ETCAL Level 3 NVQ Diploma in Engineering Technical Support 601/1821/0
Assessment

Diploma - Assessment Principles

Introduction

ETA qualifications are developed in conjunction with the industries and employers they service. They are designed to add value and deliver multidimensional outputs that provide impact for both learners and employers.

It is therefore important that the assessment requirements of ETA qualifications are robust whilst not containing unnecessary and over-burdensome challenges that detract from the intended outcomes and impact. These assessment principles are prepared with that in mind and are applicable to this qualification:

Level 3 NVQ Diploma in Engineering Technical Support

Principles

There are four key principles to underpin assessment delivery:

1. Assessment should contribute to developing a learner's knowledge and/or skills and provide relevant and current development as the related industry requires.

2. Systems for capturing evidence of competence should be integrated and efficient. Assessment practices for both competence-based and knowledge-based aspects of qualifications should, where possible, be integrated with industry driven standards and requirements.

3. Assessment methods must be appropriate for the level and nature of the qualification units to be assessed. Methods of assessing achievement against learning outcomes and assessment principles must be accommodating and flexible, whilst remaining appropriate for both the level being assessed and industry expectations of learners at that level.

4. Evidence of knowledge and understanding must be recorded and be clearly attributable to the learner. This can be delivered using task based activity with questions and answer sessions, supported by assessor observation.

The choice and application of assessment methods must be consistent with these principles and will generally include:

- Direct Observation
- Written evidence (portfolio/workbook)
- Centre set assignment
- Centre set coursework
- Oral examination
- Professional/open discussion

Delivery Team Requirements

Tutors / Assessors

- Tutors / Assessors should have a detailed knowledge of, and be competent in, the occupational requirements of the units
- Tutors / Assessors should hold or be working towards the related professional qualifications for delivery and assessment as required
- This competence will have been acquired either in direct employment in the occupational role to which the unit relates, or in employment as a manager, supervisor or in-house trainer of employees carrying out the role
- It is unlikely that occupational competence will have been achieved in less than twelve months of employment but individuals with less experience could be considered as assessors if sufficiently occupationally competent

Internal Quality Assurers (IQAs)

- IQAs must have a thorough understanding of the structure, content and occupational requirements of the units that they are internally quality assuring. This understanding will have been acquired while either working directly within or delivering within the relevant occupational area in either an operational or a support function
- The level of understanding must be sufficient to allow the IQA to judge whether the assessor has fully assessed learners against all the principles within the unit
- It is unlikely that a person could have gained this level of understanding in less than twelve months of being employed but individuals with less experience could be considered as IQAs if they have the required level of experience, knowledge and understanding.

Technical / Expert Witness

Expert witnesses can be drawn from a wide range of people who can observe, 'measure and examine performance against the industry and qualification principles. These can include line managers and experienced individuals within a related sector-based organisation. The Technical Expert Witnesses should have proven practical experience and knowledge relating to the content of the principles being assessed.

It is unlikely that someone could become an expert in their entire job role in less than twelve months of being employed in their industry. They could, however, very quickly become an expert in the content of a single unit if this was the focus of their job role. The assessor should make a

judgement as to the level of expertise held by a potential Technical Expert Witness and, where necessary, this should be confirmed with the awarding organisation.

Assessment Materials

ETC Awards Ltd. (ETA) Assessment Materials are protected by copyright and are supplied only to Approved Centres for use solely for the purpose of the assessment of ETA learners.

Instructions for Conducting Assessment

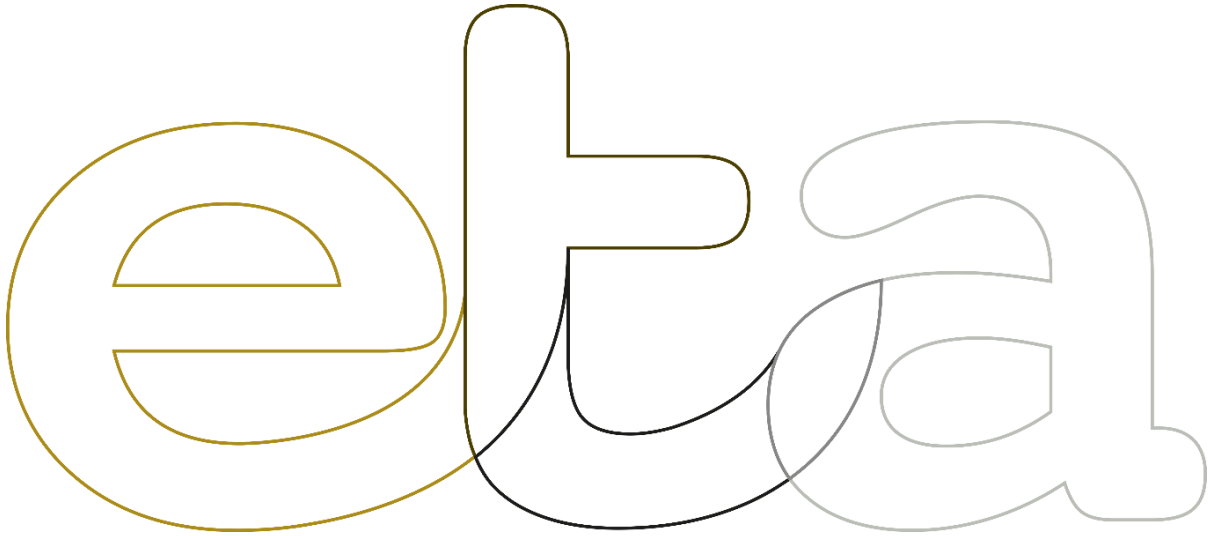
the Approved Centre must either:

- secure approval of in-house assessment material by ETA's External Quality Assurance team prior to use
- use ETA Assessment Materials
- we recognise that reasonable adjustments may be considered at the time of assessment, please refer to the ETA Reasonable adjustments and considerations policy

All approved centres must then handle and store securely all Assessment Materials in accordance with the following:

- Assessment Material must be accessible to learners only during their programme
- The Approved Centre must not make public in any format the contents of any materials either in part or in full.
- Materials must be securely handled and under no circumstances shared with third party organisations or individuals
- The Approved Centre must seek permission from ETA through the External Quality Assurance team if they want to convert Material for alternative storage, retrieval and delivery in electronic formats.

All centre based assessment material must be agreed with ETA prior to use and will be subject to robust monitored during sampling and verification activity.



Level 3 Unit – Complying with Statutory Regulations and Organisational Safety Requirements

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to deal with statutory regulations and organisational safety requirements. It does not deal with specific safety regulations or detailed requirements, it does, however, cover the more general health and safety requirements that apply to working in an industrial environment.

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

The learner will also be required to identify the hazards and risks that are associated with their job. Typically, these will focus on their working environment, the tools and equipment that they use, the materials and substances that they use, any working practices that do not follow laid-down procedures, and manual lifting and carrying techniques.

Unit introduction

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

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		A/601/5013
Qualification Framework		QCF
Title		Complying with Statutory Regulations and Organisational Safety Requirements
Unit Level		Level 4
Guided Learning Hours		35
Unit Credit Value		5
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Complying with Statutory Regulations and Organisational Safety Requirements	1.01	Comply with their duties and obligations as defined in the Health and Safety at Work Act	
		1.02	Demonstrate their understanding of their duties and obligations to health and safety by: • applying in principle their duties and responsibilities as an individual under the Health and Safety at Work Act • identifying, within their organisation, appropriate sources of information and guidance on health and safety issues, such as: • eye protection and personal protective equipment (PPE) • COSHH regulations • Risk assessments • identifying the warning signs and labels of the main groups of hazardous or dangerous substances • complying with the appropriate statutory regulations at all times	
		1.03	Present themselves in the workplace suitably prepared for the activities to be undertaken	
		1.04	Follow organisational accident and emergency procedures	
		1.05	Comply with emergency requirements, to include: • identifying the appropriate qualified first aiders and the location of first aid facilities • identifying the procedures to be followed in the event of injury to themselves or others • following organisational procedures in the event of fire and the evacuation of premises • identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions of equipment	

		1.06	Recognise and control hazards in the workplace	
		1.07	Identify the hazards and risks that are associated with the following: • their working environment • the equipment that they use • materials and substances (where appropriate) that they use • working practices that do not follow laid down procedures	
		1.08	Use correct manual lifting and carrying techniques	
		1.09	Demonstrate one of the following methods of manual lifting and carrying: • lifting alone • with assistance of others • with mechanical assistance	
		1.10	Apply safe working practices and procedures to include: • maintaining a tidy workplace, with exits and gangways free from obstruction • using equipment safely and only for the purpose intended • observing organisational safety rules, signs and hazard warnings • taking measures to protect others from any harm resulting from the work that they are carrying out	

Level 3 Unit – Using and Interpreting Engineering Data and Documentation

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to make effective use of text, numeric and graphical information, by interpreting and using technical information extracted from documents such as engineering drawings, technical manuals, reference tables, specifications, technical sales/marketing documentation, charts or electronic displays, in accordance with approved procedures. The learner will be required to extract the necessary information from the various documents, in order to establish and carry out the work requirements, and to make valid decisions about the work activities based on the information extracted.

Unit introduction

The learner's responsibilities will require them to comply with organisational policy and procedures for obtaining and using the documentation applicable to the activity. They will be expected to report any problems with the use and interpretation of the documents that they cannot personally resolve, or are outside their permitted authority, to the relevant people. They will be expected to work to instructions if necessary, with an appropriate level of supervision or as a member of a team and take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		Y/601/5012
Qualification Framework		QCF
Title		Using and Interpreting Engineering Data and Documentation
Unit Level		Level 3
Guided Learning Hours		25
Unit Credit Value		5
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Using and Interpreting Engineering Data and Documentation	1.01	Use the approved source to obtain the required data and documentation	
		1.02	Use the data and documentation and carry out **all** of the following: • check the currency and validity of the data and documentation used • exercise care and control over the documents at all times • correctly extract all necessary data in order to carry out the required tasks • seek out additional information where there are gaps or deficiencies in the information obtained • deal with or report any problems found with the data and documentation • make valid decisions based on the evaluation of the engineering information extracted from the documents • return all documents to the approved location on completion of the work • complete all necessary work related documentation such as production documentation, installation documentation, maintenance documentation, planning documentation	
		1.03	Correctly identify, interpret and extract the required information	
		1.04	Extract information that includes **three** of the following: • materials or components required • dimensions • tolerances • build quality • installation requirements • customer requirements • time scales • financial information	

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

			• other specific drawings/documents	
		1.07	Use information extracted from related documentation, to include **two** from the following: • instructions (such as job instructions, drawing instructions, manufacturers instructions) • specifications (such as material, finish, process, contractual, calibration) • reference materials (such as manuals, tables, charts, guides, notes) • schedules • operation sheets • service/test information • planning documentation • quality control documents • company specific technical instructions • national, international and organisational standards • health and safety standards relating to the activity (such as COSHH) • other specific related documentation	
		1.08	Deal promptly and effectively with any problems within their control and report those which cannot be solved	
		1.09	Report any inaccuracies or discrepancies in documentation and specifications	

Level 3 Unit – Working Efficiently and Effectively in Engineering

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to work efficiently and effectively in the workplace, in accordance with approved procedures and practices. Prior to undertaking the engineering activity, the learner will be required to carry out all necessary preparations within the scope of their responsibility. This may include preparing the work area and ensuring that it is in a safe condition to carry out the intended activities, ensuring they have the appropriate job specifications and instructions and that any tools, equipment, materials and other resources required are available and in a safe and usable condition.

On completion of the engineering activity, the learner will be required to return their immediate work area to an acceptable condition before recommencing further work requirements. This may involve placing completed work in the correct location, returning and/or storing any tools and equipment in the correct area, identifying any waste and/or scrapped materials and arranging for their disposal, and reporting any defects or damage to tools and equipment used.

In order to be efficient and effective in the workplace, the learner will also be required to demonstrate that they can create and maintain effective working relationships with colleagues and line management. The learner will also be expected to review objectives and targets for their personal development and make recommendations to, and communicate any opportunities for, improvements that could be made to working practices and procedures.

Unit introduction

The learner's responsibilities will require them to comply with organisational policy and procedures for the engineering activities undertaken, and to report any problems with the activities, or the tools and equipment that are used that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to working efficiently and effectively in an engineering environment. The learner will understand the need to work efficiently and effectively, and will know about the areas they need to consider when preparing and tidying up the work area, how to contribute to improvements, deal with problems, maintain effective working relationships and agree their development objectives and targets, in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

The learner will understand the safety precautions required when carrying out engineering activities. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		K/601/5055
Qualification Framework		QCF
Title		Working Efficiently and Effectively in Engineering
Unit Level		Level 3
Guided Learning Hours		25
Unit Credit Value		5
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Working Efficiently and Effectively in Engineering	1.01	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.02	Prepare the work area to carry out the engineering activity	
		1.03	Prepare to carry out the engineering activity, taking into consideration **all** of the following, as applicable to the work to be undertaken: • the work area is free from hazards and is suitably prepared for the activities to be undertaken • any required safety procedures are implemented • any necessary personal protection equipment is obtained and is in a usable condition • tools and equipment required are obtained and checked that they are in a safe and useable condition • all necessary drawings, specifications and associated documentation is obtained • job instructions are obtained and understood • the correct materials or components are obtained • storage arrangements for work are appropriate • appropriate authorisation to carry out the work is obtained	
		1.04	Check that there are sufficient supplies of materials and/or consumables and that they meet work requirements	
		1.05	Ensure that completed products or resources are stored in the appropriate location on completion of the activities	
		1.06	Complete work activities, to include **all** of the following: • completing all necessary documentation accurately and legibly • returning tools and equipment • returning drawings and work instructions • identifying, where appropriate, any unusable tools, equipment or components • arranging for disposal of waste materials	

		1.07	Tidy up the work area on completion of the engineering activity	
		1.08	Deal promptly and effectively with problems within their control and report those that cannot be resolved	
		1.09	Deal with problems affecting the engineering process, to include **two** of the following: • materials • tools and equipment • drawings • job specification • quality • people • timescales • safety • activities or procedures	
		1.10	Contribute to and communicate opportunities for improvement to working practices and procedures	
		1.11	Make recommendations for improving to **two** of the following: • working practices • working methods • quality • safety • tools and equipment • supplier relationships • internal communication • customer service • training and development • teamwork • other	
		1.12	Maintain effective working relationships with colleagues to include **two** of the following: • colleagues within own working group • colleagues outside normal working group • line management • external contacts	
		1.13	Review personal training and development as appropriate to the job role	
		1.14	Review personal development objectives and targets to include **one** of the following: • dual or multi-skilling • training on new equipment / technology • increased responsibility • understanding of company working practices, procedures, plans and policies • other specific requirements	

Level 3 Unit – Producing Mechanical Engineering Drawings using Computer Aided Techniques

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to set up and operate a computer aided drawing (CAD) system to produce fully detailed drawings for mechanical engineering activities, in accordance with approved procedures. The drawings produced will include detail component drawings for manufacturing, assembly and sub-assembly drawings, installation drawings, and fault location aids such as flow diagrams and modification drawings. The learner will be given a detailed drawing brief or a request for change/modification order and will be required to access these requirements and to extract all necessary information in order to carry out the drawing operations. The learner will need to select the appropriate equipment and drawing software to use, based on the type and complexity of the drawing functions to be carried out. The learner will be expected to use current British, European, International and company standards to produce a drawing template, for a range of paper sizes, that must include the drawing title, scale used, date of drawing, material to be used and other relevant information. The learner will then be expected to produce fully detailed drawings to enable the manufacture, assembly, installation or modification of the product to take place.

