawings:** Highlighting specific components or features. ○ **General Arrangement Drawings:** Showing how components fit together within an assembly. ○ **Sub-Assembly Drawings:** Focusing on smaller sections within a larger assembly. ○ **Installation Drawings:** Illustrating how parts should be installed in a mechanical system.
2. Be able to produce mechanical drawings which comply with British Standards (BS) and International Organization for Standardization (ISO).	**Scope** **Teaching will cover:** • **Using Drawing Tools:** Teach the application of drawing tools within CAD software to produce accurate drawing features such as straight lines, curves, circles, dimensions, and text. Provide practical sessions where students practice these skills while creating standardised components. • **Compliance with BS and ISO Standards:** Discuss the significance of complying with British Standards (BS) and ISO guidelines in technical drawings. Teach students how to ensure their drawings meet these standards by incorporating proper symbols, abbreviations, and tolerancing. • **Producing Feature-Rich Drawings:** Guide students in producing mechanical drawings that include a variety of features: • **Geometrical Tolerancing:** Teach how to apply tolerances for dimensions and geometrical features (e.g., flatness, roundness). • **Hidden and Sectional Details:** Explain the use of hidden lines to indicate concealed features and sectional views to show interior details of components. • **Parts Lists and Bill of Materials (BOM):** Teach how to create and format parts lists that include relevant information like item numbers, quantities, and descriptions.

Title	Hand Fitting
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG243
Unit Reference No	J/650/7661
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to produce components using hand fitting techniques.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for hand fitting activities in a manufacturing environment.	1.1. Describe the health and safety issues and requirements associated with carrying out hand fitting activities in a manufacturing environment. 1.2. Describe how to prepare and plan for hand fitting activities. 1.3. Carry out a risk assessment for a given hand fitting activity in a manufacturing environment.
2. Be able to carry out engineering processes to manufacture products safely.	2.1. Describe the process and demonstrate how to mark out different material forms to given tolerances, to include at least two of the following: a) square or rectangular bar stock, sheet material or machined components b) circular or cylindrical bar stock, tubes, turned components or flat disks. c) sections including angles channel, tee section, joists, or extrusions. d) irregular shaped castings, forgings, or odd shape components 2.2. Describe the process and demonstrate how to cut and shape at least two different types of material to given tolerances for the following: a) low carbon or mild steel b) high carbon steel c) cast iron. d) stainless steel e) aluminium or aluminium alloys f) brass or brass alloys g) plastic, nylon, or synthetic materials h) composite 2.3. Describe and demonstrate the techniques used to carry out the following engineering activities safely to manufacture products to given tolerances: a) filing b) hand sawing. c) drilling d) threads external e) threads internal 2.4. Describe and demonstrate the techniques used to carry out at least one of the following engineering activities safely to manufacture products: a) power sawing. b) offhand grinding c) scraping

	d) chiselling e) lapping 2.5. Demonstrate how to manufacture components through combination of different operations and have the following: a) flat datum faces b) faces which are square to each other c) curved profiles d) drilled through holes e) reamed holes f) internal threads g) external threads **and also three of the following:** h) faces that are parallel to each other i) faces angled to each other j) holes drilled to a depth k) chamfers and radii l) counterbore, countersink, or spot face m) sliding or mating parts
3. Be able to carry out quality checks on manufactured products.	3.1. Carry out quality checks on products manufactured in AC 2.2, 2.3, and 2.4 to ensure products meet requirements in relation to: a) linear dimensions b) flatness c) squareness d) angles e) profiles f) hole position g) hole size/fit h) depths i) thread size and fit j) surface finish

Additional Assessment Guidance

Re: AC 2.1 - (Description and demonstration should include how to prepare the materials in readiness for the marking out activities, including holding and measuring to prescribed tolerances).

Prescribed Tolerances:

Produce components to the following standards, as applicable to the process:

- Components to be free from false tool cuts, burrs and sharp edges
- General dimensional tolerance +/- 0.25mm
- Flatness and squareness 0.05mm per 25mm
- Angles within +/- 1 degree
- Screw threads to BS Medium fit
- Reamed and bored holes within H8
- Surface finish 63 µin or 1.6 µm

Re: AC 2.2 - (Explanation should include how to use tools
Safely and efficiently while cutting and shaping).

Re: AC 2.5 - At least one of the components produced must be of a significant nature and have a minimum of five of the features listed in AC 2.5.

Assessment Guidance		
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.		
Assessment Method	**Definition**	**Possible Content**
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion

Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Hand Fitting
1. Be able to plan, prepare and carry out a risk assessment for hand fitting activities in a manufacturing environment.	**Scope** **Teaching will cover:** • Health and Safety issues while carrying out Hand Fitting activities. • **Safe working practices:** wearing appropriate protective clothing and equipment (overalls, safety footwear, eye protection, hearing protection, use of barrier cream), maintaining a clean and tidy work area, preparing the work area, leaving the work area in a safe and clean condition, risk assessments Hazards: handling of coolants and cutting oils/compounds, misuses of tools, use of damaged or badly maintained tools. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific hand fitting activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to carry out engineering processes to manufacture products safely.	**Scope** **Teaching will cover:** • **Tools and equipment:** marking out, punches surface plate/table, angle plate parallels and vee blocks, hand tools, measuring instruments, protractor, micrometers, verniers, dial test indicators, surface finish, cutting and shaping, drills, taps and dies, reamers, forms of power supply, powered hand tools, forming equipment Safe working practices: wearing appropriate protective clothing and equipment (overalls, safety footwear, eye protection, hearing protection, use of barrier cream), maintaining a clean and tidy work area, preparing the work area, leaving the work area in a safe and clean condition, risk assessments. • **Portable machines and equipment:** emergency stop procedures, use of guards and interlocking devices, operating procedures, moving parts, removal of swarf, setting, checking and operating offhand grinding machines (gap between rest and wheel, wheel imperfections, changing the wheel), angle grinder (position of guards, wheel selection, changing the wheel) • **Produce and assemble component parts:** setting of work datums, use charts to obtain drill diameters for clearance and tapping hole, assemble component parts in the correct sequence and without damage Accuracy and quality: inspection, quality control, compliance records. Dispose of waste: legal requirements for the disposal of waste and the implications of failure to comply, materials (metallic materials, plastics, textiles, paper and card), procedures (segregate, label, dispose) • **Tools and equipment:** marking out (scribers, scribing block, punches [centre and dot], surface plate/table, angle plate parallels and vee blocks) hand tools (files, screwdrivers, hammers and mallets, pin punches, spanners (open-ended, socket sets, ring, torque wrenches), measuring instruments (rules, inside and outside calipers, protractor, micrometers (external, depth), verniers (height gauge, protractor, callipers), gauges (feeler, blocks/slip, radius, thread) dial test indicators, surface finish (comparison plates, tactile machines), cutting and shaping (saws [hand, mechanical], drills (high speed steel [HSS] carbide tips drill speed tables, cutting speed formula [cutting speed = πdN/1000]), taps (spiral flute, straight flute [taper, second, bottoming], use of charts for selecting tapping sizes) and dies (circular split, rectangular, pipe), reamers, forms of power supply (230V, 110V, pneumatic, battery), powered hand tools (drills,

	screwdrivers, angle grinders, saws), forming equipment (bench folders, fly press). • **-Produce and assemble component parts:** setting of work datums (faces, lines, centres, corners, edges), marking out (datum and centre lines, circles and radial lines, squares and rectangles, linear hole positions, witness mark), use of types of hole (drilled, flat bottom, countersunk, counterbored, spotface), screw fittings (bolts, screws, hexagon, countersink and caphead) • **-Restore the work area:** leave the work area free of unused consumables, cleaning the work area, putting tools and equipment into safe storage, identifying and recording finished work
3. Be able to carry out quality checks on manufactured products.	**Scope** **Teaching will cover:** • Completeness • Alignment • Positional accuracy • Component security • Damage or foreign objects • Specific component checks, e.g. pipework (correct direction and flow, component quality such as pipes free from ripple, creases), sub-assemblies (function, dimensions, freedom of movement, orientation, operating and working clearances, bearing end float)

Title	Preparing and Using Lathes for Turning Operations
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG244
Unit Reference No	K/650/7662
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to prepare and use lathes for turning operations.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for turning activities.	1.1. Summarise the key aspects of health and safety requirements for turning activities. 1.2. Plan turning activities prior to manufacturing. 1.3. Carry out a risk assessment for a given turning activity.
2. Be able to set up and use lathes and associated accessories and tools.	2.1. Summarise the main features of a given lathe and accessories including: a) saddle b) capstan/turret head c) compound slide d) tailstock e) taper turning attachments f) profile attachments g) fixed and travelling steadies 2.2. Describe how to position and secure work holding devices to a machine spindle, and associated checks including: a) ensuring that all seating/location faces are clean and undamaged. b) location marks are lined up with those on the machine spindle where appropriate. c) bolts, cam locks or other securing devices are tightened securely. 2.3. Machine two components for each of the following types of material: a) ferrous b) nonferrous c) non metallic 2.4. Describe how to mount and secure cutting tools in tool holding devices and the importance of ensuring correct centre height and overhang is kept to a minimum including: a) front or rear tools posts b) mounting drills in chucks c) use of morse taper sockets 2.5. Mount, secure and machine components using two of the following work-holding devices: a) three-jaw chucks with hard jaws b) three-jaw chucks with soft jaws c) four-jaw chucks d) collet chucks 2.6. Mount, secure and machine components using at least one of the following: a) drive plate and centres b) magnetic or pneumatic devices c) fixtures d) fixed steadies or traveling steadies e) faceplates

	f) special purpose work-holding devices 2.7. Mount and use at least eight of the following types of tools: a) turning b) knurling c) recessing/grooving d) twist/core drills e) thread forming tools f) facing g) parting off h) chamfering i) reamers j) dies k) boring l) forming m) centre drills n) taps
3. Be able to produce machined components using different operations and carry out checks for accuracy.	3.1. Produce machined components which combine different operations and have features that include the following: a) flat faces b) stepped diameters c) drilled holes. d) chamfers e) parallel diameters f) tapered diameters g) reamed holes h) grooves/undercuts i) bored holes **including at least four more of the following:** a) internal threads (taps) b) external threads (dies) c) eccentric diameters d) knurls or special finishes e) profile forms. f) parting off g) external threads (screw cutting using formed tooling) h) internal threads (screw cutting using formed tooling) 3.2. Carry out the following checks for accuracy on the components produced in AC 3.1: a) external diameters b) bore/hole size/fit c) surface finish d) parallelism e) angle/taper f) linear dimensions (such as lengths, depths) g) grooves/undercuts (such as position, width, depth) **including at least two of the following checks for accuracy:** a) internal diameters b) concentricity c) eccentricity d) ovality e) thread fit 3.3. Describe factors that influence the selection of cutting feeds, speeds, and the depth of cut that can be taken.

	3.4. Describe the following in relation to machining components: a) techniques of taking trial cuts b) checking dimensional accuracy c) application of roughing and finishing cuts, and the effect on tool life, surface finish and dimensional accuracy
4. Be able to use different measuring equipment to carry out quality inspection ensuring the quality and accuracy of components produced.	4.1. Use the following measuring equipment during machining and checking activities: a) external micrometers b) dial test indicators (DTI) c) vernier/digital/dial callipers d) surface finish equipment (such as comparison plates, machines) **including at least six of the following:** e) rules f) bore/hole gauges. g) internal micrometers h) thread gauges (such as ring, plug, profile) i) depth micrometers j) plug gauges k) depth verniers l) radius/profile gauges m) slip gauges n) protractors o) coordinate measuring machine (CMM) 4.2. Produce components to the following quality and accuracy standards, as applicable to the operation: a) components to be free from false tool cuts, burrs, and sharp edges b) general dimensional tolerance +/- 0.15mm or +/- 0.006” c) have one or more specific dimensional tolerances within +/- 0.05mm or +/- 0.002” d) screw threads British Standard (BS) medium fit e) reamed / bored holes within H8 f) surface finish 63 µin or 1.6µm g) angles within +/- 0.5 degree 4.3. Describe how to check that measuring equipment is within current calibration dates and instruments are correctly zeroed, measuring internal and external dimensions including: a) lengths, diameters, depths, slots, hole positions, angles, profiles b) geometric features including flatness, squareness, parallelism, concentricity, ovality c) checking surface finish by using comparison blocks or instruments

Additional Assessment Guidance
Re: AC 3.1 - at least one of the machined components produced, must be of a significant nature, and have a minimum of six of the features identified in AC 3.1. **Re: AC 3.3** – factors to be considered may include type of material, type of tool used, size of material, operations being performed, work-holding method/security of workpiece, condition of machine, finish and tolerance required.
Assessment Guidance
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Preparing and Using Lathes for Turning Operations
1. Be able to plan, prepare and carry out a risk assessment for turning activities.	**Scope** **Teaching will cover:** • **Health and safety precautions**: emergency stop procedures, use of guards, operating procedures, moving parts, removal of swarf. • **Datum**: faces, centres. • **Classes of fit**: clearance, interference. • **Measuring equipment**: micrometers (external, internal, depth), vernier (calliper, depth, protractor, digital), Dial Test Indicator (DTI), gauges (plug, blocks, thread, radius/profile, bore/hole), surface finish (comparison plates), how to check that measuring equipment is within current calibration dates. • **Coolants and cutting oils**: oils, compounds, synthetic. • **Cutting tool materials**: High Speed Steel (HSS), carbide tips. Cutting speeds and feeds: cutting tool material/material being cut, surface finish required, type of cutting operation, power output of the machine, use of coolant. • **Mounting tools**: four-way, quick change, tailstock. • **Work holding devices**: chuck (three jaw self-centring, including soft jaws), collet, four jaw independent, face plate, steadies (fixed, travelling), catch plate and carriers.
2. Be able to set up and use lathes and associated accessories and tools.	**Scope** **Teaching will cover:** • **Equipment:** dead, live and running, centres, catch plate, carriers, taper turning attachment, micrometers, vernier calliper and protractors. • **Parallel shafts**: setting centres parallel, diameters to be concentric, run out to be within tolerance (±0.1 mm). • Tools and equipment as per above.
3. Be able to produce machined components using different operations and carry out checks for accuracy.	**Scope** **Teaching will cover:** • **Work holding devices**: four jaw chuck, self-centring chuck, face plate, between centres, clamps, setting (scribe circle and pin), wobble bar, balancing (four jaw chuck, face plate). • **Mark centres**: vernier height gauge, surface plate/table, vee blocks, angle plate, centre drill, drilling machine. • **Bore and ream**: boring bars (solid, tip, insert), drills and reamers (morse taper shank, expanding, chucking, floating), sleeves (tailstock).
4. Be able to use different measuring equipment to carry out quality inspection ensuring the quality and accuracy of components produced.	**Scope** **Teaching will cover:** • **Tolerances**: Dial Test Indicator (DTI), micrometer (internal, external, depth) vernier calliper (digital). • **Restore the work area**: leave the work area free of unused consumables, cleaning the work area, putting tools and equipment into safe storage, identifying and recording finished work.

Title	Producing Plate Work Components and Assemblies
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG245
Unit Reference No	L/650/7663
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to produce platework components and assemblies.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for plate work activities.	1.1. Describe the health and safety issues and requirements associated with carrying out plate work activities in a manufacturing environment. 1.2. Describe how to prepare and plan for plate work activities. 1.3. Carry out a risk assessment for a given plate work activity.
2. Be able to mark out materials.	2.1. Describe how to select and establish a suitable datum including: a) importance of ensuring that marking out is undertaken from the selected datum. b) possible effects of working from a different datum. 2.2. Use the following marking out tools: a) scriber b) punch c) rule and /or tape d) straight edge e) square f) protractor g) dividers or trammels h) chalk, blueing or paint **to mark out the following:** a) datum and centre lines b) square/rectangular profiles c) angles d) circles e) curved profiles f) hole centres g) cutting and bending detail **on flat plates and one of the following materials:** a) pipe or tube b) solid bar c) rolled section d) non-ferrous material
3. Be able to carry out cutting and forming processes using industrial fabrication equipment.	3.1. Describe how to set up and use two of the following types of forming equipment and techniques: a) hand or powered bending machine. b) hand or powered rolling machine. c) press d) heating techniques

	3.2. Describe the tools and techniques that may be used for cutting and shaping heavy plate and section materials. 3.3. Describe the selection and fitting of abrasive cutting discs including: a) cutting disc identification markings b) identifying the correct type of disc for the type of material being cut c) statutory regulations regarding the fitting and use of abrasive discs 3.4. Describe different shearing machine cutting methods and techniques including: a) cutting to marking out b) using machine back-stops c) setting plates at an angle to the machine slides 3.5. Cut materials safely using both guillotines and drills and at least two of following: a) abrasive discs b) cropping machines c) machine saws 3.6. Perform cutting operations safely to produce components that have the following features: a) parallel sides b) sides square to each other c) holes linearly pitched **and have at least two of the following features:** d) angled sides e) bevelled edges or weld preps f) curves g) holes radially pitched 3.7. Perform forming operations safely to produce components that have the following features: a) bends at 90° and other angles b) cylinders **and have at least two of the following features:** c) set plate ends d) box square and rectangular sections e) curved plates f) pipe sections g) cones h) segments of a cylindrical tank i) curved section or sector of an otherwise flat plate j) counter-curved sections k) flattening or straightening plate
4. Be able to assemble, secure and produce platework components.	4.1. Describe different methods of securing the assembled components including: a) mechanical fastening devices such as nuts and bolts, rivets, screws, special fasteners b) tack welding methods and techniques. 4.2. Describe inspection techniques that can be applied to confirm platework components are in line with specification and within acceptable limits including checking:

	a) shape including straightness b) dimensions 4.3. Assemble and secure plate work components in their correct positions and using at least two of the following methods: a) temporary tack welding b) hot or cold riveting c) adhesive bonding d) mechanically fastened 4.4. Produce platework components that meet all the following criteria: a) all dimensions are within +/- 3.0mm or +/- 0.125” b) finished components meet the required shape and geometry c) completed components are free from excessive tooling marks, deformation, cracking, sharp edges, slivers or burrs d) all components are correctly assembled, and have secure and firm joints

Additional Assessment Guidance

Re: Learning Outcome 3 - At least one of the platework components produced must be of a significant nature and contain components with a minimum of three of the cuttings features in AC 3.6 and three of the forming features listed in AC 3.7.

Re: AC 3.2 - Machines may include guillotines, cropping machines, abrasive discs such as hand-held portable machines and bench type radiac cutting machines, drilling machines and machine saws.

Re: AC 4.4b - Components features shapes and geometry that depending on component are square, straight, angles free from twists.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner’s progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log

Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Producing Plate Work Components and Assemblies
1. Be able to plan, prepare and carry out a risk assessment for plate work activities.	**Scope** **Teaching will cover:** • **Health and Safety Requirements:** Discuss the key health and safety issues related to plate work activities, including the use of personal protective equipment (PPE), machine safety protocols, and safe working practices when handling large or heavy materials. Provide examples of common hazards, such as sharp edges and the risks associated with cutting and forming operations. • **Planning Plate Work Activities:** Teach how to effectively plan plate work operations, including selecting the appropriate materials, tools, and machines. Emphasise the importance of understanding project specifications and setting up equipment correctly. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific plate work activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to mark out materials.	**Scope** **Teaching will cover:** • **Selecting and Establishing a Datum:** Teach the importance of establishing a datum point and how to select an appropriate datum. Discuss how working from a consistent datum ensures accuracy throughout the marking out and fabrication process. • **Using Marking Out Tools:** Provide hands-on training in using common marking out tools, including scribers, punches, rulers, and protractors. Teach how to use these tools to mark out key features like datum lines, center lines, square/rectangular profiles, and hole centers. • **Marking Out Various Materials:** Discuss the differences in marking out flat plates, pipes, tubes, and rolled sections. Provide practical sessions where students practice marking out on different materials and shapes.
3. Be able to carry out cutting and forming processes using industrial fabrication equipment.	**Scope** **Teaching will cover:** • **Setting Up and Using Forming Equipment:** Teach how to set up and use various forming equipment, such as bending machines, rolling machines, and presses. Include training on hand-powered and motorized options. • **Cutting Techniques:** Explain the tools and techniques used for cutting heavy plate and section materials, including guillotines, abrasive discs, and cropping machines. Emphasize the importance of safety protocols when operating these machines. • **Material Handling and Forming Processes:** Teach how to safely handle and manipulate materials during cutting and forming operations. Include practical sessions where students produce components with features like parallel sides, angled sides, curved sections, and bevelled edges. • **Quality Control:** Discuss how to inspect components during and after cutting and forming processes to ensure they meet design specifications and are free from defects.

4. Be able to assemble, secure and produce platework components.	**Scope** **Teaching will cover:** • **Securing Components:** Teach various methods for securing platework assemblies, including mechanical fastening devices (e.g., nuts, bolts, rivets), tack welding, and adhesive bonding. Provide practical exercises where students assemble components using these methods. • **Inspection and Quality Control:** Explain how to inspect assembled components to ensure they meet specifications, focusing on shape, straightness, and dimension accuracy. Discuss how to measure components using appropriate instruments. • **Producing Quality Assemblies:** Guide students in assembling and securing components to produce finished platework assemblies that meet specified tolerances. Emphasise ensuring that all joints are secure and the assembly is free from defects like excessive marks, deformation, or burrs.

Title	Preparing and Using Manual Metal Arc Welding Equipment
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG246
Unit Reference No	M/650/7664
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to prepare and use manual metal arc welding equipment.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for manual metal arc welding activities.	1.1. Describe the health and safety issues and requirements associated with carrying out manual metal arc welding activities. 1.2. Plan and prepare for manual metal arc welding activities prior to welding. 1.3. Carry out a risk assessment for given manual metal arc welding activities.
2. Be able to safely set up manual metal arc welding equipment and select electrodes.	2.1. Describe and safely set up manual metal-arc welding and related equipment to include: a) alternating current (AC) equipment b) direct current (DC) equipment 2.2. Describe the following types of welding electrodes and their applications: a) rutile b) cellulosic c) basic d) other suitable electrodes 2.3. Select and safely set up appropriate welding electrodes for the welding of the following materials and material forms: one type of material from the following: a) carbon steel b) stainless steel c) aluminium 2.4. and one form of material from the following: a) plate b) sheet (less than 3mm) c) pipe-tube. d) section e) other forms 2.5. Describe the terminology used for welding positions. 2.6. Set up equipment to weld joints in good access situations for at least two of the following British Standard (BS) European Standard (EN) International Organization for Standardization (ISO) 6947 positions: a) flat (PA) b) vertical upwards (PF) c) horizontal vertical (PB) d) vertical downwards (PG) e) horizontal (PC)
3. Be able to safely weld different joints in different positions and check weld quality.	3.1. Describe the techniques of operating welding equipment to produce different joints in different joint positions.