Unit introduction

The learner's responsibilities will require them to comply with organisational policy and procedures for working in the drawing office or CAD suite. The learner will be required to report any problems with the computer hardware, software or drawing procedures that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to verbal/written instructions and draught specifications, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner knowledge will provide a good understanding of their work and will provide an informed approach to applying computer aided drawing procedures for mechanical engineering drawings. The learner will understand the computer system and software used, and its application, and will know about the various tools and techniques used to produce the drawings, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the computer drawing system. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		H/600/5415
Qualification Framework		QCF
Title		Producing Mechanical Engineering Drawings using Computer Aided Techniques
Unit Level		Level 3
Guided Learning Hours		294
Unit Credit Value		150
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Mechanical Engineering Drawings using Computer Aided Techniques	1.1	Prepare the CAD system for operation by carrying out all of the following: • check that all the equipment is correctly connected and is in a safe and usable condition (cables undamaged, correctly connected, safely routed) • power up the equipment and activate the drawing software • set up the drawing system to be able to produce the drawing to the appropriate scale • set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitiser/tablet, scanner, printer, plotter) • set the drawing datum at a convenient point (where applicable) • set up drawing parameters to include layers, line types, colour, text styles, to company procedures or to suit the drawing produced • create a drawing template to the required standards, which includes all necessary detail (such as title, drawing number, scale, material, date, etc)	
		1.2	Carry out all of the following before producing the engineering drawing: • ensure that data and information is complete and accurate • review the data and information to identify the drawing requirements • recognise and deal with problems (information based and technical)	
		1.3	Use three of the following to obtain the necessary data to produce the required drawings: • drawing brief/request • change order/modification request • manuals • calculations • sketches • specifications • regulations • sample component	

			• previous drawings/designs • other available data • standards reference documents (such as limits and fits, tapping drill charts) • notes from meetings/discussions	
		1.4	Produce drawings that are sufficiently and clearly detailed	
		1.5	Take into account eight of the following design features, as appropriate to the drawing being produced: • function • quality • manufacturing method • ergonomics • materials • cost • lifetime of the product • tolerances • clearance • aesthetics • physical space • interfaces • operating environment • standard parts/components • safety	
		1.6	Produce two of the following types of drawing: • detail drawings • general arrangement drawings • sub-assembly drawings	
		1.7	Produce mechanical drawings which include ten of the following: • straight lines • dimensions • angled lines • text • insertion of standard components • symbols and abbreviations • curved/contour lines • circles or ellipses • geometrical tolerancing • hidden detail • sectional detail • parts lists	

			• other specific detail	
		1.8	Produce drawings in the required formats	
		1.9	Interpret and produce drawings using two of the following methods of projection: • first angle orthographic projections • isometric/oblique projections • third angle orthographic projections	
		1.10	Use codes and other references that follow the required conventions	
		1.11	Produce drawings which comply with one or more of the following: • organisational guidelines • statutory regulations and codes of practice • CAD software standards • BS and ISO standards • other international standard	
		1.12	Make sure that drawings are checked and approved within agreed timescales by authorised people	
		1.13	Ensure that drawings are properly registered and stored securely	
		1.14	Save and store drawings in the appropriate locations, to include carrying out all of the following: • ensure that their drawing has been checked and approved by the appropriate person/s • check that the drawing is correctly titled and referenced • save the drawing to an appropriate storage medium • create a separate backup copy and place it in safe storage • produce a hard copy printout of the drawing for file purposes • register and store the drawings in the appropriate company information system • where appropriate, record and store any changes to the drawings in the appropriate company information system	
		1.15	Ensure that changes are completed as required by organisational procedures	
2.	Know how to Produce Mechanical Engineering Drawings using Computer Aided Techniques	2.1	Describe the specific safety precautions to be taken when working with computer systems (to include such things as safety guidance relating to the use of visual display unit (VDU) equipment and work station environment (such as lighting, seating, positioning of equipment), repetitive strain injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections)	
		2.2	Describe the good housekeeping arrangements (such as cleaning down work surfaces; putting disks, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)	
		2.3	Describe the basic set-up and operation of the computer system, and the peripheral devices that are used (such as mouse, light pen, digitiser and tablet, printer or plotter, and scanner)	
		2.4	Describe the correct start-up and shutdown procedures to be used for the computer system	
		2.5	Explain how to access the specific computer drawing software to be used, and the use of software manuals and related documents to aid efficient operation of the relevant drawing system	

		2.6	Explain how to deal with system problems (such as error messages received, peripherals which do not respond as expected, obvious faults with the equipment or connecting leads)	
		2.7	Describe the documentation required for particular applications (such as drawing briefs, specification sheets, request for change orders)	
		2.8	Describe the types of drawings that may be produced by the software (such as first and third angle drawings, sectional elevations, isometric or oblique drawings)	
		2.9	Explain how to set up the viewing screen to show multiple views of the pattern to help with drawing creation (to include isometric front and side elevations)	
		2.10	Describe the national, international and organisational standards and conventions that are used for the drawings	
		2.11	Explain how to set up the drawing template parameters (such as layers of drawings, scale, paper size, colour set-up, line types, dimensioning system and text styles)	
		2.12	Describe the application and use of drawing tools (such as for straight lines, curves and circles; how to create hatching and shading on drawings; how to add dimensions and text to drawings, producing layers of drawings)	
		2.13	Explain how to access, recognise and use a wide range of standard components and symbol libraries from the CAD equipment	
		2.14	Describe the need for document control (such as ensuring that completed drawings are approved, labelled and stored on a suitable storage medium, the need to create backup copies and to file them in a separate and safe location away from electromagnetic sources, filing and storing hard copies for use in production)	
		2.15	Describe the procedures for drawing change notes, trial changes, up-issuing of drawings, modifications, and miscellaneous amendments to drawings	
		2.16	Describe the sources and methods for obtaining the required technical information relevant to the drawing being produced (such as limits and fits, contraction allowances, bearing selection, surface finish)	
		2.17	Describe the basic principles of engineering manufacturing operations, assembly and installation methods, and limitations of the equipment/processes that are used to produce the drawn item (such as machining methods, joining processes, fabrication, casting and forging), and how these can influence the way they present the drawing	
		2.18	Describe the functionality of the component, and its interrelationship with other components and assemblies	
		2.19	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve when producing the drawings	
		2.12	Explain how the various disposal bins can be identified (such as colour coded, labelled)	
		2.13	Explain the procedures for disposing of hazardous materials (such as chemicals, adhesives, oil, hydraulic fluids, fuel)	

Level 3 Unit – Producing Engineering Drawings/Models using 3D Computer Aided Techniques

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to set up and operate a computer aided drawing (CAD) system to produce three-dimensional (3D) drawings, in accordance with approved procedures. The learner will be given a detailed drawing brief or a request for change/modification order and will be required to access these requirements and to extract all necessary information, in order to carry out the drawing operations. The learner will need to select the appropriate equipment and drawing software to use, based on the type and complexity of the drawing functions to be carried out. The learner will be expected to set up co-ordinate systems in 3D space, set up the screen into split views to show true 3D views (isometric) and plan views. The learner will then be expected to produce both surface and solid models, and to understand their differences and applications. The learner will use boundary modelling techniques, as well as graphic primitives, to produce their models, and will apply Boolean operators to construct the solid models.

Unit introduction

The learner's responsibilities will require them to comply with organisational policy and procedures for working in the drawing office or CAD suite. The learner will be required to report any problems with the computer hardware, software or drawing procedures that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to verbal or written instructions and draught specifications, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying computer aided drawing procedures. The learner will understand the 3D CAD system and software used, and its application, and will know about the various tools and techniques used to produce the drawings, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the CAD system. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		H/600/5429
Qualification Framework		QCF
Title		Producing Engineering Drawings/Models using 3D Computer Aided Techniques
Unit Level		Level 3
Guided Learning Hours		294
Unit Credit Value		150
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Engineering Drawings/Models using 3D Computer Aided Techniques	1.1	Prepare the CAD system for operation, by carrying out all of the following: • check that all the equipment is correctly connected and is in a safe and usable condition (cables undamaged, correctly connected, safely routed) • power up the equipment and activate the drawing software • set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitiser/tablet, scanner, printer, plotter) • set up the viewing screen to show multiple views of the components (this will involve isometric, front and side elevations) • set the drawing datum at a convenient point (where applicable) • set up drawing parameters to include layers, line types, colour, text styles to company procedures or to suit the drawing produced • create a drawing template to British Standards, European or company standards, which includes all necessary detail (such as title, drawing number, scale, material, date, etc)	
		1.2	Carry out all of the following before producing the engineering drawing: • ensure that data and information is complete and accurate • review the data and information to identify the drawing requirements • recognise and deal with problems (information based and technical)	
		1.3	Use three of the following to obtain the necessary data to produce the required drawings: • drawing brief/request • change order/modification request • manuals • calculations • sketches • notes from meetings/discussions • specifications • regulations	

			• sample component • previous drawings/designs • other available data	
		1.4	Produce drawings that are sufficiently and clearly detailed	
		1.5	Take into account eight of the following, as appropriate to the drawing being produced: • function • quality • manufacturing method • ergonomics • materials • cost • lifetime of the product • tolerances • clearance • aesthetics • physical space • operating environment • interfaces • standard parts/components • safety	
		1.6	Use two of the following drawing tools: • surface modelling • solid modelling • wire frame modelling	
		1.7	Produce and modify 3D drawings, using two of the following tools and techniques: • graphic primitives • boundary techniques • surface/solid modifying tools • Boolean operators	
		1.8	Produce drawings which include ten of the following: • straight lines • dimensions • angular surfaces • text • symbols and abbreviations • insertion of standard components • curved surfaces • circles or ellipses • hidden detail	

			• hatching and shading • sectional detail • parts lists • other specific detail	
		1.9	Produce drawings in the required formats	
		1.10	Use two of the following co-ordinate measurements to produce 3D models: • cartesian • cylindrical • spherical	
		1.11	Produce drawings using two of the following methods of projection: • isometric • oblique • orthographic • perspective • planometric	
		1.12	Use codes and other references that follow the required conventions	
		1.13	Produce drawings which comply with one or more of the following: • organisational guidelines • statutory regulations and codes of practice • CAD software standards • BS and ISO standards • other international standard	
		1.14	Make sure that drawings are checked and approved within agreed timescales by authorised people	
		1.15	Ensure that drawings are properly registered and stored securely	
		1.16	Save and store drawings in the appropriate locations, to include carrying out all of the following: • ensure that their drawing has been checked and approved by the appropriate person/s • check that the drawing is correctly titled and referenced • save the drawing to an appropriate storage medium • create a separate backup copy and place it in safe storage • produce a hard copy printout of the drawing for file purposes • register and store the drawings in the appropriate company information system • record and store any changes to the drawings in the appropriate company information system	
		1.17	Ensure that changes are completed as required by organisational procedures	

2.	Know how to Produce Engineering Drawings/Models using 3D Computer Aided Techniques	2.1	Describe the specific safety precautions to be taken when working with computer systems (to include such things as safety guidance relating to the use of visual display unit (VDU) equipment and work station environment (such as lighting, seating, positioning of equipment), repetitive strain injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections)	
		2.2	Describe the good housekeeping arrangements (such as cleaning down work surfaces; putting disks, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)	
		2.3	Describe the basic set-up and operation of the 3D drawing system, and the peripheral devices that are used (such as mouse, light pen, digitiser and tablet, printer or plotter, and scanner)	
		2.4	Describe the correct start-up and shutdown procedures to be used for the computer system	
		2.5	Explain how to access the specific computer drawing software to be used, and the use of software manuals and related documents to aid efficient operation of the relevant drawing system	
		2.6	Explain how to deal with system problems (such as error messages received, peripherals which do not respond as expected, obvious faults with the equipment or connecting leads)	
		2.7	Describe the documentation required for particular applications (such as design briefs, specification sheets, request for change orders)	
		2.8	Describe the types of drawings that may be produced by the software	
		2.9	Explain how to set up the viewing screen to show multiple views of the component to help with drawing creation (to include isometric front and side elevations)	
		2.10	Describe the national, international and organisational standards and conventions that are used for the drawings	
		2.11	Explain how to set up the drawing template parameters (such as layers of drawings, scale, paper size, colour set-up, line types, dimensioning system and text styles)	
		2.12	Describe the application and use of drawing tools (such as for straight lines, curves and circles; how to create hatching and shading on drawings; producing layers of drawings)	
		2.13	Explain how to access, recognise and use a wide range of standard components and symbol libraries from the CAD equipment	
		2.14	Describe the applications of different 3D modelling programmes (such as surface, solid and wire frame)	
		2.15	Describe the different projections used to create 3D drawings (such as isometric, oblique, orthographic, perspective and planometric)	
		2.16	Describe the application of different co-ordinate measurements used to create 3D drawings (such as Cartesian, spherical and cylindrical)	

		2.17	Describe the display views that can be used on 3D drawings (such as view co-ordinate geometry and object co-ordinate geometry	
		2.18	Describe the application and use of drawing tools for surface or solid modelling; how to modify drawings using surface/solid modelling tools or Boolean operators; how to add dimensions and text to drawings	
		2.19	Describe the need for document control (such as ensuring that completed drawings are approved, labelled and stored on a suitable storage medium, the need to create backup copies and to file them in a separate and safe location away from electromagnetic sources, filing and storing hard copies for use in production)	
		2.20	Describe the procedures for drawing change notes, trial changes, up-issuing of drawings, modifications, and miscellaneous amendments to drawings	
		2.21	Describe the sources and methods for obtaining the required technical information relevant to the drawing being produced (such as limits and fits, contraction allowances, bearing selection, surface finish)	
		2.22	Describe the basic principles of engineering manufacturing operations, assembly and installation methods and limitations of the equipment/processes that are used to produce the drawn item (such as machining methods, joining processes, fabrication, casting and forging), and how these can influence the way they present the drawing	
		2.23	Describe the functionality of the component and its interrelationship with other components and assemblies	
		2.24	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve when producing the drawings	

Level 3 Unit – Producing Electrical Engineering Drawings using Computer Aided Techniques

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to set up and operate a computer aided drawing (CAD) system to produce fully detailed drawings for electrical engineering activities, in accordance with approved procedures. The types of drawing produced will include circuit and wiring diagrams, block diagrams, schematics, electrical cabling/routing, installation, assembly of panels and sub-assemblies and system design/modification. The learner will be given a detailed drawing brief or a request for change/modification order and will be required to access these requirements and to extract all necessary information in order to carry out the drawing operations. The learner will need to select the appropriate equipment and drawing software to use, based on the type and complexity of the drawing functions to be carried out. The learner will be expected to use current British, European, International and company standards to produce a drawing template, for a range of paper sizes, that must include the drawing title, scale used, date of drawing, and other relevant information. The learner will then be expected to produce fully detailed drawings to enable the electrical circuits to be assembled, installed, maintained, commissioned or modified.

Unit introduction

The learner's responsibilities will require them to comply with organisational policy and procedures for working in the drawing office or CAD suite. The learner will be required to report any problems with the computer hardware, software or drawing procedures that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to verbal/written instructions and draught specifications, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying computer aided drawing procedures for electrical engineering drawings. The learner will understand the computer system and software used, and its application, and will know about the various tools and techniques used to produce the drawings, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the computer drawing system. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		H/600/5463
Qualification Framework		QCF
Title		Producing Electrical Engineering Drawings using Computer Aided Techniques
Unit Level		Level 3
Guided Learning Hours		294
Unit Credit Value		150
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Electrical Engineering Drawings using Computer Aided Techniques	1.1	Prepare the CAD system for operation, by carrying out all of the following: • check that all the equipment is correctly connected and is in a safe and usable condition (cables undamaged, correctly connected, safely routed) • power up the equipment and activate the drawing software • set up the drawing system to be able to produce the drawing to the appropriate scale • set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitiser/tablet, scanner, printer, plotter) • set the drawing datum at a convenient point (where applicable) • set up drawing parameters to include layers, line types, colour, text styles to company procedures or to suit the drawing produced • create a drawing template to the required standards, which includes all necessary detail (such as title, drawing number, scale, material, date, etc)	
		1.2	Carry out all of the following before producing the engineering drawing: • ensure that data and information is complete and accurate • review the data and information to identify the drawing requirements • recognise and deal with problems (information based and technical)	
		1.3	Use three of the following to obtain the necessary data to produce the required drawings: • drawing brief/request • change order/modification request • manuals • calculations • sketches • specifications • electrical regulations • previous drawings/designs	

			• other available data • standards reference documents (such as current carrying capacity of cables, component catalogues) • notes from meetings/discussions	
		1.4	Produce drawings that are sufficiently and clearly detailed	
		1.5	Take into account eight of the following design features, as appropriate to the drawing being produced: • function • operating environment • types of electrical components available • position of circuit elements/components • connections between components • power supplies • method of installation (such as conduit, trunking, traywork) • type of cables (such as PVC, wire armoured, mineral insulated) • operating voltages • cost • ergonomics • lifetime of the product • aesthetics • physical space • interfaces • safety	
		1.6	Produce electrical drawings which include ten of the following: • straight lines • dimensions • angled lines • text • insertion of standard electrical components • type and size of cables • connection/termination details • electrical symbols and abbreviations • curved/contour lines • circles or ellipses • hidden detail • colour/component coding • fault diagnosis aids (such as fault trees, flow diagrams) • parts lists	

		• other specific electrical detail	
	1.7	• Produce drawings in the required formats	
	1.8	Produce two of the following types of electrical drawings: • circuit diagrams • wiring diagrams • block diagrams • schematics • system/distribution drawings • panel assembly • installation/commissioning • cabling and routeing • assembly of cable looms/harnesses	
	1.9	Use codes and other references that follow the required conventions	
	1.10	Produce drawings which comply with one or more of the following: • organisational guidelines • statutory regulations and codes of practice • CAD software standards • BS and ISO standards • other international standard	
	1.11	• Make sure that drawings are checked and approved within agreed timescales by authorised people	
	1.12	Ensure that drawings are properly registered and stored securely	
	1.13	Save and store drawings in appropriate locations, to include carrying out all of the following: • ensure that their drawing has been checked and approved by the appropriate person/s • check that the drawing is correctly titled and referenced • save the drawing to an appropriate storage medium • create a separate backup copy and place it in safe storage • produce a hard copy printout of the drawing for file purposes • register and store the drawings in the appropriate company information system • where appropriate, record and store any changes to the drawings in the appropriate company information system	
	1.14	• Ensure that changes are completed as required by organisational procedures	
2.	Know how to Produce Electrical Engineering Drawings using Computer Aided Techniques	2.1	Describe the specific safety precautions to be taken when working with computer systems to (include such things as safety guidance relating to the use of visual display unit (VDU) equipment and work station environment (such as lighting, seating, positioning of equipment), repetitive strain injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections)	

		2.2	Describe the good housekeeping arrangements (such as cleaning down work surfaces; putting disks, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)	
		2.3	Describe the basic set-up and operation of the computer system, and the peripheral devices that are used (such as mouse, light pen, digitiser and tablet, printer or plotter, and scanner)	
		2.4	Describe the correct start-up and shutdown procedures to be used for the computer system	
		2.5	Explain how to access the specific computer drawing software to be used, and the use of software manuals and related documents to aid efficient operation of the relevant drawing system	
		2.6	Explain how to deal with system problems (such as error messages received, peripherals which do not respond as expected, obvious faults with the equipment or connecting leads)	
		2.7	Describe the documentation required for particular applications (such as drawing briefs, specification sheets, request for change orders)	
		2.8	Describe the types of electrical drawings that may be produced by the software (such as circuit and wiring diagrams, block and schematic diagrams, assembly and installation drawings)	
		2.9	Describe the national, international and organisational standards and conventions that are used for the drawings	
		2.10	Explain how to set up the drawing template parameters (such as layers of drawings, scale, paper size, colour set-up, line types, dimensioning system and text styles)	
		2.11	Describe the application and use of drawing tools (such as for straight lines, curves and circles; how to add dimensions and text to drawings, producing layers of drawings)	
		2.12	Explain how to access, recognise and use a wide range of standard electrical component symbol libraries from the CAD equipment	
		2.13	Describe the factors to be taken into account when producing electrical drawings (such as safety requirements, operating parameters of components, position of components in relation to other sources or circuits, possibility of external interference, etc)	
		2.14	Describe the electrical equipment and circuits being drawn, and the function of the individual components within the circuits	
		2.15	Describe the selection of the various components and cables being used, with regard to their operating ranges and current carrying capacity	
		2.16	Describe the use of specific regulations and standard reference tables when selecting components and cables (such as IEE regulations)	
		2.17	Explain how power cables might affect/corrupt signal transmission, and the need to consider this in siting and routeing cables	
		2.18	Describe the calculations that may be required to verify the value/rating of components and circuits (such as Ohm's Law)	

		2.19	Describe the constraints laid down by existing national and international legislation, statutory and non-statutory regulations, industry and national standards, industry guidelines and professional codes that regulate electrical drawing/design activities	
		2.20	Describe the need for document control (such as ensuring that completed drawings are approved, labelled and stored on a suitable storage medium, the need to create backup copies and to file them in a separate and safe location away from electromagnetic sources, filing and storing hard copies for use in production)	
		2.21	Describe the procedures for drawing change notes, trial changes, up-issuing of drawings, modifications, and miscellaneous amendments to drawings	
		2.22	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve when producing the drawings	

Level 3 Unit – Producing Electronic Engineering Drawings using Computer Aided Techniques

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to set up and operate a computer aided drawing (CAD) system to produce fully detailed drawings for electronic engineering activities, in accordance with approved procedures. The types of drawing produced will include circuit and wiring diagrams, block diagrams, schematics, printed circuit board layouts, assembly and installation drawings, and system design/modification drawings. The learner will be given a detailed drawing brief or a request for change/modification order and will be required to access these requirements and to extract all necessary information in order to carry out the drawing operations. The learner will need to select the appropriate equipment and drawing software to use, based on the type and complexity of the drawing functions to be carried out. The learner will be expected to use current British, European, International and company standards to produce a drawing template, for a range of paper sizes, that must include the drawing title, scale used, date of drawing, and other relevant information. The learner will then be expected to produce fully detailed drawings to enable the electronic circuits to be assembled, installed, maintained, commissioned or modified.

Unit introduction

The learner's responsibilities will require them to comply with organisational policy and procedures for working in the drawing office or CAD suite. The learner will be required to report any problems with the computer hardware, software or drawing procedures that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to verbal/written instructions and draught specifications, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying computer aided drawing procedures for electronic engineering drawings. The learner will understand the computer system and software used, and its application, and will know about the various tools and techniques used to produce the drawings, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the computer drawing system. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		F/600/5471
Qualification Framework		QCF
Title		Producing Electronic Engineering Drawings using Computer Aided Techniques
Unit Level		Level 3
Guided Learning Hours		294
Unit Credit Value		150
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Electronic Engineering Drawings using Computer Aided Techniques	1.1	Prepare the CAD system for operation, by carrying out all of the following: • check that all the equipment is correctly connected and is in a safe and usable condition (cables undamaged, correctly connected, safely routed) • power up the equipment and activate the drawing software • set up the drawing system to be able to produce the drawing to the appropriate scale • set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitiser/tablet, scanner, printer, plotter) • set the drawing datum at a convenient point (where applicable) • set up drawing parameters to include layers, line types, colour, text styles to company procedures or to suit the drawing produced • create a drawing template to the required standards, which includes all necessary detail (such as title, drawing number, scale, material, date, etc)	
		1.2	Carry out all of the following before producing the engineering drawing: • ensure that data and information is complete and accurate • review the data and information to identify the drawing requirements • recognise and deal with problems (information based and technical)	
		1.3	Use three of the following to obtain the necessary data to produce the required drawings: • drawing brief/request • change order/modification request • manuals • calculations • sketches • specifications • electrical regulations	

			• previous drawings/designs • other available data • standards reference documents (such as current carrying capacity of cables, electronic component catalogues) • notes from meetings/discussions	
		1.4	Produce drawings that are sufficiently and clearly detailed	
		1.5	Take into account eight of the following design features, as appropriate to the drawing being produced: • uses an appropriate type of circuit (such as digital, analogue, hybrid) • physical dimensions of the circuit • position of circuit elements/components • function • connectors/test points access • connections between components • component orientation • special labels (such as orientation reference points) • types of component to be used • lifetime cost of the product • tolerances • aesthetics • interfaces • safety • power supplies • uses appropriate technology of circuit design (such as single sided, double sided, multi-layer, flexi-rigid) • meets signal integrity parameters (such as capacitance, inductance, resistance, insulation voltages) • meets specified operating conditions (such as temperature, humidity, shock and vibration) • any assembly/manufacturing schedule constraints (such as high profile components mounted after low profile 'surface mount' ones)	
		1.6	Produce electronic drawings which include ten of the following: • straight lines • dimensions • angled lines • text • insertion of electronic components	

			• type and size of cables • connection/termination details • electrical/electronic symbols and abbreviations • curved/contour lines • circles or ellipses • parts lists • test points • colour/component coding • fault diagnosis aids (such as fault trees, flow diagrams) • other specific electronic detail	
		1.7	Produce drawings in the required formats	
		1.8	Produce three of the following types of electronic drawings: • circuit diagrams • wiring diagrams • block diagrams • schematics • system drawings • circuit board assembly • circuit board layout • general assembly drawings • assembly of cable looms/harnesses	
		1.9	Use codes and other references that follow the required conventions	
		1.10	Produce drawings which comply with one or more of the following: • organisational guidelines • statutory regulations and codes of practice • CAD software standards • BS and ISO standards • other international standard	
		1.11	Make sure that drawings are checked and approved within agreed timescales by authorised people	
		1.12	Ensure that drawings are properly registered and stored securely	
		1.13	Save and store drawings in appropriate locations, to include carrying out all of the following: • ensure that their drawing has been checked and approved by the appropriate person/s • check that the drawing is correctly titled and referenced • save the drawing to an appropriate storage medium • create a separate backup copy and place it in safe storage • produce a hard copy printout of the drawing for file purposes • register and store the drawings in the appropriate company information system	

			• where appropriate, record and store any changes to the drawings in the appropriate company information system	
		1.14	Ensure that changes are completed as required by organisational procedures	
2.	Know how to Produce Electronic Engineering Drawings using Computer Aided Techniques	2.1	Describe the specific safety precautions to be taken when working with computer systems (to include such things as safety guidance relating to the use of visual display unit (VDU) equipment and work station environment (such as lighting, seating, positioning of equipment), repetitive strain injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections)	
		2.2	Describe the good housekeeping arrangements (such as cleaning down work surfaces; putting disks, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)	
		2.3	Describe the basic set-up and operation of the computer system, and the peripheral devices that are used (such as mouse, light pen, digitiser and tablet, printer or plotter, and scanner)	
		2.4	Describe the correct start-up and shutdown procedures to be used for the computer system	
		2.5	Explain how to access the specific computer drawing software to be used, and the use of software manuals and related documents to aid efficient operation of the relevant drawing system	
		2.6	Explain how to deal with system problems (such as error messages received, peripherals which do not respond as expected, obvious faults with the equipment or connecting leads)	
		2.7	Describe the documentation required for particular applications (such as drawing briefs, specification sheets, request for change orders)	
		2.8	Describe the types of electronic drawings that may be produced by the software (such as circuit and wiring diagrams, block and schematic diagrams, assembly and installation drawings, circuit board layouts and circuit board assembly)	
		2.9	Describe the difficulties that can emerge in manufacturing processes because of poor drawings/design	
		2.10	Describe the national, international and organisational standards and conventions that are used for the drawings	
		2.11	Explain how to set up the drawing template parameters (such as layers of drawings, scale, paper size, colour set-up, line types, dimension system and text styles)	
		2.12	Describe the application and use of drawing tools (such as for straight lines, curves and circles; how to add dimensions and text to drawings, producing layers of drawings)	
		2.13	Explain how to access, recognise and use a wide range of standard electronic component symbol libraries from the CAD equipment	
		2.14	Describe the factors to be taken into account when producing electronic drawings (such as safety requirements, operating parameters of components, position of components in relation to other sources or circuits, possibility of external interference, etc)	

		2.15	Describe the electronic equipment and circuits being drawn, and the function of the individual components within the circuits	
		2.16	Describe the selection of the various components and cables being used, with regard to their operating ranges and current carrying capacity	
		2.17	Describe the use of specific regulations and standard reference tables when selecting components and cables (such as IEE regulations)	
		2.18	Describe the basic calculations that may be required to be carried out to verify the value/rating of components and circuits (such as Ohm's Law)	
		2.19	Explain how power cables might affect/corrupt electronic components, and the need to consider this when producing the drawing (such as the positioning, siting and routing of electrical cables and wires)	
		2.20	Describe the manufacturing processes used for populating circuits with components	
		2.21	Describe the constraints laid down by existing national and international legislation, statutory and non-statutory regulations, industry and national standards, industry guidelines and professional codes that regulate electronic design activities	
		2.22	Describe the need for document control (such as ensuring that completed drawings are approved, labelled and stored on a suitable storage medium, the need to create backup copies and to file them in a separate and safe location away from electromagnetic sources, filing and storing hard copies for use in production)	
		2.23	Describe the procedures for drawing change notes, trial changes, up-issuing of drawings, modifications, and miscellaneous amendments to drawings	
		2.24	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve when producing the drawings	

Level 3 Unit – Producing Fabrication/Structural Engineering Drawings using Computer Aided Techniques

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to set up and operate a computer aided drawing (CAD) system to produce fully detailed drawings for fabrication or structural engineering activities, in accordance with approved procedures. The types of drawing produced will include detail component drawings for manufacturing, assembly, sub-assembly and installation drawings. The learner will be given a detailed drawing brief or a request for change/modification order and will be required to access these requirements and to extract all necessary information in order to carry out the drawing operations. The learner will need to select the appropriate equipment and drawing software to use, based on the type and complexity of the drawing functions to be carried out. The learner will be expected to use current British, European, International and company standards to produce a drawing template, for a range of paper sizes, that must include the drawing title, scale used, date of drawing, material to be used and other relevant information. The learner will then be expected to produce fully detailed drawings to enable the manufacture, assembly, installation, commissioning, maintenance or modification of the product to take place.

Unit introduction

The learner's responsibilities will require them to comply with organisational policy and procedures for working in the drawing office or CAD suite. The learner will be required to report any problems with the computer hardware, software or drawing procedures that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to verbal/written instructions and draught specifications, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying computer aided drawing procedures for fabrication or structural engineering drawings. The learner will understand the computer system and software used, and its application, and will know about the various tools and techniques used to produce the drawings, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the computer drawing system. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		M/600/5482
Qualification Framework		QCF
Title		Producing Fabrication/Structural Engineering Drawings using Computer Aided Techniques
Unit Level		Level 3
Guided Learning Hours		294
Unit Credit Value		150
Unit Grading Structure		Pass / Fail

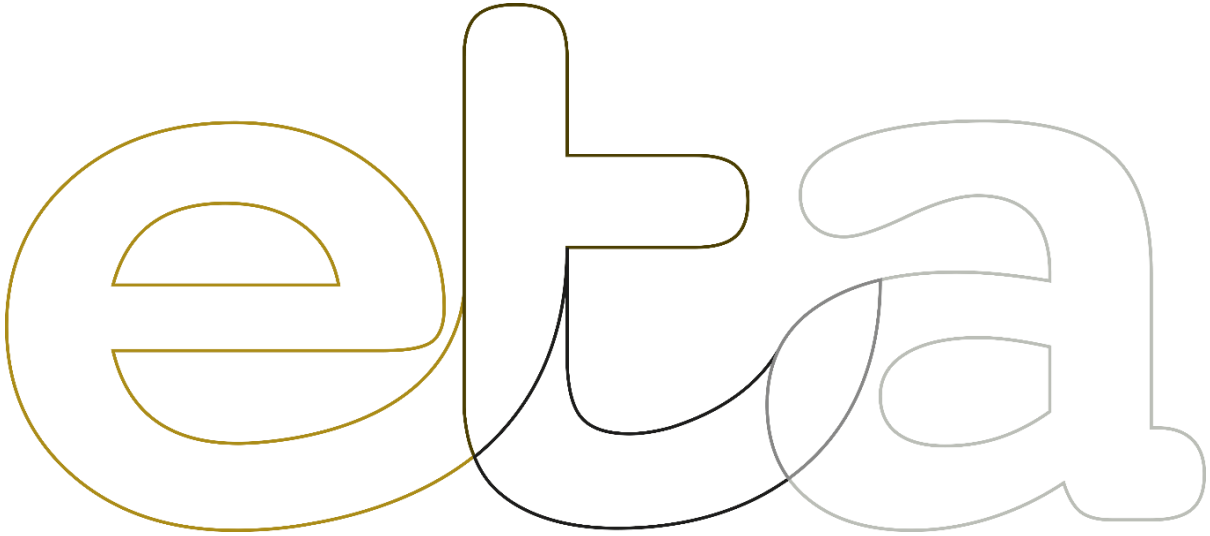
Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Fabrication/Structural Engineering Drawings using Computer Aided Techniques	1.1	Prepare the CAD system for operation, by carrying out all of the following: • check that all the equipment is correctly connected and is in a safe and usable condition (cables undamaged, correctly connected, safely routed) • power up the equipment and activate the drawing software • set up the drawing system to be able to produce the drawing to the appropriate scale • set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitiser/tablet, scanner, printer, plotter) • set the drawing datum at a convenient point (where applicable) • set up drawing parameters to include layers, line types, colour, text styles to company procedures or to suit the drawing produced • create a drawing template to the required standards, which includes all necessary detail (such as title, drawing number, scale, material, date, etc)	
		1.2	Carry out all of the following before producing the engineering drawing: • ensure that data and information is complete and accurate • review the data and information to identify the drawing requirements • recognise and deal with problems (information based and technical)	
		1.3	Use three of the following to obtain the necessary data to produce the required drawings: • drawing brief/request • change order/modification request • manuals • calculations • sketches • specifications	

			• regulations • sample component • previous drawings/designs • other available data • standards reference documents • notes from meetings/discussions	
		1.4	• Produce drawings that are sufficiently and clearly detailed	
		1.5	Take into account eight of the following design features, as appropriate to the drawing being produced: • function • quality • manufacturing method • joining method • ergonomics • materials • cost • lifetime of the product • tolerances • clearance • aesthetics • physical size • operating environment • interfaces • safety	
		1.6	Produce fabrication/structural engineering drawings which include ten of the following: • straight lines • dimensions • angled lines • text • insertion of standard components • symbols and abbreviations • weld detail • curved/contour lines • circles or ellipses • geometrical tolerancing • joint detail (such as bolting, riveting) • installation detail • hidden detail	