	3.2. Describe methods used to control distortion including welding sequence and deposition technique. 3.3. Weld at least three of the following types of joints to given specifications safely each at least 150mm long, by single or multi-run as appropriate, using appropriate electrodes, with at least one stop and start included: a) fillet lap b) corner c) tee fillet d) butt 3.4. Weld joints to given specifications safely in good access situations in at least two of the following BS EN ISO 6947 positions: a) flat (PA) b) vertical upwards (PF) c) horizontal vertical (PB) d) vertical downwards (PG) e) horizontal (PC) 3.5. Check the quality of the welded joints produced in AC 3.3 and 3.4 conforms to given specifications including: a) dimensional accuracy b) size and profile of weld c) number of runs d) alignment/squareness
4. Be able to produce welds and carry out non-destructive and destructive tests and identify different weld defects in line with quality standards.	4.1. Describe different procedures for visually examining welds for cracks, porosity and slag inclusions including: a) dye penetrant b) fluorescent penetrant c) magnetic particle testing 4.2. Carry out non-destructive testing of given welds, using at least one of the following: a) dye penetrant b) fluorescent penetrant c) magnetic particle 4.3. Describe different procedures for carrying out destructive tests on the welds including: a) macroscopic examination b) bend tests. c) nick break tests 4.4. Carry out destructive tests on weld specimens using at least one of the following: a) macroscopic examination b) nick break test c) bend tests such as face, root or side, as appropriate 4.5. Identify the following defects in given welds: a) lack of continuity of the weld b) uneven and irregular ripple formation c) incorrect weld size or profile **and at least four of the following:** d) undercutting e) internal cracks f) overlap g) surface cracks h) inclusions

	i) lack of fusion j) porosity k) lack of penetration 4.6. Produce welded joints at least 150mm long, using single or multi-run welds as appropriate, with at least one stop and start which meet all of the following (with reference to BS 4872 Part 1 Weld test requirements): a) welds meet the required dimensional accuracy b) fillet welds are equal in leg length and slightly convex in profile, with the size of the fillet equivalent to the thickness of the material welded c) the weld contour is linear, of uniform profile, free from excessive undulations, with regular and even ripple d) the welds are adequately fused, and there is minimal undercut, overlap and surface inclusions e) joins at stop/start positions merge smoothly, with no pronounced hump or crater in the weld surface f) tack welds are blended in to form part of the finished weld, without excessive hump g) corner joints have minimal burn through to the underside of the joint or, where appropriate, penetration is present to a maximum depth of 3mm for at least 75% of the joint h) the weld surface is free from cracks, and substantially free from porosity, shrinkage cavities and trapped slag i) the weld surface and adjacent parent metal is substantially free from arcing or chipping marks

Additional Assessment Guidance

Re AC 2.1 - Description should include basic principles of fusion welding, AC and DC power sources and power ranges.

Re AC3.1 - Description should include striking and initiating the arc, fine adjustment of parameters, correct manipulation and welding speed of electrode, blending in stops/starts and tack welds.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion

	the learner's progression through the course	
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Preparing and Using Manual Metal Arc Welding Equipment
1. Be able to plan, prepare and carry out a risk assessment for manual metal arc welding activities.	**Scope** **Teaching will cover:** • **Welding Process:** describe the use of Personal Protective Equipment (PPE) in Manual Metal Arc (MMA) welding. • **Describe the hazards:** welding fume, electricity, arc radiation, hot metal/slag/sparks. • **PPE:** headshield, filter lens, cover lens, light reactive filters, gauntlets, protective footwear, eye protection, flame retardant overalls, leather apron, skull cap, leather jacket, factors render PPE provided as protection against the above ineffective or unsafe. • **Welding fume:** types of fume (visible (particulate), invisible (gaseous), carbon monoxide (CO), oxides of nitrogen, nitrous oxide (NO), nitrogen dioxide (NO2), use of extraction (background, local, natural ventilation (e.g. on-site), air-fed headshields, respirator. • **Electricity:** shock hazards (use of electrical insulation (condition, correct size, correct connection, tightness of connection) welding lead, welding return, welding earth); fire, burns. • **Arc radiation:** visible light, infra-red, ultra-violet, PPE (types, purpose), screening (types, purpose), warnings (verbal, notices). Hot metal/slag/sparks: means of avoiding hazards (identification of hazard, use of tools (tongs, etc), use of PPE. • **Describe types of welding equipment:** Describe welding leads identify electrode holders describe types of return clamps describe the function and safe use of equipment used for preparing and finishing materials welded joints. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific metal arc welding activities. Provide practical scenarios for them to assess potential risks and identify control measures.

2. Be able to safely set up manual metal arc welding equipment and select electrodes.	**Scope**
	
	Teaching will cover:
	• **How to prepare materials and equipment for safe welding operations.**
	  ○ **Welding equipment:** Alternating Current (AC) (transformer), Direct Current (DC) (transformer/rectifier, inverter, engine driven generators).
	  ○ **Leads:** welding, return, earth.
	• **Electrode holders:** fully insulated, partially insulated.
	• **Return clamps:** types. Preparing and finishing: grinders (angle, mini, safe use), linishers, files, flame cutting, chipping hammer, wire brushes, hammer, and chisel.

3. Be able to safely weld different joints in different positions and check weld quality.	**Scope** **Teaching will cover:** • Types of electrodes • Electrode storage requirements • Select types of welding current and polarity • Applying electrode sizes to material thickness and types of joint

	• Applying welding current ranges to electrode sizes differentiate between welding voltages operate manual metal arc welding equipment safely. • Applying EN ISO 6947 welding positions apply welding techniques in accordance with BS 4872 • Applying post welding activities • How to apply appropriate assembly and distortion control methods • State methods of distortion rectification • Use welding consumables safely • How to produce standard carbon steel or stainless-steel welded joints in the EN ISO 6947 positions, minimum 5 mm thick, minimum 150 mm long using single or multiple-run welds as appropriate • How to restore the work area using the correct procedures for the disposal of waste. • **Electrodes:** cellulosic, rutile, basic, applications. • **Storage requirements:** temperature, humidity. • **Welding current and polarity:** alternating (AC), direct (DC) (electrode positive, electrode negative). • Apply electrode sizes to material thickness and types of joint: Ø2.5, Ø3.2, Ø4.0 mm; 3 mm to 10 mm thickness; butt, tee, lap, corner. • Welding current ranges to electrode sizes: Ø2.5, Ø3.2, Ø4.0 mm. Welding voltages: open circuit voltage, arc voltage. • **Welding positions:** flat – EN ISO 6947 PA position, horizontal/vertical – EN ISO 6947 PB position, horizontal – EN ISO 6947 PC position, vertical upwards – EN ISO 6947 PF position. • **Welding techniques:** arc striking, crater filling at the end of a weld, stop/restart, stringer beading, weaving, single – run, multiple-run. BS 4872 Part 1: test type, joint set-up, test piece dimensions, assessment of weld quality, destructive testing. • **Post welding activities:** cleaning, slag removal, spatter removal, wiring brushing, removal of excess weld metal where required. • **Assembly and distortion control methods:** clamping, alignment jigs, run on/off plates, tack welds. Distortion rectification: mechanical, thermal.
4. Be able to produce welds and carry out non-destructive and destructive tests and identify different weld defects in line with quality standards.	**Scope** **Teaching will cover:** • **Weld flaws:** describe visual assessment techniques describe non-destructive testing techniques describe workshop destructive testing methods perform visual checks to find weld defects check weld against criteria based upon BS 4872 Part 1. • -**Weld flaws:** lack of continuity, even or irregular weld profile, incorrect weld size or profile, undercutting, overlap, inclusions, porosity, surface cracks, internal cracks, lack of fusion (root, side wall, inter-run), lack of penetration. • **Qualitative:** (defect levels, appearance), quantitative (extent, size, dimensional accuracy). Visual assessment: use of magnification, use of weld gauges (fillet, universal), use of illumination to aid assessment. • **Non-destructive testing:** dye penetrant (applications, procedure, limitations) magnetic particle techniques (current flow, magnetic flow, procedures, applications, limitations). • **Destructive testing:** macroscopic examination (purpose, preparation of specimen, examination of specimen) nick-break test (purpose, preparation of specimen, breaking of specimen, examination of specimen) bend tests (types (face, root, side), purpose, preparation of specimen, bending of specimen, former sizes.

Title	Using Semi-Automatic Metal Inert Gas, Metal Active Gas and Flux Cored Arc-Welding Equipment
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG247
Unit Reference No	R/650/7665
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to prepare and use semi-automatic Metal Inert Gas (MIG), Metal Active Gas (MAG) and flux cored arc-welding equipment.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for welding activities.	1.1. Describe the health and safety issues and requirements associated with carrying out welding activities. 1.2. Plan and prepare for welding activities prior to welding. 1.3. Carry out a risk assessment for given welding activities.
2. Be able to safely set up welding equipment and select appropriate consumables, gas and welding positions.	2.1. Describe how to safely set up the following types of welding equipment: a) MIG b) MAG c) Flux cored wire 2.2. Set up one of the following types of welding equipment safely: a) MIG b) MAG c) Flux cored wire 2.3. Describe consumables including gas appropriate to different materials and applications, to include one of the following wire types: a) solid b) cored 2.4. Select consumables for the welding of the following materials and material forms: one type of material from the following: a) carbon steel b) stainless steel c) aluminium and two forms of material from the following: a) plate b) sheet (less than 3mm) c) pipe/tube d) section e) other forms 2.5. Describe different types of shielding gas and reasons for use. 2.6. Use one of the following types of shielding gas: a) inert b) active 2.7. Describe the terminology used for welding positions.

	2.8. Set up equipment to weld joints in good access situations for at least two of the following British Standard (BS) European Standard (EN) International Organization for Standardization (ISO) 6947 positions: a) flat (PA) b) vertical upwards (PF) c) horizontal vertical (PB) d) vertical downwards (PG) e) horizontal (PC)
3. Be able to safely weld different joints in different positions and check weld quality.	3.1. Describe the techniques of operating welding equipment to produce different joints in the various joint positions. 3.2. Describe methods used to control distortion including welding sequence and deposition technique. 3.3. Weld at least three of the following types of joints to given specifications safely each at least 150mm long, by single or multi –run as appropriate with at least one stop and start included: a) fillet lap b) corner c) tee fillet d) butt 3.4. Weld joints to given specifications safely in good access situations in at least two of the following BS EN ISO 6947 positions: a) flat (PA) b) vertical upwards (PF) c) horizontal vertical (PB) d) vertical downwards (PG) e) horizontal (PC) 3.5. Check the quality of the welded joints produced in AC 3.3 and 3.4 conforms to given specifications including: a) dimensional accuracy b) size and profile of weld c) number of runs d) alignment/squareness
4. Be able to carry out non-destructive and destructive tests and identify different weld defects in line with quality standards.	4.1. Describe different procedures for visually examining welds for cracks, porosity and slag inclusions including: a) dye penetrant b) fluorescent penetrant c) magnetic particle testing 4.2. Carry out non-destructive testing of given welds, using at least one of the following: a) dye penetrant b) fluorescent penetrant c) magnetic particle 4.3. Describe different procedures for carrying out destructive tests on the welds including: a) macroscopic examination b) bend tests c) nick break tests 4.4. Carry out destructive tests on weld specimens using at least one of the following: a) macroscopic examination

	b) nick break test c) bend tests (such as face, root or side, as appropriate) 4.5. Identify the following defects in given welds: a) lack of continuity of the weld b) uneven and irregular ripple formation c) incorrect weld size or profile **and at least four of the following:** d) undercutting e) internal cracks f) overlap g) surface cracks h) inclusions i) lack of fusion j) porosity k) lack of penetration 4.6. Produce welded joints at least 150mm long, using single or multi-run welds as appropriate, with at least one stop and start which meet all of the following (with reference to BS 4872 Part 1 Weld test requirements): a) welds meet the required dimensional accuracy. b) fillet welds are equal in leg length and slightly convex in profile, with the size of the fillet equivalent to the thickness of the material welded. c) the weld contour is linear, of uniform profile, free from excessive undulations, with regular and even ripple. d) the welds are adequately fused, and there is minimal undercut, overlap and surface inclusions. e) joins at stop/start positions merge smoothly, with no pronounced hump or crater in the weld surface. f) tack welds are blended in to form part of the finished weld, without excessive hump. g) corner joints have minimal burn through to the underside of the joint or, where appropriate, penetration is present to a maximum depth of 3mm for at least 75% of the joint h) the weld surface is free from cracks, and substantially free from porosity, shrinkage cavities and trapped slag. i) the weld surface and adjacent parent metal is substantially free from arcing or chipping marks

Additional Assessment Guidance
Re: AC 2.1 - Description should include the basic principles of fusion, power sources, the major parts of the welding equipment and their function **Re: AC 3.1** - Description should include fine adjustment of parameters; correct manipulation of the welding gun; blending in stops/starts and tack welds

Assessment Guidance		
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.		
Assessment Method	**Definition**	**Possible Content**
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Using Semi-Automatic Metal Inert Gas, Metal Active Gas and Flux Cored Arc-Welding Equipment
1. Be able to plan, prepare and carry out a risk assessment for welding activities.	**Scope** **Teaching will cover:** • **PPE:** headshield, filter lens, cover lens, light reactive filters, gauntlets, protective footwear, eye protection, flame retardant overalls, leather apron, skull cap, leather jacket, factors render PPE provided as protection against the above ineffective or unsafe. • **Welding fume:** types of fume (visible (particulate), invisible (gaseous): ozone (O3), carbon monoxide (CO), oxides of nitrogen, nitrous oxide (NO), nitrogen dioxide (NO2), use of extraction (background, local, natural ventilation (e.g. on-site), air-fed headshields, respirator. • **Electricity:** shock hazards (use of electrical insulation (condition, correct size, correct connection, tightness of connection) welding lead, welding return, welding earth); fire, burns. • **Arc radiation:** visible light, infra-red, ultra-violet, PPE (types, purpose), screening (types, purpose), warnings (verbal, notices). • **Hot metal/sparks:** means of avoiding hazards, identification of hazard, use of tools (tongs, etc), use of PPE. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific welding activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to safely set up welding equipment and select appropriate consumables, gas and welding positions.	**Scope** **Teaching will cover:** • **Welding equipment:** Direct Current (DC) (transformer/rectifier, inverter, engine driven generators). • **Leads:** welding (water cooled, air cooled, construction of lead, supplies to gun/torch), return, earth. • **Guns/torches:** goose neck, pistol, push, pull, push-pull, reel-on-gun, water cooled, air cooled. • **Preparing and finishing:** grinders (angle, mini, safe use), linishers, files, flame cutting, chipping hammer, wire brushes, hammer, and chisel.
3. Be able to safely weld different joints in different positions and check weld quality.	**Scope** **Teaching will cover:** • **Electrodes:** solid wires (copper coated, uncoated, reel sizes), cored wire (flux cored, iron cored, self-shielded). • **Storage requirements:** temperature, humidity. • **Welding current and polarity:** direct (DC) (electrode positive). • **Electrode sizes to material thickness and types of joint:** Ø2.5, Ø3.2, Ø4.0 mm; 3 mm to 10 mm thickness; butt, tee, lap, corner Arc voltage and wire feed speed ranges to electrode sizes: Ø0.8, Ø1.0, Ø1.2 mm. • **Welding voltages:** open circuit voltage, arc voltage. • **Shielding gases:** inert (argon, helium, argon/helium mixtures) active (carbon dioxide (CO2), argon/oxygen (O2), argon/CO2, argon/O2 /CO2, argon/helium/O2 /CO2), applications. • **Welding positions:** flat – EN ISO 6947 PA position, horizontal/vertical – EN ISO 6947 PB position, horizontal – EN ISO 6947 PC position, vertical upwards – EN ISO 6947 PF position. • **Welding techniques:** arc striking, crater filling at the end of a weld, stop/restart, stringer beading, weaving, single – run, multiple-run. BS

	4872 Part 1: test type, joint set-up, test piece dimensions, assessment of weld quality, destructive testing. • **Post welding activities:** cleaning, slag removal, spatter removal, wiring brushing, removal of excess weld metal where required. • **Assembly and distortion control methods:** clamping, alignment jigs, run on/off plates, tack welds. • **Distortion rectification:** mechanical, thermal.
4. Be able to carry out non-destructive and destructive tests and identify different weld defects in line with quality standards.	**Scope** **Teaching will cover:** • **Weld flaws:** lack of continuity, even or irregular weld profile, incorrect weld size or profile, undercutting, overlap, inclusions, porosity, surface cracks, internal cracks, lack of fusion (root, side wall, inter-run), lack of penetration. • **Assessment criteria:** qualitative (defect levels, appearance), quantitative (extent, size, dimensional accuracy). • **Visual assessment:** use of magnification, use of weld gauges (fillet, universal), use of illumination to aid assessment. • **Non-destructive testing:** dye penetrant (applications, procedure, limitations) magnetic particle (techniques (current flow, magnetic flow, procedures, applications, limitations). • **Destructive testing:** macroscopic examination (purpose, preparation of specimen, examination of specimen) nick-break test (purpose, preparation of specimen, breaking of specimen, examination of specimen) bend tests (types (face, root, side), purpose, preparation of specimen, bending of specimen, former sizes, former arrangements, bend radius, angle of bend, examination of specimen).

Title	Forming and Installing Cable Enclosures
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG248
Unit Reference No	T/650/7666
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to install electrical cable enclosures.	

Learning Outcomes	Assessment Criteria
1. Understand health and safety in relation to forming and assembling cable enclosures and support systems.	1.1. Summarise the key aspects of the following in relation to forming and assembling cable enclosure and support systems: a) health and safety legislation b) regulations c) safety practices and procedures
2. Be able to plan, prepare and carry out a risk assessment for the assembly of electrical cable enclosures.	2.1. Use a British Standard (BS) wiring diagram to identify cable enclosure layouts. 2.2. Prepare for assembly of electrical cable enclosures including: a) carrying out a risk assessment 2.3. Complete the following activities prior to installing electrical enclosures: a) a risk assessment b) interpret a control of substances hazardous to health (COSHH) assessment c) identify and use appropriate personal protective equipment (PPE)
3. Be able to form electrical cable enclosures.	3.1. Compare the advantages and disadvantages of the following electrical cable enclosures including the effects of ambient temperature: a) metallic and non-metallic trunking b) cable tray c) metallic and non-metallic conduit 3.2. Identify and use the correct tools for forming and installing electrical enclosures, working safely and following job instructions at all times. 3.3. Cut, form and construct cable enclosure components to the required size and shape taking into account couplers and bends and removing burrs and sharp edges. 3.4. Produce external threads on conduit holding the conduit securely to avoid damage when cutting and bending. 3.5. Form bends, up to, including and over 90°. 3.6. Make tee junctions in trunking and tray work. 3.7. Form offsets and bridge/saddle sets. 3.8. Assemble cable enclosures and tray work to include the following: a) inspection type bends and elbows b) horizontal runs and vertical drops c) couplings d) tee-pieces
4. Be able to secure and check electrical cable enclosure assemblies.	4.1. Outline the checks required to be undertaken for services within walls.

	4.2. Secure electrical cable enclosures to given surfaces in accordance with BS wiring regulations. 4.3. Secure conduits ensuring saddles are spaced in accordance with BS wiring regulations. 4.4. Use a spirit-level and/or plumb bob to ensure horizontal and vertical runs are level and straight. 4.5. Check that all connections and mountings are secure.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Forming and Installing Cable Enclosures
1. Understand health and safety in relation to forming and assembling cable enclosures and support systems.	**Scope** **Teaching will cover:** • **Health and Safety Legislation and Regulations:** Teach the relevant health and safety legislation and regulations, such as the Health and Safety at Work Act and the Electricity at Work Regulations. Emphasise the importance of following these guidelines when working with cable enclosures. • **Safety Practices and Procedures:** Discuss the best practices for maintaining safety during cable enclosure installation, including safe use of tools, correct manual handling, and the proper use of personal protective equipment (PPE). • **Risk Assessment Procedures:** Provide examples of risk assessments specifically related to cable installation environments, focusing on identifying hazards and implementing control measures.
2. Be able to plan, prepare and carry out a risk assessment for the assembly of electrical cable enclosures.	**Scope** **Teaching will cover:** • **Using Wiring Diagrams:** Teach students how to interpret British Standard (BS) wiring diagrams to plan cable enclosure layouts. Provide practical exercises where students identify routes and plan the enclosure assembly process. • **Preparing for Installation:** Guide students in preparing for the installation of electrical enclosures by conducting risk assessments, interpreting Control of Substances Hazardous to Health (COSHH) assessments, and identifying appropriate PPE. • **Pre-Installation Checks:** Discuss the critical activities that should be completed before installation, such as confirming the work area is clear, verifying that all necessary tools and materials are available, and ensuring that safety procedures are in place.
3. Be able to form electrical cable enclosures.	**Scope** **Teaching will cover:** • **Types of Cable Enclosures:** Compare the benefits and drawbacks of various enclosure types (metallic and non-metallic trunking, cable trays, conduits) in terms of durability, ease of installation, and resistance to environmental factors. • **Tools and Techniques for Forming Enclosures:** Teach students how to select and use the appropriate tools for cutting, forming, and installing enclosures. Emphasise the importance of following job instructions and maintaining safety throughout the process. • **Practical Forming and Installation:** Provide hands-on training in cutting, forming, and constructing cable enclosures to specified shapes and sizes. Cover techniques for producing bends, forming external threads on conduit, and creating tee junctions in trunking and tray work. • **Assembly of Enclosures:** Teach students how to assemble and install enclosures and tray work, focusing on maintaining alignment and ensuring secure joints.

4. Be able to secure and check electrical cable enclosure assemblies.	**Scope** **Teaching will cover:** • **Securing Assemblies:** Teach the methods for securely fastening cable enclosures to different surfaces in compliance with British Standards. Provide practical sessions where students apply these methods using appropriate fixings and tools. • **Checking for Level and Alignment:** Discuss the importance of ensuring that cable runs are straight and level. Teach students how to use spirit levels and plumb bobs to check the alignment of horizontal and vertical runs. • **Final Checks and Quality Control:** Explain the final checks required to ensure all connections and mountings are secure. Teach students how to identify and correct common issues, such as loose fittings or misaligned components.