			• sectional detail • parts lists • other specific detail	
		1.7	Produce drawings in the required formats	
		1.8	Produce drawings using two of the following methods of projection: • first angle orthographic projections • isometric/oblique projections • third angle orthographic projections	
		1.9	Produce two of the following: • detail drawings • general arrangement drawings • sub-assembly drawings • installation/commissioning drawings	
		1.10	Use codes and other references that follow the required conventions	
		1.11	Produce drawings which comply with one or more of the following: • organisational guidelines • statutory regulations and codes of practice • CAD software standards • BS and ISO standards • other international standard	
		1.12	Make sure that drawings are checked and approved within agreed timescales by authorised people	
		1.13	Ensure that drawings are properly registered and stored securely	
		1.14	Save and store drawings in appropriate locations, to include carrying out all of the following: • ensure that their drawing has been checked and approved by the appropriate person/s • check that the drawing is correctly titled and referenced • save the drawing to an appropriate storage medium • create a separate backup copy and place it in safe storage • produce a hard copy printout of the drawing for file purposes • register and store the drawings in the appropriate company information system • where appropriate, record and store any changes to the drawings in the appropriate company information system	
		1.15	Ensure that changes are completed as required by organisational procedures	
2.	Know how to Produce Fabrication/Structural Engineering Drawings using Computer Aided Techniques	2.1	Describe the specific safety precautions to be taken when working with computer systems (to include such things as safety guidance relating to the use of visual display unit (VDU) equipment and work station environment (such as lighting, seating, positioning of equipment), repetitive strain injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections)	

		2.2	Describe the good housekeeping arrangements (such as cleaning down work surfaces; putting disks, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)	
		2.3	Describe the basic set-up and operation of the computer system, and the peripheral devices that are used (such as mouse, light pen, digitiser and tablet, printer or plotter, and scanner)	
		2.4	Describe the correct start-up and shutdown procedures to be used for the computer system	
		2.5	Explain how to access the specific computer drawing software to be used, and the use of software manuals and related documents to aid efficient operation of the relevant drawing system	
		2.6	Explain how to deal with system problems (such as error messages received, peripherals which do not respond as expected, obvious faults with the equipment or connecting leads)	
		2.7	Describe the documentation required for particular applications (such as drawing briefs, specification sheets, request for change orders)	
		2.8	Describe the types of drawings that may be produced by the software (such as first and third angle drawings, sectional elevations, isometric or oblique drawings)	
		2.9	Explain how to set up the viewing screen to show multiple views of the pattern to help with drawing creation (to include isometric front and side elevations)	
		2.10	Describe the national, international and organisational standards and conventions that are used for the drawings	
		2.11	Explain how to set up the drawing template parameters (such as layers of drawings, scale, paper size, colour set-up, line types, dimensioning system and text styles)	
		2.12	Describe the application and use of drawing tools (such as for straight lines, curves and circles; how to create hatching and shading on drawings; how to add dimensions and text to drawings, producing layers of drawings)	
		2.13	Explain how to access, recognise and use a wide range of standard components and symbol libraries from the CAD equipment	
		2.14	Describe the need for document control (such as ensuring that completed drawings are approved, labelled and stored on a suitable storage medium, the need to create backup copies and to file them in a separate and safe location away from electromagnetic sources, filing and storing hard copies for use in production)	
		2.15	Describe the procedures for drawing change notes, trial changes, up-issuing of drawings, modifications, and miscellaneous amendments to drawings	
		2.16	Describe the relevant sources and methods for obtaining any required technical information relevant to the drawing being produced (such as bend allowances, weld details, locking and securing devices)	
		2.17	Describe the basic principles of fabrication engineering manufacturing operations, assembly and installation methods relevant to the drawn item (such as bending and forming methods,	

			joining processes, welding procedures), and how these can influence the way they prepare the drawing	
		2.18	Describe the functionality of the component, and its interrelationship with other components and assemblies	
		2.19	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve when producing the drawings	



Level 3 Unit – Producing Fluid Power Engineering Drawings using Computer Aided Techniques

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to set up and operate a computer aided drawing (CAD) system to produce fully detailed drawings for fluid power engineering activities such as hydraulics, pneumatics or vacuum, in accordance with approved procedures. The types of drawing produced will include circuit diagrams, block diagrams, schematics, assembly and installation, and system design/modification. The learner will be given a detailed drawing brief or a request for change/modification order and will be required to access these requirements and to extract all necessary information in order to carry out the drawing operations. The learner will need to select the appropriate equipment and drawing software to use, based on the type and complexity of the drawing functions to be carried out. The learner will be expected to use current British, European, International and company standards to produce a drawing template, for a range of paper sizes, that must include the drawing title, scale used, date of drawing, and other relevant information. The learner will then be expected to produce fully detailed drawings to enable the fluid power circuits to be assembled, installed, commissioned, maintained or modified.

Unit introduction

The learner's responsibilities will require them to comply with organisational policy and procedures for working in the drawing office or CAD suite. The learner will be required to report any problems with the computer hardware, software or drawing procedures that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to verbal/written instructions and draught specifications, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying computer aided drawing procedures for fluid power engineering drawings. The learner will understand the computer system and software used, and its application, and will know about the various tools and techniques used to produce the drawings, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the computer drawing system. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		Y/600/5489
Qualification Framework		QCF
Title		Producing Fluid Power Engineering Drawings using Computer Aided Techniques
Unit Level		Level 3
Guided Learning Hours		294
Unit Credit Value		150
Unit Grading Structure		Pass / Fail

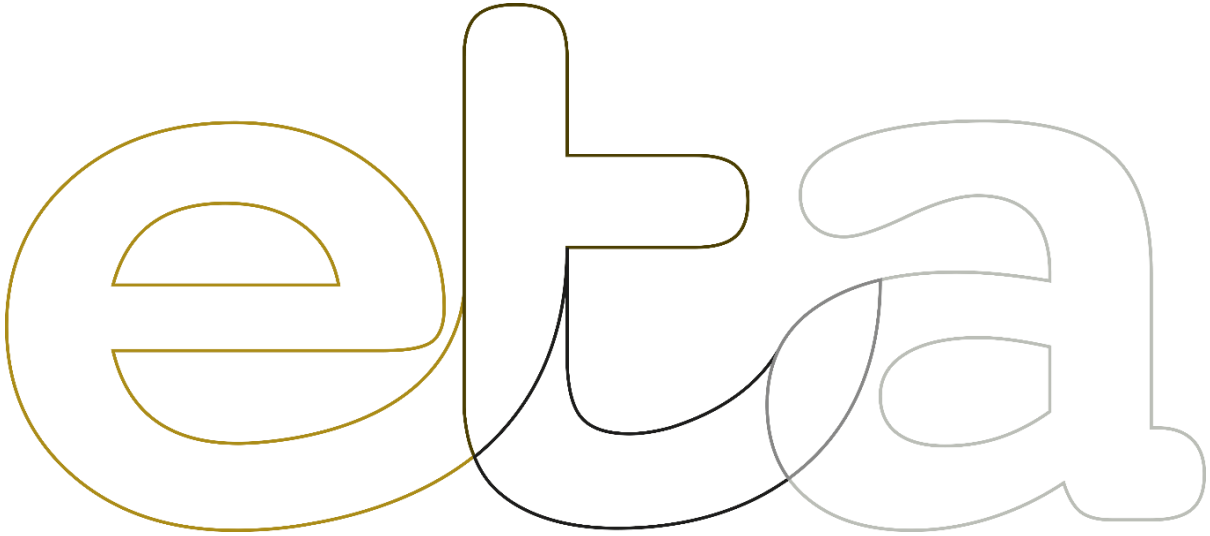
Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Fluid Power Engineering Drawings using Computer Aided Techniques	1.1	Prepare the CAD system for operation, by carrying out all of the following: • check that all the equipment is correctly connected and is in a safe and usable condition (cables undamaged, correctly connected, safely routed) • power up the equipment and activate the drawing software • set up the drawing system to be able to produce the drawing to the appropriate scale • set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitiser/tablet, scanner, printer, plotter) • set the drawing datum at a convenient point (where applicable) • set up drawing parameters to include layers, line types, colour, text styles to company procedures or to suit the drawing produced create a drawing template to the required standards, which includes all necessary detail (such as title, drawing number, scale, material, date, etc)	
		1.2	Carry out all of the following before producing the engineering drawing: • ensure that data and information is complete and accurate • review the data and information to identify the drawing requirements • recognise and deal with problems (information based and technical)	
		1.3	Use three of the following to obtain the necessary data to produce the required drawings: • drawing brief/request • change order/modification request • manuals • calculations • sketches • specifications • fluid power regulations	

			• previous drawings/designs • other available data • standards reference documents (such as pipe and tube tables, fluid power component catalogues) • notes from meetings/discussions	
		1.4	Produce drawings that are sufficiently and clearly detailed	
		1.5	Take into account eight of the following design features, as appropriate to the drawing being produced: • function • operating environment • routeing of fluid power circuit • position fluid power components • connections between components • operating pressures • types of fluid power equipment (such as valves, cylinders) • type of pipes (such as such as flexible hoses or rigid pipes) • cost • method of installation • ergonomics • lifetime of the product • tolerances • aesthetics • physical space • interfaces • safety	
		1.6	Produce fluid power drawings which include ten of the following: • straight lines • dimensions • angled lines • text • insertion of standard fluid power components • type and size of pipes and hoses • connection/termination details • fluid power symbols and abbreviations • pressure characteristics of the circuit • curved/contour lines • circles or ellipses	

			• hidden detail • installation/commissioning details • parts lists • fault diagnostics (such as fault trees, flow diagrams) • other specific fluid power detail	
		1.7	Produce drawings in the required formats	
		1.8	Produce drawings for one of the following types of fluid power system: • hydraulics • pneumatics • vacuum	
		1.9	Produce three of the following types of fluid power drawings: • circuit diagrams • block diagrams • schematics • system drawings • installation/commissioning • piping and tubing layouts	
		1.10	Use codes and other references that follow the required conventions	
		1.11	Produce drawings which comply with one or more of the following: • organisational guidelines • statutory regulations and codes of practice • CAD software standards • BS and ISO standards • other international standard	
		1.12	Make sure that drawings are checked and approved within agreed timescales by authorised people	
		1.13	Ensure that drawings are properly registered and stored securely	
		1.14	Save and store drawings in appropriate locations, to include carrying out all of the following: • ensure that their drawing has been checked and approved by the appropriate person/s • check that the drawing is correctly titled and referenced • save the drawing to an appropriate storage medium • create a separate backup copy and place it in safe storage • produce a hard copy printout of the drawing for file purposes • register and store the drawings in the appropriate company information system • where appropriate, record and store any changes to the drawings in the appropriate company information system	
		1.15	Ensure that changes are completed as required by organisational procedures	

2.	Know how to Produce Fluid Power Engineering Drawings using Computer Aided Techniques	2.1	Describe the specific safety precautions to be taken when working with computer systems (to include such things as safety guidance relating to the use of visual display unit (VDU) equipment and work station environment (such as lighting, seating, positioning of equipment), repetitive strain injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections)	
		2.2	Describe the good housekeeping arrangements (such as cleaning down work surfaces; putting disks, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)	
		2.3	Describe the basic set-up and operation of the computer system, and the peripheral devices that are used (such as mouse, light pen, digitiser and tablet, printer or plotter, and scanner)	
		2.4	Describe the correct start-up and shutdown procedures to be used for the computer systems	
		2.5	Explain how to access the specific computer drawing software to be used, and the use of software manuals and related documents to aid efficient operation of the relevant drawing system	
		2.6	Explain how to deal with system problems (such as error messages received, peripherals which do not respond as expected, obvious faults with the equipment or connecting leads)	
		2.7	Describe the documentation required for particular applications (such as drawing briefs, specification sheets, request for change orders)	
		2.8	Describe the types of fluid power drawings that may be produced by the software (such as circuit diagrams, block and schematic diagrams, assembly and installation drawings, fault diagnosis diagrams)	
		2.9	Describe the national, international and organisational standards and conventions that are used for the drawings	
		2.10	Explain how to set up the drawing template parameters (such as layers of drawings, scale, paper size, colour set-up, line types, dimension system and text styles)	
		2.11	Describe the application and use of drawing tools (such as for straight lines, curves and circles; how to add dimensions and text to drawings, producing layers of drawings)	
		2.12	Explain how to access, recognise and use a wide range of standard fluid power component symbol libraries from the CAD equipment	
		2.13	Describe the factors to be taken into account when producing fluid power drawings (such as safety requirements, operating parameters of components, position of components in relation to other sources or circuits, possibility of external interference, etc)	
		2.14	Describe the fluid power equipment and circuits being drawn and the function of the individual components within the circuits (such as pumps, reservoirs, accumulators, pressure intensifiers, various valves for pressure, flow, and directional control, cylinders and actuating mechanisms, safety devices)	
		2.15	Describe the selection of the various components, pipes and hoses being used with regard to their operating ranges and pressure capabilities	

		2.16	Describe the use of specific regulations and standard reference tables when selecting fluid power components and hoses	
		2.17	Explain how pipes and hoses might become damaged or obstruct movement, and the need to consider this in siting and routing the pipes and hoses	
		2.18	Describe the constraints laid down by existing national and international legislation, statutory and non-statutory regulations, industry and national standards, industry guidelines and professional codes that regulate fluid power drawing/design activities	
		2.19	Describe the need for document control (such as ensuring completed drawings are approved, labelled and stored on a suitable storage medium, the need to create backup copies and to file them in a separate and safe location away from electromagnetic sources, filing and storing hard copies for use in production)	
		2.20	Describe the procedures for drawing change notes, trial changes, up-issuing of drawings, modifications, and miscellaneous amendments to drawing	
		2.21	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve when producing the drawings	



Level 3 Unit – Producing Engineering Systems/Services Drawings using Computer Aided Techniques

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to set up and operate a computer aided drawing (CAD) system to produce fully detailed drawings for engineering systems/services activities, such as water distribution, waste water, environmental control, refrigeration, heating and ventilation, air conditioning and ventilation, gas distribution, plant and equipment, compressed air, process control, and instrumentation and control, in accordance with approved procedures. The types of drawing produced will include circuit diagrams, block diagrams, schematics, assembly and installation, and system design/modification. The learner will be given a detailed drawing brief or a request for change/modification order and will be required to access these requirements and extract all necessary information in order to carry out the drawing operations. The learner will need to select the appropriate equipment and drawing software to use, based on the type and complexity of the drawing functions to be carried out. The learner will be expected to use current British, European, International and company standards to produce a drawing template, for a range of paper sizes, that must include the drawing title, scale used, date of drawing, and other relevant information. The learner will then be expected to produce fully detailed drawings to enable the systems/services to be installed, commissioned, maintained or modified.

Unit introduction

The learner's responsibilities will require them to comply with organisational policy and procedures for working in the drawing office or CAD suite. The learner will be required to report any problems with the computer hardware, software or drawing procedures that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to verbal/written instructions and draught specifications, with a minimum of supervision, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying computer aided drawing procedures for engineering systems/service drawings. The learner will understand the computer system and software used, and its application, and will know about the various tools and techniques used to produce the drawings, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with the computer drawing system. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		M/600/5496
Qualification Framework		QCF
Title		Producing Engineering Systems/Services Drawings using Computer Aided Techniques
Unit Level		Level 3
Guided Learning Hours		294
Unit Credit Value		150
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Producing Engineering Systems/Services Drawings using Computer Aided Techniques	1.1	Prepare the CAD system for operation, by carrying out all of the following: • check that all the equipment is correctly connected and is in a safe and usable condition (cables undamaged, correctly connected, safely routed) • power up the equipment and activate the drawing software • set up the drawing system to be able to produce the drawing to the appropriate scale • set up and check that all peripheral devices are connected and correctly operating (such as keyboard, mouse, light pen, digitiser/tablet, scanner, printer, plotter) • set the drawing datum at a convenient point (where applicable) • set up drawing parameters to include layers, line types, colour, text styles to company procedures or to suit the drawing produced • create a drawing template to the required standards, which includes all necessary detail (such as title, drawing number, scale, material, date, etc)	
		1.2	Carry out all of the following before producing the engineering drawing: • ensure that data and information is complete and accurate • review the data and information to identify the drawing requirements • recognise and deal with problems (information based and technical)	
		1.3	Use three of the following to obtain the necessary data to produce the required drawings: • drawing brief/request • change order/modification request • manuals • calculations • sketches • specifications • statutory regulations	

			• previous drawings/designs • other available data • standards reference documents (such as pipe and tube tables, fluid power component catalogues) • notes from meetings/discussions	
		1.4	Produce drawings that are sufficiently and clearly detailed	
		1.5	Take into account eight of the following design features, as appropriate to the drawing being produced: • function • operating environment • position of equipment • connections between equipment/components • operating conditions (such as pressure, temperature, air flow) • type of fluid power components (such as pipework, valves) • types of electrical components (such as cables, relays, switches) • types of mechanical plant or components (such as pumps, valves, machines) • types of instrumentation/control equipment (gauges, meters, monitoring) • cost • ergonomics • lifetime of the product • tolerances • aesthetics • physical space • interfaces • safety	
		1.6	Produce drawings for one of the following engineering systems/services: • fresh water distribution • waste water • environmental control • process control • gas distribution • refrigeration • compressed air • emergency power generation • heating and ventilation • air conditioning and ventilation • instrumentation and control	

			• plant and equipment	
		1.7	Produce engineering system/service drawings which include twelve of the following: • straight lines • dimensions • angled lines • text • insertion of standard mechanical components, plant or equipment • insertion of standard electrical components • insertion of standard fluid power components • insertion of standard instrumentation/process control equipment • fault diagnostics (such as fault trees, flow diagrams) • installation/commissioning details • connection/termination details • service supplies • type and size of pipes and hoses • symbols and abbreviations • characteristics of the system/service • curved/contour lines • circles or ellipses • hidden detail • parts lists • other specific service/system detail	
		1.8	• Produce drawings in the required formats	
		1.9	Produce three of the following types of engineering system/service drawings: • circuit diagrams • piping and tubing layouts • block diagrams • schematics • system drawings • service drawings • installation/commissioning	
		1.10	Use codes and other references that follow the required conventions	
		1.11	Produce drawings which comply with one or more of the following: • organisational guidelines • statutory regulations and codes of practice • CAD software standards • BS and ISO standards	

			• other international standard	
		1.12	Make sure that drawings are checked and approved within agreed timescales by authorised people	
		1.13	Ensure that drawings are properly registered and stored securely	
		1.14	Save and store drawings in appropriate locations, to include carrying out all of the following: • ensure that their drawing has been checked and approved by the appropriate person/s • check that the drawing is correctly titled and referenced • save the drawing to an appropriate storage medium • create a separate backup copy and place it in safe storage • produce a hard copy printout of the drawing for file purposes • register and store the drawings in the appropriate company information system • where appropriate, record and store any changes to the drawings in the appropriate company information system	
		1.15	Ensure that changes are completed as required by organisational procedures	
2.	Know how to Produce Engineering Systems/Services Drawings using Computer Aided Techniques	2.1	Describe the specific safety precautions to be taken when working with computer systems (to include such things as safety guidance relating to the use of visual display unit (VDU) equipment and work station environment (such as lighting, seating, positioning of equipment), repetitive strain injury (RSI); the dangers of trailing leads and cables; how to spot faulty or dangerous electrical leads, plugs and connections)	
		2.2	Describe the good housekeeping arrangements (such as cleaning down work surfaces; putting disks, manuals and unwanted items of equipment into safe storage; leaving the work area in a safe and tidy condition)	
		2.3	Describe the basic set-up and operation of the computer systems, and the peripheral devices that are used (such as mouse, light pen, digitiser and tablet, printer or plotter, and scanner)	
		2.4	Describe the correct start-up and shutdown procedures to be used for the computer system	
		2.5	Explain how to access the specific computer drawing software to be used, and the use of software manuals and related documents to aid efficient operation of the relevant drawing system	
		2.6	Explain how to deal with system problems (such as error messages received, peripherals which do not respond as expected, obvious faults with the equipment or connecting leads)	
		2.7	Describe the documentation required for particular applications (such as drawing briefs, specification sheets, request for change orders)	
		2.8	Describe the types of engineering system/service drawings that may be produced by the software (such as circuit diagrams, block and schematic diagrams, assembly and installation drawings, fault diagnosis diagrams)	
		2.9	Describe the national, international and organisational standards and conventions that are used for the drawings	

		2.10	Explain how to set up the drawing template parameters (such as layers of drawings, scale, paper size, colour set up, line types, dimension system and text styles)	
		2.11	Describe the application and use of drawing tools (such as for straight lines, curves and circles; how to add dimensions and text to drawings, producing layers of drawings)	
		2.12	Explain how to access, recognise and use a wide range of standard component symbol libraries from the CAD equipment	
		2.13	Describe the factors to be taken into account when producing engineering system/service drawings (such as safety requirements, operating parameters of components, position of components in relation to other sources or circuits, possibility of external interference, etc)	
		2.14	Describe the system/service equipment and circuits being drawn, and the function of the equipment and individual components within the system/service (such as mechanical, electrical, fluid power, instrumentation and control components)	
		2.15	Describe the selection of the various components, pipes and hoses being used, with regard to such things as pipeline contents, pressure capabilities or heat properties	
		2.16	Describe the need to follow regulations/codes of practice with regard to colour coding/identifying the contents of the pipelines	
		2.17	Describe the use of specific regulations and standard reference tables when selecting cables, pipes, hoses and other service/system components	
		2.18	Explain how pipelines or cables might become damaged or obstruct movement, and the need to consider this in siting and routeing the pipes and cables	
		2.19	Describe the selection of the various electrical components and cables being used, with regard to their operating ranges and current carrying capacity	
		2.20	Describe the use of specific regulations and standard reference tables when selecting electrical components and cables (such as IEE regulations)	
		2.21	Describe the constraints laid down by existing national and international legislation, statutory and non-statutory regulations, industry and national standards, industry guidelines and professional codes that regulate engineering system/service drawing/design activities	
		2.22	Describe the need for document control (such as ensuring that completed drawings are approved, labelled and stored on a suitable storage medium, the need to create backup copies and to file them in a separate and safe location away from electromagnetic sources, filing and storing hard copies for use in production)	
		2.23	Describe the procedures for drawing change notes, trial changes, up-issuing of drawings, modifications, and miscellaneous amendments to drawings	
		2.24	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve when producing the drawings	

Level 3 Unit – Inspecting Mechanical Products

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to inspect mechanical products, in accordance with approved procedures. The learner will be required to prepare the work area, ensuring that it is safe and free from hazards, to obtain all relevant and current documentation, and to obtain the tools and equipment required. The learner will be required to select the appropriate inspection equipment, based on the features to be checked and the accuracy to be measured. This will involve checking that the appropriate equipment is within current test dates and, where necessary, setting up and calibrating the equipment ready for the inspection operations to be performed. In carrying out the inspection activities, the learner will be expected to check the components for both dimensional and geometrical accuracy, and this may be required to be undertaken at various stages of manufacture, such as random sampling during production, pre-assembly, intermediate and final assembly. Components to be inspected could include machined components, pressings, mouldings, castings, forgings, assemblies and sub-assemblies, treated and coated components.

Unit introduction

The learner's responsibilities will require them to comply with organisational policy and procedures for inspecting mechanical products, and to report any problems that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to ensure that all tools and equipment used to inspect the mechanical product are correctly accounted for on completion of the activities and are returned to the correct location. The learner will be expected to work with a minimum of supervision, taking personal responsibility for their own actions and for the accuracy of the work that they carry out.

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying inspection techniques and procedures to mechanical products including, where appropriate, British, European and International standards. The learner will understand how to use the appropriate tools and equipment to inspect mechanical products, in adequate depth to provide a sound basis for carrying out the inspection activities and identifying where features of the products do not meet the required specification tolerances.

The learner will understand the safety precautions required when carrying out the inspection activities. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		Y/600/5511
Qualification Framework		QCF
Title		Inspecting Mechanical Products
Unit Level		Level 3
Guided Learning Hours		287
Unit Credit Value		142
Unit Grading Structure		Pass / Fail

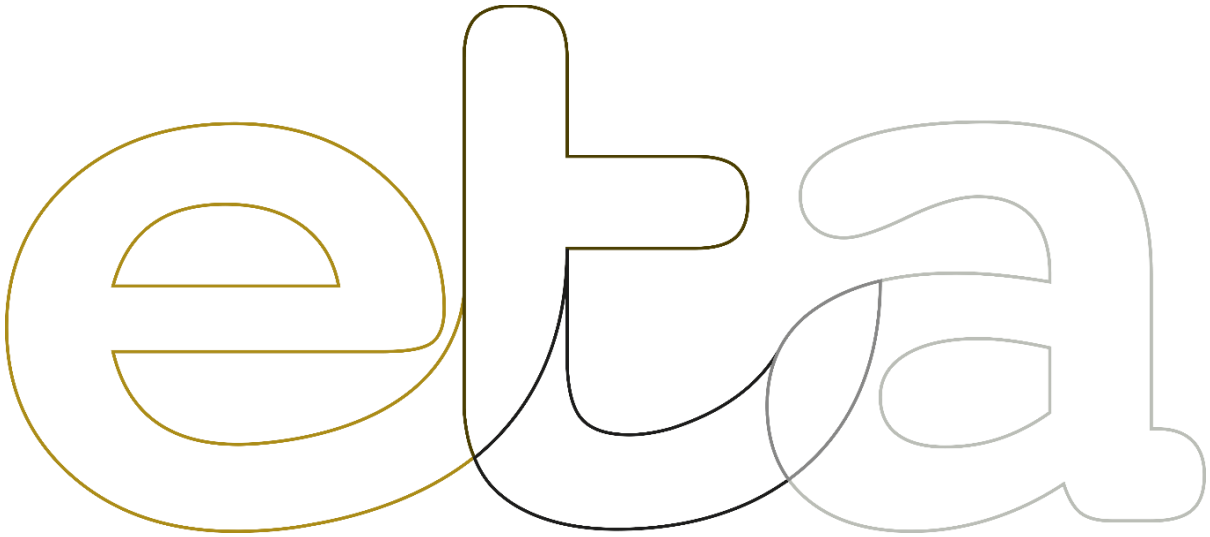
Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Inspecting Mechanical Products	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the correct specification for the product or equipment being inspected	
		1.3	Use the correct equipment to carry out the inspection	
		1.4	Inspect mechanical products, using twelve of the following: • rule or tape • external micrometer • internal micrometer • depth micrometer • height micrometer • specialist micrometers • length vernier • depth vernier • height vernier • straight edge • engineer's square • gap gauge • feeler gauge • hole gauge • thread gauge • thread wires • slip gauge • protractors • sine bar or table	

			• dial test indicator • radius/profile gauges • torque wrench • inclinometer • surface texture comparison plates • surface texture measuring machines • optical equipment (such as shadowgraphs, microscopes) • temperature gauges • flow meters • pressure gauges • co-ordinate measuring machines • electrical measuring equipment • visual checks for appearance and completion • other specific equipment	
		1.5	Use the relevant equipment to measure and check twelve of the following features: • external diameters • internal diameters/bores • length/linear dimensions • shoulders and steps • depth • internal tapers • external tapers • eccentric features • recesses • slots • thread fit • thread form/profile • internal profiles/forms/surfaces • external profiles/forms/surfaces • angular faces • chamfers and radii • grooves/undercuts • counterbored/countersunk holes • holes or slots on pitch circles • holes or slots on linear/angular pitch • special forms (such as gear, spline, serrations) • fit/working clearance	

			• physical properties (such as hardness) • bonding strength • coating thickness • torque • electrical characteristics	
		1.6	Use appropriate equipment to check eight of the following geometric features: • flatness • alignment • squareness • ovality/lobing • straightness • position/location • orientation • concentricity • eccentricity • level • verticality • parallelism • geometry • distortion • surface finish	
		1.7	Identify and confirm the inspection checks to be made and acceptance criteria to be used	
		1.8	Carry out all required inspections as specified	
		1.9	Carry out all of the following during the inspecting activities: • obtain and use the correct issue of drawings, job instructions and specifications • obtain and check the condition and calibration dates of tools, measuring instruments and equipment to be used • follow specified or appropriate inspection procedures • use the correct and appropriate tools and equipment at all times • apply adjustment of inspection results for temperature correction (where applicable) • identify and record out-of-specification features, in the appropriate format • investigate and, where appropriate, obtain a concession for out-of-specification products • place products in the correct location on completion of the inspection activities (in and out of specification) • leave the work area in a safe and tidy condition on completion of the activities	
		1.10	Inspect one of the following types of mechanical product: • machined components • mechanical assemblies/sub-assemblies	

			• pressings • mouldings • castings • forgings • overhauled products • treated/coated components • extrusions • patterns • other	
		1.11	Carry out two of the following inspection procedures: • first/one-off • in-process sample/patrol inspection • statistical quality control • one hundred percent final inspection of components or products • random/selective sampling of finished components or product	
		1.12	Identify any defects or variations from the specification	
		1.13	Record the results of the inspection in the appropriate format	
		1.14	Complete inspection documentation, to include one from the following, and pass to the appropriate people: • inspection report • concession report • job card • customer specific documentation	
		1.15	• Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Inspect Mechanical Products	2.1	Describe the specific safety precautions to be taken when inspecting mechanical components (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice)	
		2.2	Describe the health and safety requirements of the work area in which they are carrying out the inspection activities, and the responsibility these requirements place on them	
		2.3	Describe the COSHH regulations with regard to the substances used in the inspection process	
		2.4	Describe the hazards associated with inspecting mechanical products, and how they can be minimised	
		2.5	Describe the appropriate personal protective equipment and clothing to be worn during the inspection activities	
		2.6	Explain how and where to obtain the required drawings and related specifications, and how to check that they are current and complete	

		2.7	Explain how to extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken	
		2.8	Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing	
		2.9	Describe the use of British, European and International standards in determining if components and products are fit for purpose	
		2.10	Describe the general principles of quality assurance systems and procedures	
		2.11	Describe the preparations to be undertaken before the product is inspected	
		2.12	Describe the effects that the environment may have on the measurements taken (such as in particular where precision measurements are concerned)	
		2.13	Describe the need to select and use set datum faces, and the effects of taking readings from different datums (such as accumulation of limits leading to errors)	
		2.14	Describe the application and uses of the tools and equipment to inspect mechanical products (such as micrometers, Verniers, gauges, special measuring equipment)	
		2.15	Explain how to determine the correct equipment for the feature to be inspected, taking into account tolerances to be achieved	
		2.16	Describe the importance of ensuring that tools and equipment are set up correctly and are in a safe and useable condition	
		2.17	Describe the procedure and methods used to check that tools and equipment are within calibration date	
		2.18	Explain why sampling is used, and when it is an effective means of quality assurance	
		2.19	Describe the typical defects and variations that can be found on mechanical products, and how to identify them	
		2.20	Describe the need to carry out the checks and to record the results on the appropriate documentation	
		2.21	Describe the procedure to be followed when inspected products are out of specification	
		2.22	Describe the importance of completing inspection documentation, what needs to be recorded and where records are kept	
		2.23	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve	



Level 3 Unit – Inspecting Components using Co-ordinate Measuring Machines (CMM)

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to inspect components using manual and/or computer numerical control (CNC) co-ordinate measuring machines (CMM), in accordance with approved procedures. The learner will be required to prepare and set up the equipment in readiness for the inspection operations. This will involve obtaining and using the correct issue of drawings, job instructions and specifications including, where appropriate, downloading the correct CNC measuring program. The learner will be expected to set up the co-ordinate measuring machine, to position and secure the component/product in a suitable location, and to select and mount the correct inspection probes. In carrying out the inspection activities, the learner will be expected to check the components/product for both dimensional and geometrical accuracy, and this may be required to be undertaken at various stages of the engineering/manufacturing process, such as first-off inspection, during production and final inspection. Components to be inspected could include machined components, pressings, mouldings, extrusions, castings, forgings, patterns, assemblies and sub-assemblies, treated and coated components.

Unit introduction

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

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to the quality control procedures used. The learner will understand the co-ordinate measuring equipment being used, and its application, and will know about the inspection probes, setting-up and operating procedures, in adequate depth to provide a sound basis for using the equipment effectively, identifying faults and ensuring that the inspection activities are carried out to the required specification.