Title	Wiring and Testing Electrical Circuits and Equipment
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG249
Unit Reference No	Y/650/7667
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to plan, prepare, carry out and test the installation of wiring of electrical circuits and equipment.	
Learning Outcomes	**Assessment Criteria**
1. Understand the health and safety issues associated with the installation of electrical wiring systems and cable enclosures and supports.	1.1. Describe the key aspects of health and safety legislation, regulations and safety practices and procedures in relation to: a) forming and assembling cable enclosure and support systems b) installation and testing of electrical wiring systems 1.2. Describe how to identify that an individual has suffered an electric shock and actions to be taken.
2. Be able to plan, prepare and carry out a risk assessment for the wiring and testing of electrical equipment and circuits.	2.1. Interpret a British Standard (BS) wiring diagram to identify electrical components and circuits. 2.2. Identify the correct tools for wiring and testing electrical equipment and circuits. 2.3. Describe and demonstrate how to confirm the safe isolation of circuits before commencing work. 2.4. Check that tools are in good working order and appropriately insulated. 2.5. Check that testing equipment is calibrated and has been Portable Appliance Testing (PAT) tested. 2.6. Complete the following activities prior to installation of wiring: a) a risk assessment b) interpret a Control of Substances Hazardous to Health (COSHH) assessment. c) select appropriate personal protective equipment (PPE)
3. Be able to install wiring of electrical circuits.	3.1. Describe typical uses of the different cable types for different applications. 3.2. Describe the importance of bonding and earthing to the installation and operation of safe electrical wiring systems. 3.3. Install wiring safely, using appropriate PPE and following job instructions to connect three circuits using three different cable types and at least five different components and: a) ensure wiring runs and equipment are installed level and in accordance with BS regulations. b) determine required cable current ratings and selecting appropriate cables.

	c) install cables appropriately without twisting. 3.4. Carry out eight of the following cable termination activities: a) stripping cable sheaths without damage to conductor insulation b) removing cable insulation c) connecting accessories (such as plugs, sockets multi-way connectors) d) crimping (such as spade end, loops, tags and pins). e) soldering and de-soldering. f) terminating armoured cables g) attaching suitable cable identification. h) heat shrinking (devices and boots). i) earth bonding. j) making mechanical/screwed/clamped connections. k) terminating mineral insulated cables l) sealing/protecting cable connections. m) securing wires and cables (such as clips, plastic strapping, lacing, harnessing) n) cable glands and grips
4. Be able to test and check the wiring of electrical systems.	4.1. Describe the function of and demonstrate the use of at least two of the following test instruments during the wiring and testing activities: a) multimeter b) insulation resistance tester c) polarity tester/indicator d) residual current device (RCD) tester e) earth-loop impedance tester f) other specific test equipment 4.2. Carry out checks, appropriate to the equipment and circuits being wired, to include at least three of the following: a) visual checks for signs of damage, incorrect termination, sound bonding/earthing connections b) movement checks to identify loose fittings and connections c) testing that equipment operates to the circuit specification d) using fault finding techniques such as half-split, input/output, unit substitution **and testing at least three of the following:** e) protective conductor resistance values f) insulation resistance values g) continuity h) voltage levels i) load current. j) polarity k) resistance l) RCD disconnection time

Assessment Guidance		
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.		
Assessment Method	**Definition**	**Possible Content**
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Wiring and Testing Electrical Circuits and Equipment
1. Understand the health and safety issues associated with the installation of electrical wiring systems and cable enclosures and supports.	**Scope** **Teaching will cover:** • **Health and Safety Legislation and Regulations:** Introduce students to relevant health and safety laws, such as the Health and Safety at Work Act, Electricity at Work Regulations, and standards for working with electrical systems. Emphasise the importance of compliance in preventing accidents and injuries. • **Safe Practices in Electrical Installation:** Discuss the safety practices that must be followed during the installation and testing of electrical systems, including the correct use of tools, safe isolation procedures, and the importance of earthing and bonding. • **Recognising and Responding to Electric Shock:** Teach students how to identify the signs of electric shock and the immediate actions to take, including emergency first aid and the use of circuit breakers or residual current devices (RCDs) to prevent injury.
2. Be able to plan, prepare and carry out a risk assessment for the wiring and testing of electrical equipment and circuits.	**Scope** **Teaching will cover:** • **Interpreting Wiring Diagrams:** Teach students how to read and interpret British Standard (BS) wiring diagrams to identify electrical components and circuits. Provide practical exercises that allow students to apply their knowledge to real-world scenarios. • **Tool Selection and Safe Isolation:** Explain how to select and inspect tools for wiring and testing, ensuring they are in good working order and appropriately insulated. Demonstrate safe isolation procedures to de-energise circuits before commencing work. • **Pre-Installation Activities:** Discuss the importance of conducting risk assessments and COSHH (Control of Substances Hazardous to Health) assessments. Teach students how to identify and use the correct personal protective equipment (PPE) for specific tasks.
3. Be able to install wiring of electrical circuits.	**Scope** **Teaching will cover:** • **Understanding Cable Types and Applications:** Explain the different types of cables used in electrical installations and their specific applications. Discuss factors such as current ratings, insulation, and environmental considerations when selecting cables. • **Importance of Bonding and Earthing:** Teach the principles of bonding and earthing to ensure safe operation of electrical systems. Discuss how proper earthing reduces the risk of electric shock and equipment damage. • **Installing Wiring Safely:** Provide hands-on training in installing wiring systems according to BS regulations, ensuring that wiring runs are level and components are correctly aligned. Emphasise avoiding cable twisting and maintaining correct cable current ratings. • **Cable Termination Techniques:** Teach the procedures for cable termination, including stripping sheaths, connecting accessories, crimping, soldering, and terminating armoured cables. Provide exercises for students to practice these skills and ensure their work is free from damage.

4. Be able to test and check the wiring of electrical systems.	**Scope** **Teaching will cover:** • **Using Test Instruments:** Introduce students to the different types of test instruments used in electrical installations, such as multimeters, insulation resistance testers, polarity testers, and RCD testers. Provide demonstrations and hands-on practice for using these instruments accurately. • **Conducting Electrical Checks:** Teach students how to perform checks on electrical systems, including visual inspections for damage, verifying connections, and testing circuit functionality. Discuss fault-finding techniques, such as half-split testing and unit substitution. • **Testing Electrical Parameters:** Provide training on measuring and interpreting test results for parameters like continuity, insulation resistance, voltage levels, polarity, and RCD disconnection times. Ensure students understand how to record and evaluate test data according to industry standards.

Title	Robotic Systems for Engineering
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG250
Unit Reference No	A/650/7668
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to develop programs for robotic systems to carry out engineering functions.	

Learning Outcomes	Assessment Criteria
1. Be aware of health and safety requirements associated with using a robotic system and carry out a risk assessment.	1.1. Describe the health and safety requirements associated with using a robotic system. 1.2. Carry out a risk assessment for given robotic system related activities.
2. Be able to develop programs for robotic systems.	2.1. Describe the information required and how to develop complete and accurate programs for a given robotic system. 2.2. Develop complete and accurate programs for robotic systems to undertake at least two engineering applications which may include: a) welding b) surface coating c) gluing/sealing d) machine loading/unloading e) assembly f) logistics movement/control g) packaging h) stud welding
3. Be able to prepare, load and prove programs for robotic systems and select and set up robot end effectors.	3.1. Describe the process used to prepare, load, and prove robotic programs. 3.2. Describe how to produce effective and efficient programs to avoid unnecessary operations including the use of macro programs and canned cycles to reduce program size. 3.3. Prepare, load, and prove programs using one of the following types of robot programming methods: a) positional commands (x,y,xz) b) teach pendant c) lead by the nose d) off-line programming e) other specific method 3.4. Select and set up one of the following types of robot end effectors for the engineering application of: a) welding guns b) spot welders c) spray guns d) grippers e) drills f) vacuum devices g) other specific tooling

4. Be able to develop programs to control robotic systems.	4.1. Develop programs to include the following as applicable to a given robot type and work specification: a) safe and start positions b) all necessary positional information c) types of motion (such as joint interpolated, linear, circular) d) preparatory commands and process management/auxiliary functions e) repetitive programs (sub-routines, canned cycles, labels) f) speed/acceleration parameters. g) sensor information h) part programs downloaded from a computer (such as patch programs) i) use of work frames (such as tool, global, joint, user)
5. Know the methods to check work specifications have been completed safely, accurately and efficiently.	5.1. Describe methods that can be used to check completed programs perform safely, accurately, and efficiently including: a) conducting trial runs b) using single block run c) dry run d) speed override controls 5.2. Describe how to check that the finished operations meet the work specification.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Robotic Systems for Engineering
1. Be aware of health and safety requirements associated with using a robotic system and carry out a risk assessment.	**Scope** **Teaching will cover:** • **Introduction to Health and Safety:** Overview of health and safety regulations relevant to robotics in engineering (e.g., HSE guidelines, ISO standards). Discuss risks associated with robotic systems such as mechanical hazards, electrical hazards, and environmental factors (e.g., noise, lighting). • **Risk Assessment Process:** Teach the principles of risk assessment, covering hazard identification, risk evaluation, and control measures. Discuss specific robotic system scenarios, like automated assembly lines, where students can practice assessing risks. • **Practical Exercise:** Guide students through performing a risk assessment for a simulated or real-world engineering task involving a robotic system (e.g., loading/unloading tasks).
2. Be able to develop programs for robotic systems.	**Scope** **Teaching will cover:** • Teach programming concepts and methodologies relevant to different robotic systems. • Cover the information needed to develop accurate and efficient programs for engineering tasks such as welding, surface coating, machine loading/unloading, and logistics control.
3. Be able to prepare, load and prove programs for robotic systems and select and set up robot end effectors.	**Scope** **Teaching will cover:** • Cover various methods of robot programming (e.g., teach pendant, off-line programming) and the procedures for loading and testing programs. Include practical sessions on selecting and configuring end effectors for specific applications (e.g., welding guns, grippers).
4. Be able to develop programs to control robotic systems.	**Scope** **Teaching will cover:** • Provide in-depth knowledge on developing programs for robotic systems, including integrating safety features, positional data, motion types, and sensor integration. Discuss methods to optimise performance using sub-routines and parameter settings.
5. Know the methods to check work specifications have been completed safely, accurately and efficiently.	**Scope** **Teaching will cover:** • Guide students on methods to verify program efficiency, safety, and accuracy. • Cover practical strategies like trial runs, dry runs, and speed override checks.

Title	Preparing and Using Manual TIG Welding Equipment
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG251
Unit Reference No	D/650/7669
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to gain the skills and knowledge needed to prove the competences required to prepare and use manual TIG welding equipment.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for manual TIG welding activities.	1.1. Describe the health and safety issues and requirements associated with carrying out manual TIG welding activities. 1.2. Plan and prepare for TIG activities prior to welding. 1.3. Carry out a risk assessment for given TIG welding activities.
2. Be able to safely set up manual TIG welding equipment and select consumables and gas.	2.1. Describe the principles of fusion, power sources, major component parts of manual TIG welding equipment and their function. 2.2. Describe how to and safely set up manual TIG welding and related equipment. 2.3. Describe and select welding consumables (including gas) appropriate to the material being welded and application for either AC or DC current types for the welding of the following materials and material forms: One type of material from the following: a) carbon steel b) stainless steel c) aluminium **and two forms of material from the following:** a) sheet (less than 3mm) b) pipe/tube c) plate d) section e) other forms 2.4. Describe the terminology used for welding positions. 2.5. Set up equipment to weld joints in good access situations for at least two of the following British Standard (BS) European Standard (EN) International Organization for Standardization (ISO) 6947 positions: a) flat (PA) b) vertical upwards (PF) c) horizontal vertical (PB) d) vertical downwards (PG) e) horizontal (PC)
3. Be able to safely weld different joints in different positions and check weld quality.	3.1. Describe the techniques of operating welding equipment to produce different joints in different joint positions. 3.2. Describe methods used to control distortion including welding sequence and deposition technique.

	3.3. Weld at least three of the following types of joints to given specifications safely each at least 150mm long, by single or multi-run as appropriate, with or without filler wire, with at least one stop and start included: a) fillet lap b) corner c) tee fillet d) butt 3.4. Weld joints to given specifications safely in good access situations in at least two of the following BS EN ISO 6947 positions: a) flat (PA) b) vertical upwards (PF) c) horizontal vertical (PB) d) vertical downwards (PG) e) horizontal (PC) 3.5. Check the quality of the welded joints produced in AC 3.3 and 3.4 conforms to given specifications including: a) dimensional accuracy b) size and profile of weld c) number of runs d) alignment/squareness
4. Be able to produce welds and carry out non-destructive and destructive tests and identify different weld defects in line with quality standards.	4.1. Describe different procedures for visually examining welds for cracks, porosity and slag inclusions including: a) dye penetrant b) fluorescent penetrant c) magnetic particle testing 4.2. Carry out non-destructive testing of given welds, using at least one of the following: a) dye penetrant b) fluorescent penetrant c) magnetic particle 4.3. Describe different procedures for carrying out destructive tests on the welds including: a) macroscopic examination b) bend tests c) nick break tests 4.4. Carry out destructive tests on weld specimens using at least one of the following: a) macroscopic examination b) nick break test c) bend tests such as face, root, or side, as appropriate 4.5. Identify the following defects in given welds: a) lack of continuity of the weld b) uneven and irregular ripple formation c) incorrect weld size or profile **and at least four of the following:** d) undercutting e) internal cracks f) overlap g) surface cracks h) inclusions

	i) lack of fusion j) porosity k) lack of penetration 4.6. Produce welded joints at least 150mm long, using single or multi-run welds as appropriate, with at least one stop and start which meet all of the following (with reference to BS 4872 Part 1 Weld test requirements): a) welds meet the required dimensional accuracy b) fillet welds are equal in leg length and slightly convex in profile, with the size of the fillet equivalent to the thickness of the material welded c) the weld contour is linear, of uniform profile, free from excessive undulations, with regular and even ripple d) the welds are adequately fused, and there is minimal undercut, overlap and surface inclusions e) joins at stop/start positions merge smoothly, with no pronounced hump or crater in the weld surface f) tack welds are blended in to form part of the finished weld, without excessive hump g) corner joints have minimal burn through to the underside of the joint or, where appropriate, penetration is present to a maximum depth of 3mm for at least 75% of the joint h) the weld surface is free from cracks, and substantially free from porosity, shrinkage cavities and trapped slag i) the weld surface and adjacent parent metal is substantially free from arcing or chipping marks

Additional Assessment Guidance

Re AC 3.1 - Description should include fine adjustment of parameters, correct manipulation of welding gun, blending in stops/starts and tack welds.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion

Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Preparing and Using Manual TIG Welding Equipment
1. Be able to plan, prepare and carry out a risk assessment for manual TIG welding activities.	**Scope** **Teaching will cover:** **Personal Protective Equipment (PPE)** used in relation to welding process and the use of Personal Protective Equipment (PPE) in TIG welding: • **PPE:** headshield, filter lens, cover lens, light reactive filters, gauntlets, protective footwear, eye protection, flame retardant overalls, skull cap, factors render PPE provided as protection against the above ineffective or unsafe. **Hazards from:** • **Welding fume:** types of fume (visible (particulate), invisible (gaseous): ozone (O3), oxides of nitrogen, nitrous oxide (NO), nitrogen dioxide (NO2), use of extraction (background, local, natural ventilation (e.g. on-site)), air- fed headshields, respirator. • **Electricity:** shock hazards (use of electrical insulation (condition, correct size, correct connection, tightness of connection) welding lead, welding return, welding earth); fire, burns. • **Arc radiation:** visible light, infra-red, ultra-violet, PPE (types, purpose), screening (types, purpose), warnings (verbal, notices). • **Hot metal**: means of avoiding hazards (identification of hazard, use of tools (tongs, etc), use of PPE. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific TIG welding activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to safely set up manual TIG welding equipment and select consumables and gas.	**Scope** **Teaching will cover:** • **Types of welding equipment:** Direct Current (DC) (transformer/rectifier, inverter, engine driven generators, AC/DC converters). • **Welding leads identify guns/torches: Leads:** welding (water cooled, air cooled, construction of lead, supplies to gun/torch), return, earth. • **Types of return clamps** • **Guns/torches:** water cooled, air cooled, pencil. • The function and safe use of equipment used for preparing and finishing materials welded joints. • **Preparing materials and equipment for safe welding operations:** Preparing and finishing: grinders (angle, mini, safe use), linishers, files, wire brushes.
3. Be able to safely weld different joints in different positions and check weld quality.	**Scope** **Teaching will cover:** • select types of electrodes • select filler wires describe filler wire storage requirements. • select types of welding current and polarity relate electrode sizes to material thickness and types of joint and types of current relate welding current ranges to electrode sizes. • differentiate between welding voltages. • classify shielding gases for welding operate TIG welding equipment safely. • apply EN ISO 6947 welding positions

4. Be able to produce welds and carry out non-destructive and destructive tests and identify different weld defects in line with quality standards.	**Scope** **Teaching will cover:** • apply welding techniques in accordance with BS 4872 Part 1 and BS 4872 Part 2 apply post welding activities. • describe appropriate assembly and distortion control methods. • state methods of distortion rectification • produce standard carbon steel or stainless-steel welded joints in the EN ISO 6947 positions, less than 5 mm thick, minimum 150 mm long using single or multiple-run welds as appropriate. • Restore the work area. • describe weld flaws: Weld flaws: lack of continuity, even or irregular weld profile, incorrect weld size or profile, undercutting, overlap, inclusions, porosity, surface cracks, internal cracks, lack of fusion (root, side wall, inter-run), lack of penetration. • describe assessment criteria: Assessment criteria: qualitative (defect levels, appearance), quantitative (extent, size, dimensional accuracy). • describe visual assessment techniques: use of magnification, use of weld gauges (fillet, universal), use of illumination to aid assessment. • describe non-destructive testing techniques: dye penetrant (applications, procedure, limitations) magnetic particle (techniques (current flow, magnetic flow, procedures, applications, limitations). • describe workshop destructive testing methods: macroscopic examination (purpose, preparation of specimen, examination of specimen) nick-break test (purpose, preparation of specimen, breaking of specimen, examination of specimen) bend tests (types (face, root, side), purpose, preparation of specimen, bending of specimen, former sizes, former arrangements, bend radius, angle of bend, examination of specimen). • Perform visual checks to find weld defects against criteria based upon BS 4872.

Title	Producing Sheet Metal Components and Assemblies
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG252
Unit Reference No	J/650/7670
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to produce sheet metal components and assemblies.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for sheet metal activities.	1.1. Describe the health and safety issues and requirements associated with carrying out sheet metal activities. 1.2. Plan and prepare for sheet metal activities. 1.3. Carry out a risk assessment for a given sheet metal activity.
2. Be able to safely mark out materials.	2.1. Mark out sheet metal up to 3 mm safely in at least two different materials from the following: a) hot rolled mild steel b) cold rolled mild steel c) coated mild steel (such as primed, tinned, galvanised) d) copper e) brass f) lead g) stainless steel h) titanium i) aluminium 2.2. Use marking out methods and techniques safely including direct marking using instruments and at least one of the following: a) use of templates b) tracing/transfer methods 2.3. Describe how to use and demonstrate the safe use of the following marking out equipment: a) scriber b) rule or tape c) square d) dividers or trammels e) punch f) straight edge g) protractor h) chalk, blueing or paint 2.4. Describe how to and demonstrate the safe marking out of materials to include the following features: a) datum and centre lines b) curved profiles c) square/rectangular profiles d) cutting and bending detail (including allowances) e) angles

	f) hole centering and outlining (such as circular or linear) g) circles
3. Be able to safely use hand tools and industrial equipment to cut sheet metal profiles.	3.1. Describe and demonstrate the safe use of tin snips and bench shears to cut and finish materials to marked out shape plus at least two of the following hand tools: a) hacksaw b) files c) hand power tools (such as drill nibbling, saw) d) pneumatic tools e) trepanning f) thermal device g) other specific tool 3.2. Describe and demonstrate the safe use of a guillotine to cut and finish materials to the marked-out shape plus at least two of the following types of industrial equipment: a) pillar drill b) punch/cropping machine c) trepanning machine d) bench saw e) nibbling machine f) band saw 3.3. Carry out cutting operations to produce components with the following shapes: a) square or rectangular profiles b) angled profiles c) external curved profiles **and at least two of the following:** d) notches e) internal curved contours f) round holes g) square holes
4. Be able to safely use industrial forming equipment to produce sheet metal components.	4.1. Describe how to calculate allowances for the forming of sheet metal such as circumference, bend allowance and wired edges. 4.2. Describe and demonstrate the set up and safe use of the following types of industrial forming equipment and techniques: a) bending machine (hand or powered) b) rolling machine (hand or powered) **and at least two of the following:** c) hammers/panel beating equipment d) wheeling machine e) stakes and formers f) swaging machine g) presses h) shrinking techniques i) jenny/wiring machine j) stretching techniques 4.3. Carry out forming operations safely to produce components with the following shapes: a) bends/upstands b) tray/box sections c) folds/safe edges d) cylindrical sections

	and at least one of the following: e) wired edges f) cowlings and rounded covers g) swages h) square to round trunking i) curved panels j) lobster-back trunking k) ribbed components l) concertina ducting or trunking
5. Be able to safely assemble and produce sheet metal components in line with quality requirements.	5.1. Describe and demonstrate how to safely assemble sheet metal components, using at least two of the following methods: a) temporary tack welding b) adhesive bonding c) soldering or brazing d) flanged and mechanically fastened (such as bolts, screws) e) resistance spot welding f) self-securing joints (such as knocked up, paned down, swaged, joggled) g) riveting (such as hollow or solid) 5.2. Produce sheet metal components safely which meet all the following quality requirements: a) all dimensions are within +/- 2.0mm or +/- 0.079” b) finished components meet the required shape/geometry (square, straight, angles free from twists) c) completed components are free from excessive tooling marks, deformation, cracking, sharp edges, slivers or burrs all components are correctly assembled and have secure and firm joints d) all components are correctly assembled and have secure and firm joints

Additional Assessment Guidance

Re AC 5.1 and AC 5.2 - The learner should demonstrate how to combine different sheet metal cutting and forming operations for at least one of the jobs to produce a component of a significant nature, and must contain at least three of the cutting operations listed in AC 3.3 and at least three of the forming techniques listed in AC 4.3.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner’s progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion

Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Producing Sheet Metal Components and Assemblies
1. Be able to plan, prepare and carry out a risk assessment for sheet metal activities.	**Scope** **Teaching will cover:** **Equipment** • **Drills** • **Rotary shears** • **Guillotines** • **Power punch** • **Cutting-off wheel machines** • **Oxy-fuel gas cutting**: process, equipment, safe storage conditions, hazards from hot metal/sparks, types of gasses, cylinders types and identification, flashback arrestors, hose types and identification, connector types and identification, hose check valves, cutting torch, flashback arrestors, cutting nozzles guides, portable track cutting machines • **Grinders** • **Lifting equipment**: wall and overhead mounted travelling cranes, forklift trucks, pallets and pallet truck, block and tackle, pull/lift lever hoist, engine hoist, chains, ropes, slings, shackles, lifting eyes, friction clamps, welded lugs, lifting capacity. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific hand fitting activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to safely mark out materials.	**Scope** **Teaching will cover:** **Marking out Sheet Metal up to 3 mm in Different Materials** • Students should be exposed to practical activities involving at least two of the following materials: o Hot rolled mild steel o Cold rolled mild steel. o Coated mild steel (such as primed, tinned, galvanised) o Copper o Brass o Lead o Stainless steel o Titanium o Aluminium **Marking Out Methods and Techniques** • Students should be taught the following marking out methods and techniques: o Direct marking using instruments. o Use of templates o Tracing/transfer methods **Safe Use of Marking Out Equipment** • Lecturers should emphasize the safe use of the following equipment: o Scriber o Rule or tape o Square o Dividers or trammels o Punch o Straight edge o Protractor o Chalk, blueing, or paint

	Marking Out Material Features
	• Students should practice marking out features including:
	  ○ Datum and centre lines
	  ○ Curved profiles
	  ○ Square/rectangular profiles
	  ○ Cutting and bending detail (including allowances)
	  ○ Angles
	  ○ Hole centering and outlining (such as circular or linear)
	  ○ Circles

3. Be able to safely use hand tools and industrial equipment to cut sheet metal profiles.	**Scope** **Teaching will cover:** • **Equipment**: Tooling rolling machines (pyramid type, pinch type, slip rolls, hand-operated), folding machines (box and pan, universal swingbeam), fly press (tooling: dies, forming tools), health and safety considerations. • **Tools**: hammers, planishing hammers, mallets, wooden blocks, range of bench stakes. • **Forming**: forms (square, rectangular, cylindrical, cones, boxed), hand forming techniques (hollowing, raising, planishing, flanging, 'split and weld' methods, health and safety considerations. • **Stiffening techniques**: swaging, beading, wired edges (including false), folds, flanging, reinforcement, diamond break, health and safety considerations.
4. Be able to safely use industrial forming equipment to produce sheet metal components.	**Scope** **Teaching will cover:** **Lecturers should cover the following topics when teaching sheet metal forming calculations.** • **Bend Allowance:** Understanding the material stretch and how to calculate the allowance for bends based on thickness and bend radius. • **Circumference Calculations:** Calculating the developed length for cylindrical components based on material circumference. • **Wired Edges:** Understanding how to account for material required to create reinforced wired edges. **Set Up and Safe Use of Industrial Forming Equipment** Students should learn the set up and safe operation of the following forming equipment: • **Bending Machine (hand or powered):** Techniques for creating precise bends. • **Rolling Machine (hand or powered):** Forming cylindrical sections with accurate radius control. Additionally, at least two of the following equipment should be covered: • **Hammers/Panel Beating Equipment:** Hand tools for fine adjustments and shaping. • **Wheeling Machine:** Used to create curved panels and complex shapes. • **Stakes and Formers:** Hand forming techniques using specific tools and shapes. • **Swaging Machine:** Creating grooves and flanges in sheet metal. • **Presses:** Forming operations using hydraulic or mechanical presses. • **Shrinking Techniques**: Methods to reduce material dimensions for tight curves. • **Jenny/Wiring Machine:** Forming wired edges and reinforcing seams. • **Stretching Techniques:** Expanding metal to create curved or extended profiles.