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

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		F/600/5535
Qualification Framework		QCF
Title		Inspecting Components using Co-ordinate Measuring Machines (CMM)
Unit Level		Level 3
Guided Learning Hours		287
Unit Credit Value		140
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Inspecting Components using Co-ordinate Measuring Machines (CMM)	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the correct specification for the product or equipment being inspected	
		1.3	Use the correct equipment to carry out the inspection activities	
		1.4	Use one of the following types of manual and/or CNC co-ordinate measuring machines: • vertical • horizontal • gantry/bridge • other specific type	
		1.5	Mount the workpiece in a suitable position, using two of the following: • directly to the machine table • on angle plates • in special jigs • on parallels • on vee blocks • other mounting methods	
		1.6	Identify and confirm the inspection checks to be made and acceptance criteria to be used	
		1.7	Carry out all required inspections as specified	
		1.8	Carry out all of the following during the inspecting activities: • obtain and use the correct issue of drawings, job instructions and specifications • follow specified and appropriate inspection procedures • identify and record any out-of-tolerance dimensions/features, in the appropriate format • investigate and obtain concessions for out-of-specification products (where appropriate)	

			• place products in the correct location on completion of the inspection activities (in and out of specification) • shut down the equipment using the correct procedure • leave the work area in a safe and tidy condition on completion of the inspection activities	
		1.9	Inspect one of the following types of engineering components/equipment: • machined components • mechanical assemblies/sub-assemblies • pressings • mouldings • patterns • castings • forgings • overhauled components/products • extrusions • other specific components/products	
		1.10	Carry out two of the following inspection procedures: • first/one-off • in-process sample inspection • one hundred percent final inspection of components or products • statistical quality control	
		1.11	Check all of the following, as applicable to the machine type: • check that datums for each machine axis are set in relation to equipment, components and probes selected • where applicable, download the CNC program into the controller, safely and correctly • select and mount suitable inspection probes for the different features to be checked • calibrate the inspection probe (where applicable) • enter the probe information correctly into the machine controller/operating system • ensure that probe changes are carried out safely and clear from obstructions • check that all inspection operations and probe movements are executed safely and correctly • ensure that any alterations to programs are communicated fully to the appropriate personnel (where applicable)	
		1.12	Inspect components/products that have a range of different features and cover twelve of the following: • diameters • internal diameters/bores • tapered diameters • tapered bores	

			• shoulders and steps • linear dimensions (lengths) • depths • threads • eccentric features • angular faces • internal profiles/forms/surfaces • external profiles/forms/surfaces • grooves/undercuts • recesses • slots • holes or slots on linear/angular pitch • holes or slots on pitch circles • counterbored/countersunk holes • special forms (such as gear, spline, serrations)	
		1.13	Check four of the following geometric features: • flatness • alignment • squareness • ovality/lobing • straightness • position/location • concentricity • eccentricity • parallelism • geometry • distortion • surface finish	
		1.14	Identify any defects or variations from the specification	
		1.15	Record the results of the inspection in the appropriate format	
		1.16	Complete inspection documentation, to include one from the following, and pass to the appropriate people: • inspection report • concession report • job card • customer specific documentation	
		1.17	Deal promptly and effectively with problems within their control and report those that cannot be solved	

2.	Know how to Inspect Components using Co-ordinate Measuring Machines (CMM)	2.1	Describe the specific safety precautions to be taken when inspecting components/products (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice)	
		2.2	Describe the health and safety requirements of the work area in which they are carrying out the inspection activities, and the responsibility these requirements place on them	
		2.3	Describe the COSHH regulations with regard to the substances used in the inspection process	
		2.4	Describe the hazards associated with inspecting components/products, and how they can be minimised	
		2.5	Describe the appropriate personal protective equipment and clothing to be worn during the inspection activities	
		2.6	Explain how and where to obtain the required drawings and/or CNC operating program and related specifications	
		2.7	Describe the importance of checking that all inspection documentation, programs and specifications are current and complete	
		2.8	Explain how to extract information from engineering drawings and or CNC operating programs and related specifications (to include codes, symbols and conventions to appropriate BS or ISO standards) in relation to the inspection work being undertaken	
		2.9	Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing	
		2.10	Describe the use of British, European and International standards in determining if components and products are fit for purpose	
		2.11	Describe the general principles of quality assurance systems and procedures	
		2.12	Describe the preparations to be undertaken before the component/product is inspected	
		2.13	Describe the application of different co-ordinate measuring machines (such as vertical, horizontal and gantry/bridge)	
		2.14	Describe the function keys and operating system used on co-ordinate measuring machines	
		2.15	Describe the application of the different types of inspection probes that are available	
		2.16	Describe the importance of ensuring that equipment is set up correctly and is in a safe and useable condition	
		2.17	Describe the systems of measurement that are used on co-ordinate measuring machines	
		2.18	Explain how to ensure that inspection probes are correctly calibrated before undertaking the inspection activities	
		2.19	Explain how to deal with equipment and/or program error messages	
		2.20	Describe the effects that the environment may have on the measurements taken, particularly where precision measurements are required	
		2.21	Describe the need to select and use set datum points, and the effects of taking readings from different datums (such as accumulation of limits, leading to errors)	

		2.22	Explain why sampling is used, and when it is an effective means of quality assurance	
		2.23	Describe the typical defects and variations that can be found on components/products, and how to identify them	
		2.24	Describe the procedure to be followed when inspected products are out of specification (including obtaining concessions, where appropriate)	
		2.25	Describe the importance of completing inspection documentation, what needs to be recorded and where records are kept	
		2.26	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve	

Level 3 Unit – Inspecting Fabricated Components and Structures

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out the dimensional and visual inspection of fabricated components and structures, in accordance with approved procedures. The learner will be required to select the appropriate inspection equipment, based on the features to be checked and the accuracy to be measured. This will involve checking that the appropriate equipment is within current test dates and, where necessary, setting up and calibrating the equipment ready for the inspection operations to be performed. In carrying out the inspection activities, the learner will be expected to check the components for both dimensional and geometrical accuracy, and this may be required to be undertaken at various stages of manufacture, such as pre-assembly, intermediate and final assembly. Components to be inspected could include fabricated frames, tanks, pipe sections, modular components, fabricated tubular components and fabricated structures.

Unit introduction

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

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying inspection procedures to fabricated components and structures. The learner will understand the inspection process and its application, and will know about the equipment and inspection techniques, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with fabricated components, and the safeguards necessary for undertaking the activities safely and correctly. The learner will be required to demonstrate safe working practices and procedures throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		F/600/5549
Qualification Framework		QCF
Title		Inspecting Fabricated Components and Structures
Unit Level		Level 3
Guided Learning Hours		287
Unit Credit Value		142
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Inspecting Fabricated Components and Structures	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the correct specification for the product or equipment being inspected	
		1.3	Carry out the inspection checks to one of the following quality and accuracy standards: • approved construction drawings • client specifications/detail drawings • applicable national and international standards	
		1.4	• Use the correct equipment to carry out the inspection activities	
		1.5	Use six of the following types of inspection equipment: • rules and tapes • squares • spirit levels • dividers • gauges • protractors • plumb lines • callipers • Vernier instruments • torque instruments • rafter squares • templates and jigs • theodolites • laser equipment	
		1.6	Identify and confirm the inspection checks to be made and acceptance criteria to be used	

		1.7	Carry out all required inspections as specified	
		1.8	Carry out all of the following activities during the inspection process: • observe all the required safety procedures for the work area/activity • obtain and use the correct issue of drawings, job instructions and specifications • obtain and check the condition and calibration dates of tools, measuring instruments and equipment used • place and coordinate temporary survey stations, where required • perform the dimensional survey and determine out-of-tolerance values • apply adjustment of survey results for temperature correction (where applicable) • produce recommendations for control of final global dimensions, using intermediate data • report and investigate the possibility of gaining a concession for out-of-specification products • leave the work area in a safe and tidy condition on completion of the activities	
		1.9	Carry out the inspection of two of the following types of fabrications: • fabricated frames • structures • square/rectangular tanks • curved/profiled structures • trunking/ducting systems • pipe sections • cylindrical components • conical components • tubular structures • panels • transformers • reduction pieces • segmented bends • modular components • other specific fabrication	
		1.10	Carry out twelve of the following checks: • dimensional accuracy • squareness • angle • alignment • circularity or ovality • visual appearance • straightness • position/location	

			• freedom from distortion/damage • completeness • flatness • orientation • security of joints • weld size and profile • computation of best-fit centres • prediction of erection positions • development of cut lines • computation of allowances for weld gap tolerances and weld shrinkage for attainment of global tolerances • practical allowances for expansion and contraction	
		1.11	• Identify any defects or variations from the specification	
		1.12	• Record the results of the inspection in the appropriate format	
		1.13	Complete inspection documentation, to include one from the following, and pass to the appropriate people: • inspection report • concession report • job card • customer specific documentation	
		1.14	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Inspect Fabricated Components and Structures	2.1	Describe the specific safety precautions to be taken when inspecting fabricated components (specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice, relevant sections of COSHH	
		2.2	Describe the personal protective clothing and equipment that should be worn (such as leather gloves, eye protection, ear protection, safety harness, etc)	
		2.3	Describe the hazards associated with inspecting fabricated products (such as working at height, handling fabricated structures, slips, trips and falls), and how they can be minimised	
		2.4	Explain how and where to obtain the required drawings and related specifications, and how to check that they are current and complete	
		2.5	Explain how to extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards), in relation to work undertaken	
		2.6	Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing	

		2.7	Describe the use of British, European and International standards in determining if components and products are fit for purpose	
		2.8	Describe the general principles of quality assurance systems and procedures	
		2.9	Describe the preparations to be undertaken before the product is inspected	
		2.10	Describe the visual and dimensional inspection methods and techniques that are used for fabrications	
		2.11	Describe the need to select and use set datum faces, and the effects of taking readings from different datums (such as accumulation of limits leading to errors)	
		2.12	Describe the effects that the environment may have on the measurements taken (such as where precision measurements are concerned)	
		2.13	Describe the equipment that is used to carry out the various inspection checks (such as rules and tapes, precision Vernier instruments, levels and plumb lines, laser equipment and theodolite)	
		2.14	Describe the importance of ensuring that tools and equipment are set up correctly and are in a safe and useable condition	
		2.15	Describe the need to check that the equipment is approved for the inspection activities undertaken (including calibration checks and current certification dates)	
		2.16	Describe the techniques used to check for alignments, verticality and roundness/ovality	
		2.17	Describe the need to carry out the checks and to record the results on the appropriate documentation	
		2.18	Describe the calculations used to adjust survey results for temperature differences	
		2.19	Explain how to calculate and predict erection positions from the data given	
		2.20	Explain how to calculate allowances for weld gaps and weld shrinkage, in order to attain overall global tolerances	
		2.21	Describe the typical defects and variations that can be found on the fabrications, and how to identify them	
		2.22	Explain why sampling is used, and when it is an effective means of quality assurance	
		2.23	Describe the procedure to be followed when inspected products are out of specification	
		2.24	Describe the importance of completing inspection documentation, what needs to be recorded and where records are kept	
		2.25	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve	

Level 3 Unit – Carrying Out Visual Inspection of Welded Fabrications

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out the dimensional and visual inspection of welded fabrications, in accordance with approved procedures. This includes checks during production, and post fabrication checks. The learner will be required to select the appropriate inspection equipment, based on the features to be checked and the accuracy to be measured. This will involve checking that the appropriate equipment is within current test dates and, where necessary, setting up and calibrating the equipment ready for the inspection operations to be performed. The learner will check that the materials to be fabricated are in the specified state and condition, and that the set-up arrangements for welding are correct. Inspection during manufacture will check that welding activities are proceeding according to the welding procedure specification and good practice. On completion of welding and fabrication activities, the learner will visually inspect the welded joints against the acceptance criteria, and check that dimensions and distortion are within specified tolerances. The learner will mark areas where non-compliance exists and record the results of the inspection.

Unit introduction

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

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying visual inspection procedures to welded fabrications. The learner will understand the inspection process and its application, and will know about the equipment and inspection techniques, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

The learner will understand the safety precautions required when working with fabricated components, and the safeguards necessary for undertaking the activities safely and correctly. The learner will be required to demonstrate safe working practices and procedures throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		K/600/5559
Qualification Framework		QCF
Title		Carrying Out Visual Inspection of Welded Fabrications
Unit Level		Level 3
Guided Learning Hours		287
Unit Credit Value		142
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Carrying Out Visual Inspection of Welded Fabrications	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the correct specification for the product or equipment being inspected	
		1.3	Carry out the inspection checks to one or more of the following: • approved construction drawings • client specifications/detail drawings • applicable national and international standards • welding procedure specification	
		1.4	Use the correct equipment to carry out the inspection activities	
		1.5	Ensure that they have the required inspection equipment and that it is in good working order, to include six of the following, as appropriate to the operation/features being checked: • weld measuring gauge • rule, tape or other linear measuring device • adjustable square/protractor • depth gauge • bore scope • CCTV viewing system • magnifying glass • mirror • portable lighting • means of marking defective areas	
		1.6	Identify and confirm the inspection checks to be made and acceptance criteria to be used	
		1.7	Carry out all required inspections as specified	
		1.8	Carry out all of the following activities during the inspection process:	

			• observe all the required safety procedures for the work area/activity • obtain and use the correct issue of drawings, job instructions and welding procedure specifications • obtain and check the condition and calibration dates of tools, measuring instruments and equipment used • follow specified or appropriate inspection procedures • identify and record out-of-specification features, in the appropriate format • mark and identify areas where non-compliance with specification or defect indications are found • leave the work area in a safe and tidy condition on completion of the activities	
		1.9	Carry out specified prefabrication or sub-assembly inspection checks, to include all of the following: • the condition of joint preparations • welded joint preparation dimensions • flatness or profile of sheets, plates, and linearity of sections • the set-up arrangements for welding • the condition of consumables	
		1.10	Carry out the inspection of two of the following types of welded fabrications: • fabricated frames • structures • square/rectangular tanks • curved/profiled structures • pipe sections • cylindrical components • conical components • tubular structures • transformers • segmented bends • modular components • other specific fabrications	
		1.11	Carry out specified inspection during fabrication, to check all of the following: • condition of the weld root zone and inter-runs • inter-run cleaning of weld faces and surfaces • distortion and shrinkage	
		1.12	Carry out the specified final inspection checks, to include all of the following: • overall dimensional tolerances • extent of distortion, shrinkage or misalignment • visual appearance of welds/weld profile	

			• evidence of damage (requiring restoration) • defect indications manifested on weld or parent metal surface • extent of excess metal, undercut, penetration or lack of penetration	
		1.13	Identify any defects or variations from the specification	
		1.14	Record the results of the inspection in the appropriate format	
		1.15	Complete the inspection documentation, to include one from the following, and pass to the appropriate people: • weld inspection report • job card • customer specific documentation • concession report	
		1.16	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Carry Out Visual Inspection of Welded Fabrications	2.1	Describe the specific safety precautions to be taken when inspecting welded fabrications (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice, risk assessment procedures and relevant requirements of HASAWA, COSHH and Work Equipment Regulations)	
		2.2	Describe the personal protective clothing and equipment that should be worn (such as leather gloves, eye protection, ear protection, safety harness, etc)	
		2.3	Describe the hazards associated with the inspecting welded fabrications (such as working at height, safety in enclosed/confined spaces, handling fabricated structures, slips, trips and falls), and how they can be minimised	
		2.4	Explain how and where to obtain the required drawings and related specifications, and how to check that they are current and complete	
		2.5	Explain how to extract information from engineering drawings and related specifications (to include symbols and conventions to appropriate BS or ISO standards) in relation to work undertaken	
		2.6	Explain how to interpret first and third angle drawings, imperial and metric systems of measurement, workpiece reference points and system of tolerancing	
		2.7	Explain how to extract information required from drawings and welding procedure specifications (such as interpretation of welding symbols; scope, content and application of the welding procedure specification)	
		2.8	Describe the types and features of welded joints in plate, tube and sections (including fillet and butt welds, single and multi-run welds, welding positions, weld quality)	
		2.9	Describe the use of British, European and International standards in determining if welded fabrications are fit for purpose	
		2.10	Describe the general principles of quality assurance systems and procedures	

		2.11	Describe the preparations to be undertaken before the welded fabrications are inspected (such as access to test area cleanliness and physical condition of test area)	
		2.12	Describe the visual and dimensional inspection methods and techniques that are used for welded fabrications	
		2.13	Describe the equipment that is used to carry out the various inspection checks (such as rules and tapes, weld measuring gauge, bore scope, optical aids (such as magnifying glass and mirror), CCTV viewing system)	
		2.14	Describe the things that need to be checked prior to welding the fabrications (such as joint preparation, joint set-up, parent metal condition, condition of consumables, equipment settings)	
		2.15	Describe the features of the welded joints to be checked (such as linearity or profile, weld root run, inter-runs, final dimensional tolerances, distortion, shrinkage, visual appearance of welds, excess weld metal, undercut, penetration and profile)	
		2.16	Explain how to calculate allowances for weld gaps and weld shrinkage, in order to attain overall global tolerances	
		2.17	Describe the acceptance criteria to be used, and the influence of defects on the service performance of the fabrications (including risks and consequences of failure)	
		2.18	Describe the need to carry out the checks and to record the results using the appropriate documentation	
		2.19	Describe the procedure to be followed when inspected products are out of specification	
		2.20	Describe the importance of completing inspection documentation, what needs to be recorded and where records are kept	
		2.21	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve	

Level 3 Unit – Inspecting and Testing Electrical Products

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out visual inspections and specific tests on electrical products, in accordance with approved procedures. The learner will be required to carry out pre-test inspections and tests of electrical products such as motors, transformers, power or control equipment, white goods, brown goods and electrical panels, to establish that they are safe and to specification. The learner will be required to use a range of electrical test instruments to carry out the necessary measurements.

Unit introduction

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

The learner's knowledge will provide a sound understanding of their work and will provide an informed approach to applying test procedures to electrical products. The learner will understand the equipment being worked on, the test equipment to be used, and the various test procedures, in adequate depth to provide a sound basis for carrying out the activities to the required specification. In addition, the learner will be expected to review the outcome of the tests, to compare the results with appropriate standards, to determine the action required, and to record and report the results in the appropriate format.

The learner will understand the safety precautions required when carrying out the inspection and testing activities, especially those for isolating the equipment and for taking the necessary safeguards to protect themselves and others against direct and indirect electric shock. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		J/600/5570
Qualification Framework		QCF
Title		Inspecting and Testing Electrical Products
Unit Level		Level 3
Guided Learning Hours		287
Unit Credit Value		142
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Inspecting and Testing Electrical Products	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the appropriate procedures for use of tools and equipment to carry out the required tests	
		1.3	Carry out two of the following inspection procedures: • first/one-off • in-process/sample • final inspection	
		1.4	Set up and carry out the tests using the correct procedures and within agreed timescales	
		1.5	Carry out all of the following during the testing activities: • obtain and use the correct issue of company and/or manufacturers' drawings and testing documentation • adhere to risk assessment, COSHH and other relevant safety standards • check that test equipment is correctly calibrated and appropriate for test(s) to be carried out • provide safe access and working arrangements for the testing area • carry out the inspection and testing activities, using appropriate techniques and procedures • operate test equipment within its specification range • apply adjustment of inspection results for temperature correction (where applicable) • identify and record out-of-specification features, in the appropriate format • report and investigate the possibility of gaining a concession for out-of-specification products	

			• place products in the correct location on completion of the inspection activities (in and out of specification) • leave the work area in a safe and tidy condition on completion of the activities	
		1.6	Carry out tests on two of the following types of electrical equipment: • rotating equipment (such as motors, alternators) • power equipment (such as transformers/inductors) • control equipment (such as switchgear, distribution equipment) • bus bar systems • electrical panels • fans/blowers • heating equipment • portable tools/equipment • white goods • brown goods • emergency power equipment • electrical plant • alarm equipment • process control equipment • communication equipment • wiring looms/harnesses • vehicle control equipment • power supplies • other specific equipment	
		1.7	Carry out visual inspection of electrical products, to include ensuring all of the following: • all manufacturing/assembly procedures are complete • all components are correctly orientated, positioned and secured • all connections are mechanically secure • products are free from damage or obvious defects	
		1.8	Carry out tests using four of following: • oscilloscope • ohmmeter • ammeter • voltmeter (such as 2-pole voltage detector) • torque tester • flash tester • multimeter • insulation resistance tester	

			• loop impedance tester • specialist test equipment • current injection tester • residual current device (RCD) tester • portable appliance tester (PAT) • EMC meter	
		1.9	Use the relevant test equipment to measure and check five of the following: • protective resistance values • insulation resistance values • current levels • voltage detection/levels • continuity • power rating • resistance • polarity • capacitance • frequency values • inductance • safety device trip speed • specialised tests (such as speed, sound levels, temperature, interference)	
		1.10	Record the results of the tests in the appropriate format	
		1.11	Complete the relevant paperwork, using one of the following, and pass it to the appropriate person: • inspection report • customer specific documentation • concession report • job card	
		1.12	• Review the results and carry out further tests if necessary	
		1.13	Check that the electrical products meet one of the following quality and accuracy standards: • BS or ISO standards and procedures • customer standards and requirements • statutory regulations • company standards and procedures • specific system requirements	

2.	Know how to Inspect and Test Electrical Products	2.1	Describe the specific safety precautions to be taken when inspecting and testing electrical products (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice, erection of protective barriers, displaying of warning notices)	
		2.2	Describe the health and safety requirements of the work area where they are carrying out the testing activities, and the responsibility these requirements place on them	
		2.3	Describe the hazards associated with inspecting and testing electrical products, and how they can be minimised	
		2.4	Describe the importance of wearing protective clothing and other appropriate safety equipment during the electrical inspection and testing activities	
		2.5	Describe the equipment isolation and lock-off procedure that applies to the testing activities	
		2.6	Explain how to recognise and deal with victims of electrical shock (to include methods of safely removing the victim from the power source, isolating the power source, and methods of first aid resuscitation)	
		2.7	Describe the protection techniques for electrical systems (to prevent burn or fire risk)	
		2.8	Explain how to obtain and interpret drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations, and other documents needed in the testing activities	
		2.9	Describe the use of British, European and International standards in determining if components and products are fit for purpose	
		2.10	Describe the general principles of quality assurance systems and procedures	
		2.11	Describe the preparations to be undertaken before the product is inspected and tested	
		2.12	Describe the types of test equipment to be used, and their selection for particular types of tests	
		2.13	Explain how to ensure that the test equipment is maintained and correctly calibrated, in accordance with the appropriate organisational procedures	
		2.14	Explain how to connect the appropriate test equipment for the measurement of resistance, current, voltage, power, capacitance, inductance, frequency, power factor, and protective device disconnection/trip times	
		2.15	Describe the various testing methods and procedures, as recommended in approved electrical codes of practice, and how to apply them to different operating conditions	
		2.16	Explain why sampling is used, and when it is an effective means of quality assurance	
		2.17	Explain how to display/record test results, and the documentation to be used	
		2.18	Explain how to interpret the value and significance of the test readings	
		2.19	Explain how to analyse test results using tables in approved electrical codes of practice, and how to use comparison and sequential techniques	

		2.20	Describe the importance of ensuring that test equipment is used only for its intended purpose and within its specified range and limits	
		2.21	Describe the typical defects and variations that can be found on electrical products, and how to identify them	
		2.22	Describe the problems or errors that could occur and which may affect the test results, and how they can be avoided	
		2.23	Describe the environmental control and company operating procedures relating to the testing activities	
		2.24	Describe the importance of completing inspection documentation, what needs to be recorded and where records are kept	
		2.25	Describe the procedure to be followed when inspected products are out of specification	
		2.26	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve	

Level 3 Unit – Inspecting and Testing Electronic Products

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out visual inspection and tests on electronic products, in accordance with approved procedures. The learner will be required to satisfy all preliminary essentials, such as obtaining risk assessment/permits to work, following clean work area protocols in appropriate cases. In addition, the learner will be expected to check the currency of and review testing requirements, set up and prepare the testing facilities for use, conduct prescribed tests, consider the implications of the results obtained and record and report their findings.

Unit introduction

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

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying inspection and test procedures for electronic products. The learner will understand the basic operating principles of the items being tested, and their application, in adequate depth to provide a sound basis for carrying out the activities and recognising when circuits/components do not meet the required specification.

The learner will understand the safety precautions required when working in the electronic product and circuit-testing environment, and with the equipment that is used. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		J/600/5603
Qualification Framework		QCF
Title		Inspecting and Testing Electronic Products
Unit Level		Level 3
Guided Learning Hours		287
Unit Credit Value		142
Unit Grading Structure		Pass / Fail

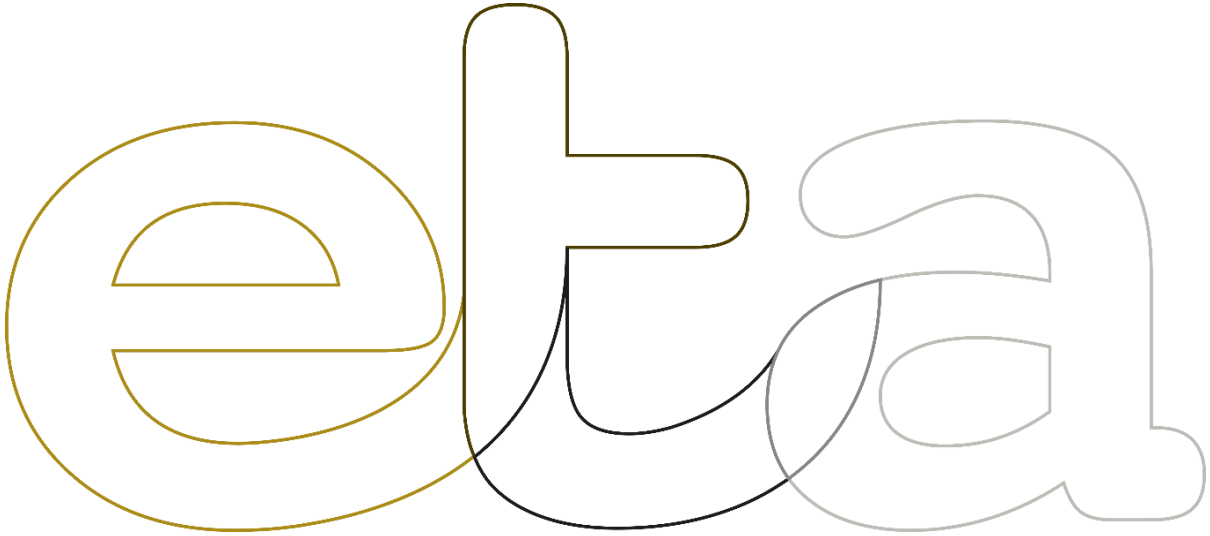
Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Inspecting and Testing Electronic Products	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Follow the appropriate procedures for use of tools and equipment to carry out the required tests	
		1.3	Carry out tests which comply with one or more of the following standards: • BS or ISO standards and procedures • customer standards and requirements • company standards and procedures • other international standards • statutory regulations • specific system requirements	
		1.4	Carry out two of the following inspection procedures: • first/one-off • in-process/sample • final inspection	
		1.5	Use technical information to assist in the inspection and testing activities, by referring to three of the following: • technical manuals • flow charts/fault algorithms • logic diagrams • fault finding/troubleshooting guides	
		1.6	Set up and carry out the tests using the correct procedures and within agreed timescales	
		1.7	Carry out all of the following during the testing of the electronic products:	

			• obtain and use the correct issue of company and/or manufacturers' drawings and testing documentation • adhere to risk assessment, COSHH and other relevant safety standards • follow clean work area protocols, where appropriate • check that test equipment is correctly calibrated and appropriate for test(s) to be carried out • use grounded wrist straps and other electrostatic discharge (ESD) precautions, as appropriate • provide safe access and working arrangements for the testing area • carry out the inspection and testing activities, using appropriate techniques and procedures • operate test equipment within its specification range • apply adjustment of inspection results for temperature correction (where applicable) • identify and record out-of-specification features, in the appropriate format • report and investigate the possibility of gaining a concession for out-of-specification products • place products in the correct location on completion of the inspection activities (in and out of specification) • leave the work area in a safe and tidy condition on completion of the activities	
		1.8	Test one of the following manufactured electronic products: • printed circuit board assemblies • visual display tubes/screens • microwave components • electronic assemblies • electronic modules/sub-assemblies • other specific electronic product • power supplies (such as switched mode, series regulation, parallel regulation) • motor control systems (such as closed loop servo and proportional control, solid state, inverter control) • sensor/actuator equipment (such as linear, temperature, photo-optic, flow, rotational, level, pressure, mass/weight) • digital devices (such as process control, microprocessor-based, logic devices, display devices) • signal generating/processing equipment (such as frequency modulating/demodulating, oscillators, amplifiers, filters) • alarms and protection devices • ADC and DAC hybrid circuits and equipment	

		1.9	Carry out visual inspection of electronic products, to include ensuring all of the following: • all manufacturing/assembly procedures are complete • all components are correctly assembled and orientated • all connections are mechanically secure • soldered joints are free from excess solder and flux residue • products are free from damage or obvious defects	
		1.10	Carry out tests using four of following tools and test equipment: • oscilloscope • signal generator • multimeter • continuity tester • measuring instrument or gauge • computer aided diagnostic equipment • recording devices (such as shock, vibration, humidity, temperature) • computer-aided diagnostic equipment • special purpose testing equipment • ammeter • Q meter • signal tracer • automatic test equipment • pulse sequencing analyser • spectrum analyser • network analyser • logic probe/analyser • other specific test equipment	
		1.11	Carry out four of the following tests: • pulse train sequencing and pulse width/rise time • waveform shape/frequency and amplitude checks • frequency modulation/demodulation • signal noise/interference levels • logic states • dc voltage/current levels • ac voltage/current levels • clock/timer switching • component value tests (such as resistance, capacitance, inductance) • continuity, open and short circuit tests • shock and vibration withstand tests • humidity, temperature and damp tests • insulation resistance	

			• heat dissipation • other specific tests	
		1.12	Record the results of the tests in the appropriate format	
		1.13	Complete the relevant paperwork, using one of the following, and pass it to the appropriate person: • inspection report • customer specific documentation • concession report • job card	
		1.14	Review the results and carry out further tests if necessary	
2.	Know how to Inspect and Test Electronic Products	2.1	Describe the specific safety precautions to be taken to protect themselves and others when conducting the prescribed tests on particular categories of electronic products (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice, erection of protective barriers, displaying of warning notices)	
		2.2	Describe the personal protective equipment (PPE) to be worn whilst carrying out the testing activities concerned, both for personal protection and protection of the components or circuits (such as protective clothing, eye and hearing protection, anti-static devices)	
		2.3	Describe the hazards associated with the tests being conducted (such as heat, radiation, chemicals, static electricity, high voltage points on equipment exposed to contact during tests, trapping points on equipment), and how they can be minimised	
		2.4	Explain how to obtain the necessary authority to conduct testing, the relevant work areas, and any specific permit-to-work procedures that are used	
		2.5	Explain how to recognise and deal effectively in the workplace with victims of electric shock (to include methods of safely removing the victim from the power source, isolating the power source, and methods of first aid resuscitation)	
		2.6	Describe the clean work area protocols that should be used (in appropriate cases)	
		2.7	Explain how to obtain and use data/specifications for the post-production tests being undertaken	
		2.8	Explain how to obtain and interpret drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations, and other documents needed in the testing activities	
		2.9	Describe the use of British, European and International standards in determining if components and products are fit for purpose	
		2.10	Describe the general principles of quality assurance systems and procedures	
		2.11	Describe the preparations to be undertaken before the product is inspected and tested	
		2.12	Explain how to recognise and read component values and, where appropriate, the polarity of electronic components	

		2.13	Describe the types of test equipment to be used, and their selection for particular types of tests	
		2.14	Explain how to ensure that the test equipment is maintained and correctly calibrated, in accordance with the appropriate organisational procedures	
		2.15	Explain how to set up and use the range of test equipment items needed for the tests (such as logic and waveform analysis equipment, storage oscilloscopes, signal generators, sensing and measuring devices, current, voltage and impedance measuring instruments)	
		2.16	Describe the importance of ensuring that test equipment is used only for its intended purpose and within its specified range and limits	
		2.17	Describe the importance of using the appropriate test points in the circuit, and how these are identified	
		2.18	Describe the types of test used to verify the correct functioning of electronic equipment	
		2.19	Explain why sampling is used, and when it is an effective means of quality assurance	
		2.20	Describe the basic operating principles of the electronic components/circuits being tested	
		2.21	Explain how to analyse and evaluate the results of the tests carried out	
		2.22	Describe the problems or errors that could occur and which may affect the test results, and how they can be avoided	
		2.23	Describe the typical defects and variations that can be found on the electronic products, and how to identify them	
		2.24	Describe the importance of completing inspection documentation, what needs to be recorded and where records are kept	
		2.25	Describe the procedure to be followed when inspected products are out of specification	
		2.26	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve during testing of the electronic equipment	



Level 3 Unit – Checking and Calibrating Mechanical Inspection Equipment

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out calibration and setting activities on mechanical inspection equipment, in accordance with approved procedures. The learner will be required to prepare the equipment and the work area, ensuring that it is safe and free from hazards, to obtain all relevant and current documentation, and to obtain the necessary calibration equipment. The learner will be required to select the appropriate calibration equipment, based on the type of instruments to be calibrated and the accuracy of the measurements that will be taken. In carrying out the calibration activities, the learner will be expected to set up, calibrate and check the equipment across its full operating range (where this is appropriate). Equipment to be calibrated could include measuring instruments such as micrometers and Verniers, protractors, squares and straight edges, gauges such as plug, ring, gap and length, mechanical test equipment such as torque wrenches, engineers' levels and inclinometers.

Unit introduction

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

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying calibration techniques and procedures to mechanical measuring instruments including, where appropriate, British, European and International standards. The learner will understand how to use the tools and equipment to calibrate the instruments, in adequate depth to provide a sound basis for carrying out the calibration activities and identifying where instruments do not meet the required calibration specification.