	Performing Forming Operations to Create Components Students should practice forming operations to achieve the following shapes: • **Bends/Upstands:** Straight bends with controlled angles. • **Tray/Box Sections:** Fabrication of tray-like profiles with accurate edges. • **Folds/Safe Edges:** Creating folded edges for safety and reinforcement. • **Cylindrical Sections:** Rolling techniques to form cylindrical shapes. Additionally, at least one of the following shapes should be produced. • **Wired Edges:** Reinforced edges using wiring techniques. • **Cowlings and Rounded Covers:** Shaping of rounded or contoured covers. • **Swages:** Forming grooves or indentations in sheet metal.
5. Be able to safely assemble and produce sheet metal components in line with quality requirements.	**Scope** **Teaching will cover:** **Students should be taught and practice the following assembly methods:** • **Temporary Tack Welding:** Techniques for holding parts together using small welds. • **Adhesive Bonding:** Use of industrial adhesives for joining sheet metal components. • **Soldering or Brazing:** Techniques for low-temperature metal joining. • **Flanged and Mechanically Fastened (Bolts, Screws):** Creating secure joints using flanges and fasteners. • **Resistance Spot Welding:** Quick and efficient spot welds for thin materials. • **Self-Securing Joints:** Methods such as knocked up, paned down, swaged, or joggled joints. • **Riveting (Hollow or Solid):** Securely joining materials with rivets. **Quality Requirements for Assembled Sheet Metal Components** Students should be guided to ensure the following quality standards are met in their assemblies: • All dimensions are within +/- 2.0mm or +/- 0.079” for accuracy. • Finished components meet the required shape/geometry (square, straight, angles free from twists). • Components are free from excessive tooling marks, deformation, cracking, sharp edges, slivers, or burrs • All components are correctly assembled and have secure and firm joints. **Safe Practices for Assembling Sheet Metal Components** Lecturers should demonstrate and guide students in the following: • Preparing surfaces for joining (cleaning, deburring, etc.) • Proper alignment and clamping techniques for assembly. • Safety precautions when working with heat sources (welding, soldering, etc.) and chemicals (adhesives). • Inspecting joints and assemblies for strength, alignment, and overall quality.

Title	Assembling and Testing Electronic Circuits
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG253
Unit Reference No	K/650/7671
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to assemble and test electronic circuits.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for the assembly and testing of electronic circuits.	1.1. Describe the health and safety issues and requirements associated with carrying out assembling and testing electronic circuits. 1.2. Plan and prepare assembly and testing activities prior to manufacturing. 1.3. Carry out a risk assessment for a given assembly or testing activity.
2. Be able to safely assemble an electronic circuit using different assembly techniques and tools.	2.1. Describe and demonstrate how to safely assemble one of the following electronic circuit types: a) single-sided b) thick film c) thin film d) flexible e) double-sided f) hybrid 2.2. Describe the principles of the following techniques and methods and demonstrate how to safely assemble electronic components on a circuit board using at least two of the following: a) manual soldering techniques b) surface mount techniques. c) mechanical fixing methods 2.3. Assemble electronic circuits safely using at least four of the following tools: a) heat shunts/tweezers. b) component forming devices. c) mechanical fasteners (screwdriver, spanners) d) snipe or long nosed pliers. e) wire strippers f) anti-static packaging, mats, and straps g) sleeving pliers h) side or end cutters i) specialised assembly tools/equipment
3. Be able to safely assemble electronic circuits using different components and carry out visual checks on completed circuits.	3.1. Assemble electronic circuits safely to given specification, to include at least fifteen of the following types of components: a) fixed resistors b) variable resistors c) potentiometers d) encoders or resolvers e) transistors f) inverters or servo controllers g) thyristors h) edge connectors. i) thermistors j) light dependent resistors (LDR)

	k) analogue or digital integrated circuits l) wiring pins/tags/wire links m) fixing spacers n) fixed capacitors o) variable capacitors p) insulators q) surface mount packages. r) rectifiers s) small heat sinks t) electrolytic capacitors u) switches v) cables w) diodes x) Zener diodes y) light emitting diodes (LEDs) z) mini transformers aa) decoders bb) protection devices cc) cable connectors dd) regulators ee) relays ff) inductors gg) other specific electronic components 3.2. Describe the function of at least five of the following types of electronic circuits and demonstrate how to safely assemble them using electronic components: a) audio amplifiers b) filters c) regulated power supplies d) signal converters. e) microprocessor based applications (such as PIC chips) f) logic function controls g) signal generators h) comparators i) display circuits j) counter/timers k) power amplifiers l) ADC and DAC hybrid circuits m) oscillators n) motor control o) sensor/actuator circuit (such as linear, rotational, temperature, photo-optic, flow, level, pressure) p) digital circuit (such as process control, microprocessor, logic devices, display devices) q) signal processing circuit (such as frequency modulating/demodulating, amplifiers, filters) r) alarms and protection circuits s) other specific circuit 3.3. Describe the importance of and carry out visual checks on the circuits assembled in AC 3.2 to confirm the following: a) soldered joints are clean, shiny, free from solder spikes, bridges, holes, excess solder, and flux.

	b) components are correctly mounted for best physical support and are correctly orientated. c) excess component leads have been trimmed off to the standard required. d) circuit tracks are free from faults (such as lifting, breaks, bridges, hot spots) e) there are no obvious signs of damage, to components or to the substrate. f) all required connectors, wire links, spacers and other ancillary items are in place
4. Be able to use testing equipment to carry out diagnostic checks in line with standards.	4.1. Describe the function of and use at least five of the following types of test equipment: a) multimeter b) signal generator c) oscilloscope d) signal tracer e) logic probe/clip f) stabilised power supplies g) logic analyser h) measuring bridges i) pulse sequencing analyser j) software diagnostic programs k) counter/timers l) data communications test set m) signature analysers n) bus exerciser/analyser o) protocol analyser 4.2. Describe how to and carry out at least six of the following checks, adjustments, and fault rectification where appropriate to given circuits being assembled: a) logic states b) pulse width/rise time c) inductance d) dc voltage/current levels e) open/short circuit f) frequency modulation/demodulation g) ac voltage/current levels h) resistance i) amplification j) clock/timer switching k) capacitance l) signal noise/interference levels m) oscillations n) waveform analysis o) attenuation 4.3. Produce electronic circuits in accordance with one of the following: a) British Standards (BS) or International Standards Organisation (ISO) standards and procedures b) customer standards and requirements c) company standards and procedures other international standards

Additional Assessment Guidance
Re: Learning outcomes 3 and 4 - at least one of the electronic circuit assemblies produced and tested must be of a significant nature, and contain at least ten of the electronic components listed in AC 3.1.

Assessment Guidance		
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.		
Assessment Method	**Definition**	**Possible Content**
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Assembling and Testing Electronic Circuits
1. Be able to plan, prepare and carry out a risk assessment for the assembly and testing of electronic circuits.	**Scope** **Teaching will cover:** • **Carrying out a risk assessment using 5 step assessment:** risks should include those associated with Assembling and testing electronic circuits, • **BS and ISO standards to include:** procedures, customer standards and requires • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific assembly and testing of electronic circuits activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to safely assemble an electronic circuit using different assembly techniques and tools.	**Scope** **Teaching will cover:** • How to safely assembly single-sided, thick film, thin film, flexible, double-sided, hybrid • Manual soldering techniques, surface mount techniques, mechanical fixing methods • How to safely use the following tools: heat shunts/tweezers, component forming devices mechanical fasteners (screwdriver, spanners), snipe or long nosed pliers, wire strippers, anti-static packaging, mats and straps, sleeving pliers, side or end cutters specialised assembly tools/equipment.
3. Be able to safely assemble electronic circuits using different components and carry out visual checks on completed circuits.	**Scope** **Teaching will cover:** How to safely use the following components- students should understand the purpose of each component to include: • fixed resistors • variable resistors • potentiometers • encoders or resolvers • transistors • inverters or servo controllers • thyristors • edge connectors • thermistors • light dependent resistors (LDR) • analogue or digital integrated circuits • wiring pins/tags/wire links • fixing spacers • fixed capacitors • variable capacitors • insulators • surface mount packages • rectifiers • small heat sinks • electrolytic capacitors • switches • cables • diodes • Zener diodes • light emitting diodes (LEDs) • mini transformers

	• decoders • protection devices • cable connectors • regulators • relays • inductors • audio amplifiers • filters • regulated power supplies • signal converters • microprocessor based applications (such as PIC chips) • logic function controls • signal generators • comparators • display circuits • counter/timers • power amplifiers • ADC and DAC hybrid circuits • oscillators • motor control • sensor/actuator circuit (such as linear, rotational, temperature, photo-optic, flow, level, pressure) • digital circuit (such as process control, microprocessor, logic devices, display devices) • signal processing circuit (such as frequency modulating/demodulating, amplifiers, filters) • alarms and protection circuits **How to correctly carry out visual checks on assemblies to include:** • soldered joints to ensure they are clean, shiny, free from solder spikes, bridges, holes, excess solder, and flux • checks to ensure components are correctly mounted for best physical support and are correctly orientated • how excess component leads have been trimmed off to the standard required • how to check circuit tracks are free from faults (such as lifting, breaks, bridges, hot spots) • how to carry out checks to ensure there are no obvious signs of damage, to components or to the substrate • how to carry out checks ensuring all required connectors, wire links, spacers and other ancillary items are in place
4. Be able to use testing equipment to carry out diagnostic checks in line with standards.	**Scope** **Teaching will cover:** **How to correctly use the following equipment for testing:** • multimeter • signal generator • oscilloscope • signal tracer • logic probe/clip • stabilised power supplies • logic analyser • measuring bridges • pulse sequencing analyse • software diagnostic programs • counter/timers • data communications test set • signature analysers

	• bus exerciser/analyser • protocol analyser **How to carry out the following checks using appropriate equipment:** • logic states • pulse width/rise time • inductance • dc voltage/current levels • open/short circuit • frequency modulation/demodulation • ac voltage/current levels • resistance • amplification • clock/timer switching • capacitance • signal noise/interference levels • oscillations • waveform analysis • attenuation

Title	Preparing and Using Milling Machines
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG254
Unit Reference No	L/650/7672
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to prepare and use milling machines.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for milling activities.	1.1. Describe the health and safety issues and requirements associated with carrying out milling activities. 1.2. Plan and prepare for milling activities prior to manufacturing. 1.3. Carry out a risk assessment for a given milling activity.
2. Be able to safely set up components and use tools for the milling of different materials.	2.1. Describe the process and safely mount, secure and machine components made from two of the following types of material: a) ferrous b) nonferrous c) non metallic **using two of the following work holding devices:** a) fixed vice (must include setting/clocking up to ensure it is square) b) direct clamping to machine table c) magnetic or pneumatic devices d) swivel or universal vice e) angle plates f) chucks g) fixtures h) vee block and clamps i) indexing device j) other devices 2.2. Describe the function of, safely mount and use at least six of the following types of milling cutters/tools: a) face mills b) slot cutters c) twist/core drills d) slab/cylindrical cutters e) slitting saws f) reamers g) end mills h) vee cutters i) boring bars j) slot drills k) taps l) side and face cutters m) other form cutters
3. Be able to safely mill components using different operations and carry out checks for accuracy.	3.1. Describe how to and produce milled components safely combining different operations and have the following features: a) flat faces b) parallel faces c) open ended slots

	d) square faces e) steps/shoulders f) enclosed slots g) drilled holes. **and at least two more of the following:** h) angular faces i) reamed holes j) bored holes k) indexed or rotated forms l) recesses m) tee slots. n) profile forms (such as vee, concave, convex, gear forms, serrations, special forms) 3.2. Carry out checks for accuracy, to include: a) linear dimensions b) surface finish c) depths d) slots (such as position, width, depth) e) flatness f) angles (where appropriate) g) squareness h) hole size/fit (where appropriate)
4. Be able to use different measuring equipment to carry out quality inspections.	4.1. Describe and use the following measuring equipment during the machining and checking activities: a) rules b) squares c) external micrometers d) dial test indicators (DTI) e) vernier/digital/dial callipers f) surface finish equipment (such as comparison plates, machines) **and at least three of the following:** g) feeler gauges h) bore/hole gauges i) internal micrometers j) slip gauges k) depth micrometers l) radius/profile gauges m) depth verniers n) protractors o) coordinate measuring machine (CMM) 4.2. Produce components to the following quality and accuracy standards, as applicable to the operation: a) components to be free from false tool cuts, burrs, and sharp edges. b) general dimensional tolerance +/- 0.15mm or +/- 0.006” c) there must be one or more specific dimensional tolerances within +/- 0.05mm or +/- 0.002” d) flatness and squareness within 0.125mm per 25mm or 0.005” per inch e) reamed / bored holes within H8. f) surface finish 63 µin or 1.6µm g) angles within +/- 1 degree

Additional Assessment Guidance
Re: AC 2.1 - Description should include the work holding devices and techniques used to ensure that the components are set up correctly and checked before milling such as ensuring all seating/location faces are clean and undamaged, ensuring that the device is suitably aligned using measuring instruments, as appropriate, and checking that all bolts or other securing devices are tightened securely **Re AC 3.1** - Description should include features and tools used and how tool speed and feed is calculated for each operation. **Re AC 3.1, 4.1 and 4.2** - At least one of the components produced must be of a significant nature and have at least five of the features listed in AC 3.1.

Assessment Guidance		
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.		
Assessment Method	**Definition**	**Possible Content**
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Preparing and Using Milling Machines
1. Be able to plan, prepare and carry out a risk assessment for milling activities.	**Scope** **Teaching will cover:** • Health and safety precautions: emergency stop procedures, use of guards, operating procedures, moving parts, removal of swarf. • Datum: faces, centres. Classes of fit: clearance. • Measuring equipment: micrometers, vernier, Dial Test Indicator (DTI), gauges, surface finish. Coolants and cutting oils: oils, compounds, synthetic. • Cutting tool materials: High Speed Steel (HSS), carbide tips. • Cutting speeds and feeds: cutting tool material/material being cut, surface finish required, type of cutting operation, power output of the machine, use of coolant, determine spindle speeds. • Mounting tools: arbor (standard, short, stub); chucks (auto lock, jacobs); collets (pull (friction) positive grip, auto-lock). • Work holding: machine vice (fixed jaw, swivel and universal), direct clamping, fixtures, angle plates, vee blocks, equipment used when setting work holding devices: squares, protractors (adjustable, vernier), Dial Test Indicators (plunger, lever), levels. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific milling activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to safely set up components and use tools for the milling of different materials.	**Scope** **Teaching will cover:** • **Cutters:** vertical mounted: end mills, slot drills, tee slot, dovetail, fly cutter; mounted: side and face, staggered tooth, slitting saw, angular, slab mill, helical mill, form, shell end mills. • **Cutter nomenclature and cutter/workpiece movement**: milling cutters, twist drills, up-cut milling, down-cut milling. • **Calculate:** spindle speeds for different materials and cutter diameters; cutting speeds for materials to be machined (carbon steels, cast iron, aluminium alloys, brass, cutting tool material, high speed steel, carbides). • **Arbor mounted cutters**: side and face, cylindrical cutters (slab mill), saws, angular cutters, concave and convex cutters, radius, form cutters, fluting cutters; parts and types of arbors, stub arbors and methods of mounting (construction, mounting procedures, setting cutters, support brackets, knee braces). • **Collet held cutters**: end mill, slot drill, fly cutters, tee slot, woodruff key and dovetail cutters; shank styles: screwed, straight, flatted; operation and application of collet chucks (types of locking devices, ease of changeability).
3. Be able to safely mill components using different operations and carry out checks for accuracy.	**Scope** **Teaching will cover:** • **Drawings:** orthographic and auxiliary views (dimensions (functional, non-functional), tolerance (linear, angular), scale, datum (face, point)).

	• **Work holding devices**: clamps, machine vice, angle plate (fixed and adjustable), methods of securing work, setting aid (Dial Test Indicators). • **Measure**: micrometers (external and depth) vernier (callipers and protractor).
4. Be able to use different measuring equipment to carry out quality inspections.	**Scope** **Teaching will cover:** • **Calculations**: simple indexing (Pitch Circle Diameter (PCD), angular rotation). • **Mill holes, slots, and flat angled surfaces**: vertical mill, depth of holes machined within depth slot drill, angles, and flat surfaces end mill. • **Measuring equipment**: micrometer (0-25, 25-50 and 50-11 mm): external, depth, vernier callipers (digital) and protractor, surface texture gauges (tactual method).

Title	Wiring and Testing Programmable Controllers
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG255
Unit Reference No	M/650/7673
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to wire and test programmable controller-based systems.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for the wiring and testing of programmable controller-based systems.	1.1. Describe the health and safety issues and requirements associated with wiring and testing programmable controller-based systems. 1.2. Plan and prepare for wiring and testing activities prior to manufacturing. 1.3. Carry out a risk assessment for a given wiring and testing activity.
2. Be able to safely connect and test programmable controller systems using different equipment, components and connection methods.	2.1. Describe the function and operation of different types of programmable controllers. 2.2. Compare differences between the following types of connections: a) mechanical b) screwed/clamped c) soldered 2.3. Connect and test equipment safely for at least one of the following types of programmable controller systems: a) monitoring system b) combination system c) process/product control system d) diagnostic system e) other specific system 2.4. Connect up and test safely at least one of the following types of programmable controller equipment/components: a) rack mounted controller units b) modular controller units c) unitary controller units **and at least five of the following:** d) sensors (such as inductive, proximity, temperature, colour, optical) e) actuators (such as pneumatic or hydraulic) f) printers, panels, and sub-assemblies g) switches (such as emergency stop, limit, pressure) h) valves (such as pneumatic or hydraulic) i) electrical wires and cable connections j) safety interlocks k) signal transmission components/cables. l) motor starters m) overload protection devices. n) barcode scanners. o) personal computer (PC) peripheral devices p) analogue to digital modules q) proportional integral derivative (PID) controller

	r) other devices 2.5. Use wiring and connection methods and techniques safely including: a) locating and securing equipment in the correct positions b) attaching suitable cable identification c) making mechanical/screwed/clamped connections. d) routing and securing wires and cables e) stripping cable insulation/protection f) crimping (such as tags and pins) g) connecting all input and output devices h) soldering and de-soldering connections (where applicable) i) using heat shrinking devices or boots (where applicable) j) sealing and protecting cable connections (where applicable)
3. Be able to develop, prove and edit programmable logic controller (PLC) programs.	3.1. Compare three programming languages used in PLCs. 3.2. Develop programs applicable to given type of controller and programming software using one of the following: a) ladder and logic diagrams b) function block diagrams c) statement/instruction lists d) state logic e) structured text f) sequential function charts g) other specific programming language 3.3. Prove and edit a PLC program, using the following: a) edit facilities b) program full run **and at least five from the following:** c) single block/sub routine run d) program save/store facilities e) data input facilities f) search facilities g) program override controls h) graphic displays i) taking test measurements j) using monitoring mode k) using process simulation techniques (forcing contacts on/off) l) counter and timer settings
4. Be able to use testing equipment to carry out diagnostic checks in line with standards.	4.1. Use at least three of the following test instruments during wiring and testing activities: a) multimeter b) voltmeter/indicator c) programming devices (such as loader terminal, handheld programmer, personal computer) d) network testing equipment e) other specific test equipment 4.2. Explain the function of two of the test instruments above including their range of options.

	4.3. Carry out the following on completion of the programming activity: a) check and review program content. b) edit programs using the correct procedure (where appropriate) c) check that the program is correctly titled and referenced d) ensure that programs are stored safely and correctly in the correct format e) create a separate backup copy of the program in case of file corruption 4.4. Use all of the following diagnostic techniques, tools, and aids: a) visual checks (such as signs of damage, missing parts, wear/deterioration) b) movement checks (such as loose fittings and connections) c) fault finding techniques (such as input/output, half-split, unit substitution) d) diagnostic aids (such as manuals, flow charts, logic diagrams, troubleshooting guides) e) test instrumentation measurement (such as continuity, voltage, resistance, current) f) controller error warning lights/displays 4.5. Wire up and test programmable controllers, in accordance with two of the following standards: a) equipment manufacturer's specification/operation range b) British Standard (BS) S7671/ Institution of Engineering and Technology (IET) wiring regulations c) other BS and/or International Standards Organization (ISO) standards d) company standards and procedures

Additional Assessment Guidance

At least one of the PLC systems must be of a significant nature and at least five of the types of equipment or components identified in AC 2.4.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion

Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Wiring and Testing Programmable Controllers
1. Be able to plan, prepare and carry out a risk assessment for the wiring and testing of programmable controller-based systems.	**Scope** **Teaching will cover:** • **Health and Safety Considerations:** Teach the key health and safety issues associated with wiring and testing programmable controllers. Cover relevant regulations, such as the Health and Safety at Work Act, and provide practical examples of how these regulations apply to working with programmable controller systems. • **Planning and Preparation for Wiring Activities**: Guide students through planning and preparation tasks, including selecting appropriate tools, gathering necessary components, and understanding job specifications. Discuss the importance of following project documentation and wiring diagrams. • **Conducting a Risk Assessment**: Teach the principles of carrying out a risk assessment specific to programmable controller systems. Highlight potential hazards, such as electrical risks, incorrect wiring, and component failure, and how to mitigate these risks through proper assessment and control measures.
2. Be able to safely connect and test programmable controller systems using different equipment, components and connection methods.	**Scope** **Teaching will cover:** • **Understanding Programmable Controllers:** Teach the function and operation of different types of programmable controllers, such as rack-mounted and modular controllers. Discuss their applications in automation, process control, and diagnostics. • **Connection Methods:** Explain and demonstrate different types of connections, including mechanical, screwed/clamped, and soldered connections. Provide practical sessions where students can practise making these connections. • **Connecting and Testing Controller Systems:** Guide students through the process of connecting and testing programmable controller systems, focusing on monitoring, control, and diagnostic systems. Discuss the importance of following safety protocols and using correct tools during the installation. • **Working with Components:** Provide hands-on training in connecting various components, such as sensors, actuators, switches, valves, and motor starters. Teach students how to troubleshoot and test these components for functionality and reliability.
3. Be able to develop, prove and edit programmable logic controller (PLC) programs.	**Scope** **Teaching will cover:** **Comparing PLC Programming Languages** Students should explore the advantages, disadvantages, and use cases of three key PLC programming languages, such as: • **Ladder Diagrams:** Widely used due to visual resemblance to electrical relay logic. • **Function Block Diagrams:** Graphical language suitable for process control and complex systems. • **Structured Text:** High-level textual language for more complex logic and control tasks.

	Developing Programs for Specific Controllers Lecturers should guide students in developing programs using one of the following methods: • **Ladder and Logic Diagrams:** Creating programs with relay-style logic. • **Function Block Diagrams:** Designing logic with interconnected functional blocks. • **Statement/Instruction Lists:** Writing code using low-level textual commands. • **State Logic:** Implementing state-based control systems. • **Structured Text:** Creating more complex algorithms and logic using a high-level language. • **Sequential Function Charts:** Programming sequential operations and workflows. • **Other Specific Languages:** Exploring languages relevant to specific PLC models or applications. **Proving and Editing PLC Programs** Students should practice using various techniques to prove and edit PLC programs, including: • **Edit Facilities:** Modifying and refining program logic. • **Program Full Run:** Running the program end-to-end to validate functionality. Additionally, students should be introduced to at least five of the following methods: • **Single Block/Subroutine Run:** Testing isolated parts of the program. • **Program Save/Store Facilities:** Ensuring program versions are safely stored. • **Data Input Facilities:** Inputting and adjusting variables and setpoints. • **Search Facilities:** Quickly finding specific elements within the program. • **Program Override Controls:** Temporarily modifying program behavior. • **Graphic Displays:** Visualising the program logic and operational status. • **Taking Test Measurements:** Monitoring signals and outputs during testing. • **Using Monitoring Mode:** Observing program performance in real-time. • **Using Process Simulation Techniques:** Forcing inputs or outputs for testing purposes. • **Counter and Timer Settings:** Configuring and adjusting counters and timers for process control.
4. Be able to use testing equipment to carry out diagnostic checks in line with standards.	**Scope** **Teaching will cover:** **Using Test Instruments in Wiring and Testing Activities** Students should gain experience using at least three of the following test instruments: • **Multimeter:** Used for measuring voltage, resistance, and continuity in circuits • **Voltmeter/Indicator:** Specialized instruments for monitoring voltage levels in electrical systems • **Programming Devices:** Such as loader terminals, handheld programmers, and personal computers for programming PLCs • **Network Testing Equipment:** Tools for verifying network integrity and communication in automation systems

	• **Other Specific Test Equipment:** Devices specific to certain control systems or industries **Explaining the Function of Test Instruments** Students should be able to explain the function and range of options for at least two test instruments. For example: • **Multimeter:** Capable of measuring AC/DC voltage, current, resistance, and performing continuity checks. Often includes features like auto-ranging and data hold. • **Programming Devices:** Used to interface with PLCs for uploading, downloading, and modifying programs. They may include software with options for simulation, real-time monitoring, and debugging. **Post-Programming Checks and Procedures** Students should carry out the following activities upon completing a programming task: • **Check and Review Program Content:** Ensuring logic, sequences, and functions are correct. • **Edit Programs Using Correct Procedures:** Making necessary adjustments or corrections. • **Verify Program Titles and References:** Ensuring correct labeling for future identification. • **Safely Store Programs:** Saving programs in the correct format, in appropriate locations. • **Create Backup Copies:** Maintaining separate backups to protect against data corruption. **Diagnostic Techniques, Tools, and Aids** Students should learn and apply the following diagnostic methods: • **Visual Checks:** Identifying signs of damage, wear, or missing parts. • **Movement Checks:** Detecting loose fittings or connections. • **Fault Finding Techniques:** Using methods such as input/output analysis, half-split, or unit substitution. • **Diagnostic Aids:** Utilizing manuals, flow charts, logic diagrams, and troubleshooting guides. • **Test Instrumentation Measurements:** Measuring continuity, voltage, resistance, and current during diagnostics. • **Controller Error Warning Lights/Displays:** Interpreting error indicators on controllers. **Wiring and Testing PLCs According to Standards** Students should wire and test programmable controllers according to at least two of the following standards: • **Equipment Manufacturer's Specification/Operation Range:** Ensuring adherence to the manufacturer's guidelines. • **British Standard (BS) S7671 / IET Wiring Regulations:** Following recognized industry standards for electrical installations. • **Other BS and/or ISO Standards:** Complying with additional British or International standards. • **Company Standards and Procedures:** Following internal guidelines specific to the organisation.

Title	Fluid Power Systems
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG256
Unit Reference No	K/650/7680
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how plan, prepare and carry out fluid power assembly activities.	

Learning Outcomes	Assessment Criteria
1. Be aware of health and safety issues and requirements and carry out a risk assessment for using fluid power systems.	1.1. Describe the health and safety issues and requirements associated with the use of fluid power systems. 1.2. Carry out a risk assessment for given fluid power systems activities.
2. Be able to plan, prepare and safely use fluid power techniques and methods to produce fluid power assemblies.	2.1. Compare the differences between two of the following types of fluid power systems: a) pneumatic b) hydraulic c) vacuum 2.2. Plan and prepare fluid power assembly using one of the following fluid power systems: a) pneumatics b) hydraulics c) vacuum 2.3. Describe the function of the following components: a) actuators b) pumps c) compressors d) reservoirs/storage devices e) motors f) lubricators 2.4. Produce fluid power assemblies safely comprising the following components: a) rigid pipework b) hoses c) valves d) cylinders/actuators **and at least six of the following:** e) pumps f) compressors g) accumulators h) reservoirs/storage devices i) motors j) lubricators k) pressure intensifiers l) regulators m) gauges/indicators n) switches o) sensors p) receivers q) filters r) bearings s) cables and wires t) gaskets and seals u) other specific components

	2.5. Use fluid power assembly methods and techniques safely including: a) checking components for serviceability b) positioning equipment/components c) aligning pipework and connections d) dressing and securing pipes and hoses e) setting, aligning and adjusting system components f) securing by using mechanical fixings g) applying screw fastener locking devices h) tightening fastenings to the required torque i) applying hose/cable clips and fasteners j) making de-energised checks before filling and/or pressurising the system
3. Be able to safely carry out the testing and fault finding of fluid power systems.	3.1. Carry out quality checks safely using appropriate equipment to confirm the following: a) the system is complete, as per specification b) dimensions are within specification requirements c) components are correctly positioned d) components are correctly aligned e) direction and flow indicators on components are correct f) components are securely held in place g) connections to components are tightened to the required torque h) pipework is free from ripple and creases i) electrical connections are correctly made (where applicable) 3.2. Describe the procedures for checking that test equipment is correctly calibrated. 3.3. Carry out the following checks safely to ensure the accuracy and quality of the tests carried out: a) test equipment is correctly calibrated b) test equipment used is appropriate for the tests being carried out c) test procedures used are as recommended in the appropriate specifications d) test readings are taken at the appropriate points, and where appropriate components are adjusted to give the required readings e) test equipment is operated within its specification range 3.4. Carry out leak tests and at least one of the following tests and adjustments safely as required on assembled fluid power systems: a) pressure line pressure tests b) return line pressure test c) flow d) speed e) sequence f) operational performance g) contamination

Additional Assessment Guidance
At least one of the fluid power assemblies produced above must be of a significant nature and contain at least six of the components identified in AC 2.4.
Assessment Guidance
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Fluid Power Systems
1. Be aware of health and safety issues and requirements and carry out a risk assessment for using fluid power systems.	**Scope** **Teaching will cover:** Hazards associated with fluid systems maintenance activities. Produce a plan for an assembly/maintenance activity for a fluid power circuit. • **Hazards:** handling of oils and grease (toxicity, harmful effects to skin and body) misuses of tools, use of damaged or badly maintained tools, not following laid-down maintenance procedures, stored energy/force, handling of compressed air (harmful effects to skin and body). • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific fluid power system activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to plan, prepare and safely use fluid power techniques and methods to produce fluid power assemblies.	**Scope** **Teaching will cover:** • **Plan**: description of task, location(s), date, and times (commencement, completion, handover), parts and consumables to be used, test data requirements, checks to be made, permits to work required, tools and equipment requirements, isolation/barrier requirements, sequence of operations for dismantle/re-assemble components, provision for spillages. • **Information sources**: drawings, charts, circuit and physical layouts, specifications, manufacturers manuals, maintenance reports, compilation of material/component list from information sources, current symbols used in hydraulic systems (valves – pressure, flow control, directional control, actuators, accumulators, pumps, filters, reservoirs, gauges, hoses and connectors), current symbols used in pneumatic systems (valves: pressure control – regulating and relief, flow control – restrictors and by-pass form, directional control – rotary and spool, quick exhaust; actuators: linear – single and double acting, cylinders, rotary, accumulators, pressure intensifiers, filters, silencers, gauges, pipework connecting methods – rigid, flexible and push-in.
3. Be able to safely carry out the testing and fault finding of fluid power systems.	**Scope** **Teaching will cover:** • **How to assess fluid power system for common faults**: Common faults: ensure all pipes/components are secure, moving parts are chocked or parked, evaluation using sensory information, diagnostic techniques, fault location techniques, diagnostic aids. **How to carry out fluid power testing identify and rectify leaks/faults**: • **Fluid power testing:** connect and use suitable calibrated test/diagnostic equipment to circuit to test and/or investigate problem, importance of correct calibration of test equipment, handling/application of measuring/test equipment, static tests, dynamic test. • **Leaks/faults:** connecting hydraulic pumps and power packs to circuit including: o filling hydraulic system with fluid o bleeding air from system o applying test pressures in incremental stages o Check for leaks

	○ take test readings ○ Adjust components to give required operating conditions ○ Re-run of tests to confirm that system performs to specification ○ Check that: no open ends valves in test position/status moving parts in test position/status pipe/components fitted to specification clamps/brackets position and fitted correctly bleed vents accessible equipment/components which may be damaged/faulty are removed o equipment: - - - - pump/pressure source connections leak detection fluids smoke candles ○ determine when to repair or replace faulty units. **Pneumatic:** • Applying test pressures in incremental stages • check for leaks o take test readings. • adjust components to give required operating conditions. • re-run of tests to confirm that system performs to specification. • Check for: all connections have been completed all components are secure moving parts are 'parked'. • equipment: pump/pressure source connections leak detection fluids calibrated pressure gauge. • determine when to repair or replace faulty units. **How to complete relevant test/maintenance records/documentation.** • Test/maintenance records/documentation: description of work undertaken, location(s), date, and times (commencement, completion, handover), parts and consumables used, test data, movement of parts, noise and vibration levels, temperature, adjustment required, permit to work reference. **While learners carry out practical tasks ensure:** • **Safe working practices:** wearing appropriate protective clothing and equipment, maintaining a clean and tidy work area, use of barriers and/or tapes, post warning signs, informing personnel of maintenance activities, system isolation procedures for power and pressure sources, permit-to work procedures, preparing the work area, leaving the work area in a safe and clean condition. • **Tools and equipment:** spanners (open-ended, socket sets, ring), torque wrenches, screwdrivers, Allen Keys, fastening devices for hydraulic equipment (nuts, bolts, studs, screws, locking devices. • **Dismantle**: release pressure, proof marking, extraction, label and store safely parts that have been removed. • **Clean**: dust (blow, vacuum), dirt (brushing, vacuum), grease (degreasing agents, solvents, stream, health and safety considerations). Inspect: checking that components are fit for purpose, damage, distortion, leaks (pipes and hose connections, cylinders and valves, corrosion). • **Re-assemble**: cut pipe to length, fittings, hand bending methods, screwed fittings, flanged fittings, push in fittings, leak free joints (gaskets, jointing and sealing compounds, seals), securing components and pipe (clamps, brackets), install flexible hose between rigid and moving components; hydraulic: valves (pressure, flow, directional control), actuators (single and double acting cylinders, rotary), accumulators, filters, strainers and lubricators, pumps, gauges, pipes, hoses and connectors (rigid and flexible). Report: importance of completing a maintenance documentation following the maintenance activities, reporting defect (tools, equipment, components).

Title	Installing Aircraft Mechanical Fasteners
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG257
Unit Reference No	L/650/7681
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to install aircraft mechanical fasteners.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment prior to installation of aircraft mechanical fasteners.	1.1. Describe the health and safety issues and requirements associated with the installation of aircraft mechanical fasteners. 1.2. Plan and prepare for installation of aircraft mechanical fasteners prior to manufacturing. 1.3. Carry out a risk assessment prior to installation of aircraft mechanical fasteners.
2. Be able to use appropriate equipment to safely install different aircraft mechanical fasteners.	2.1. Describe the function of and demonstrate the safe use of the following types of equipment: a) riveting guns (appropriate to rivet type) b) gripping pins and location dowels **and at least two of the following:** c) gauges (such as for intrusions) d) redline templates. e) clamps f) drills and tools with attachments g) jigs 2.2. Describe three of the following aircraft mechanical fasteners and one use for each: a) hollow rivets b) solid rivets c) threaded fasteners d) quick release fasteners e) collared fasteners f) split pins g) pin clips h) wire locks i) anchor nuts j) Rivnuts k) NAPPY pins l) PIP/PIT pins m) other locking devices 2.3. Install different aircraft mechanical fasteners safely including: a) hollow rivets b) solid rivets c) threaded fasteners d) quick release fasteners **and at least two of the following:** e) collared fasteners f) split pins g) pin clips h) wire locks i) anchor nuts j) Rivnuts k) NAPPY pins l) PIP/PIT pins

	m) other locking devices
3. Be able to safely use installation methods and techniques on different connections.	3.1. Describe two of the following installation methods and techniques and a typical application for each: a) countersinking b) solid riveting (single and double handed) c) through-hole d) milling rivets e) wire locking f) blind riveting 3.2. Use all of the following installation methods and techniques safely: a) countersinking b) solid riveting (single and double handed) c) through-hole d) milling rivets e) wire locking f) blind riveting 3.3. Make three types of connection safely from the following: a) wet assembly b) panels c) structures d) dry assembly e) skins f) repairs
4. Be able to safely check and inspect the installation of aircraft mechanical fasteners using different measuring equipment.	4.1. Describe and use at least four of the following to carry out appropriate checks and inspections during, and on completion of installation activities: a) rules b) feeler gauges c) squares d) bore/hole gauges e) calipers f) radius/profile gauges g) protractors h) dial test indicators (DTI) i) micrometers j) torque wrenches/gauges k) Verniers l) rivet intrusion gauges m) slip gauges 4.2. Install aircraft mechanical fasteners to comply with the following requirements: a) all components are correctly assembled and aligned, in accordance with the specification b) overall dimensions are within specification tolerances c) assemblies meet appropriate geometric tolerances (such as square, straight, angles free from twists) d) where appropriate, pitches of rivets/fasteners meet specification requirements e) completed assemblies have secure and firm joints, and are clean and free from burrs/flash, deformation, or cracking

Additional Assessment Guidance
At least one of the assemblies produced above must be of a significant nature and contain at least four of the mechanical fasteners identified in learning outcome 2.
Assessment Guidance
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Installing Aircraft Mechanical Fasteners
1. Be able to plan, prepare and carry out a risk assessment prior to installation of aircraft mechanical fasteners.	**Scope** **Teaching will cover:** • **Health and Safety Legislation and Regulations:** Introduce students to relevant aviation safety standards and regulations, such as the Civil Aviation Authority (CAA) guidelines and European Aviation Safety Agency (EASA) requirements. Emphasise the importance of adhering to these standards during installation work. • **Common Hazards in Aircraft Installation:** Teach students to identify potential hazards, such as electrical risks, heavy lifting, and exposure to harmful substances. Discuss strategies for mitigating these risks, including the use of appropriate PPE and safe handling techniques. • **Installation Environment Considerations:** Highlight the importance of working in controlled environments with proper ventilation, lighting, and temperature controls to ensure safety and precision during component installation. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific installation of aircraft mechanical fasteners activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to use appropriate equipment to safely install different aircraft mechanical fasteners.	**Scope** **Teaching will cover:** • **Interpreting Installation Manuals and Drawings:** Teach students how to read and interpret technical drawings, schematics, and installation manuals. Provide exercises where students practice translating these documents into actionable steps. • **Tools and Equipment Preparation:** Discuss the importance of selecting and preparing the correct tools for the job, including torque wrenches, gauges, and alignment devices. Emphasise the significance of calibrating tools and ensuring they are in good working order. • **Pre-Installation Checks:** Guide students through performing pre-installation checks, such as verifying component part numbers, inspecting for damage, and ensuring all required materials are present. Discuss the importance of environmental control checks, like humidity and cleanliness, to prevent contamination.
3. Be able to safely use installation methods and techniques on different connections.	**Scope** **Teaching will cover:** • **Installation Techniques and Procedures:** Provide hands-on training in installing various aircraft components, such as structural parts, avionics systems, and control surfaces. Teach best practices for securing components using rivets, bolts, and fasteners. • **Alignment and Positioning:** Explain the importance of precise alignment during installation, especially for components like wings, stabilisers, and landing gear. Teach students how to use alignment tools and jigs to achieve the required accuracy. • **Use of Inspection and Testing Tools:** Teach students how to verify that installations meet specified tolerances using measurement instruments like micrometers, calipers, and angle gauges. Discuss the importance of documenting inspection results.

4. Be able to safely check and inspect the installation of aircraft mechanical fasteners using different measuring equipment.	**Scope** **Teaching will cover:** • **Post-Installation Checks:** Teach students how to conduct thorough post-installation inspections to verify that all components are securely fastened and meet the required specifications. Cover visual inspections, torque checks, and functional testing. • **System Integration Testing:** Discuss the importance of testing the interaction between installed components and existing systems, such as verifying that control systems respond correctly or that electrical connections are functioning as intended. • **Recording and Reporting Results:** Guide students on how to document inspection results, report any non-conformances, and complete the necessary maintenance logs.

Title	Producing Aircraft Detail Assemblies
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG258
Unit Reference No	M/650/7682
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to produce aircraft detail assemblies.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for producing aircraft detail assemblies.	1.1. Describe the health and safety issues and requirements associated with producing aircraft detail assemblies. 1.2. Plan and prepare for producing aircraft detail assemblies prior to manufacturing. 1.3. Carry out a risk assessment prior to producing aircraft detail assemblies.
2. Be able to safely produce detail assemblies using different assembly methods and techniques.	2.1. Produce aircraft detail assemblies safely, which include at least seven of the following components: a) skins b) frames c) trays d) jumper braids, bonding clips e) earthing straps f) stringers g) ribs h) angles i) cleats j) panels k) pipes, unions and joints l) aircraft general supplies m) tanks n) brackets o) other small specific assemblies 2.2. Describe and use all of the following assembly methods and techniques: a) drilling and riveting b) ensuring that correct part numbers are used c) applying sealants/adhesives d) electrical bonding of components e) ensuring that correct hand of components is used (left or right-handed) f) positioning and aligning components for cosmetic appearance and skin lines. g) securing components using mechanical fasteners and threaded devices h) applying bolt locking methods (such as split pins, wire locking, lock nuts, stiff nuts)
3. Be able to safely carry out quality and accuracy checks on assemblies to ensure they comply with standards.	3.1. Describe and carry out quality and accuracy checks safely including at least three of the following: a) cosmetic appearance b) freedom from damage c) electrical bonding and continuity d) accuracy of skin lines

	e) torque loading checks 3.2. Describe one consequence of not meeting specification tolerances. 3.3. Produce assemblies safely that comply with the following requirements: a) all components are correctly assembled and aligned, in accordance with specification b) overall dimensions are within specification tolerance c) assemblies meet appropriate geometric tolerances (such as square, straight, angles free from twists) d) where appropriate, pitches of rivets/fasteners meet specification requirements e) completed assemblies have secure and firm joints, and are clean and free from burrs/flash, deformation, or cracking

Additional Assessment Guidance

At least one of the assemblies produced above must be of a significant nature and contain at least four of the components identified in assessment criteria 2.1.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Producing Aircraft Detail Assemblies
1. Be able to plan, prepare and carry out a risk assessment for producing aircraft detail assemblies.	**Scope** **Teaching will cover:** • **Health and Safety Legislation:** Teach students about key health and safety legislation relevant to aircraft wiring systems, such as the Health and Safety at Work Act and Civil Aviation Authority (CAA) regulations. Discuss the importance of adhering to these regulations during installation activities. • **Risk Identification and Management:** Cover the identification of risks specific to installing aircraft wiring systems, such as electrical hazards, sharp objects, and working at heights. Discuss how to mitigate these risks using control measures like safe working procedures and personal protective equipment (PPE). • **Safe Use of Tools and Equipment:** Introduce students to the correct usage of hand tools, electrical testing instruments, and equipment used in aircraft wiring installations. Emphasise the importance of inspecting tools before use to ensure they are in good working condition. • **Conducting a Risk Assessment:** Provide training on how to carry out risk assessments for specific installation activities. Teach students to identify hazards, assess risks, and implement control measures that are appropriate for an aircraft environment.
2. Be able to safely produce detail assemblies using different assembly methods and techniques.	**Scope** **Teaching will cover:** • **Interpreting Technical Drawings:** Teach students how to read and interpret aircraft wiring diagrams, schematics, and installation manuals. Provide exercises where students can practice understanding and extracting relevant information from these documents. • **Planning Installation Activities:** Guide students on how to plan installation tasks, including selecting appropriate materials, tools, and methods. Discuss the importance of ensuring that all materials comply with aviation standards.

3. Be able to safely carry out quality and accuracy checks on assemblies to ensure they comply with standards.	**Scope**
	
	Teaching will cover:
	• **How to perform and assess at least three of the following quality checks:**
	  ○ Cosmetic Appearance: Evaluating the finish, surface quality, and visual appeal of assemblies.
	  ○ Freedom from Damage: Inspecting for any signs of damage, deformation, or defects.
	  ○ Electrical Bonding and Continuity: Ensuring proper electrical continuity where applicable.
	  ○ Accuracy of Skin Lines: Verifying the smoothness and accuracy of external surfaces.
	  ○ Torque Loading Checks: Confirming that fasteners are torqued correctly to maintain joint integrity.
	• **Consequences of Failing to Meet Specification Tolerances**
	  ○ Lecturers should explain the importance of adhering to specification tolerances and describe one potential consequence, such as:
	  ○ Reduced structural integrity, leading to component failure or assembly malfunction.

	○ Increased wear and tear due to misalignment or excessive stress. ○ Safety risks associated with poorly fitting or unstable components. • **Producing Compliant Engineering Assemblies** • Students should practice assembling components while ensuring they comply with the following requirements: ○ Correct alignment and assembly according to specifications. ○ Dimensional accuracy within the specified tolerances. ○ Meeting geometric tolerances, such as square, straight, and angles free from twists. ○ Proper pitch and placement of rivets/fasteners according to design requirements. ○ Ensuring assemblies have secure joints, are free from burrs, deformation, or cracking, and meet cleanliness standards.

Title	Aircraft Detail Fitting
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG259
Unit Reference No	R/650/7683
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to carry out aircraft detail fitting activities.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for aircraft detail fitting activities.	1.1. Describe the health and safety issues and requirements associated with carrying out aircraft detail fitting activities. 1.2. Plan and prepare for aircraft detail fitting activities prior to manufacturing. 1.3. Carry out a risk assessment for a given aircraft fitting activity.
2. Be able to mark out different materials.	2.1. Compare the differences between metallic and composite materials. 2.2. Describe and use marking out methods and techniques including direct marking using instruments and at least one of the following: a) use of templates b) tracing/transfer methods c) other specific method 2.3. Use the following marking out tools: a) marking tools b) squares c) vernier instruments d) rules/tapes e) protractors f) dividers/compass 2.4. Describe the characteristics of and mark out the following: a) datum/centre lines b) circles and radial profiles c) square/rectangular profiles d) linear hole positions **and at least two of the following:** e) angles/angular profiles f) allowances for bending g) radial hole positions h) simple pattern development
3. Be able to safely carry out cutting and forming processes using industrial equipment.	3.1. Describe how to use and cut materials using at least four of the following: a) saws (hand or mechanical) b) tin snips c) cropping machines d) guillotines e) drills and hole saws f) files g) bench knives h) nibblers i) abrasive discs 3.2. Describe how to use and carry out cutting operations to produce components that combine operations and produce the following features:

	a) edges/faces that are square to each other b) curved or circular forms c) edges/faces that are parallel d) holes linearly pitched **and at least two of the following:** e) edges/faces that are angled. f) external profiles g) internal profiles h) holes radially pitched 3.3. Bend and form materials using at least four of the following: a) bench folding machines b) hand tools c) box pan folding machines d) heating techniques e) pinch or pyramid rolling machines f) shrinking techniques g) presses h) stretching techniques 3.4. Describe how to use and carry out forming operations to produce components that combine operations and produce at least five of the following features: a) right angled bends b) curved profile c) angled bends d) cylindrical shape e) square flanges f) conical shape g) tray sections and channels h) dished profile i) curved/circular flanges
4. Be able to safely check and inspect detail fitting and components using different measuring equipment.	4.1. Describe the function of and use external micrometers and vernier calipers during detail fitting and checking activities, and at least four of the following: a) rules b) feeler gauges c) squares d) bore/hole gauges. e) calipers (external and internal) f) radius/profile gauges g) vernier protractors h) thread gauges i) micrometers (internal and external) j) dial test indicators (DTI) k) depth Verniers l) surface finish equipment (such as comparison plates, machines) m) slip gauges n) coordinate measuring machine (CMM) 4.2. Produce components to the following standards, as applicable to the process: a) components to be free from false tool cuts, burrs and sharp edges b) finished components meet the required shape/geometry (to the template profile)

	c) completed components are free from excessive tooling marks, deformation including from heat sources or cracking d) dimensional tolerance +/- 0.25mm or +/- 0.010” e) flatness and squareness 0.05mm per 25mm or 0.002" per inch f) angles within +/- 0.5 degree g) screw threads to BS Medium fit h) reamed and bored holes within H8 i) surface finish 63 µin or 1.6 µm

Additional Assessment Guidance

Re AC 2.2, 2.3 and 2.4 - Marking out should be on both:

a) metallic materials relevant to the aerospace sector
b) composite materials relevant to the aerospace sector

These materials should include the at least three of the following forms and include a description of each form:

a) square/rectangular (such as bar stock, sheet material, machined components) circular/cylindrical (such as bar stock, tubes, turned components, flat discs, rolled cylinders/cones)
b) sections (such as angle, channel, tee section, joists, extrusions)
c) irregular shapes (such as castings, forgings, odd-shaped components)
d) detail assemblies.

At least one of the aircraft detail fittings activities produced above must be of a significant nature and contain at least five features identified in assessment criteria 3.2.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner’s progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner’s final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners’ work	Electronic portfolio E-tests

Learning Outcome	Unit: Aircraft Detail Fitting
1. Be able to plan, prepare and carry out a risk assessment for aircraft detail fitting activities.	**Scope** **Teaching will cover:** • **Introduction to Aircraft Fitting:** Explain the basics of aircraft detail fitting, including its significance in ensuring safety, structural integrity, and operational performance. Use real-world examples of aircraft components to illustrate the scope of fitting activities. • **Types of Aircraft Fitting Components:** Cover the types of components involved, such as brackets, hinges, ribs, and panels. Discuss the materials commonly used, including aluminium alloys, titanium, and composites. • **Engineering Drawings and Specifications:** Teach how to interpret engineering drawings and specifications related to aircraft fitting tasks. Include exercises on reading and understanding detail fitting diagrams and blueprints. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific aircraft detail fitting activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to mark out different materials.	**Scope** **Teaching will cover:** • **Fitting Techniques and Procedures:** Provide hands-on training on different fitting techniques such as drilling, reaming, riveting, and bolting. Demonstrate the use of appropriate hand tools and precision instruments (e.g., micrometers, calipers). • **Assembly and Installation Practices:** Teach procedures for the installation of detailed aircraft components, emphasizing accuracy and adherence to specifications. Include demonstrations on fitting components like control surfaces and landing gear parts. • **Use of Jigs and Fixtures:** Explain the use of jigs and fixtures in ensuring precision and repeatability during assembly. Conduct practical sessions where students can set up and use these tools for aircraft fitting tasks. • **Safety and Quality Control:** Incorporate training on safety practices and the importance of quality control checks during and after fitting operations.
3. Be able to safely carry out cutting and forming processes using industrial equipment.	**Scope** **Teaching will cover:** • **Inspection Techniques:** Teach visual inspection methods and the use of non-destructive testing (NDT) techniques such as dye penetrant inspection and ultrasonic testing to assess fitting work. • **Measuring and Tolerances:** Provide guidance on measuring tolerances and clearances using precision instruments. Discuss the implications of exceeding or not meeting tolerance requirements. • **Documentation and Reporting:** Explain the process of documenting inspection findings and reporting non-conformances. Provide examples of inspection reports and teach students how to create their own.

4. Be able to safely check and inspect detail fitting and components using different measuring equipment.	**Scope** **Teaching will cover:** • **Common Repair Techniques:** Cover the basic principles of repairing and modifying aircraft components, including patch repairs, splicing, and replacing damaged parts. Use case studies to demonstrate common repair scenarios. • **Modification Procedures:** Discuss how modifications are carried out according to approved documentation (e.g., modification sheets, service bulletins). Teach how to prepare components for modification and the significance of following OEM specifications. • **Regulatory Considerations:** Introduce the regulatory framework governing aircraft repairs and modifications, focusing on relevant guidelines from aviation authorities (e.g., EASA, FAA).

Title	Industrial Coatings Application
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG260
Unit Reference No	T/650/7684
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand the application of industrial coatings.	

Learning Outcomes	Assessment Criteria
1. Understand health and safety and environmental issues relating to the application of industrial coatings.	1.1. Describe the health and safety and environmental issues and requirements associated with the application of industrial coatings.
2. Understand how to prepare surfaces safely for industrial coating application.	2.1. Compare different types of industrial coating materials, techniques and equipment used for surface preparation and coating application. 2.2. Describe the causes of typical surface preparation and coatings defects, how they can be avoided and rectified. 2.3. Describe the importance of completing quality documentation, reporting procedures and the need to maintain accurate records.
3. Be able to safely carry out industrial coating applications.	3.1. Prepare and maintain work areas in order to work safely and effectively including the safe use and secure storage of equipment and materials. 3.2. Prepare surfaces for industrial coating application including the preparation of steelwork to required standards 3.3. Carry out spray application to appropriate work standard including use of quality control measuring and test equipment, and instrumentation. 3.4. Identify surface preparation and coatings defects and rectify as required. 3.5. Ensure health and safety and environmental protection requirements are maintained when carrying out the application of industrial coatings.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion

	the learner's progression through the course	
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Industrial Coatings Application
1. Understand health and safety and environmental issues relating to the application of industrial coatings.	**Scope** **Teaching will cover:** • **Introduction to Industrial Coatings:** Discuss the purpose and significance of industrial coatings in engineering, including protection against corrosion, enhancing aesthetics, and providing functional surfaces. • **Types of Coatings:** Cover different types of industrial coatings such as primers, topcoats, and specialty coatings (e.g., anti-corrosion, fire-resistant coatings). Include details about the composition and applications of various coatings. • **Coating Materials:** Explain the materials used in industrial coatings (e.g., epoxies, polyurethanes, acrylics) and how their properties affect performance. • **Surface Preparation:** Teach the importance of proper surface preparation, covering methods like blasting, grinding, and chemical cleaning.
2. Understand how to prepare surfaces safely for industrial coating application.	**Scope** **Teaching will cover:** • **Application Methods:** Provide practical training on coating application techniques such as spraying, brushing, and dipping. Emphasize selecting the correct method for different surfaces and environments. • **Coating Process Steps:** Teach the step-by-step process of applying coatings, from surface preparation to the final coat. Discuss factors such as coating thickness, drying times, and environmental controls. • **Use of Equipment:** Demonstrate how to properly use and maintain equipment like spray guns, pressure pots, and other coating application tools. • **Health and Safety in Coating Application:** Highlight the importance of safety practices, including PPE usage, ventilation requirements, and handling hazardous materials.
3. Be able to safely carry out industrial coating applications.	**Scope** **Teaching will cover:** • **Inspection Techniques:** Teach visual inspection methods and introduce tools like dry film thickness gauges, adhesion testers, and gloss meters. • **Testing Procedures:** Explain common testing methods for coatings, including hardness tests, impact resistance, and chemical resistance testing. • **Quality Control:** Discuss the criteria for a successful coating application, such as uniform coverage, proper adhesion, and meeting specified thickness tolerances. • **Documentation:** Teach students how to document inspection results and create reports for coating applications. • **Regulatory Standards:** Introduce key regulations and standards governing industrial coatings, such as environmental guidelines (e.g., VOC content regulations) and industry-specific standards (e.g., ISO 12944 for corrosion protection).

	• **Environmental Impact:** Discuss the environmental considerations of coating processes, including waste management, emissions control, and sustainable practices. • **Safe Disposal and Handling:** Teach proper procedures for disposing of hazardous waste and handling chemicals to minimise environmental impact.

Title	Preparing and Using Computerised Numerical Control Mills for Milling Operations
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG538
Unit Reference No	K/651/0261
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to prepare and use Computerised Numerical Control (CNC) milling machines.	

Learning Outcomes	Assessment Criteria
1. Be able to plan and prepare for CNC milling activities and carry out a risk assessment.	1.1. Describe the key health and safety requirements for CNC milling activities. 1.2. Plan CNC milling activities prior to manufacturing. 1.3. Carry out a risk assessment for a given milling activity.
2. Be able to safely set up and use components and tools for CNC milling a range of materials.	2.1. Describe the differences between ferrous, non-ferrous and non-metallic materials. 2.2. Machine components made from two of the following types of materials: a) ferrous b) non-ferrous c) non-metallic 2.3. Mount, secure and machine components using two the following work-holding devices: a) machine vices b) fixtures c) chucks d) angle plate e) direct clamping to machine table f) pneumatic or magnetic table g) ancillary indexing devices 2.4. Select four of the following types of milling cutters and mount them to the appropriate tool holding device: a) face mills b) end mills c) twist/core drills d) boring tools e) reamers f) slot drills g) special profile cutters 2.5. Carry out the following activities to prepare the tooling for operation as applicable to the machine type: a) securing tools to the machine spindle or positioning tools in the correct position in the tool magazine/carousel b) checking that tools have specific tool number in relation to the operating program. c) entering all relevant tool data to the operating program such as tool lengths, tool offsets, radius compensation d) pre-setting tooling using setting jigs/fixtures where appropriate. e) setting tool datum

	f) saving changes to the program 2.6. Confirm that the machine and program operate safely and correctly, by checking all of the following: a) datums for each machine axis are set in relation to all equipment and tooling used b) all operations are carried out to the program co-ordinates c) tool change positions are safe and clear of the workpiece and machine equipment d) the correct tools are selected at the appropriate points in the program. e) tool offsets are correctly entered into the machine controller f) tool cutter paths are executed safely and correctly g) auxiliary functions operate at the correct point in the program such as cutter start/stop, coolant flow h) programs have been saved in the appropriate format
3. Be able to safely CNC mill components using different operations and carry out checks for accuracy.	3.1. Produce machined components which combine different operations and have the following features: a) flat faces b) steps/shoulders c) open ended slots d) enclosed slots/recesses e) drilled holes linearly pitched **and three of the following features:** f) parallel faces g) square faces h) angular faces i) internal profiles j) external profiles k) drilled holes on pitched circles l) bored holes m) reamed holes n) tapped holes o) circular/curved profiles p) special forms such as concave or convex 3.2. Carry out checks for accuracy of the following: a) linear dimensions such as lengths and depths b) slots such as position, width, and depth c) flatness d) surface finish **and four of the following:** e) squareness f) parallelism g) hole size/fit h) angles i) recesses j) thread fit

	3.3. Describe and demonstrate how to shut down the equipment to a safe condition on completion of the machining activities.
4. Be able to carry out quality inspections to ensure the quality and accuracy of the components produced.	4.1. Use the following measuring equipment during the machining and checking activities: a) external micrometers b) dial test indicators (DTI) c) vernier/digital/dial calipers d) surface finish equipment such as comparison plates and machines **and four of the following:** e) rules f) internal micrometers g) depth micrometers h) depth Verniers i) slip gauges j) bore/hole gauges k) thread gauges l) plug gauges m) radius/profile gauges n) Vernier protractors o) coordinate measuring machine (CMM) 4.2. Produce components to the following quality and accuracy standards, as applicable to the operation: a) components to be free from false tool cuts, burrs, and sharp edges b) general dimensional tolerance +/- 0.15mm or +/- 0.006” c) there must be one or more specific dimensional tolerances within +/- 0.05mm or +/- 0.002” d) screw threads BS medium fit e) reamed / bored holes within H8 f) surface finish 63 µin or 1.6µm g) angles within +/- 0.5 degree

Additional Assessment Guidance

Re: Learning Outcome 3 in order to demonstrate the ability to combine different CNC milling operations, at least one of the machined components produced must be of a significant nature and must have a minimum of five of the features listed in assessment criteria 3.1.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner’s progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion

Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Preparing and Using Computerised Numerical Control Mills for Milling Operations
1. Be able to plan and prepare for CNC milling activities and carry out a risk assessment.	**Scope** **Teaching will cover:** • **Introduction to CNC Technology:** Discuss the evolution of CNC machining, the importance of automation in modern manufacturing, and the role of CNC machines in precision engineering. • **Types of CNC Machines:** Provide an overview of different CNC machines, such as lathes, milling machines, and multi-axis machining centres. Discuss their applications and advantages. • **Understanding CNC Programs:** Teach the basics of G-code and M-code, which are the standard programming languages used for controlling CNC machines. Introduce students to CNC programming software. • **Reading Engineering Drawings:** Explain how to interpret engineering drawings and translate them into CNC programs, focusing on dimensions, tolerances, and surface finish requirements. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific CNC milling activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to safely set up and use components and tools for CNC milling a range of materials.	**Scope** **Teaching will cover:** • **Setting Up the Machine:** Teach students how to set up a CNC machine, including installing and securing tools, workpieces, and fixtures. Emphasize the importance of accurate alignment and calibration. • **Tool Selection and Tool Offsets:** Explain the criteria for selecting appropriate cutting tools based on the material and the type of machining operation. Teach how to set and adjust tool offsets. • **Loading CNC Programs:** Demonstrate how to load and verify CNC programs into the machine's controller. Include steps for ensuring that the program matches the intended design and specifications. • **Safety Considerations:** Cover the safety protocols for setting up and operating CNC machines, including emergency stop procedures, safe working distances, and the correct use of personal protective equipment (PPE).
3. Be able to safely CNC mill components using different operations and carry out checks for accuracy.	**Scope** **Teaching will cover:** • **Operating Procedures:** Provide hands-on training on starting and running CNC machines. Teach the sequential steps from running initial tests to full production runs. • **Process Monitoring and Adjustments:** Instruct students on how to monitor the machining process and make real-time adjustments for tool wear, speed, and feed rates to maintain precision and surface finish. • **Quality Assurance:** Explain the importance of inspecting machined components during and after production. Teach students how to measure critical dimensions using precision instruments such as micrometers and coordinate measuring machines (CMM).

	• **Production Efficiency:** Discuss techniques for optimizing cycle times while maintaining quality, including the use of canned cycles, subroutines, and other program efficiencies.
4. Be able to carry out quality inspections to ensure the quality and accuracy of the components produced.	**Scope** **Teaching will cover:** • **Routine Maintenance Procedures:** Teach basic maintenance tasks such as cleaning, lubrication, and inspection of moving parts. Discuss the importance of following manufacturer guidelines for maintenance schedules. • **Diagnosing Common Issues:** Explain how to diagnose and troubleshoot common issues such as tool breakage, program errors, and machine misalignment. Provide practical scenarios for students to practice identifying and resolving issues. • **Documentation and Reporting:** Emphasise the need for accurate record-keeping of maintenance activities, machine errors, and corrective actions taken. Teach students how to fill out maintenance logs and service reports.

Title	Producing Computer Aided Design Models
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG539
Unit Reference No	H/650/9669
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to set up and operate a computer aided design (CAD) system to produce CAD models.	

Learning Outcomes	Assessment Criteria
1. Be able to plan and prepare for CAD modelling.	1.1. Describe the health and safety requirements for using a CAD system. 1.2. Plan CAD modelling activities. 1.3. Use appropriate data and design sources to obtain required information to create CAD models.
2. Be able to produce CAD models using a CAD system.	2.1. Summarise the types of drawings that may be produced by the modelling software. 2.2. Explain why it is necessary to be able to recall previous issues of modified models. 2.3. Use three of the following to obtain the necessary data to produce the required model: a) model brief/request b) change order/modification request c) manuals d) calculations e) sketches f) specifications g) regulations h) sample component i) previous models/designs j) standards reference documents k) notes from meetings/discussions l) other available data 2.4. Demonstrate how to incorporate three of the following, as appropriate to the CAD model being produced: a) function b) quality c) manufacturing method d) ergonomics e) materials f) cost g) lifetime of the product h) tolerances i) clearance j) aesthetics k) physical space l) operating environment m) interfaces n) safety 2.5. Use one of the following tools to produce a CAD model: a) surface modelling b) solid modelling c) wire frame modelling

	which includes the use of eight of the following from the part feature menu: a) extrude b) revolve c) hide d) fillet e) shell f) solid model g) solid model h) wire frame i) rib j) cut/remove k) mirror l) radius m) rectangular pattern n) circular pattern o) other specific feature 2.6. Explain how to access, identify, and use different standard components and symbol libraries from a CAD platform database. 2.7. Modify parts in the assembly environment using constrained parts and assemblies with eight of the following features: a) straight lines b) dimensions c) angular surfaces d) text e) surface texture f) insertion of standard components g) symbols and abbreviations h) curved surfaces i) circles or ellipses j) material colour k) hidden detail l) hatching and shading m) parts lists n) other specific details
3. Be able to complete CAD models to expected standards and formats.	3.1. Summarise the key features of national, international, and organisational standards and conventions that are used for the models and drawings. 3.2. Summarise the different types of drawings that may be produced by CAD modelling software and the importance of data indicated on drawings including: a) datums b) surface finishes c) tolerances 3.3. Explain the importance of document control including ensuring that completed models are approved, labelled, and stored on a suitable storage medium. 3.4. Produce a CAD model for export to one of the following manufacturing systems: a) Computer Numerical Control (CNC) machine b) 3D printer c) other specific system

	3.5. Produce CAD models which comply with two of the following: a) organisational guidelines b) statutory regulations and codes of practice c) CAD software standards d) British Standards (BS) and International Organization for Standardization (ISO) standards e) Other international standard 3.6. Save and store CAD models appropriately including: a) ensuring models have been checked to comply with organisational quality assurance procedures b) ensuring models are correctly titled, referenced, and annotated c) saving models to an appropriate storage medium (such as hard drive, DVD, external storage device) d) creating separate backup copies, and placing in safe storage e) registering and storing models in the appropriate organisational information system in line with organisational procedures f) recording and storing changes to models in the appropriate organisational information system in line with organisational procedures 3.7. Print hard copies of CAD models, with sufficient detail to facilitate manufacture.

Additional Assessment Guidance

RE Learning Outcome 2: at least one of the models/drawings produced must be of a significant nature. It must involve a minimum of five of the part features listed in assessment criteria AC 2.3 and must include a minimum of seven of the features listed in assessment criteria AC 2.5.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log

Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Producing Computer Aided Design Models
1. Be able to plan and prepare for CAD modelling.	**Scope** **Teaching will cover:** • **Introduction to CAD Systems:** Explain the purpose and benefits of CAD in engineering design, focusing on accuracy, speed, and the ability to create complex geometries. Provide an overview of different CAD software tools available in the industry, such as AutoCAD, SolidWorks, and Fusion 360. • **2D and 3D CAD Concepts:** Discuss the key differences between 2D and 3D modelling, focusing on the benefits and uses of each. Teach students about coordinate systems, drawing tools, and design constraints. • **CAD in Engineering Design:** Explore how CAD integrates into the broader design process, from conceptualization to final production. Discuss industry applications where CAD is critical, such as product design, architecture, and mechanical engineering.
2. Be able to produce CAD models using a CAD system.	**Scope** **Teaching will cover:** • **Drawing Fundamentals:** Teach the basics of creating 2D drawings, including line drawing, dimensioning, and adding text annotations. Focus on accuracy and proper use of drawing tools. • **Editing and Modifying 2D Designs:** Introduce techniques for editing and refining drawings, including trimming, extending, mirroring, and scaling. Provide practical exercises where students can practice modifying existing designs. • **Layer Management and Annotation:** Explain the use of layers in CAD to organize different elements of a drawing. Teach how to apply annotations like labels, notes, and dimensions effectively to create clear and professional drawings. • **Output and File Management:** Demonstrate how to save, export, and print drawings in various formats, such as DWG, DXF, and PDF.
3. Be able to complete CAD models to expected standards and formats.	**Scope** **Teaching will cover:** • **Introduction to 3D Modelling:** Teach the fundamentals of 3D modelling, including creating basic shapes, extrusions, and revolutions. Discuss the importance of geometric constraints and parametric modelling. • **Advanced 3D Modelling Techniques:** Introduce more complex modelling operations such as filleting, chamfering, lofting, and shelling. Provide students with practical exercises where they can apply these techniques to create intricate parts. • **Creating Assemblies:** Teach how to combine multiple components into an assembly. Discuss the use of constraints to ensure correct alignment and movement of parts within the assembly. • **Rendering and Visualisation:** Introduce basic rendering techniques to help visualise 3D models. Discuss how to apply materials, lighting, and camera settings to produce realistic images of designs.

	• **Creating Technical Drawings:** Teach how to generate 2D technical drawings from 3D models. Focus on creating standard views (e.g., front, top, side), sectional views, and exploded views. • **Dimensioning and Tolerances:** Explain how to add dimensions, tolerances, and other annotations to technical drawings according to industry standards (e.g., BS 8888, ISO 128). • **Bill of Materials (BOM):** Discuss how to generate a bill of materials from an assembly, including item numbers, quantities, and descriptions. • **Output for Manufacturing:** Explain how to prepare technical drawings for manufacturing, focusing on export settings, file formats, and ensuring drawings meet industry specifications.

Title	Producing Components using Rapid Prototyping and Additive Manufacturing
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG540
Unit Reference No	L/650/9670
Learner Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to produce components using rapid prototyping and additive manufacturing.	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out risk assessment for rapid prototyping and additive manufacturing activities.	1.1. Describe the health and safety issues and requirements associated with carrying out rapid prototyping and additive manufacturing activities. 1.2. Describe how to prepare and plan for rapid prototyping and additive manufacturing activities. 1.3. Carry out a risk assessment for a given rapid prototyping or additive manufacturing activity.
2. Be able to prepare a digital model file for rapid prototyping and additive manufacturing activities.	2.1. Describe the process of transforming Computer Aided Design (CAD) models through to a programming language for computer numerical control (CNC), including the importance of file type, units and resolution when producing a mesh file. 2.2. Describe the key factors of manufacture established at the point of computer code creation that relate directly to the types of additive manufacture being used including: a) speed b) temperature c) wall thickness d) infill density and type 2.3. Convert CAD files to applicable mesh model for slicing software at an appropriate resolution. 2.4. Transfer mesh model file to slicing software and slice model to given specifications to produce appropriate computer code. 2.5. Transfer computer code to additive manufacturing equipment using appropriate means.
3. Be able to safely set up for rapid prototyping and additive manufacturing activities.	3.1. Describe the key principles of rapid prototyping and additive manufacturing relevant to the machine being used. 3.2. Explain the different materials used to produce components by the rapid prototyping process including how the materials used will affect the operating conditions that can be applied relevant to the machine being used. 3.3. Summarise the key factors associated with material form relevant to the type of rapid prototyping and additive manufacturing process being utilised, and their importance including: a) dimensions

	b) shelf life c) control of water content 3.4. Carry out appropriate checks to ensure that equipment is in a safe and usable working condition including ensuring equipment is: a) undamaged b) clean c) and safety devices are in place and operational 3.5. Confirm sufficient quantities of relevant materials and available and load material into the additive manufacturing equipment. 3.6. Calibrate rapid prototyping and additive manufacturing equipment using appropriate techniques and equipment.
4. Be able to safely carry out rapid prototyping and additive manufacturing to produce components.	4.1. Describe Three different forms of Rapid Prototyping/Additive Manufacturing, explaining typical applications and advantages and disadvantages of each. 4.2. Summarise three potential problems and defects that can occur in components produced by rapid prototyping processes, including possible reasons these occur, and preventative actions to prevent them. 4.3. Describe the importance of leaving the machine in a safe condition on completion of the rapid prototyping and additive manufacturing activities including: a) correctly isolating b) closing or removing operating programs c) cleaning the machine d) removing and disposing of waste appropriately 4.4. Produce components using one of the following types of rapid prototyping and additive manufacturing equipment from appropriate material: a) stereo lithography apparatus (SLA) b) fused deposition modelling (FDM) c) selective laser sintering (SLS) d) direct metal laser sintering (DMLS) e) selective laser melting (SLM) f) 3D printing (thermojet) g) laminated object manufacturing (LOM) h) digital light process (DLP) i) other specific additive manufacturing equipment 4.5. Produce components made from one of the following materials: a) photo-polymer resin b) plastics c) wax d) metal e) laminated paper f) polyurethane 4.6. Demonstrate how to unload the components from rapid prototyping and additive manufacturing equipment, to include: a) removing the part from remaining raw material

	b) removing the part from supports (where applicable) c) pre-cleaning d) infiltrate (when required) e) packing to avoid damage f) storing g) completing all relevant documentation (such as material batch number, CAD file name, date of manufacture, operator's name, quality report) 4.7. Produce components which meet all the following quality and accuracy requirements: a) correctly formed b) checked against model specification. c) free from manufacturing defects d) satisfactory visual appearance and finish 4.8. Demonstrate how to safely shut down equipment on completion of activities.

Additional Assessment Advice

Re: Learning Outcome 2: the computer code and computer programming language used should be one used for computer numerical control (CNC) in current wide use eg G-Code at time of writing.
AC 3.6 - Learner should demonstrate that they can determine material volume from slicing simulation. The learner should demonstrate that there is sufficient material available from previously utilised stock (e.g., mass of filament remaining on spool)
AC 4.4 & 4.5 - At least three work pieces must be completed. The workpieces should include a variety of features such as overhangs, captive fasteners, and integrated assembly.
AC 4.7 - Learner should be capable of utilising standard engineering measuring equipment such as micrometers and vernier calipers, prior to executing these activities.

Assessment Guidance

The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.

Assessment Method	Definition	Possible Content
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
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Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Producing Components using Rapid Prototyping and Additive Manufacturing
1. Be able to plan, prepare and carry out risk assessment for rapid prototyping and additive manufacturing activities.	**Scope** **Teaching will cover:** • **Introduction to Rapid Prototyping (RP):** Provide an overview of the evolution and principles of rapid prototyping technologies. Discuss how RP is used in various industries, including aerospace, automotive, and medical sectors. • **Different Types of Rapid Prototyping Methods**: Explain the various RP methods such as stereolithography (SLA), selective laser sintering (SLS), and fused deposition modelling (FDM). Highlight their specific applications, advantages, and limitations. • **Materials Used in Rapid Prototyping:** Teach the range of materials used in RP processes, including polymers, metals, and ceramics. Discuss how material properties influence the selection of a particular RP method. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific rapid prototyping and additive manufacturing activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to prepare a digital model file for rapid prototyping and additive manufacturing activities.	**Scope** **Teaching will cover:** • **Setting Up the Equipment:** Provide step-by-step guidance on setting up different RP machines, focusing on calibration, material loading, and configuring build parameters. Discuss the importance of preparing the machine according to the manufacturer's guidelines. • **Preparing CAD Models for RP:** Teach the process of preparing 3D CAD models for printing, including file formatting (e.g., STL files), checking for errors in the model, and optimising the design for the RP process. • **Selecting Appropriate Build Settings:** Explain how to determine build settings such as layer height, infill density, and support structures based on the specific requirements of the component being produced.
3. Be able to safely set up for rapid prototyping and additive manufacturing activities.	**Scope** **Teaching will cover:** • **Executing the RP Process:** Teach students how to run the RP process from start to finish, including monitoring the build process and making adjustments as needed. Discuss how to troubleshoot common issues such as warping, layer misalignment, and incomplete builds. • **Post-Processing Techniques:** Explain the importance of post-processing steps such as cleaning, curing, and finishing. Provide hands-on training in removing support structures, sanding, and applying coatings to improve the quality of the final component. • **Control and Inspection:** Guide students in inspecting the final components to ensure they meet design specifications. Teach

	methods for measuring dimensions, checking for surface defects, and evaluating the component's functional performance.
4. Be able to safely carry out rapid prototyping and additive manufacturing to produce components.	**Scope** **Teaching will cover:** • **Routine Maintenance Tasks**: Teach how to perform routine maintenance on RP equipment, such as cleaning build platforms, replacing nozzles, and ensuring the machine's calibration remains accurate. • **Troubleshooting Common Issues**: Discuss common issues that arise during the RP process, such as material jams, print failures, and software errors. Provide guidance on diagnosing and resolving these problems to minimise downtime. • **Maintaining Machine Safety Standards**: Emphasise the importance of following safety standards while maintaining and operating RP equipment. Discuss safe handling practices for materials and the use of PPE.

Title	Producing Composite Mouldings Using Wet Lay-up Techniques
Level	Two
Credit Value	10
Guided Learning Hours (GLH)	80
OCN NI Unit Code	CBG541
Unit Reference No	L/651/0262
Learn Direct Code	XA1
Unit purpose and aim(s): This unit will enable the learner to understand how to produce composite mouldings using wet lay-up laminating techniques	

Learning Outcomes	Assessment Criteria
1. Be able to plan, prepare and carry out a risk assessment for composite laminating activities.	1.1. Describe the health and safety requirements associated with carrying out composite laminating activities. 1.2. Describe how to prepare and plan for composite laminating activities. 1.3. Carry out a risk assessment for a given composite laminating activity.
2. Be able to safely set up and prepare for composite laminating activities using wet lay-up techniques.	2.1. Describe the standards and terminology used for the following wet lay-up techniques used in producing composite laminates: a) resin and fibre weights/volumes. b) material orientation c) material identification d) material tailoring e) mixing ratios f) gel times g) exotherm h) bleed plies 2.2. Describe the different types of materials used and their applications in composite laminating processes including: a) resins b) reinforcement catalysts c) accelerators d) additives 2.3. Illustrate how to estimate or calculate resin volume/weight required to wet-out the reinforcing fibres. 2.4. Prepare production tooling including: a) checking that tooling is correct and complete b) cleaning the tooling and removal of resin build-ups c) checking for surface defects d) correctly applying sealers/release agents e) clean and store tooling suitably after use 2.5. Prepare materials for production of composite laminates including: a) obtaining correct materials for given activity and checking fitness for purpose b) cutting materials to correct size and shape c) checking correct quantity of resin is available d) calculating correct resin to fibre ratios

	e) checking correct measure and mix of resin and catalyst f) identification and protection of materials in the work area
3. Be able to safely carry out moulding activities using wet lay-up techniques.	3.1. Describe the following and their applications in the production of composite mouldings: a) different types of fibre materials including fabrics, orientations, their combinations b) different core, insert and filler materials c) different types of production tooling used 3.2. Summarise the methods of preparation for patterns, moulds, and tooling, (including the correct use of surface sealers and release agents). 3.3. Summarise the different methods and techniques used to cure composite mouldings including cure cycles and the need for monitoring. 3.4. Produce different mouldings using two of the following application techniques: a) spray application of fibre/resin b) spray application of a gel coat c) brush application of a gel coat d) brush application of fibre/resin e) roller application of fibre/resin f) removal of voids and air pockets g) brush/roller consolidation h) use of vacuum bagging **and incorporating four of the following shape features:** a) internal corner b) external corner c) horizontal surface d) vertical surface e) return surfaces f) double curvature g) concave surface h) convex surface i) joggle details 3.5. Produce different mouldings using one of the following types of resin: a) bio resin b) acrylic c) polyester d) vinyl ester e) epoxy f) phenolic g) other 3.6. Produce different mouldings using appropriate techniques for one of the following types of fibre from: a) natural fibre b) thermoplastic c) glass d) aramid e) carbon f) hybrid g) other

	3.7. Produce different mouldings using techniques for two of the following types of reinforcement: a) uni-directional b) roving c) braids d) tapes e) chopped strand f) continuous filament g) tissues/veils h) bonded fabrics i) woven j) multi axis/stitched k) other
4. Be able to remove mouldings from the formers and trim and finish to specification.	4.1. Describe the methods and techniques used for the following: a) trimming mouldings prior to release including green trimming b) removing mouldings from production tooling. c) identifying defects in the composite moulding (such as de-lamination, voids, contaminants) 4.2. Demonstrate how to remove moulds including: a) visually checking mouldings to confirm they are complete and free from defects b) using appropriate equipment and gauges to check for dimensional accuracy (such as overall dimensions, thickness of material or moulding, geometric features) c) marking out mouldings for trimming of excess material d) cutting and trimming mouldings, using appropriate tools and equipment (such as cutting wheels/discs, routers, saws) e) carrying out repairs where appropriate f) finishing mouldings, using appropriate tools and equipment (such as rubbing blocks, diamond files, disc or belt sanders, pencil grinders) g) polishing mouldings, using appropriate tools and equipment (such as wet sanding, cutting compounds) 4.3. Produce composite mouldings which comply with one of the following standards: a) components are dimensionally accurate within specification requirements b) finished components meet the required shape and geometry (such as squareness, straightness, angularity and being free from twists) c) completed components are free from defects, sharp edges, or slivers. d) components meet company standards and procedures

Additional Assessment Advice
Re AC 2.5 and AC 4.2 The learner should determine and record the individual masses of all materials and consumables prior to laminating and again after removal from tool. Precise matrix and reinforcement masses should then be calculated to determine fibre volume fraction. At least one of the mouldings produced must be of a significant nature and have a minimum of three of the shape features identified in AC 3.4.

Assessment Guidance		
The following assessment method/s may be used to ensure all learning outcomes and assessment criteria are fully covered.		
Assessment Method	**Definition**	**Possible Content**
Portfolio of evidence	A collection of documents containing work undertaken to be assessed as evidence to meet required skills outcomes. OR A collection of documents containing work that shows the learner's progression through the course	Learner notes/written work Learner log/diary Peer notes Record of observation Record of discussion
Practical demonstration/assignment	A practical demonstration of a skill/situation selected by the tutor or by learners, to enable learners to practise and apply skills and knowledge	Record of observation Learner notes/written work Learner log
Coursework	Research or projects that count towards a learner's final outcome and demonstrate the skills and/or knowledge gained throughout the course	Record of observation Learner notes/written work Tutor notes/record Learner log/diary
E-assessment	The use of information technology to assess learners' work	Electronic portfolio E-tests

Learning Outcome	Unit: Producing Composite Mouldings Using Wet Lay-up Techniques
1. Be able to plan, prepare and carry out a risk assessment for composite laminating activities.	**Scope** **Teaching will cover:** • **Introduction to Composite Materials**: Explain the basics of composite materials, including fibre reinforcement (e.g., glass, carbon, aramid) and resin systems (e.g., epoxy, polyester). Discuss the advantages of composite materials in engineering applications, such as lightweight and high strength. • **Overview of the Wet Lay-Up Process:** Cover the fundamental steps in the wet lay-up process, from surface preparation to resin application and lay-up. Discuss the importance of controlling factors such as temperature, humidity, and curing time. • **Mould Types and Materials:** Teach the different types of moulds used in composite production, including open moulds, closed moulds, and tooling materials like fibreglass, wood, and metal. • **Health and Safety in Composite Manufacturing**: Highlight the health and safety considerations, including the use of personal protective equipment (PPE), handling hazardous materials, and ensuring proper ventilation. • **Conducting a Risk Assessment:** Guide students through the process of carrying out a risk assessment for specific production of composite moulding activities. Provide practical scenarios for them to assess potential risks and identify control measures.
2. Be able to safely set up and prepare for composite laminating activities using wet lay-up techniques.	**Scope** **Teaching will cover:** • **Surface Preparation:** Teach students how to prepare mould surfaces, including cleaning, applying release agents, and setting up for lay-up. Emphasize the importance of avoiding contamination. • **Applying Layers and Resin:** Provide practical instruction on the correct technique for applying fibre layers and resin. Discuss how to ensure consistent resin distribution, control air pockets, and achieve optimal layer consolidation. • **Curing and Finishing:** Explain the curing process, including controlling environmental conditions and post-curing methods. Teach finishing techniques like trimming, sanding, and inspecting for defects. • **Quality Control:** Guide students on the methods for checking the quality of the moulding, including visual inspection for defects like delamination, voids, and uneven surface finish.
3. Be able to safely carry out moulding activities using wet lay-up techniques.	**Scope** **Teaching will cover:** • **Repair Techniques:** Cover common repair methods for composite components, including patch repairs, scarf joints, and resin injection. Discuss how to assess damage and determine the appropriate repair strategy. • **Modification Procedures:** Teach how modifications can be made to composite structures, including cutting, drilling, and bonding additional components. Highlight the importance of maintaining structural integrity during modifications.

	• **Regulatory and Documentation Requirements:** Discuss the documentation needed for repairs and modifications, including service bulletins, repair logs, and regulatory approvals.
4. Be able to remove mouldings from the formers and trim and finish to specification.	**Scope** **Teaching will cover:** • **Regulatory Standards in Composite Manufacturing:** Introduce students to relevant regulations and industry standards (e.g., ISO 9001, AS9100) that govern composite manufacturing and quality control. • **Environmental Impact:** Discuss the environmental considerations of composite production, including waste management, the use of sustainable materials, and methods to minimise emissions and hazardous waste. • **Safe Disposal and Recycling:** Teach students the correct procedures for disposing of composite waste and the potential for recycling materials. Emphasise reducing the environmental footprint through sustainable practices.

11. Quality Assurance of Centre Performance

11.1 Internal Assessment

When delivering and assessing this qualification, centres must align with stakeholders' expectations and address learners' needs by implementing a practical and applied programme. Centres have the flexibility to customise programmes to meet local requirements and establish connections with local employers and the broader vocational sector.

The Assessor should work with the IQA to ensure that the assessment is planned in line with OCN NI requirements. Assessment Plans must be developed and approved by the Internal Verifier prior to the delivery of the qualification.

All units within this qualification must undergo internal assessment. Learners must provide evidence that they have appropriately met all assessment criteria required for that grade.

The assessment format for all units involves a task conducted after the delivery of the unit's content, or part of it, if multiple tasks are used. Tasks may exhibit in various forms, encompassing practical and written types. Please refer to 'OCN NI's Assessment Definitions Guide' for additional details.

A task constitutes a distinct activity completed independently by learners, separated from teaching, practice, exploration, and other activities guided by tutors. Tasks are assigned to learners with a specified start date, completion date, and explicit requirements for the evidence to be produced. Some tasks may include observed practical components and require diverse forms of evidence.

A valid assignment will enable a clear and formal assessment outcome, which meets the requirements of the assessment criteria. Assessment decisions are based on the specific assessment criteria given in each unit and set at each grade level. The way in which individual units are written provides a balance of assessment of understanding, practical skills and vocational attributes appropriate to the purpose of qualifications.

It is the Assessor's role to ensure that learners are appropriately prepared for assessment, this begins from induction onwards. Assessors should ensure that learners understand how assessment tasks are used to determine the award of credit, the importance of meeting assessment timelines, and that all learners work must be independently created, where source documents are used this should be appropriately referenced, learners should be aware of what would constitute plagiarism and the possible consequences.

When conducting the assessment, Assessors must ensure they do not provide direct input, instructions or specific feedback which may compromise the authenticity of the work submitted.

Once the Assessor has authenticated the learners work, they must transparently demonstrate the rationale behind their assessment decisions. Once a learner completes all assigned tasks for a unit, the Assessor will allocate a grade for the unit. Refer to the 'Unit Grading Matrix' for additional information on the grading process.

Once the Assessor has completed the assessment process for the task, the assessment decision is recorded formally, and feedback is provided to the learner. The feedback should show the learner the outcome of the assessment decision, how it was determined or where the criteria has been met, it may indicate to the learner why achievement of the assessment criteria has not been met. It must be clear to the learner that this Assessment outcome is subject to verification.

For further information on assessment practice, please see the 'OCN NI Centre Handbook'. Assessment Training is also available and can be booked through the OCN NI Website.

11.2 Internal Quality Assurance

The role of the IQA is to ensure appropriate internal quality assurance processes are carried out. The IQA must oversee that assessments are conducted in accordance with relevant OCN NI policies, regulations, and this specification.

The IQA must ensure assessments are fair, reliable, and uniform, thereby providing a consistent standard for all learners.

IQAs are required to provide constructive feedback to Assessors, identifying areas of strength and those that may require improvement. This feedback contributes to the ongoing professional development of Assessors.

Contributing to the standardisation of assessment practices within the centre is an important function of this role. This entails aligning assessment methods, grading criteria, and decision-making processes to maintain fairness and equity.

IQAs will actively engage in the sampling and monitoring of assessments to ensure the consistency and accuracy of assessment decisions. This process helps identify trends, areas for improvement, and ensures the robustness of the overall assessment system.

For further information on Internal Quality Assurance practice, please see the 'OCN NI Centre Handbook'. IQA Training is also available and can be booked through the OCN NI Website.

11.3 Documentation

For internal quality assurance processes to be effective, the internal assessment and IQA team needs to keep effective records.

- The programme must have an assessment and internal quality assurance plan. When producing a plan, they should consider:
    - the time required for training and standardisation activities
    - the time available to undertake teaching and carry out assessment,
    - consider when learners may complete assessments and when quality assurance will take place
    - the completion dates for different assessment tasks
    - the date by which the assignment needs to be internally verified
    - sampling strategies
    - how to manage the assessment and verification of learners' work so that they can be given formal decisions promptly
    - how resubmission opportunities can be scheduled

The following documents are available from OCN NI and document templates can be found in the Centre Login section of the OCN NI website www.ocnni.org.uk:

- A1 – Learner Assessment Record per Learner
- Learner Authentication Declarations
- Records of any reasonable adjustments applied for and the outcome – please see 'OCN NI's Reasonable Adjustments and Special Consideration Policy' for further information
- M1 IQA Sample Record
- M2 Feedback to Assessor
- Records of any complaints or appeals

11.4 External Quality Assurance

All OCN NI recognised centres are subject to External Quality Assurance. External quality assurance activities will be conducted to confirm continued compliance with the CCEA Regulation General conditions of recognition, OCN NI terms and conditions and the requirements outlined within this qualification specification.

The External Quality Assurance is assigned by OCN NI. The External Quality Assurer will review the delivery and assessment of this qualification. This will include, but is not limited to, the review of a sample of assessment evidence and evidence of the internal verification of assessment and assessment decisions. This will form the basis of the External Quality Assurance report and will help OCN NI determine the centre's risk.

The role of the External Quality Assurer serves as an external overseer of assessment quality, working to uphold consistency, compliance, and continuous improvement within the assessment process. Their role is crucial in ensuring that assessments are valid, reliable, fair, and aligned with the required standards and regulations.

For further information on OCN NI Centre Assessments Standards Scrutiny (CASS) Strategy, please see the OCN NI Centre Handbook.

11.5 Standardisation

As a process, standardisation is designed to ensure consistency and promote good practice in understanding and the application of standards. Standardisation events:

- make qualified statements about the level of consistency in assessment across centres delivering a qualification
- make statements on the standard of evidence that is required to meet the assessment criteria for units in a qualification
- make recommendations on assessment practice
- produce advice and guidance for the assessment of units
- identify good practice in assessment and internal quality assurance

Centres offering this qualification must carry out internal standardisation activities prior to the claim for certification.

Centres offering units of an OCN NI qualification must attend and contribute assessment materials and learner evidence for standardisation events if requested.

OCN NI will notify centres of the nature of sample evidence required for standardisation events (this will include assessment materials, learner evidence and relevant Assessor and IQA documentation). OCN NI will make standardisation summary reports available and correspond directly with centres regarding event outcomes.

12. Administration

12.1 Registration

A centre must register learners for this qualification within 90 days of commencement of the delivery of the programme.

For further information on learner registration please see the OCN NI Centre Handbook and the QuartzWeb Manual, available through the Centre Login section of the OCN NI website. Administration training is also available and can be booked through www.ocnni.org.uk.

12.2 Certification

Once all internal quality assurance activities have been successfully completed, the centre can claim certification for the learner(s).

Certificates will be issued to centres within 20 working days from completion of a satisfactory external quality assurance activity, if appropriate, alternatively from the submission of an accurate and complete marksheet.

It is the responsibility of the centre to ensure that certificates received from OCN NI are held securely and distributed to learners promptly and securely.

For further information on the uploading of results please see the QuartzWeb Manual for guidance, administration training is also available and can be booked through OCN NI

12.3 Charges

OCN NI publishes all up-to-date qualification fees in its Fees and Invoicing Policy document. Further information can be found on the centre login area of the OCN NI website.

12.4 Equality, Fairness and Inclusion

OCN NI's are committed to ensuring all learners have an equal opportunity to access our qualifications and assessment, and that our qualifications are awarded in a way that is fair to every learner.

OCN NI is committed to making sure that:

- learners with a protected characteristic are not, when they are undertaking one of our qualifications, disadvantaged in comparison to learners who do not share that characteristic

- all learners achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers

For information on reasonable adjustments and special considerations please see the OCN NI Centre Handbook and Reasonable Adjustments and Special Considerations Policy held in the back office of the OCN NI website.

12.5 Retention of Evidence

OCN NI has published guidance for centres on the retention of evidence. Details are provided in the OCN NI Centre Handbook and can be accessed via the OCN NI website.

OCN NI Level OCN NI Level 2 Diploma in Engineering
Qualification Number: 610/2947/6

Operational start date: 15 July 2023
Operational end date: 14 July 2028
Certification end date: 14 July 2030

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12.6 Appendix 1 - Definition of OCN NI's Assessment Verbs

The following verbs are working definitions of those used in OCN NI assessments with examples of how they can be applied and used in different but equally valid contexts.

Verb	Definition	Example
Analyse	To examine closely and break into components to enable results to be interpreted and findings presented	The learner will be expected to perform a critical process which will involve closely examining data, breaking it into meaningful components, interpreting the results, and presenting clear findings to inform future decisions and / or draw meaningful conclusions.
Apply	To effectively utilize information, items, or equipment to achieve specific objectives, produce tangible outcomes, or enhance understanding.	The learner will be expected to understand and use information, items, or equipment to complete tasks accurately, solve problems, and achieve specific goals efficiently and effectively in practical situations. This involves combining various resources to create coherent and effective outcomes. The learner demonstrates efficiency in using the resources, minimising waste and maximising effectiveness. This involves planning, organising, and executing tasks in a streamlined manner.
Assemble	To put together various components or parts to create a complete and functional item or piece of equipment	The learner will be expected to understand and prepare components, follow instructions, use tools correctly, check quality, and solve problems to assemble parts into a complete and functional item. The learner addresses any issues or obstacles that arise during assembly. This involves identifying problems, finding solutions, and making adjustments as needed
Bend and form	To shape and manipulate materials or items using appropriate techniques and tools to produce a desired outcome or item.	The learner will be expected to have a clear understanding of the properties and characteristics of the materials they are working with. This involves knowing how the materials respond to bending and forming processes. The learner demonstrates proficiency in the techniques required for bending and forming. This includes understanding and applying the correct methods, such as heating, pressing, or using specific tools to achieve the desired shape. The learner must use appropriate tools and equipment for the bending and forming processes. This involves selecting the right tools,

		handling them correctly, and ensuring they are in good working condition. The learner performs the bending and forming tasks with accuracy and precision. This involves carefully measuring, aligning, and shaping the materials to meet the specifications and desired outcome. The learner adheres to safety protocols and practices to prevent injuries and accidents. This includes wearing personal protective equipment (PPE), using tools safely, and maintaining a clean and organised workspace. The learner inspects the final product to ensure it meets the required standards and specifications. This involves checking for defects, ensuring the shape and dimensions are correct, and making any necessary adjustments.
Calibrate	To adjust, set, and validate equipment to ensure accurate and precise measurements or performance, in order to produce high-quality items.	The learner will be expected to comprehend the specific calibration requirements for the equipment being used. This involves understanding the equipment specifications, preparing and adjusting equipment accurately making precise adjustments to settings, controls, or components to achieve accurate measurements, validating performance with tests, documenting the process, and regularly checking to maintain calibration.
Carry out	To effectively utilise information, items, or equipment to achieve specific objectives, produce tangible outcomes, or enhance understanding.	The learner will be expected to comprehend the information, items, or equipment they are required to use. This involves understanding the purpose, function, and relevance of the resources. The learner must carry out tasks using the information, items, or equipment to produce specific results. This involves following procedures accurately and demonstrating the ability to use resources effectively. The learner uses the resources to address challenges and find solutions. This involves planning, organising, and executing tasks in a streamlined manner.
Check	To inspect, verify, and confirm the accuracy, functionality, and suitability of information, items, or equipment to ensure the quality and reliability of produced items or informed understanding.	The learner will be expected to thoroughly inspect and test information, items, or equipment, ensuring accuracy, functionality, and readiness, and document the process and results to meet required standards. This involves cross-referencing with reliable sources, guidelines, or standards to confirm that they meet the required criteria and are fit for purpose.

Compare	To examine and evaluate the similarities and differences between information, items, or equipment in order to enhance understanding and make informed decisions.	The learner will be expected to identify the specific information, items, or equipment to be compared. This involves selecting relevant subjects for comparison based on the task or objective. The learner analyzes the characteristics, features, and attributes of each subject. The learner identifies relevant items, analyses their features, evaluates similarities and differences, and draws conclusions to make informed decisions or solve problems.
Complete	To finish a task fully and accurately, producing items or achieving understanding as required by the task objectives.	The learner will be expected to comprehend the task's objectives and what is required to achieve them. This involves following steps accurately, managing time well, and ensuring the final product meets high standards and is completed on time. The learner pays close attention to details throughout the task. This involves being meticulous in performing each part of the task to ensure nothing is overlooked or done incorrectly. The learner produces high-quality items or achieves a thorough understanding as a result of completing the task. The learner reviews the completed task to ensure all objectives are met. This involves evaluating the output for accuracy, completeness, and quality, and making any necessary adjustments or corrections.
Configure	To set up and customise settings to optimise functionality and meet specific requirements.	The learner will be expected to adjust settings to allow the application to optimise performance and tailor functionality to specific user needs and system environments
Confirm	To verify, validate, and ensure the accuracy and correctness of information, items, or equipment to produce reliable outcomes or enhance understanding.	The learner will be expected to verify the information, items, or equipment. This involves checking against reliable sources, standards, or specifications to ensure correctness and validity. The learner validates the accuracy and functionality of the items or equipment. The learner cross-references data and documents the process and results to ensure correctness.
Connect	To join, link, or interface items or equipment correctly and securely to produce functional outcomes or enhance understanding.	The learner will be expected to have a clear understanding of the items or equipment to be connected. This involves knowing the purpose, function, and proper usage of each component. The learner prepares them properly, using correct techniques, verifying functionality to

		ensure stable and secure connections. The learner adheres to safety protocols to prevent accidents and damage. This includes wearing personal protective equipment (PPE), using tools safely, and following best practices for handling items or equipment.
Convert	To transform or change the form, function, or characteristics of information, items, or equipment to produce new items or enhance understanding.	The learner will be expected to comprehend the requirements and objectives for the conversion. This involves understanding the desired outcome and the criteria for a successful transformation. The learner must have knowledge of the processes and techniques required for conversion. This includes understanding the methods and tools necessary to perform the transformation. The learner performs the conversion accurately and systematically checking that the transformed information, items, or equipment meet the desired outcome and adhere to the specified criteria.
Cut	To accurately and safely divide, shape, or trim materials or items using appropriate tools and techniques to produce specific items or enhance understanding.	The learner will be expected to understand the properties and characteristics of the material to be cut. This involves knowing how the material behaves under different cutting conditions. The learner selects the appropriate cutting tools and equipment for the task. This includes choosing tools that are suitable for the type and thickness of the material. The learner employs correct cutting techniques to achieve precise and clean cuts. The learner adheres to safety protocols to prevent injuries and accidents. This includes wearing personal protective equipment (PPE), using tools safely, and maintaining a clean and organized workspace. The learner performs the cutting tasks with accuracy and precision to ensure they meet the required standards and specifications. This involves checking for defects, smooth edges, and correct dimensions.
Define	Description of what a term means and its application i.e. to specify meaning	The learner will be expected to explain and provide a clear definition of key terms or concepts within a subject area. This may involve describing the meaning of a specific term, concept, or idea and illustrating its application in relevant contexts. The learner should demonstrate understanding by

		accurately defining terms and their significance or relevance
Demonstrate	To undertake an activity on a system or process showing complex skills and knowledge in more than one familiar and unfamiliar area and/or contexts.	The learner will be expected to demonstrate how to use tools, equipment, applications or follow a specific process requiring them to apply theoretical knowledge or skills in real-world scenarios to demonstrate competency and practical understanding.
Describe	To paint a full picture of a concept, process or thing in words.	The learner will be expected to explore a concept, process, or object and provide a detailed verbal or written account that includes significant features, characteristics, and relevant details. The learner should be able to demonstrate the ability to convey a comprehensive understanding and include all key components, stages and/or features of concept, process, or object being described.
Design	To create a detailed plan or blueprint for an item or process, incorporating functional, aesthetic, and practical considerations to meet specific objectives.	The learner will be expected to conduct thorough research and analysis to understand the requirements, constraints, and objectives of the design. This involves gathering relevant information, identifying needs, and defining the problem to be solved. The learner generates ideas and concepts for the design. This involves brainstorming, sketching, and exploring various approaches to meet the design objectives. The learner creates a detailed plan and specifications for the design. The learner develops prototypes or models to test and refine the design. This involves creating preliminary versions of the item or process to evaluate its functionality, feasibility, and aesthetics. The learner finalizes the design, ensuring that it meets all requirements and objectives.
Determine	To ascertain or establish something precisely through examination, investigation, and/or calculation, often leading to a decision, conclusion, or resolution.	The learner will be expected to identify or decide upon specific information, outcomes, or solutions based on analysis, evidence, calculation and/or reasoning within a given context.

Develop	To create, refine, and advance an item, process, or algorithm from initial concept to a functional and optimized solution.	The learner will be expected to generate an initial concept or idea for the item, process, or algorithm. This involves identifying a problem or need and proposing an innovative solution. This includes gathering relevant information, studying existing solutions, and understanding the requirements and constraints. The learner creates detailed designs and plans for the development. The learner implements the design by constructing the item, executing the process, or coding the algorithm. The learner tests and evaluates the developed solution to ensure it meets the desired objectives and performs as expected. The learner documents the development process, including the initial concept, research, design, implementation, testing, and refinements.
Explain	Make clear a given subject matter and / or give reasons for the procedure in a given situation or regarding a given subject matter. Set out purposes or reasons to rationaise a response or action.	The learner will be expected to provide clarity on the subject, outlining the procedure or procedures associated with it, and set out reasons for its importance and / or significance. The learner will be expected to demonstrate a detailed comprehension of the subject matter.
Evaluate	An evaluation is normally detailed and provides a solution or conclusion and/or recommendation (perhaps for further exploration). An evaluation could include a comparative element and will ascertain the usefulness or contribution of each part to the whole.	The learner will be expected to assess, analyse, and form judgments about a subject, considering its merits, shortcomings, and potential improvements based on evidence and reasoning.
Form	To shape and create items or equipment using appropriate techniques and tools to achieve specific outcomes or enhance understanding.	The learner will be expected to have a thorough understanding of the materials being used. This involves knowing the properties, characteristics, and behaviour of the materials during the forming process. The learner demonstrates proficiency in the techniques required for forming. This includes methods such as molding, shaping, bending, or assembling materials to create the desired item or equipment. The learner uses appropriate tools and equipment for the forming process. The learner performs the forming tasks with precision and accuracy. The learner adheres to safety protocols to prevent injuries and accidents. This includes wearing personal protective equipment (PPE), using tools safely, and maintaining a

		clean and organized workspace. The learner inspects the formed items to ensure they meet the required standards and specifications.
Identify	To select and list appropriate items from information that you have been given or collected.	The learner will be expected to review a set of data, information or items, and accurately select and list the required individual elements of data, information or items. The learner should be able demonstrate the ability to filter relevant information from a broader set, showing comprehension and attention to detail.
Illustrate	To visually or descriptively depict an item, activity, or process in a clear and detailed manner to enhance understanding and convey information effectively.	The learner will be expected to have a thorough understanding of the item, activity, or process being illustrated. This involves comprehending its components, functions, and overall purpose. The learner must ensure that the illustration is clear and detailed. This involves providing enough information to accurately represent the subject and using appropriate visual, role play or descriptive techniques to enhance clarity. The learner employs effective visual techniques, such as role play, diagrams, charts, sketches, or infographics, to depict the subject. This involves choosing the appropriate method to best convey the information. The learner uses descriptive language to complement the visual elements. This involves providing explanations, annotations, or labels to enhance the understanding of the illustration. The learner ensures that the illustration is accurate and free from errors.
Implement	To effectively carry out and execute processes, procedures, or plans, ensuring they are completed as intended	The learner will be expected to have a clear comprehension of the process or procedure to be implemented. This involves understanding the steps, objectives, and expected outcomes. The learner must develop a plan to execute the process. This involves organising resources, setting timelines, and preparing for potential challenges. The learner must carry out the process according to the plan. This involves following the steps meticulously and ensuring that each action is performed correctly.

Incorporate	To integrate and combine an item, activity, or process into a broader framework or system to enhance functionality and achieve specific objectives.	The learner will be expected to comprehend the broader framework or system into which the item, activity, or process will be incorporated. This involves understanding the purpose, objectives, and how the new element fits within the existing structure. The learner demonstrates the ability to effectively integrate the item, activity, or process. The learner adapts the item, activity, or process to fit within the broader framework. This involves making necessary modifications or adjustments to ensure alignment and functionality. The learner coordinates with other components or stakeholders to ensure smooth incorporation. This involves effective communication, collaboration, and alignment of efforts. The learner evaluates the incorporation process to ensure it achieves the desired outcomes.
Install	To set up, configure, and establish an item, activity, or process to ensure it functions correctly and meets required standards.	The learner will be expected to comprehend the installation instructions and specifications. This involves reading and interpreting manuals, guidelines, or blueprints to understand the requirements and steps for installation. The learner prepares the environment and resources for installation. This includes gathering necessary tools and equipment, ensuring the workspace is ready, and verifying that all components are available. The learner performs the installation accurately and systematically. The learner verifies the installation to ensure it functions correctly and meets required standards. This involves testing the installation, checking for errors, and making any necessary adjustments. The learner documents the installation process and outcomes.
Interpret	To analyze, explain, and make sense of information to enhance understanding and inform decisions or actions.	The learner will be expected to comprehend the information being interpreted. This involves understanding the content, context, and relevance of the information.The learner analyzes the information to identify key points, patterns, and relationships. This involves breaking down complex information into manageable parts and examining it critically. The learner explains the information in a clear and coherent manner. This involves communicating the meaning, implications, and significance of the information to others.The

		learner places the information within the appropriate context. This involves understanding how the information relates to broader concepts, situations, or fields of study. The learner applies the interpreted information to inform decisions, actions, or further understanding. This involves using the insights gained from interpretation to solve problems, make informed choices, or deepen knowledge.
Machine	To use machinery and tools to shape, cut, and finish materials to specified dimensions and tolerances, producing precise and functional items.	The learner will be expected to have a thorough understanding of the machinery and tools being used. This involves knowing the functions, capabilities, and limitations of each machine and tool. The learner must understand the properties and characteristics of the materials being machined. This involves knowing how different materials respond to machining processes. The learner sets up and calibrates the machinery correctly. The learner demonstrates proficiency in machining techniques. This includes operations such as cutting, drilling, milling, turning, and grinding, using appropriate methods to achieve precise results. The learner adheres to safety protocols to prevent injuries and accidents. This includes wearing personal protective equipment (PPE), following safety guidelines, and maintaining a clean and organized workspace. The learner inspects the machined items to ensure they meet the required standards and specifications. The learner is able to identify and resolve issues that arise during machining.
Make	To create, construct, or assemble items using appropriate materials, tools, and techniques to achieve a specific purpose or outcome.	The learner will be expected to plan and prepare for the making process. This involves understanding the requirements, gathering necessary materials and tools, and organising the workspace. The learner selects appropriate materials for the item being made. The learner demonstrates proficiency in using the required tools. This includes selecting the right tools, handling them correctly, and ensuring they are in good working condition. The learner carries out the making process accurately and systematically. The learner inspects the final product to ensure it meets the required standards and specifications. This

		involves checking for defects, ensuring functionality, and making any necessary adjustments. The learner adheres to safety protocols throughout the making process. This includes wearing personal protective equipment (PPE), using tools safely, and maintaining a clean and organised workspace.
Mark out	To delineate and define specific areas, items, or processes using appropriate tools and techniques to ensure accuracy and precision in subsequent steps.	The learner will be expected to comprehend the specifications and requirements for the marking out task. This involves understanding the dimensions, shapes, and reference points that need to be marked. The learner prepares the materials, tools, and workspace for marking out. This includes gathering necessary tools such as rulers, squares, compasses, markers, and ensuring a clean and organized workspace. The learner takes precise measurements to ensure that the markings are accurate. The learner employs proper marking techniques to delineate the item, area, activity, or process. The learner verifies the markings to ensure they are accurate and meet the required standards. The learner adheres to safety protocols during the marking out process. This includes using tools safely, wearing personal protective equipment (PPE), and maintaining a tidy workspace.
Modify	To change, adapt, or improve an item, activity, or process to meet specific requirements, enhance functionality, or achieve desired outcomes.	The learner will be expected to have a thorough understanding of the original item, activity, or process. This involves knowing its components, purpose, and current functionality. The learner identifies specific areas or aspects that need modification. The learner creates a detailed plan for the modifications. This includes outlining the changes to be made, the methods and tools to be used, and the expected outcomes. The learner performs the modifications accurately and systematically. The learner tests and evaluates the modified item, activity, or process to ensure it meets the desired outcomes. The learner documents the modification process and outcomes.

Mount	To fix, attach, or position items or tools securely and accurately as part of an activity, ensuring they are functional and properly aligned	The learners will be expected to comprehend the specific requirements and objectives for the mounting task. The learner prepares the items or tools to be mounted and the surface or structure to which they will be attached. This includes gathering necessary tools, ensuring a clean and stable mounting area, and verifying that all components are available. The learner selects the correct mounting method and materials. The learner positions the items or tools accurately in the desired location. The learner securely attaches the items or tools using the chosen mounting method. This involves ensuring that the items or tools are firmly fixed and stable, with no risk of displacement or detachment. The learner adheres to safety protocols throughout the mounting process. This includes wearing personal protective equipment (PPE), using tools safely, and maintaining a clean and organised workspace.
Outline	To give general idea and overview without going into detail.	The learner will be expected to review a topic or concept and provide a brief summary that highlights the main points or key elements, without delving into detailed explanations or analysis. The learner should be able to demonstrate the ability to understand and convey the essence of a subject clearly and concisely.
Perform	To execute and carry out a specific activity or process effectively and efficiently to achieve a desired outcome.	The learner will be expected to comprehend the instructions or guidelines related to the activity or process. This involves understanding the steps, objectives, and expected outcomes. The learner prepares for the activity or process by organizing necessary resources, materials, and tools. The learner carries out the activity or process according to the instructions or plan. The learner applies relevant skills and knowledge during the performance of the activity or process. This involves using techniques and methods appropriate to the task. The learner manages their time effectively to complete the activity or process within the given timeframe. The learner evaluates the results of the activity or process to ensure that the objectives are met. This involves

		assessing the quality of the produced items or the accuracy of the understanding gained.
Plan	To create a detailed strategy or roadmap for an activity or process, outlining the necessary steps, resources, and timeline to achieve specific objectives.	The learner will be expected to identify clear and specific objectives for the activity or process. The learner conducts thorough research and analysis to inform the planning process. This includes gathering relevant information, studying existing solutions, and understanding constraints and opportunities. The learner identifies and allocates the necessary resources, such as materials, tools, personnel, and budget. The learner creates a detailed step-by-step plan outlining the tasks and activities needed to achieve the objectives. The learner assesses potential risks and develops strategies to mitigate them. The learner develops a timeline and schedule for the activity or process. The learner documents the planning process and the final plan. This includes recording the objectives, research findings, resource allocations, steps, risk assessments, and timelines to provide a clear and comprehensive guide.
Prepare	To gather necessary materials, plan steps, and organise resources in advance to ensure readiness for a task or activity, following specified procedures and guidelines	The learner will be expected to organise and arrange the necessary components or materials, create a step-by-step plan, and ensure all resources are available and ready for a specific task or activity. The learner will be able to demonstrate the ability to systematically plan ahead, coordinate elements effectively, and adhere to any required guidelines or protocols demonstrating readiness and a clear understanding of the preparation process required for successful task completion.
Present	To effectively communicate and display information or items in a clear, organized, and engaging manner to enhance understanding and convey key messages to an audience.	The learner will be expected to have a thorough understanding of the content being presented. This involves knowing the key points, data, or items and their significance. The learner organises the content logically and coherently. This involves structuring the presentation in a way that flows naturally and is easy for the audience to follow. The learner ensures that the presentation is clear and easy to understand. The learner engages the audience through effective communication techniques. The learner effectively uses visual aids, such as

		slides, charts, diagrams, or props, to enhance the presentation. The learner presents with confidence and delivers the content smoothly. The learner is able to respond to questions and engage in discussions with the audience.
Print	To use printing technologies and techniques to produce physical or digital copies of information or items, ensuring clarity, accuracy, and quality to meet specific objectives.	The learner will be expected to comprehend the specific requirements and objectives for the printing task. This involves understanding the type of information or items to be printed, the desired format, and the quality standards. The learner prepares the content and equipment for printing. The learner selects the appropriate printing technique and method. This involves choosing between different types of printers (e.g., inkjet, laser, 3D printers) and techniques (e.g., digital printing, screen printing) based on specific requirements. The learner carries out the printing process accurately and systematically. This involves setting up the printer, configuring the print settings, and initiating the print job to produce the desired output. The learner inspects the printed items to ensure they meet the required standards and specifications. The learner identifies and resolves any issues that arise during the printing process.
Produce	To create, generate, or fabricate items or information through appropriate processes and techniques to meet specified objectives and quality standards.	The learner will be expected to comprehend the requirements and objectives for the production task. This involves understanding the specifications, desired outcomes, and quality standards. The learner plans and prepares for the production process. This includes organising necessary resources, materials, tools, and setting up the workspace. The learner selects the appropriate materials needed for production. The learner executes the production process accurately and systematically. The learner inspects the produced items or information to ensure they meet the required standards and specifications.
Prove (computer program)	To demonstrate that a computer program or algorithm operates correctly and meets the specified requirements by systematically testing, verifying, and validating its functionality, logic, and performance.	The learner will be expected to comprehend the specifications and requirements of the computer program. This involves understanding the desired functionality, expected behavior, and performance criteria. The learner employs appropriate testing methodologies to evaluate the program. The learner develops comprehensive test cases based on the program's

		requirements. The learner executes the tests systematically and records the results. This involves running the program with various test cases, observing its behavior, and documenting the outcomes. The learner analyzes the test results to verify that the program meets the requirements. The learner identifies and resolves any issues or bugs that arise during testing. This involves debugging the program, making necessary corrections, and refining the code to ensure it operates as intended. The learner documents the proof process and outcomes.
Research	To systematically investigate and study materials and sources in order to establish facts and reach new conclusions.	The learner will be expected to conduct a structured and methodical approach to defining objectives, gathering data from various sources, systematically investigating and analysing that data, establishing facts, and reaching new conclusions that can inform decision-making and program development
Save and store (computer files)	To correctly and securely save digital files or data and store them in an appropriate and organized manner, ensuring accessibility and protection against loss or damage.	The learner will be expected to comprehend different file types and formats, and their appropriate uses. This involves knowing the characteristics and requirements of various file formats. The learner performs the action of saving files accurately. This includes using the correct file naming conventions, choosing the appropriate location for saving, and ensuring the files are saved in the correct format. The learner organises saved files in a logical and structured manner. The learner implements security measures to protect saved and stored files. The learner establishes and follows backup procedures to ensure data protection. The learner ensures that saved and stored files are easily retrievable and accessible
Select	To choose and identify the most appropriate items or information from a range of options based on specific criteria, relevance, and requirements.	The learner will be expected to comprehend the criteria and requirements for selection. This involves understanding the specific attributes, qualities, or characteristics that are important for the task. The learner conducts research and gathers a range of potential items or information. The learner evaluates the available options against the selection criteria. This involves comparing and contrasting different items or pieces of information to determine their suitability. The learner makes informed decisions based on their evaluation. The learner ensures that the selected items or information are accurate and

		relevant to the task. This involves verifying the validity and reliability of the chosen options.
Set up	To arrange, configure, and prepare equipment, items, or information for use, ensuring functionality, efficiency, and readiness for the intended purpose.	The learner will be expected to comprehend the specific requirements and objectives for the set-up task. This involves understanding the purpose, desired outcome, and any relevant instructions or guidelines. The learner prepares the equipment, items, or information for set-up. The learner configures the equipment, items, or information according to the specified requirements The learner calibrates and tests the set-up to ensure it functions correctly. The learner adheres to safety protocols during the set-up process. This includes following safety guidelines, using personal protective equipment (PPE), and ensuring a safe and organized workspace. The learner documents the set-up process and outcomes.
Summarise	To provide a brief account giving the main points of a topic or range of topics.	The learner will be expected to examine a topic or set of information and condense it into a concise summary that captures the essential points, themes, or arguments, without including unnecessary details. The learner should be able to demonstrate the ability to distill complex or extensive information into its core components and present it in a clear and coherent manner focusing on the most significant aspects and omitting extraneous details.
Test	Undertake a process of evaluating and verifying that a system or application performs as required, showing complex skills and knowledge in more than one familiar and unfamiliar area and/or context.	The learner will be expected to conduct a thorough evaluation process requiring a deep understanding of both the system or application itself and its intended purpose. Testing is intended to provide findings to verify the system or application performs as intended and / or identify areas for improvement. This may involve an iterative process of making adjustments in light of test findings and subsequent testing.

Transfer (computer files)	To move or copy files from one location, device, or format to another, ensuring accuracy, security, and proper organization throughout the process.	The learner will be expected to comprehend the specific requirements and objectives for the file transfer. This involves understanding the source and destination, file types, and any constraints or conditions. The learner prepares for the transfer by organising the files and ensuring they are ready for the move. The learner selects the appropriate method for transferring the files. This involves choosing between different transfer methods, such as USB drives, cloud storage, network transfers, or email, based on the specific needs and limitations. The learner carries out the transfer process accurately and systematically. The learner verifies that the files have been successfully transferred. The learner adheres to security protocols during the transfer process. The learner documents the transfer process and outcomes.
Use	Operate a system or process showing skills and knowledge in more than one area and/or contexts and generally carried out on at least three occasions.	The learner will be expected to use a system, process or tool in a practical assessment activity requiring them to apply theoretical knowledge or skills in real-world scenarios to demonstrate competency and understanding.
Weld	To join materials, typically metals or thermoplastics, by using heat, pressure, or a combination of both to create a strong, permanent bond.	The learner will be expected to comprehend the fundamental principles of welding. This includes understanding different welding processes (e.g., MIG, TIG, arc welding), heat sources, and the characteristics of materials being welded. The learner prepares the materials and workspace for welding. The learner selects the appropriate welding technique and settings for the task. The learner performs the welding process accurately and systematically. This involves controlling the welding arc, maintaining the correct travel speed, and ensuring consistent weld quality throughout the process. The learner adheres to safety protocols to prevent injuries and accidents. This includes wearing personal protective equipment (PPE) such as welding helmets, gloves, and aprons, and following safety guidelines to protect against burns, fumes, and electrical hazards. The learner inspects the welded joints to ensure they meet the required standards and specifications.

Wire up	To connect electrical components or equipment using appropriate wiring techniques and tools to ensure safe and functional operation.	The learner will be expected to comprehend the basic principles of electricity and circuitry. This involves understanding concepts such as voltage, current, resistance, and the function of different electrical components. The learner interprets electrical schematics and diagrams to understand the wiring configuration. The learner selects the appropriate materials and tools for the wiring task. The learner performs wiring connections accurately and systematically. The learner adheres to safety protocols to prevent electrical hazards. This includes turning off power sources before working on wiring, wearing personal protective equipment (PPE), and following safety guidelines to avoid electric shocks and fires. The learner tests and verifies the wired connections to ensure proper functionality. This involves using testing equipment, such as multimeters, to check for continuity, voltage levels, and correct operation of the components. The learner identifies and resolves any issues that arise during the wiring process.