The learner will understand the safety precautions required when carrying out the calibration activities. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

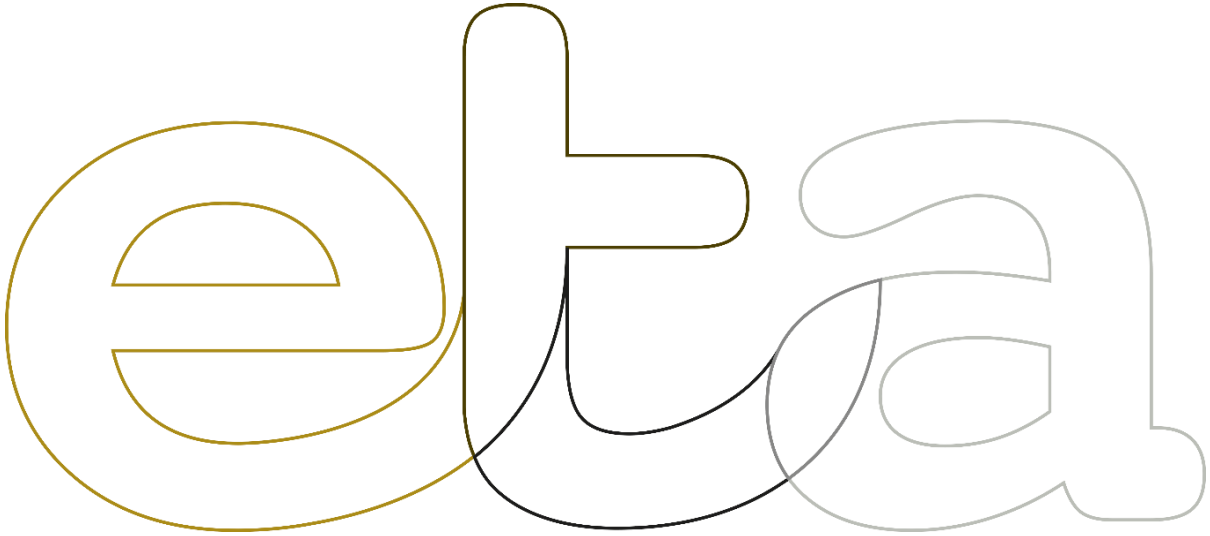
Unit Reference Number		K/600/5612
Qualification Framework		QCF
Title		Checking and Calibrating Mechanical Inspection Equipment
Unit Level		Level 3
Guided Learning Hours		287
Unit Credit Value		139
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Checking and Calibrating Mechanical Inspection Equipment	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Prepare for the calibration activities, by carrying out all of the following: • ensure that the work area is in a safe and tidy condition • ensure that environmental conditions are suitable for the calibration checks being made (such as temperature, cleanliness, humidity) • obtain and use the correct quality control documentation (such as calibration records, equipment specifications) • obtain and check the general condition of the measuring instruments to be calibrated • obtain appropriate calibration/reference equipment for the job in hand	
		1.3	Obtain and use the correct equipment to carry out the calibration activities	
		1.4	Use five of the following types of calibration equipment: • reference grade slip gauges • standard reference pieces (such as balls, blocks, wires) • angular reference gauges • standard taper gauges • master cylindrical square • reference/master bores (such as ring/bore) • reference/master thread gauges • shadow graph • floating carriage micrometers • microscope • reference/master sine bars • reference/master sine tables	

			• reference/master bench centres	
		1.5	Identify and confirm the calibration checks to be made and acceptance criteria to be used	
		1.6	Correctly set up, check and calibrate the equipment, using approved techniques and procedures	
		1.7	Carry out the calibration of measuring instruments in both of the following systems of measurement: • imperial units • metric units	
		1.8	Check, and where appropriate, set and calibrate ten of the following: • micrometers (to include external, internal and depth) • Verniers (to include length, height and depth) • specialist verniers (such as gear tooth) • specialist micrometers (such as thread) • height micrometer • engineers' square • cylindrical square • straight edge • engineers' levels • surface tables • angle plates • box angle plates • taper gauges • protractors • combination squares • clinometers • sine bars • sine tables • dial test indicators • surface finish equipment • spline gauges • radius/profile gauges • workshop gauge blocks • gap gauge (fixed and adjustable) • plug/hole gauge • bore gauges (fixed and telescopic) • groove gauges • alignment gauges	

			• thread plug gauge • thread ring gauge • thread depth gauges • pneumatic gauges • torque gauge/wrench • bench centres • roughness standards • other specific equipment	
		1.9	Check and calibrate mechanical inspection equipment, to include carrying out all of the following: • obtaining calibration parameters from data records • setting and using the correct calibration equipment • following specified or appropriate calibration procedures • calibrating the instruments to manufacturers' specifications • apply appropriate coding to calibrated equipment • recording calibration results accurately and legibly, in the appropriate format • identifying and recording out-of-specification instruments • taking appropriate action in respect of instruments that fail to meet calibration specifications • diagnosing faults during the calibration process (where appropriate)	
		1.10	Record the results of the calibration checks in the appropriate format	
		1.11	Complete the calibration documentation, to include one from the following, and pass to the appropriate people: • calibration report • 'equipment withdrawal from service' report • job card • customer specific documentation	
		1.12	Where appropriate, apply suitable identification to the equipment, stating current date(s) of calibration	
		1.13	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Check and Calibrate Mechanical Inspection Equipment	2.1	Describe the specific safety precautions to be taken when checking and calibrating mechanical measuring equipment (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice)	
		2.2	Describe the health and safety requirements of the work area in which they are carrying out the calibration activities, and the responsibility these requirements place on them	

		2.3	Describe the COSHH Regulations with regard to the substances used in the calibration process	
		2.4	Describe the hazards associated with calibrating mechanical measuring equipment, and how they can be minimised	
		2.5	Describe the appropriate personal protective equipment and clothing to be worn during the calibration activities	
		2.6	How and where to obtain the required calibration specifications, and how to check that they are current and complete	
		2.7	Describe the general principles of quality assurance systems and procedures	
		2.8	Describe the preparations to be undertaken before the equipment is checked and calibrated (such as cleaned, visually inspected for damage or missing parts)	
		2.9	Describe the effects that the environment may have on the calibration activities (such as where precision measurements are concerned)	
		2.10	Describe the use of temperature controlled standards rooms for calibration activities	
		2.11	Describe the need to select and use set datum faces, and the effects of taking readings from different datums (such as accumulation of limits leading to errors)	
		2.12	Describe the application and uses of the tools and equipment to calibrate mechanical instruments (such as reference grade slip gauges, shadow graphs, cylindrical squares, optical microscopes, special measuring equipment)	
		2.13	Describe the typical defects and variations that can be found on mechanical measuring instruments, and how to identify them	
		2.14	Describe the need to carry out the calibration checks, and to record the results using the appropriate documentation	
		2.15	Describe the procedure to be followed when instruments do not meet calibration requirements	
		2.16	Describe the importance of completing calibration documentation, what needs to be recorded and where records are kept	
		2.17	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve	



Level 3 Unit – Checking and Calibrating Electrical and Electronic Test Equipment

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out visual inspections, calibration and setting activities on instruments used to check electrical and electronic equipment/circuits, in accordance with approved procedures. The learner will be required to prepare the instruments, ensuring that they are safe and free from hazards, to obtain all relevant and current documentation, and to obtain the necessary tools and equipment required. The learner will be required to select the appropriate calibration equipment, based on the type of equipment to be calibrated and the accuracy of the measurements that will be taken. In carrying out the calibration activities, the learner will be expected to set up, calibrate and check the equipment across its full operating range (where this is appropriate). Equipment to be calibrated could include instruments such as those used to measure current, voltage, resistance, polarity, insulation values, signal waveforms, etc.

Unit introduction

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

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying calibration techniques and procedures to electrical and electronic test instrumentation including, where appropriate, British, European and International standards. The learner will understand how to use the tools and equipment to calibrate the equipment, in adequate depth to provide a sound basis for carrying out the activities and identifying where instruments do not meet the required calibration specification.

The learner will understand the safety precautions required when carrying out the calibration activities. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		L/600/5618
Qualification Framework		QCF
Title		Checking and Calibrating Electrical and Electronic Test Equipment
Unit Level		Level 3
Guided Learning Hours		287
Unit Credit Value		139
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Checking and Calibrating Electrical and Electronic Test Equipment	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Prepare for the calibration activities, by carrying out all of the following: • ensure that the work area is in a safe and tidy condition • ensure that environmental conditions are suitable for the calibration checks being made (such as temperature, cleanliness, humidity) • obtain and use the correct quality control documentation (such as calibration records, equipment specifications) • obtain and check the general condition of the instrumentation to be calibrated • obtain appropriate calibration/reference equipment for the job in hand • leave the work area in a safe and tidy condition on completion of the activities	
		1.3	Obtain and use the correct equipment to carry out the calibration activities	
		1.4	Use three of the following types of equipment during the calibration activities: • reference/workshop potentiometers • measuring bridges • master/reference stabilised power supplies • master/reference meters • master/reference signal generators • master/reference oscilloscopes • spectrum analysers • network analysers • logic analysers • other specific calibration equipment	

		1.5	Identify and confirm the calibration checks to be made and acceptance criteria to be used	
		1.6	Correctly set up, check and calibrate the equipment, using approved techniques and procedures	
		1.7	Carry out the calibration of electrical/electronic test instruments in both of the following types of measurement: • analogue • digital	
		1.8	Carry out the calibration of electrical/electronic test equipment, to include eight of the following types of instruments: • multimeters • ammeter • voltmeter • watt meters • ohmmeters • oscilloscope • insulation tester • loop impedance tester • earth bond testers • current probes • chart recorders • frequency meters and counters • flash testers • resistance boxes • residual current device (RCD) tester • signal generators • portable appliance (PAT) testers • logic probes • current injection devices • phase testers • amplifiers • spectrum analysers • network analysers • logic analysers • other specific test equipment	
		1.9	Test and calibrate electrical/electronic test instrumentation, to include carrying out all of the following:	

			• obtaining calibration parameters from data records • connecting up power supplies, test and calibration equipment • following specified or appropriate calibration procedures • ensure that any special operating conditions are taken into account • calibrating to manufacturer's procedures and specifications • applying appropriate coding to calibrated equipment • recording calibration results accurately and legibly, in the appropriate format • identifying and recording out-of-specification instruments • taking appropriate action in respect of instruments that fail to meet calibration specifications • diagnosing faults during the calibration process (where appropriate)	
		1.10	Record the results of the calibration checks in the appropriate format	
		1.11	Complete the calibration documentation, to include one from the following, and pass to the appropriate people: • calibration report • 'equipment withdrawal from service' report • job card • customer specific documentation	
		1.12	Where appropriate, apply suitable identification to the equipment, stating current date(s) of calibration	
		1.13	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Check and Calibrate Electrical and Electronic Test Equipment	2.1	Describe the specific safety precautions to be taken when checking and calibrating electrical and electronic test instrumentation (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice)	
		2.2	Describe the health and safety requirements of the work area in which they are carrying out the calibration activities, and the responsibility these requirements place on them	
		2.3	Describe the COSHH regulations with regard to the substances used in the calibration process	
		2.4	Describe the hazards associated with calibrating electrical and electronic test instrumentation, and how they can be minimised	
		2.5	Describe the appropriate personal protective equipment and clothing to be worn during the calibration activities	
		2.6	Explain how and where to obtain the required calibration specifications, and how to check that they are current and complete	
		2.7	Describe the general principles of quality assurance systems and procedures	
		2.8	Describe the basic operating principles of the test instruments that are being calibrated	

		2.9	Describe the preparations to be undertaken before the equipment is checked and calibrated (such as cleaned and free from contaminants, visually inspected for damage or missing parts)	
		2.10	Describe the need to take note of any special operating conditions	
		2.11	Describe the effects that the environment may have on the calibration activities (such as where precision measurements are concerned)	
		2.12	Describe the use of temperature-controlled standards rooms for calibration activities	
		2.13	Describe the application and uses of the tools and equipment to calibrate electrical and electronic test instruments (such as stabilised power supplies, reference signal generators, measuring bridges and reference potentiometers, etc)	
		2.14	Describe the typical defects and variations that can be found on the instruments, and how to identify them	
		2.15	Describe the need to carry out the calibration checks, and to record the results using the appropriate documentation	
		2.16	Describe the procedure to be followed when instruments do not meet calibration requirements	
		2.17	Describe the importance of completing calibration documentation, what needs to be recorded and where records are kept	
		2.18	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve	

Level 3 Unit – Checking and Calibrating Process Control Instrumentation

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out visual inspections, calibration and setting activities on process control instrumentation, in accordance with approved procedures. The learner will be required to prepare the instruments, ensuring that they are safe and free from hazards, to obtain all relevant and current documentation, and to obtain the necessary tools and equipment. The learner will be required to select the appropriate calibration equipment, based on the type of equipment to be calibrated and the accuracy of the measurements that will be taken. In carrying out the calibration activities, the learner will be expected to set up, calibrate and check the equipment across its full operating range (where this is appropriate). Equipment to be calibrated will include instruments such as those used to measure pressure, level, flow, temperature, load/weight, fiscal metering, gas detection and alarm, recorders and indicators, instrument controllers, analysers, fire detection and alarm, vibration monitoring, speed measurement and control.

Unit introduction

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

The learner's knowledge will provide a good understanding of their work and will provide an informed approach to applying calibration techniques and procedures to process control instrumentation including, where appropriate, British, European and International standards. The learner will understand how to use the tools and equipment to calibrate the instrumentation, in adequate depth to provide a sound basis for carrying out the activities and identifying where instruments do not meet the required calibration specification.

The learner will understand the safety precautions required when carrying out the calibration activities. The learner will be required to demonstrate safe working practices throughout and will understand the responsibility they owe to themselves and others in the workplace.

Assessment

To achieve this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit through a variety of assessment methods appropriate to the delivery environment.

Unit Reference Number		H/600/5625
Qualification Framework		QCF
Title		Checking and Calibrating Process Control Instrumentation
Unit Level		Level 3
Guided Learning Hours		287
Unit Credit Value		139
Unit Grading Structure		Pass / Fail

Learning Outcome		**Assessment Criteria - The learner can**		**Criteria expansion**
1.	Checking and Calibrating Process Control Instrumentation	1.1	Work safely at all times, complying with health and safety and other relevant regulations and guidelines	
		1.2	Prepare for the calibration activities, by carrying out all of the following: • ensure that the work area is in a safe and tidy condition • ensure that environmental conditions are suitable for the calibration checks being made (such as temperature, cleanliness, humidity) • obtain and use the correct quality control documentation (such as calibration records, equipment specifications) • obtain and check the general condition of the instrumentation to be calibrated • obtain appropriate calibration/reference equipment for the job in hand • leave the work area in a safe and tidy condition on completion of the activities	
		1.3	Obtain and use the correct equipment to carry out the calibration activities	
		1.4	Use six of the following types of equipment during the calibration activities: • standard test gauges • dead weight tester • manometer • digital pressure indicators • hydraulic/portable pressure pump • oil/water bath • hydrometer • audio amplifiers/chambers • sand bath • electronic weight test calibrator • speed measuring devices	

			• calibrated weights • calibrated flow meter • ultraviolet light source • smoke canisters • heat guns • appropriate test gases • reference/workshop potentiometers • signal generators • oscilloscope • insulation testers • analogue and digital meters • phase testers • current injection devices • logic probes • other specific test equipment	
		1.5	Identify and confirm the calibration checks to be made and acceptance criteria to be used	
		1.6	Correctly set up, check and calibrate the equipment, using approved techniques and procedures	
		1.7	Carry out the calibration of process control equipment, to include four of the following types of instruments: • pressure • flow (fluid, gas or air) • level • temperature/humidity • speed measurement • vibration monitoring • load/weighing/strain gauges • gas detection/monitoring • fire detection • fiscal metering • alarm and trip • analysers • recorders and indicators • sound/acoustic measurement • radiation detection • instrument controllers	

		1.8	Test and calibrate process control instrumentation, to include carrying out all of the following: • obtaining calibration parameters from data records • connecting up power supplies, test and calibration equipment • following specified or appropriate calibration procedures • ensuring that any special operating conditions are taken into account (such as liquid level correction) • calibrating to manufacturer's procedures and specifications • recording calibration results accurately and legibly in the appropriate format • identifying and recording out-of-specification instruments • taking appropriate action in respect of instruments that fail to meet calibration specifications • diagnosing faults during the calibration process (where appropriate)	
		1.9	Record the results of the calibration checks in the appropriate format	
		1.10	Complete the calibration documentation, to include one from the following, and pass to the appropriate people: • calibration report • 'equipment withdrawal from service' report • job card • customer specific documentation	
		1.11	Where appropriate, apply suitable identification to the equipment, stating current date(s) of calibration	
		1.12	Deal promptly and effectively with problems within their control and report those that cannot be solved	
2.	Know how to Check and Calibrate Process Control Instrumentation	2.1	Describe the specific safety precautions to be taken when checking and calibrating process control instrumentation (such as specific legislation or regulations governing the activities or work area, safe working practices and procedures to be adopted, general workshop safety practice)	
		2.2	Describe the health and safety requirements of the work area in which they are carrying out the calibration activities, and the responsibility these requirements place on them	
		2.3	Describe the COSHH regulations with regard to the substances used in the calibration process	
		2.4	Describe the hazards associated with calibrating process control instrumentation, and how they can be minimised	
		2.5	Describe the appropriate personal protective equipment and clothing to be worn during the calibration activities	
		2.6	Explain how and where to obtain the required calibration specifications, and how to check that they are current and complete	

		2.7	Describe the general principles of quality assurance systems and procedures	
		2.8	Describe the basic operating principles of the instruments that are being calibrated	
		2.9	Describe the preparations that need to be undertaken before the equipment is checked and calibrated (such as cleaned and free from all service contaminants, visually inspected for damage or missing parts)	
		2.10	Describe the need to take note of any special operating conditions (such as liquid level correction, calibration medium)	
		2.11	Describe the effects that the environment may have on the calibration activities (such as where precision measurements are concerned)	
		2.12	Describe the use of temperature-controlled standards rooms for calibration activities	
		2.13	Describe the application and uses of the tools and equipment to calibrate process control instruments (such as standard test gauges, dead weight testers, manometers, calibrated weights, analogue and digital meters, logic probes, signal generators, etc)	
		2.14	Describe the typical defects and variations that can be found on the instruments, and how to identify them	
		2.15	Describe the need to carry out the calibration checks, and to record the results using the appropriate documentation	
		2.16	Describe the procedure to be followed when instruments do not meet calibration requirements	
		2.17	Describe the importance of completing calibration documentation, what needs to be recorded and where records are kept	
		2.18	Describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve	