

City & Guilds Level 1 Certificate in Engineering) (2850-10)

January 2022 Version 1.5

Qualification Handbook

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City & Guilds

5-6 Giltspur Street

London EC1A 9DE

T +44 (0)20 7294 2800

www.cityandguilds.com

Qualification at a glance

Subject area	Engineering
City & Guilds number	2850-10
Age group approved	Pre 16, 16-18, 19+
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds qualification number	Ofqual accreditation number	GLH	TQT
City & Guilds Level 1 Certificate in Engineering	2850-10	600/0879/9	180	210

Version and date	Change detail	Section
V1.5 January 2022	Added this page	Page 2
	Added learner entry requirements	Page 4

Contents

Qualification at a glance		2
1	About this document	4
1.1	Qualification structure	4
1.2	Opportunities for progression	5
1.3	Qualification support materials	6
2	Course design and delivery	7
2.1	Initial assessment and induction	7
2.2	Recommended delivery strategies	7
3	Assessment	9
3.1	Summary of assessment methods	9
4	Units	10
Unit 101	Working in engineering	11
Unit 102	Carrying out basic fitting techniques	18
Unit 103	Carrying out basic milling techniques	22
Unit 104	Carrying out basic turning techniques	26
Unit 105	Carrying out mechanical assembly	30
Unit 106	Carrying out electronics assembly	33
Unit 107	Carrying out electrical assembly	36
Unit 108	Working with sheet metals	40
Unit 109	Carrying out manual arc welding techniques	44
Unit 110	Carrying out MIG welding processes	48
Unit 111	Carrying out TIG welding processes	52
Unit 112	Carrying out OXY-Acetylene welding processes	56
Unit 113	Carrying out surface finishing techniques	60
Unit 114	Carrying out mechanical maintenance	63
Unit 115	Communicating using CAD systems	68
Unit 116	Producing engineering drawings	72
Appendix 1	Relationships to other qualifications	75
Appendix 2	Sources of general information	76

1 About this document

This document contains the information that centres need to offer the following certificate:

Qualification title and level	Level 1 Certificate in Engineering
City & Guilds qualification number	2850-10
Qualification accreditation number	600/0879/9
Last registration and certification dates	See Online Catalogue/Walled Garden for last dates

This award is designed to contribute towards the knowledge and understanding for the Level 1 Certificate in Engineering (City & Guilds 2850),

This certificate is aimed at candidates who:

- wish for career progression within engineering
- wish to develop the skills learnt from other qualifications

It is expected that candidates should have sufficient levels of numeracy and literacy to be able to satisfactorily complete the course of study.

Learner entry requirements

No specific prior qualifications, learning or experience are required for learners undertaking the qualification. However, centres will need to make an initial assessment of each learner to ensure that the level of the qualification is appropriate. The nature of both the learning and assessment required for the qualification is such that learners will need basic literacy and numeracy skills: i.e. the ability to read and interpret written tasks and to write answers in a legible and understandable form in the English language. Learners will also need to be able to organise written information clearly and coherently, although they will not be assessed for spelling or grammatical accuracy unless this is part of the assessment criteria.

There are no restrictions on entry for this award. City & Guilds recommend that learners should not enter for a qualification of the same level and the same content as that of a qualification they already hold.

Age restrictions

There is no age restriction for this qualification unless this is a legal requirement of the process or the environment.

1.1 Qualification structure

This qualification can be obtained by completing 3 units. Learners must complete unit 101 (mandatory) plus any additional two units of their choice (102-116). The total credit value to achieve this qualification is 21 credits

UAN	City & Guilds unit number	Unit title	Mandatory/ optional for full qualification	Credit value
Y/503/0141	2850-101	Working in engineering	M	7
D/503/0142	2850-102	Carrying out basic fitting techniques	O	7
H/503/0143	2850-103	Carrying out basic milling techniques	O	7
K/503/0144	2850-104	Carrying out basic turning techniques	O	7
A/503/0147	2850-105	Carrying out mechanical assembly	O	7
F/503/0151	2850-106	Carrying out electronics assembly	O	7
L/503/0153	2850-107	Carrying out electrical assembly	O	7
R/503/0154	2850-108	Working with sheet metals	O	7
H/503/0157	2850-109	Carrying out manual arc welding techniques	O	7
Y/503/0169	2850-110	Carrying out MIG welding processes	O	7
L/503/0170	2850-111	Carrying out TIG welding processes	O	7
R/503/0171	2850-112	Carrying out OXY-Acetylene welding processes	O	7
M/503/0162	2850-113	Carrying out surface finishing techniques	O	7
A/503/0164	2850-114	Carrying out mechanical maintenance	O	7
F/503/0165	2850-115	Communicating using Computer Aided Design (CAD) systems	O	7
L/503/0167	2850-116	Producing engineering drawings	O	7

Guided Learning Hours (GLH) 180 hours
Total Qualification Time (TQT) 210 hours

1.2 Opportunities for progression

These are a platform for progression to other City & Guilds qualifications, 2850 Level 2 Certificate in Engineering.

On completion of this qualification candidates may progress into employment or to the following City & Guilds qualifications:

- Level 2 Certificate in Engineering (2850)

1.3 Qualification support materials

City & Guilds also provides the following publications and resources specifically for this qualification:

Description	How to access
Assignment guide for centres	www.cityandguilds.com
Assignments (102 to 116)	www.cityandguilds.com (password protected)
SmartScreen	www.smartscreen.co.uk

2 Course design and delivery

Tutors/assessors should familiarise themselves with the structure and content of the award before designing an appropriate course.

City & Guilds does not itself provide courses of instruction or specify entry requirements. As long as the requirements for the award are met, tutors/assessors may design courses of study in any way that they feel best meets the needs and capabilities of the candidates. Centres may wish to introduce other topics as part of the programme which will not be assessed through the qualifications, e.g. to meet local needs.

It is recommended that centres cover the following in the delivery of the course, where appropriate:

- Health and safety considerations, in particular the need to impress to candidates that they must preserve the health and safety of others as well as themselves
- Key Skills (such as Communication, Application of Number, Information technology, Working with others, Improving own learning and performance, Problem solving)
- Equal opportunities
- Spiritual, moral, social and cultural issues
- Environmental education, related European issues.

Access to assessment

City & Guilds' guidance and regulations on access to assessment are designed to facilitate access for assessments and qualifications for candidates who are eligible for adjustments to assessment arrangements. Access arrangements are designed to allow attainment to be demonstrated. For further information, please see *Access to assessment and qualifications*, available on the City & Guilds website.

2.1 Initial assessment and induction

Centres will need to make an initial assessment of each candidate prior to the start of their programme to ensure they are entered for an appropriate type and level of qualification.

The initial assessment should identify:

- any specific training needs the candidate has, and the support and guidance they may require when working towards their qualification. This is sometimes referred to as diagnostic testing.
- any units the candidate has already completed, or credit they have accumulated which is relevant to the qualification they are about to begin.

City & Guilds recommends that centres provide an induction programme to ensure the candidate fully understands the requirements of the qualification they will work towards, their responsibilities as a candidate, and the responsibilities of the centre. It may be helpful to record the information on a learning contract.

2.2 Recommended delivery strategies

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

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

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

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

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

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

Resource	How to access
SmartScreen	www.smartscreen.co.uk
Downloadable assignments	www.cityandguilds.com

3 Assessment

The mandatory core unit 101 – Working in engineering is assessed by an online multiple-choice assessment. All other units are assessed by an assignment which contains practical and knowledge tasks.

Assignments (one per unit) assess practical activities. City & Guilds provides an assignment for assessors which contains all information required.

As assignments are designed to sample practical activities, it is essential that the centres ensure that candidates cover the content of the whole unit.

Assessment components are graded (Pass, Merit, Distinction). A pass is the achievement level required for the knowledge and understanding and generally represents the ability to follow instructions and procedures. Merit and distinction represent increasing levels of ability to adapt to changing circumstances and to independently resolve problems.

3.1 Summary of assessment methods

For this qualification, candidates will be required to complete the following assessments:

- **one** online multiple-choice assessment for the mandatory unit
- **one** assignment for each chosen optional unit which contains practical and knowledge tasks.

4 Units

Level: 1
Credit value: 7
UAN number: Y/503/0141

Unit aim

This unit will encourage candidates to find out about t working in engineering. It covers the basic skills and knowledge needed to enter engineering or manufacturing sectors.

This will cover the need to recognise and use safe working practices, consideration of the environment and working effectively as a part of a team. It includes the basic materials that engineers use in their everyday work as well as the information technology that is used.

Learning outcomes

There are **six** learning outcomes to this unit. The learner will:

1. know safe working practices
2. know the engineering environment
3. understand the importance of maintaining working relationships
4. know the sectors within engineering
5. know key engineering materials
6. know basic engineering information technology requirements

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an online multiple-choice assessment.

Unit 101

Working in engineering

Outcome 1.

know safe working practices

Assessment Criteria

The learner can:

1. state the **basic safety legislation** that applies in a workshop
2. state the **employers and employees responsibility** towards safety
3. state health and safety **emergency procedures**
4. state essential operator and bystander **safety requirements**
5. Identify **health and safety signs** that are used in an engineering/manufacturing workshop
6. state **first aid** procedures
7. state the procedures to be followed in the event of the **sounding of an emergency alarm**
8. define the **fire triangle model**
9. name types of **fire extinguishers** and state their application
10. state sources of **health and safety information**
11. state how to **act responsibly** in the workshop
12. state the importance of **good housekeeping** methods
13. identify **potential hazards** in the workshop
14. state the steps for dealing with **health and safety issues**.

Range

Basic safety legislation: Health and Safety at Work etc. Act, Control of Substances Hazardous to Health Regulations, Personal Protective Equipment at Work Regulations

Employers and employees responsibility: Health and Safety at Work etc. Act, Control of Substances Hazardous to Health Regulations, Personal Protective Equipment at Work Regulations

Emergency procedures:, fire alarm, fire drill

Safety requirements: Personal Protective Equipment (PPE), screening

Health and safety signs: warning, information, mandatory, prohibition, fire

First aid: location of facilities, requirements of qualified first aiders

Sounding of an emergency alarm: evacuation, escape routes, assembly points

Fire extinguishers: water, foam, powder, CO₂ gas, fire blankets

Health and safety information: sources of information: booklets/leaflets, posters, supervisors/managers, trade unions, Internet

Act responsibly: walking not running, proper behaviour, correct dress, follow instructions

Good housekeeping: tidy work areas, removal of waste, storage of materials, tools and equipment, maintaining access and egress: walkways, emergency exits, fire doors

Potential hazards: working at heights, slippery surfaces or spillages, uneven surfaces, waste material, flammable materials, faulty or missing machine guards, faulty, material handling or transportation, noise

Health and safety issues: reporting, lines of reporting, responsibilities, follow up actions

Additional Guidance

Fire triangle model: fuel, oxygen, source of ignition

Unit 101

Working in engineering

Outcome2.

know the engineering environment

Assessment Criteria

The learner can:

1. state the benefits of different sources of **energy and resources**
2. state the impact on the environment from different methods of **waste disposal**
3. state the importance of working with colleagues to improve work practices
4. state the benefits gained from **working in an environmentally responsible manner**.

Range

Energy and resources: energy: carbon fuels (coal, gas, oil, diesel, petrol), electricity, water, wind, compressed air, steam, nuclear, solar; resources: human, water, materials, equipment, time

Waste disposal: recycling, landfill, incineration

Working in an environmentally responsible manner: environmental impact, preservation of resources, cost, energy savings, efficiency.

Unit 101

Working in engineering

Outcome 3.

understand the importance of maintaining working relationships

Assessment Criteria

The learner can:

1. state the roles and responsibilities within an organisation structure chart for a workplace
2. state the **communication systems** used in the workplace
3. describe **how to seek assistance** to clarify instructions
4. describe **when to approach** a supervisor, trainer or colleague when experiencing difficulties with a task
5. state expectations with regard to **conduct in the workplace**
6. state the importance of maintaining good customer relationships.

Range

Communication systems: verbal, written, drawings, electronic, signs, charts

How to seek assistance: approach a supervisor, trainer or colleague

When to approach: when needing clarification of instructions, when experiencing difficulties with a task,

Conduct in the workplace: walking not running, proper behaviour, correct dress, follow instructions.

Unit 101

Working in engineering

Outcome 4.

know the sectors within engineering

Assessment Criteria

The learner can:

1. state the different **sectors of engineering**
2. name products and services associated with the different engineering sectors

Range

Sectors of engineering: maintenance/installation, manufacture/processing mechanical, electrical, electronic, chemical, energy generation and distribution, automotive engineering, aerospace, nuclear engineering, medical engineering, civil engineering, marine engineering, telecommunications

Unit 101

Working in engineering

Outcome 5.

know key engineering materials

Assessment Criteria

The learner can:

1. **classify engineering materials**
2. Identify **forms of supply** of materials
3. Identify **materials** by their physical properties
4. state the **applications** of key engineering materials.

Range

Classify engineering materials: metals (ferrous, non-ferrous), plastics, ceramics, composites, wood, rubber

Forms of supply: bar and section, sheet, wire, plate, castings and mouldings, forgings, extrusions, tube/pipe

Materials: colour, density, simple workshop tests – eg magnetism, spark tests

Applications: metals (ferrous, non-ferrous), plastics, ceramics, composites, wood, rubber

Unit 101

Working in engineering

Outcome 6.

know basic engineering information technology requirements

Assessment Criteria

The learner can:

1. identify the **hardware requirements** of a computer system
2. state how to **check** that equipment is safe for use and correctly set up
3. state the **health and safety requirements** relating to the use of workstations and VDU equipment
4. define the need for safe file **storage**
5. state the importance of making and keeping back-up copies
6. state the need for **good housekeeping**.

Range

Hardware requirements: CPU, monitor, keyboard, mouse, printer, scanner

Check: visual off-load checks

Health and safety requirements: lighting, seating, sitting and positioning of equipment, dangers of trailing leads, safe and tidy work area, screen filters

Good housekeeping: organisation of files into folders, closing down equipment correctly.

Additional Guidance

Storage: may include - paper, storage media: hard disk drive, CD ROM, DVD ROM, USB removable storage, the Internet

Level: 1
Credit value: 7
UAN number: D/503/0142

Unit aim

This unit will introduce candidates to the safe use of hand tools and fitting activities that are required in the engineering and manufacturing sectors.

It covers the basic skills and knowledge needed to produce components for assembly using appropriate tools, materials and checking techniques to achieve the required sizes and specifications, whilst complying with health and safety legislation and regulations.

Learning outcomes

There are **three** learning outcomes to this unit. The learner will:

1. be able to prepare for fitting activities
2. be able to use simple fitting techniques to produce components
3. be able to check components for correct size

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 102 Carrying out basic fitting techniques

Outcome 1 be able to be able to prepare for fitting activities

Assessment Criteria

The learner can:

1. state the key **health and safety requirements** that apply to fitting
2. read and interpret basic **engineering drawings/sketches**
3. produce a sequence of operations
4. identify and **check marking out equipment**
5. identify types of **work and tool holding devices**
6. use methods of **marking out**
7. use **work datums**.

Range

Health and safety requirements: emergency stop procedures, Personal Protective Equipment (PPE) applicable to fitting, employers' and employees' duties, barrier cream, manual handling, handling sharp tools, entanglement with revolving parts, safe methods of removal of swarf (continuous chip), coolant (soluble oil, compounds), use of guards (fixed, adjustable, interlocking), safety signs

Engineering drawings/sketches: isometric, oblique, first angle projection, third angle projection

Marking out equipment: rules, scribe, scribing block, engineer's square, dividers, dot and centre punches, odd-leg callipers

Marking out: straight and parallel lines, angles, arcs and circles

Work and tool holding devices: bench vice, machine vice, hand vice, direct clamping, vee blocks

Work datum: face, centre, corner, edge.

Unit 102

Outcome 2

Carrying out basic fitting techniques

be able to use simple fitting techniques to produce components

Assessment Criteria

The learner can:

1. use **hand tools** safely to produce simple components
2. produce simple **forms** using fitting techniques
3. select **drilling machines** and prepare for drilling operation
4. state how **spindle speeds** for specific diameters are obtained from charts and graphs
5. produce **internal and external threads**
6. operate the drilling machine safely
7. check components are within limits
8. **restore the work area** using the **correct procedures for the disposal of waste.**

Range

Hand tools: files (sizes, forms, cuts, applications), chisels (types, applications), saws (types, size of blades), hammers and mallets

Forms: flat faces, parallel faces, square faces, steps/shoulders, angled faces, drilled holes, radii

Drilling machines: types, applications, bits (parallel, taper shank), reamers

Internal and external threads: stocks and dies, taps and tap wrenches

Correct procedure for disposal of waste to include: ferrous metals, non-ferrous metals, cloths, paper, coolant

Additional Guidance

Spindle speeds: revolutions per minute

Restore the work area: tools and equipment returned to stores, swarf removal, clean machines and work area, method of holding taps and dies

Unit 102

Outcome 3

Carrying out basic fitting techniques

be able to be able to check components for correct size

Assessment Criteria

The learner can:

1. use measuring equipment to check components are within the set **tolerances**
2. state the accuracy of the **measuring equipment**
3. record measurements taken against size requirements.

Range

Tolerances: ± 0.5 mm / $\pm 2^\circ$, fits (clearance, interference)

Measuring equipment: rule, outside callipers, digital vernier callipers/protractor/height gauge, engineers' square

Level: 1
Credit value: 7
UAN number: H/503/0143

Unit aim

This unit is concerned with the underlying process in setting and operating a milling machine, following safe working practices and checking simple components for size.

The candidate will be able select the required Personal Protective Equipment and state the requirements for safe operation of the equipment.

They will be able to select the appropriate speeds and tools to achieve the desired outcome and recognise and use the appropriate items of measuring equipment to achieve the desired outcome.

Learning outcomes

There are **three** learning outcomes to this unit. The learner will:

1. be able to prepare for milling activities
2. be able to use a milling machine to produce simple components
3. be able to check milled components for correct size

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 103 Carrying out basic milling techniques

Outcome 1 be able to be able to prepare for milling activities

Assessment Criteria

The learner can:

1. state key **health and safety requirements** that apply to milling
2. identify individual **machine parts**, their location and state their function
3. identify **types of cutting tools** and state their function
4. identify the method of **mounting cutters**, their position and state the benefits of each
5. identify types of **work and tool holding devices** and state their function
6. use **work datums**.

Range

Health and safety requirements: emergency stop procedures, Personal Protective Equipment (PPE) applicable to milling, employers' and employees' duties, barrier cream, lifting heavy vices, handling sharp cutting tools, entanglement with revolving parts, safe methods of removal of swarf (continuous chip), coolant (soluble oil, compounds), use of guards (fixed, adjustable, interlocking)

Machine parts: vertical, horizontal and universal milling machines

Types of cutting tools: side and face cutters, slab/cylindrical cutters, slotting cutters, slitting saws, form cutters, end mills, slot drills

Mounting cutters: arbour, chucks (auto lock, jacobs), pull collets

Work and tool holding devices: machine vice (fixed jaw, swivel and universal), direct clamping, vee blocks

Work datum: face, centre, corner, edge

Unit 103

Outcome 2

Carrying out basic milling techniques

be able to be able to use a milling machine to produce simple components

Assessment Criteria

The learner can:

1. apply methods of tool setting for milling
2. secure work for milling
3. indicate how **spindle speeds** for specific diameters are obtained from charts and graphs
4. name types of **material**
5. operate the lathe safely to **shape** material to form simple components within dimensional tolerances
6. identify measuring equipment
7. operate equipment safely
8. **restore the work area** using the **correct procedures for the disposal of waste**.

Range

Material: high speed steel for cutting tools, material being cut (bright mild steel, aluminium alloy, brass)

Shape: flat faces, parallel faces, square faces, steps/shoulders, open-ended slots, angled faces, drilled holes

Measuring equipment: rule, outside callipers, digital vernier callipers/protractor, engineer's square

Correct procedure for disposal of waste to include: ferrous metals, non-ferrous metals, cloths, paper, coolant

Additional Guidance

Spindle speeds: revolutions per minute

Restore the work area: tools and equipment returned to stores, swarf removal, clean machine and work area

Unit 103

Outcome 3

Carrying out basic milling techniques

be able to be able to check milled components for correct size

Assessment Criteria

The learner can:

1. use measuring equipment to check components are within the set **tolerances**
2. state the **accuracy** of the measuring equipment
3. record measurements taken against size requirements.

Range

Tolerances: ± 0.25 mm / $\pm 1^\circ$, fits (clearance, interference)

Accuracy: rule, outside callipers, digital vernier callipers/protractor, engineer's square

Unit 104

Carrying out basic turning techniques

Level: 1
Credit value: 7
UAN number: K/503/0144

Unit aim

This unit is concerned with the underlying process in setting and operating a centre lathe, following safe working practices and checking simple components for size.

The candidate will be able select the required Personal Protective Equipment and state the requirements for safe operation of the equipment.

They will be able to select the appropriate speeds and tools to achieve the desired outcome and be able to recognise and use the appropriate items of measuring equipment to achieve the desired outcome.

Learning outcomes

There are **three** learning outcomes to this unit. The learner will:

1. be able to prepare centre lathe for turning operations
2. be able to use the lathe to produce simple components
3. be able to check turned components for correct size

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 104

Outcome 1

Carrying out basic turning techniques

be able to be able to prepare centre lathe for turning operations

Assessment Criteria

The learner can:

1. state the key **health and safety requirements** that apply to turning
2. identify individual **lathe parts** and their location
3. state the **function of lathe parts**
4. identify types of **lathe tool, drill, tap and die**
5. identify type of **work and tool holding devices**
6. identify different types of self centring chucks and state how they are mounted and their function.

Range

Health and safety requirements: emergency stop procedures, Personal Protective Equipment (PPE) applicable to turning, employers' and employees' duties, barrier cream, lifting heavy chucks onto the lathe without damaging the bed, handling sharp cutting tools, entanglement with revolving parts, safe methods of removal of swarf (continuous chip), coolant (soluble oil, compounds), use of guards

Lathe parts: headstock (all geared, spindle, speed selection), tailstock (barrel, Morse taper), bed, carriage (saddle, cross slide, compound slide, tool post [quick change]), apron (hand feed wheel), stop and start, coolant system (pump, tank, control valve)

Function of lathe parts: tailstock, saddle, cross slide, compound slide, tool post, apron, determination of spindle speeds (use of: graph, charts)

Types of lathe tool, drill, tap and die: tools (facing, knife, undercut, knurling, form [chamfer]), drills (centre, jobber [parallel shank], taps (taper, intermediate [second], plug), dies (slip), thread metric

Work and tool holding devices: three jaw self centring chuck, revolving centre, quick change tool post, Jacobs chuck

Unit 104

Outcome 2

Carrying out basic turning techniques

be able to be able to use the lathe to produce simple components

Assessment Criteria

The learner can:

1. use methods of **setting cutting tools** on centre
2. secure work in three jaw self centring chuck
3. indicate how **spindle speeds** for specific diameters are obtained from charts and graphs
4. identify types of **material**
5. operate the lathe safely to **shape** material to form simple components within dimensional tolerances
6. identify **measuring equipment**
7. operate equipment safely
8. **restore the work area** using the **correct procedures for the disposal of waste**.

Range

Setting cutting tools: overhang, method of centring (tailstock centre, gauge, facing, rule between work and tool)

Material: high speed steel for cutting tools, material being cut (bright mild steel, aluminium alloy, brass)

Shape: face ends, centre drill, drill and tap holes, generate and form surfaces, undercut, die threads

Measuring equipment: rules, callipers, outside, inside, digital vernier.

Correct procedure for disposal of waste: ferrous metals, non-ferrous metals, cloths, paper, coolant

Additional Guidance

Spindle speeds: revolutions per minute

Restore the work area: tools and equipment returned to stores, clean machine and work area, remove and dispose of swarf and coolant correctly

Unit 104

Outcome 3

Carrying out basic turning techniques

be able to be able to check turned components for correct size

Assessment Criteria

The learner can:

1. use measuring equipment to check components are within the set **tolerances**
2. state the accuracy of the **measuring equipment**
3. record measurements taken against size requirements.

Range

Tolerances: ± 0.25 mm

Measuring equipment: rule, outside callipers, digital vernier callipers

Unit 105

Carrying out mechanical assembly

Level: 1
Credit value: 7
UAN number: A/503/0147

Unit aim

This unit will introduce candidates to mechanical assemblies that are required in the engineering and manufacturing sectors. It will cover the skills and knowledge needed to carry out simple sub and final assemblies.

Candidates will be able to identify, select and check appropriate tools and interpret simple assembly drawings. It also covers compliance with relevant health and safety regulations.

Learning outcomes

There are **two** outcomes to this unit. The candidate will:

1. be able to plan and prepare for mechanical assembly
2. be able to apply techniques for the purpose of mechanical assembly

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 105

Outcome 1

Carrying out mechanical assembly

be able to be able to plan and prepare for mechanical assembly

Assessment Criteria

The learner can:

1. prepare the work area prior to assembly operations
2. use Personal Protective Equipment (PPE) appropriate to the various stages of the coating process
3. use safe procedures to prevent injury to skin
4. state the need to comply with Manual Handling Regulations
5. identify and interpret **information** on drawings
6. identify types, sizes and shapes of **tools/equipment** used for assembling mechanical components
7. refer to **charts** for information
8. state the procedures for preparing the work area.

Range

Information: drawings (orthographic, pictorial, sketching, assembly, exploded)

Tools/equipment: spanners (open ended, ring, socket), allen keys, screwdrivers, pliers, grips, hammers (ball peen, cross and straight peen), mallets (copper, hide, plastic), lifting equipment (levers, wedges, jacks, pulley blocks, trucks and skids)

Charts: seals and gaskets, lubrication and screw threads, etc.

Unit 105

Outcome 2

Carrying out mechanical assembly

be able to be able to apply techniques for the purpose of mechanical assembly

Assessment Criteria

The learner can:

1. plan the sequence of operations
2. remove protective packaging and clean component parts before assembly
3. state the general **rules for assembly**
4. carry out component **checks** for assembly
5. state type, size, operation and application of digital **measuring instruments**
6. state types and **effects of forces** generated in assembly
7. identify **types of fit** and state their function
8. identify methods of **sealing joints**
9. identify methods of producing **non-permanent joints**
10. identify different types of **locking devices** and state their function
11. assemble component parts
12. check that the final assembly meets the **specification**
13. **restore the work area** using the correct procedures for the disposal of waste.

Range

Rules for assembly: cleanliness of component parts, tools and equipment, planning the sequence of operations before starting to assemble, drawings/specifications must be followed, use of appropriate tools, periodic checking with specifications

Checks: lengths, angles, hole sizes, threads

Measuring instruments: digital metric depth, inside and outside micrometer, digital metric vernier caliper and height gauge, metric feeler gauges, metric thread gauges, engineer's square

Effects of forces: effects of over-tightening, shear load on pins, tensile and compressive loads on component parts

Types of fit: clearance, interference

Sealing joints: tape, compounds

Non-permanent joints: nuts, bolts, studs, screws, pins and keys

Locking devices: lock nuts, fibre nuts, castle nuts, and split pins, spring and serrated washers

Specification: rotating parts are free, nuts and bolts are tight, freedom from leaks

Dispose of waste: Cloths, Paper/Card, Chemicals, Oils

Additional Guidance

Restore the work area: tools and equipment returned to stores, clean machine and work area

Level: 1
Credit value: 7
UAN number: F/503/0151

Unit aim

The unit is concerned with the processes and equipment essential to building and testing electronic circuits and includes the use of tools and equipment.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will:

1. be able to prepare for building electronic circuits
2. be able to build electronic circuits

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 106

Outcome 1

Carrying out electronics assembly

be able to be able to prepare for building electronic circuits

Assessment Criteria

The learner can:

1. collect, read and **interpret information**
2. **plan and prepare** for electronic activities
3. state how to identify basic **electronic components** and list their values.

Range

Interpret information: circuit, block, layout and schematic diagrams, data sheets

Plan and prepare: appropriate tools and components from data sheets, catalogues

Electronic components: resistors, diodes, capacitors, inductors, transistors, light emitting diodes, switches and relays, fuses and circuit breakers.

Unit 106

Outcome 2

Carrying out electronics assembly

be able to be able to build electronic circuits

Assessment Criteria

The learner can:

1. carry out **preparatory work** to assemble electronic circuits
2. prepare a list of **components** and tools required
3. **check the availability** of all tools and test equipment
4. **assemble and build** electronic circuits
5. **test electronic circuits**
6. prove **functionality** of built assembly
7. **restore the work area** using the correct procedures for the **disposal of waste**

Range

Preparatory work: Safety checks, establish work area and circuit to be assembled, diagrams, manufacturers catalogues, data sheets, protective personal equipment (PPE), prevention of damage, anti-static devices, isolating transformers and Residual-Current Devices RCD's

Components:

Components as per designated circuit,

Tools: pliers, long nose pliers, drills.

Extraction and insertion tools: cable strippers, screwdrivers, soldering iron, desoldering wick, heatsink.

Assemble and build:

Electronic circuits of a build and energise type.

Bridge rectifier circuits, transistor switching circuits with light controls, etc.

Simple motorspeed/light dimmer control.

Test electronic circuits: Multimeters, oscilloscopes, signal generators, signal injectors

Disposal of waste: Identify materials requiring special disposal methods e.g. chemicals, sprays, flux.

Additional Guidance

Check availability: of components and source from alternatives if required. Safety checks on tools and components. Damaged components and tools. Electrical safety checks.

Functionality: Prove functionality and operation

Restore the work area: tools and equipment returned to stores, clean machine and work area

Unit 107

Carrying out electrical assembly

Level: 1
Credit value: 7
UAN number: L/503/0153

Unit aim

The unit provides the basic knowledge required for learners to be able to read and interpret data from diagrams and data sheets. It will enable learners to identify basic electrical components and their use.

Learning outcomes

There are **three** learning outcomes to this unit. The learner will:

1. be able to prepare for building electrical circuits
2. be able to build electrical circuits
3. be able to check completed circuits

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 107

Outcome 1

Carrying out electrical assembly

be able to be able to prepare for building electrical circuits

Assessment Criteria

The learner can:

1. identify electrical components from **information sources**
2. **plan and prepare** for electrical assembly.

Range

Information sources: manufacturers catalogues, data sheets, specifications, circuit, wiring, block and schematic diagrams

Plan and prepare: Work plans, risk assessment, electrical components/accessories for domestic/commercial and industrial installation types, fixed wiring as per BS 7671, flexible cords, fixings or solid and hollow surfaces, fuses, circuit breakers, control gear, containment systems, conduit, trunking, tray, basket, radial and ring final circuits, principles of earthing and bonding, circuit diagrams for one and two way lighting circuits, radial and ring final circuits.

Unit 107

Outcome 2

Carrying out electrical assembly

be able to be able to build electrical circuits

The learner can:

1. prepare a list of required **tools**
2. prepare a **requisition** of required cables, accessories and fittings
3. carry out **safety checks** on tools and work area
4. build a series of **electrical circuits**
5. **restore the work area** using the correct procedures for the **disposal of waste**

Range

Tools: Screwdrivers, pliers, side cutters, spanners, hammers, conduit dies, battery and mains drills, rivet tools, drill bits, hacksaws, tape measures, squares.

Requisition: To include: cables, accessories, fixings and fittings.

Safety checks: Carry out visual inspections to ensure that hand and power tools are safe to use, for signs of damage, check area is safe.

Electrical circuits:

- Mark out circuits.
- Construct lighting and power circuits using a range of cables and containment systems, conduit, trunking and PVC flat multicore cables.
- Connect components.

Disposal of waste: Identify items to be recycled and returned to store and those for disposal.

Additional Guidance

Restore work area: leave the work area free of unused consumables, clean the work area, put tools and equipment into safe storage, identify and record finished work.

Unit 107

Carrying out electrical assembly

Outcome 3

be able to check completed circuits

Outcome 3

be able to check completed circuits

Assessment Criteria

The learner can:

1. carry out **checks** to ensure that the completed circuit meets appropriate regulations and operational requirements
2. prove installation dead by approved methods.

Range

Checks: Visual inspection, dead tests, continuity of protective conductors, ring final circuit, insulation resistance, polarity, functional tests.

Unit 108

Working with sheet metals

Level: 1
Credit value: 7
UAN number: R/503/0154

Unit aim

This unit is concerned with the processes and technology associated with working with sheet metal to make simple assemblies. It covers a range of cutting, forming and joining techniques that are used in sheet metal working.

Candidates will be able to identify appropriate tools and methods of working for the desired result. The health and safety requirements common to the use of this process are also covered.

Learning outcomes

There are **three** outcomes to this unit. The candidate will:

1. be able to prepare sheet metal work equipment, tools and materials
2. be able to use equipment and tools for metal work forming operations
3. be able to produce fabrications using sheet metalwork assembly techniques

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 108

Working with sheet metals

Outcome 1

be able to be able to prepare sheet metal work equipment, tools and materials

Assessment Criteria

The learner can:

1. state the **health and safety measures** in the workplace that relate to sheet metal fabrication
2. state the **fire hazards** associated with hot working
3. state the hazards from **electricity**
4. use simple methods of **marking out**
5. select Personal Protective Equipment (PPE)
6. use sheet metalwork **cutting equipment** to produce simple shapes
7. use sheet metalwork **cutting tools** to produce simple shapes
8. use safe working practices
9. identify health and safety hazards.

Range

Health and safety measures: Personal Protective Equipment (PPE) (application to sheet metal working processes, employers' duties, employees' duties, function of items of Personal Protective Equipment)

Fire hazards: sources of combustion, burns, hot metal (identification of hazard ['HOT' and date and time], use of tools tongs for moving and manipulation, use of PPE)

Electricity: shock, fire, burns, methods of avoiding shock hazards

Marking out: use of datum line, edge, centre point,

Cutting equipment: drills, rotary shears, nibblers (shear type, punch type), guillotines (treadle, mechanical, back stops, front stops), fly press, portable angle grinders/sanders

Cutting tools: hand shears (straight, left hand, right hand), bench shears (hand lever), tin man's hand-level punch.

Unit 108

Outcome 2

Working with sheet metals

be able to be able to use equipment and tools for metal work forming operations

Assessment Criteria

The learner can:

1. use sheet metalwork fabrication **forming tools**
2. use sheet metalwork fabrication **forming equipment**
3. use techniques to produce **simple forms**
4. **restore the work area** using the correct procedures for the disposal of waste.

Range

Forming tools: hammers (types), planishing hammers, mallets (types), wooden blocks, range of bench stakes

Forming equipment: jennys (stiffening techniques, swaging, beading), rolling machines (pyramid type, pinch type, slip rolls, hand-operated), folding machines (box and pan, universal swing-beam), fly press (tooling, dies, forming tools)

Simple forms: square, rectangular, cylindrical, boxed.

Additional Guidance

Restore the work area: tools and equipment returned to stores, clean machine and work area

Unit 108

Working with sheet metals

Outcome 3

be able to be able to produce fabrications using sheet metalwork assembly techniques

Assessment Criteria

The learner can:

1. use simple methods of **fabrication assembly**
2. assemble simple **non self-secured joints**
3. assemble simple **self-secured joints**
4. use **mechanical joining methods**
5. use **soft soldering** techniques
6. use the resistance **spot welding** process
7. state the need for good housekeeping in the workplace
8. use equipment safely
9. produce sheet metalwork assembly
10. **restore the work area** using the correct procedures for the disposal of waste.

Range

Fabrication assembly: holding methods, clamping

Non self-secured joints: lap, corner, butt, tee, flanged butt, lock seem

Self-secured joints: grooved seam, panned down

Mechanical joining methods: hollow/solid riveting, threaded fastenings

Soft soldering: preparing the joint, cleaning the joint, types of soft solder, types of fluxes, types of soldering iron, heat sources (electrical, flame)

Spot welding: fixed and staticl, portable

.

Additional Guidance

Restore the work area: tools and equipment returned to stores, clean machine and work area , remove waste materials and reuse/recycle correctly

Level: 1
Credit value: 7
UAN number: H/503/0157

Unit aim

This unit is concerned with the underlying process technology associated with manual metal arc (MMA) welding at low carbon steel. It covers a range of joints and simple welding positions used in industry that reflect the level of the qualification.

The candidate will be able to select the appropriate tools and working methods to achieve the desired outcome.

The candidate will be able to state the risks involved in MMA welding and how to mitigate them.

Learning outcomes

There are **three** outcomes to this unit. The candidate will:

1. be able to prepare manual metal arc welding equipment and tools for safe use
2. know how to use equipment safely for manual metal arc welding low carbon steel
3. be able to produce welded joints safely using manual metal arc welding.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 109

Outcome 1

Carrying out manual arc welding techniques

be able to prepare manual metal arc welding equipment and tools for safe use

Assessment Criteria

The learner can:

1. state the **health and safety measures** in the workplace that relate to welding process
2. state the methods of avoiding and removing **welding fumes**
3. state the methods of avoiding **hazards** associated with the process
4. state **hazards** commonly encountered in the welding environment
5. select Personal Protective Equipment (PPE) for manual metal arc (MMA) welding
6. follow safe working practices.

Range

Health and safety measures: Personal Protective Equipment (PPE) (application to welding process, employers' duties, employees' duties, function of items of Personal Protective Equipment [headshield, filter lens, cover lens, gauntlets, protective footwear, eye protection, flame retardant overalls])

Welding fumes: use of extraction, natural ventilation (e.g. On-site), air-fed headshields, respirator

Hazards: fire (sources of combustion, burns), electric shock (shock hazards, welding lead, welding return, welding earth, insulation), arc radiation (visible light, infra-red, ultra-violet), arc-eye, glare, methods of avoiding (Personal Protective Equipment, screening), hot metal/slag (identification of hazard ['HOT' and date and time], use of tools tongs for moving and manipulation, use of PPE)

Unit 109

Outcome 2

Carrying out manual arc welding techniques

know how to use equipment safely for manual metal arc welding low carbon steel

Assessment Criteria

The learner can:

1. identify manual metal arc (MMA) **welding equipment** and state its function
2. state the safe use of **equipment** used for preparing and finishing materials and welded joints
3. state common types of consumable **electrodes**
4. state the types of **welding current**
5. identify **electrode sizes**
6. relate welding current for flat and horizontal/vertical welding to **electrode sizes**
7. define **welding practices**
8. identify the **types of joint**
9. define the **welding positions** as they relate to current standards
10. state the appropriate **assembly and distortion control methods**
11. state the post welding **cleaning activities**
12. state the need for good **housekeeping** in the workplace.

Range

Welding equipment: alternating current (a.c.), direct current (d.c.), welding leads (welding, return, earth), electrode holders, return clamps

Equipment: angle grinders, linishers, files, chipping hammer, wire brushes, hammer and chisel

Electrodes: rutile, basic, cellulosic

Welding current: alternating (a.c.), direct (d.c.) (electrode positive, electrode negative)

Electrode sizes: $\varnothing 2.5$ mm, $\varnothing 3.2$ mm, $\varnothing 4.0$ mm

Welding practices: arc striking, crater filling at the end of a weld, stop/restart, stringer beading, weaving

Types of joint: butt, lap, tee, corner

Welding positions: flat, horizontal/vertical

Assembly and distortion control methods: clamping, alignment jigs, run on/off plates, tack welds

Cleaning activities: slag removal, spatter removal, wiring brushing, removal of excess weld metal where required, checking welds for signs of defects

Housekeeping: leave the work area free of unused consumables, clean the work area, put tools and equipment into safe storage, identify and record finished work.

Unit 109

Outcome 3

Carrying out manual arc welding techniques

be able to produce welded joints safely using manual metal arc welding.

Assessment Criteria

The learner can:

1. use equipment for a welding operation safely
2. produce sufficient tack welded **joints** to enable welding
3. produce fillet welded joints in 3 to 6 mm thick low carbon steel safely in **welding positions**
4. use low carbon steel for a **welding operation**
5. use welding consumables safely
6. carry out **weld cleaning and checking** safely
7. **restore work area** using the correct procedure for the disposal of waste.

Range

Joints: lap, tee, corner

Welding positions: flat, horizontal/vertical

Welding operation: arc striking, crater filling at the end of a weld, stop/restart, stringer beading, weaving

Weld cleaning and checking: slag removal, spatter removal, wiring brushing, removal of excess weld metal where required, checking welds for signs of defects

Additional Guidance

Restore work area: leave the work area free of unused consumables, clean the work area, put tools and equipment into safe storage, identify and record finished work.

Unit 110

Carrying out MIG welding processes

Level: 1
Credit value: 7
UAN number: Y/503/0169

Unit aim

This unit is concerned with the underlying process technology associated with Metal Inert Gas (MIG) welding at low carbon steel. It covers a range of joints and simple welding positions used in industry that reflect the level of the qualification.

The candidate will be able to select the appropriate tools and working methods to achieve the desired outcome.

The candidate will be able to state the risks involved in MIG welding and how to mitigate them.

Learning outcomes

There are **three** outcomes to this unit. The candidate will:

1. know how to prepare MIG welding equipment and tools for safe use
2. know how to use equipment safely for MIG welding low carbon steel
3. be able to produce welded joints safely using MIG welding.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 110

Outcome 1

Carrying out MIG welding processes

know how to prepare MIG welding equipment and tools for safe use

Assessment Criteria

The learner can:

1. state the **health and safety measures** in the workplace that relate to the welding process
2. state the methods of avoiding and removing **welding fumes**
3. state the methods of avoiding **hazards** associated with the process
4. identify hazards commonly encountered in the welding environment
5. define safe working practices.

Range

Health and safety measures: Personal Protective Equipment (PPE) (application to welding process, employers' duties, employees' duties, function of items of Personal Protective Equipment [headshield, filter lens, cover lens, gauntlets, protective footwear, eye protection, flame retardant overalls])

Welding fumes: use of extraction, natural ventilation (e.g. On-site), air-fed headshields, respirator

Hazards: fire (sources of combustion, burns), electric shock (shock hazards, welding lead, welding return, welding earth, insulation), arc radiation (visible light, infra-red, ultra-violet), arc-eye, glare, methods of avoiding (Personal Protective Equipment, screening), hot metal (identification of hazard ['HOT' and date and time], use of tools tongs for moving and manipulation.

Unit 110

Outcome 2

Carrying out MIG welding processes

know how to use equipment safely for MIG welding low carbon steel

Assessment Criteria

The learner can:

1. identify MIG welding equipment
2. state the function of **welding equipment**
3. state the safe use of **equipment** used for preparing and finishing materials and welded joints
4. identify common types of **shielding gases**
5. state the type of **welding current** and polarity
6. identify **electrode sizes**
7. relate process **variables** to flat and horizontal/vertical welding of joints
8. define **welding practices**
9. identify the **types of joint**
10. state the **welding positions** as they relate to current standards
11. name the **appropriate assembly and distortion control methods**
12. state the post welding **cleaning activities**
13. state the need for good housekeeping in the workplace

Range

Welding equipment: direct current (d.c.) power source, welding leads (welding, return, earth), welding gun, wire feed unit, shielding gas supply return clamps

Equipment: angle grinders, linishers, files, wire brushes, hammer and chisel

Shielding gases: argon/oxygen/carbon dioxide mixtures, carbon dioxide

Welding current: direct (d.c.) Electrode positive

Electrode sizes: \varnothing 0.8mm, \varnothing 1.0 mm

Variables: voltage, wire feed speed, gas flow rate, inductance

Welding practices: arc striking, crater filling at the end of a weld, stop/restart, stringer beading, weaving

Types of joint: butt, lap, tee, corner

Welding positions: flat, horizontal/vertical

Assembly and distortion control methods: clamping, alignment jigs, run on/off plates, tack welds

Cleaning activities: spatter removal, wiring brushing, removal of excess weld metal where required, checking welds for signs of defects

Unit 110

Outcome 3

Carrying out MIG welding processes

be able to produce welded joints safely using MIG welding.

Assessment Criteria

The learner can:

1. use Personal Protective Equipment (PPE) effectively for MIG welding
2. use equipment for a welding operation safely
3. produce sufficient tack welded joints to enable welding
4. produce fillet welded **joints** in 3 to 6 mm thick low carbon steel safely in simple **welding positions**
5. use low carbon steel for a **welding operation**
6. use welding consumables safely
7. carry out weld cleaning and checking safely
8. restore **work area** using the correct procedure for the disposal of waste .

Range

Joints: lap, tee, corner

Welding positions: flat, horizontal/vertical

Welding operation: arc striking, crater filling at the end of a weld, stop/restart, stringer beading, weaving

Weld cleaning and checking: spatter removal, wiring brushing, removal of excess weld metal where required, checking welds for signs of defects

Additional Guidance

Restore work area leave the work area free of unused consumables, clean the work area, put tools and equipment into safe storage, identify and record finished work.

Unit 111

Carrying out TIG welding processes

Level: 1
Credit value: 7
UAN number: L/503/0170

Unit aim

This unit is concerned with the underlying process technology associated with Tungsten Inert Gas (TIG) welding at low carbon steel. It covers a range of joints and simple welding positions used in industry that reflect the level of the qualification.

The candidate will be able to select the appropriate tools and working methods to achieve the desired outcome.

The candidate will be able to state the risks involved in TIG welding and how to mitigate them.

Learning outcomes

There are **three** outcomes to this unit. The candidate will:

1. know how to prepare TIG welding equipment and tools for safe use
2. be able to use equipment safely for TIG welding low carbon steel
3. be able to produce simple welded joints safely using TIG welding.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 111

Carrying out TIG welding processes

Outcome 1

know how to prepare TIG welding equipment and tools for safe use

Assessment Criteria

The learner can:

1. state the **health and safety measures** in the workplace that relate to the welding process
2. state the methods of avoiding and removing **welding fumes**
3. state the methods of avoiding **hazards** associated with the process
4. identify hazards commonly encountered in the welding environment
5. define safe working practices.

Range

Health and safety measures: Personal Protective Equipment (PPE) (application to welding process, employers' duties, employees' duties, function of items of Personal Protective Equipment [headshield, filter lens, cover lens, gauntlets, protective footwear, eye protection, flame retardant overalls])

Welding fumes: use of extraction, natural ventilation (e.g. On-site), air-fed headshields, respirator

Hazards: fire (sources of combustion, burns), electric shock (shock hazards, welding lead, welding return, welding earth, insulation), arc radiation (visible light, infra-red, ultra-violet), arc-eye, glare, methods of avoiding (Personal Protective Equipment, screening), hot metal (identification of hazard ['HOT' and date and time], use of tools tongs for moving and manipulation

Unit 111

Outcome 2

Carrying out TIG welding processes

be able to use equipment safely for TIG welding low carbon steel

Assessment Criteria

The learner can:

1. identify TIG **welding equipment**
2. state the function of **welding equipment**
3. state the safe use of **equipment** used for preparing and finishing materials and welded joints
4. identify common shielding gas
5. state the type of **welding current and polarity**
6. identify **electrode sizes**
7. state tungsten **electrode types**
8. identify **filler wire sizes**
9. relate process **variables** to flat and horizontal/vertical welding of joints
10. state **welding practices**
11. identify the **types of joint**
12. name the **welding positions** as they relate to current standards
13. state the appropriate **assembly and distortion control methods**
14. list the post welding **cleaning activities**
15. state the need for good housekeeping in the workplace.

Range

Welding equipment: direct current (d.c.) power source, welding leads (welding, return, earth), welding torch, shielding gas supply return clamps

Equipment: angle grinders, linishers, files, wire brushes, hammer and chisel, shielding gas: argon

Welding current and polarity: direct (d.c.) Electrode negative

Electrode sizes: \varnothing 1.6 mm, \varnothing 2.4 mm

Electrode types: thoriated, ceriated, lanthanated

Filler wire sizes: \varnothing 1.6 mm, \varnothing 2.4 mm

Variables: welding current, gas flow rate

Welding practices: arc striking, crater filling at the end of a weld, stop/restart, stringer beading, weaving

Types of joint: butt, lap, tee, corner

Welding positions: flat, horizontal/vertical

Assembly and distortion control methods: clamping, alignment jigs, run on/off plates, tack welds

Cleaning activities: wiring brushing, removal of excess weld metal where required, checking welds for signs of defects

Unit 111

Outcome 3

Carrying out TIG welding processes

be able to produce simple welded joints safely using TIG welding.

Assessment Criteria

The learner can:

1. use Personal Protective Equipment (PPE) effectively for TIG welding
2. use equipment for a welding operation safely
3. produce sufficient tack welded joints to enable welding
4. produce fillet welded **joints** in 1.5 to 3 mm thick low carbon steel safely in simple **welding positions**
5. use low carbon steel for a **welding operation**
6. use welding consumables safely
7. carry out **weld cleaning and checking** safely
8. **restore work area** using the correct procedures for the disposal of waste.

Range

Joints: lap, tee, corner

Welding positions: flat, horizontal/vertical

Welding operation: arc striking, crater filling at the end of a weld, stop/restart, stringer beading, weaving

Weld cleaning and checking: wiring brushing, removal of excess weld metal where required, checking welds for signs of defects

Additional Guidance

Restore work area: leave the work area free of unused consumables, clean the work area, put tools and equipment into safe storage, identify and record finished work.

Unit 112

Carrying out OXY-Acetylene welding processes

Level: 1
Credit value: 7
UAN number: R/503/0171

Unit aim

This unit is concerned with the underlying process technology associated with oxy-acetylene (gas) welding at low carbon steel. It covers a range of joints and simple welding positions used in industry that reflect the level of the qualification.

The candidate will be able to select the appropriate tools and working methods to achieve the desired outcome.

The candidate will be able to state the risks involved in oxy-acetylene welding and how to mitigate them.

Learning outcomes

There are **three** outcomes to this unit. The candidate will:

1. know how to prepare oxy-acetylene welding equipment and tools for safe use
2. know how to use equipment safely for oxy-acetylene welding low carbon steel
3. be able to produce welded joints safely using oxy-acetylene welding.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 112 Carrying out OXY-Acetylene welding processes

Outcome 1 know how to prepare oxy-acetylene welding equipment and tools for safe use

Assessment Criteria

The learner can:

1. state the **health and safety measures** in the workplace that relate to the welding process
2. state the methods of avoiding and removing **welding fumes**
3. state the methods of avoiding **hazards** associated with the process
4. state the safe start-up and shutdown procedures
5. state the procedure for dealing with a backfire
6. list the procedure for dealing with a flashback
7. state hazards commonly encountered in the welding environment
8. define safe working practices

Range

Health and safety measures: Personal Protective Equipment (PPE) (application to welding process, employers' duties, employees' duties, function of items of Personal Protective Equipment [goggles, filter lens, cover lens, gloves, protective footwear, eye protection, flame retardant overalls, leather apron])

Welding fumes: use of extraction, natural ventilation (e.g. on-site), respirator

Hazards: fire (sources of combustion, burns), glare, methods of avoiding (PPE, screening), hot metal (identification of hazard ['HOT' and date and time], use of tools tongs for moving and manipulation, use of PPE), hazards from compressed gas cylinders (safe storage conditions, safe handling/moving, safe use)

Unit 112

Carrying out OXY-Acetylene welding processes

Outcome 2

know how to use equipment safely for oxy-acetylene welding low carbon steel

Assessment Criteria

The learner can:

1. identify oxy-acetylene **welding equipment**
2. state the **function** of welding equipment
3. state the safe use of **equipment** used for preparing and finishing materials and welded joints
4. identify **filler rod sizes**
5. relate **process variables** to flat and horizontal/vertical welding of joints
6. identify the **neutral flame** condition
7. identify the **gases** used
8. identify **welding practices**
9. identify the **types of joint**
10. state how the **welding positions** relate to current standards
11. name the appropriate **assembly and distortion control methods**
12. list the post welding **cleaning activities**
13. state the need for good housekeeping in the workplace.

Range

Welding equipment: cylinders, pressure regulators, flashback arrestors, hoses, hose check-valves, hose connectors, blowpipe/torch, nozzles

Function: cylinders (oxygen, acetylene, colour coding), pressure regulators, flashback arrestors, hoses, hose check-valves, blowpipe/torch, economisers, nozzles (sizes), use of left hand and right hand threaded connections (identification)

Equipment: angle grinders, liners, files, chipping hammer, wire brushes, hammer and chisel

Filler rod sizes: Ø1.6mm, Ø2.4 mm

Process variables: gas pressures, nozzle sizes, welding technique (leftward)

Neutral flame: inner cone, outer envelope, hottest point of the flame, other conditions (oxidising, reducing/carburising)

Gases: types (oxygen, acetylene, cylinder colour, hose colour, hazards associated with its use and how to avoid them)

Welding practices: flame ignition and setting, crater filling at the end of a weld, stop/restart, stringer beading, weaving

Types of joint: butt, lap, tee, corner

Welding positions: flat, horizontal/vertical

Assembly and distortion control methods: clamping, alignment jigs, run on/off plates, tack welds, types of distortion (longitudinal contraction, transverse contraction, angular, longitudinal angular distortion and buckling)

Cleaning activities: wiring brushing, removal of excess weld metal where required, checking welds for signs of defects

Unit 112 Carrying out OXY-Acetylene welding processes

Outcome 3 be able to produce welded joints safely using oxy-acetylene welding.

Assessment Criteria

The learner can:

1. use Personal Protective Equipment (PPE) effectively for oxy-acetylene welding
2. use equipment for a welding operation safely
3. produce sufficient tack welded joints to enable welding
4. produce fillet welded **joints** in 1.0 to 3.0 mm thick low carbon steel safely in **welding positions**
5. use low carbon steel for a **welding operation**
6. use welding consumables safely
7. carry out weld **cleaning and checking safely**
8. **restore the work** area using the correct procedures for the disposal of waste.

Range

Joints: lap, tee, corner

Welding positions: flat, horizontal/vertical

Welding operation: flame ignition and setting, crater filling at the end of a weld, stop/restart, stringer beading, weaving

Weld cleaning and checking: wiring brushing, removal of excess weld metal where required, checking welds for signs of defects

Additional Guidance

Restore work area: leave the work area free of unused consumables, clean the work area, put tools and equipment into safe storage, identify and record finished work.

Level: 1
Credit value: 7
UAN number: M/503/0162

Unit aim

This unit will introduce candidates to basic surface finishing operations. It will cover the skills and knowledge needed to prepare for and carry out simple surface finishing activities.

The candidate will be able to identify the surface finishing techniques required and their application to simple tasks. All relevant health and safety considerations are covered.

Learning outcomes

There are **two** outcomes to this unit. The candidate will:

1. be able to prepare for surface finishing
2. be able to apply surface coatings.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 113

Carrying out surface finishing techniques

Outcome 1

be able to be able to prepare for surface finishing

Assessment Criteria

The learner can:

1. define the employees' responsibility for Health & Safety
2. state the **hazards** associated with the **coating/treatment process**
3. use Personal Protective Equipment (PPE) appropriate to the various stages of the coating process
4. use safe procedures to prevent injury to skin
5. identify surface **coating/treatment processes** and their applications
6. identify **consumables** required for surface coating/treatment processes
7. state the factors influencing the **selection** of a specific surface coating/ treatment process
8. identify standard and specialist equipment and consumables required when performing surface **preparation** operations
9. prepare the work area prior to the surface finishing operation
10. prepare equipment and consumables for surface finishing operation
11. prepare material for simple surface finishing operation
12. apply health and safety procedures and practices.

Range

Hazards: fumes, particles, spillages

Coating/treatment processes: liquid coatings (painting), mechanical treatments (polishing, finishing)

Consumables: cleaning agents, paints, abrasives

Selection: type of material, component size, process availability, cost, work environment

Preparation: steaming, degreasing, grinding and sanding, brushing

Unit 113

Outcome 2

Carrying out surface finishing techniques

be able to be able to apply surface coatings.

Assessment Criteria

The learner can:

1. state the **reasons for the application** of the coating/treatment
2. state the **factors affecting coating applications**
3. select consumables to apply to **surface coatings/treatments**
4. apply the surface coating treatment
5. **restore work area** using the correct procedures for the **disposal of waste**.

Range

Reasons for the application: protective, decorative, wear resistance, insulation, type of material

Factors affecting coating applications: temperature, humidity, viscosity, time

Surface coatings/treatments: either liquid coatings (painting) or mechanical treatments (polishing or finishing)

Additional Guidance

Restore work area: leave the work area free of unused consumables, clean the work area, put tools and equipment into safe storage, identify and record finished work.

Unit 114

Carrying out mechanical maintenance

Level: 1
Credit value: 7
UAN number: A/503/0164

Unit aim

This unit is concerned with the routine inspection, lubrication, servicing and maintenance of simple mechanical devices and systems, using the most appropriate tools and equipment in a safe manner. It further deals with dismantling and rebuilding of simple devices and systems, including the replacement of 'lifer' items.

Learning outcomes

There are **three** outcomes to this unit. The candidate will:

1. be able to plan and prepare for maintaining simple mechanical devices/systems
2. be able to carry out simple servicing/maintenance in accordance with information from fault-finding
3. know how to check that the device/system conforms to the schedule.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 114

Outcome 1

Carrying out mechanical maintenance

be able to plan and prepare for maintaining simple mechanical devices/systems

Assessment Criteria

The learner will be able to:

1. gather and interpret **information** dealing with maintenance, lubrication, assembly and dismantling of devices and systems
2. list the stages in a typical **service/maintenance schedule**
3. identify **wear and/or damage**.

Range

Information: drawings (orthographic, pictorial, sketching, assembly, exploded), charts, tables, maintenance manuals, technical specifications, manufacturers' instructions

Service/maintenance schedule: permit to work, isolation procedure, locking off procedure, sequence of dismantling and assembly, lubrication requirements, lubrication requirements, tools and equipment, spare/replacement components, 'on-line' reporting requirements (signing off)

Identify wear and/or damage: bearings and shafts, linkages, drive belts, couplings, clutches, brakes, gearboxes, seals and gaskets

Unit 114

Outcome 2

Carrying out mechanical maintenance

be able to carry out simple servicing/maintenance in accordance with information from fault-finding

Assessment Criteria

The learner can:

1. select Personal Protective Equipment (**PPE**) to be used when undertaking dismantling and assembly operations
2. list the sequence to be used to dismantle a device or system
3. state the procedure for removing **covers**
4. state levels of cleanliness necessary when undertaking dismantling operations
5. use **cleaning** techniques
6. state the need for proof marking during dismantling to aid re-assembly
7. state the appropriate storage requirements for removed parts
8. use **hand tools** to dismantle mechanical devices/systems
9. separate components by removing **mechanical fastenings**
10. remove **components**
11. remove and fit seals, gaskets and packing
12. use release agents for dismantling corroded parts
13. conduct visual checks on dismantled components
14. state the need to check **fastening devices** for damage
15. check **dimensions and clearances** of components
16. identify the components to **discard and replace**
17. set out components in a logical sequence in preparation for re-assembly
18. state the need for packing and shims
19. state how to fit seals and gaskets
20. state how to **locate and secure parts**
21. check **moving parts**
22. tighten fastenings in the correct sequence to the correct torque
23. apply **lubricant** to **moving parts**
24. **restore work area** using the correct procedures for the disposal of waste.

Range

PPE: anti-splinter spectacles, skin protection agents, flame proof overalls

Covers: inspection covers, casings, guards

Cleaning: dust (blow, vacuum), dirt (brush, vacuum), grease (degreasing agents, solvents, steam

Hand tools: spanners, socket sets, pin punches, drifts and wedges, grips and pliers, extractors

Mechanical fastenings: nuts and bolts, studs and screws, clips, pins, rivets

Components: bearing extractors, hub pullers, mandrel presses

Fastening devices: studs, bolts and screws, pins and dowels, keys, bearings and shafts, gears, couplings, circlips, seals and gaskets, springs, washers (flat, tab, spring, taper)

Dimensions and clearances: digital metric inside and outside micrometer, digital metric vernier caliper and height gauge, metric feeler gauges, digital metric dial test indicator

Discard and replace: high tensile bolts and load indicating washers, nylon insert nuts, locking devices, split pins, seals and gaskets

Locate and secure parts: keys, pins and dowels, screws, nuts and bolts, circlips, mechanical locking devices, castellated nuts

Lubricant: methods of application, types of lubricants: oil, grease, wax, graphite

Moving parts: sliding, reciprocating, rotating

Additional Guidance

Restore work area: leave the work area free of unused consumables, clean the work area, put tools and equipment into safe storage, identify and record finished work.

Unit 114

Outcome 3

Carrying out mechanical maintenance

know how to check that the device/system conforms to the schedule.

Assessment Criteria

The learner can be able to:

1. state the need to maintain **maintenance logs**
2. state the need to check the completed system/device complies with the **specification**
3. state the importance of making visual checks
4. state the mechanisms and faults that can be identified by **visual, tactile or audible checks**
5. state typical **common faults** that occur with specific devices or systems
6. state methods for 'signing-off' serviced/maintained systems.

Range

Maintenance logs: (service administration information [date, name, findings, notes, etc.] Confirm the serviced/maintained device/system meets the required specification, record the results to confirm achievement of the required operating performance)

Specification: dimensions and tolerances, movement, capacities, appearance, lubrication

Visual, tactile or audible checks: metal fractures or pitting, loose or damaged mechanical fastenings, broken drive belts and/or chains, leaking seals, excessive movement/clearance, excessive temperature of bearings, brakes or drives, unfamiliar noises

Common faults: wear and abrasion, overheating, vibration, out of balance, fractures, corrosion, leakages

Unit 115

Communicating using CAD systems

Level: 1
Credit value: 7
UAN number: F/503/0165

Unit aim

This unit is concerned with forms of communication; an entrant to the field of engineering will need to be familiar with, for progression into the industry. The unit aims are to develop the communication skills of candidates' through the study of topics which include: writing, speaking, sketching, CAD, interpreting engineering information, and the use of a range of ICT methods for obtaining, processing and presenting information in oral and written forms

Learning outcomes

There are **three** learning outcomes to this unit. The learner will:

1. be able to prepare for communication
2. be able to use CAD software for engineering purposes
3. be able to use communication software for engineering purposes.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge

tasks.

Unit 115 Communicating using CAD systems

Outcome 1 be able to be able to prepare for communication

Assessment Criteria

The learner can:

1. state the **types of engineering drawing**
2. apply the basic information contained within a **title block**
3. state **additional information** that may be supplied
4. identify and use **systems of projection**
5. state **types of line** and their application
6. define standard **abbreviations**
7. list sources of **engineering data**.

Range

Types of engineering drawing: general layout, detail/component, assembly

Title block: name of draughtsperson, date drawn, projection symbol, scale, title, drawing number, unit of measurement, lettering

Additional information: general tolerance, material specifications, surface texture, issue number and revisions, warning notices (if in doubt ask, do not scale, not to scale)

Systems of projection: orthographic (first angle, third angle), pictorial (isometric, oblique), views (sectional, hatching)

Types of line: continuous thick, continuous thin, continuous thin irregular, dashed thin, chain thin, dimension (projection lines, dimension lines, leader lines) dimension types (linear: chain, base line; angular)

Abbreviations: across flats, centre line, chamfer, countersunk, diameter, drawing, hexagon head, material, radius, square, thread, undercut

Engineering data: data sheets, handbooks, reference tables, charts, manufacturers manuals

Unit 115

Outcome 2

Communicating using CAD systems

be able to be able to use CAD software for engineering purposes

Assessment Criteria

The learner can:

1. use CAD system **menus and commands** to amend features of CAD templates
2. use CAD software to produce and output simple basic circuit and detail **drawings**
3. use CAD software to create and output a simple basic **isometric** drawing or view

Range

Menus and commands: layers, templates, straight lines, curved lines, circles, ellipses, hatching, dimensioning, text; editing, modification commands (trim, extend, fillet, chamfer, etc.), viewing/navigation features (pan, zoom, etc.)

Drawings: inserting commonly used symbols, orthographic drawings for 2D output

Isometric: drawings for 2D output

Unit 115

Outcome 3

Communicating using CAD systems

be able to be able to use communication software for engineering purposes.

Assessment Criteria

The learner can:

1. create a **spreadsheet** to produce a bill of materials from a given assembly
2. create a chart or graph using a spreadsheet
3. send and receive email messages
4. create **folders** and manage files
5. operate computer / display **equipment** in compliance with current health and safety legislation.

Range

Spreadsheet: tables, costing, charts, graphs

Folders: files are sorted and backed-up saved into appropriate folders and storage media

Equipment: health and safety legislation relating to the use of VDU equipment and work station environment, understand the user's responsibilities under the data protection act, software copyright, computer misuse act, procedures for starting up and closing down systems and software, procedure to output hard copies of files.

Unit 116

Producing engineering drawings

Level: 1
Credit value: 7
UAN number: L/503/0167

Unit aim

This unit introduces candidates to methods of drawing and communication that are required in the engineering and manufacturing sectors. It covers the fundamental skills and knowledge needed to prepare and produce engineering drawings, in both orthographic and pictorial form.

Learning outcomes

There are **two** outcomes to this unit. The candidate will:

1. be able to identify standards for engineering drawings and pictorial views
2. be able to apply techniques to produce drawings and geometrical constructions.

Guided learning hours

It is recommended that **60** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Assessment

This unit will be assessed by an assignment which contains practical and knowledge tasks.

Unit 116

Outcome 1

Producing engineering drawings

be able to be able to identify standards for engineering drawings and pictorial views

Assessment Criteria

The learner will be able to:

1. state the sizes of 'A' series drawing sheets
2. state the **types of engineering drawing**
3. state the basic information contained within a **title block**
4. state **additional information** that may be supplied
5. identify and use **systems of projection**
6. state **types of line** and their application
7. define standard **abbreviations**
8. list sources of **engineering data**

Range

Types of engineering drawing: general layout, detail/component, assembly

Title block: name of draughtsperson, date drawn, projection symbol, scale, title, drawing number, unit of measurement, lettering

Additional information: general tolerance, material specifications, surface texture, issue number and revisions, warning notices (if in doubt ask, do not scale, not to scale)

Systems of projection: orthographic (first angle, third angle), pictorial (isometric, oblique), views (sectional, hatching)

Types of line: continuous thick, continuous thin, continuous thin irregular, dashed thin, chain thin, dimension (projection lines, dimension lines, leader lines) dimension types (linear: chain, base line; angular)

Abbreviations: across flats, centre line, chamfer, countersunk, diameter, drawing, hexagon head, material, radius, square, thread, undercut

Engineering data: data sheets, handbooks, reference tables, charts, manufacturers manuals

Unit 116

Outcome 2

Producing engineering drawings

be able to be able to apply techniques to produce drawings and geometrical constructions.

Assessment Criteria

The learner can:

1. state the basic **instruments and equipment** that are used
2. set out a title block
3. apply **drawing scales**
4. set out **orthographic views** using construction lines and other line types
5. use methods of **geometrical construction**
6. use representation of **common features**
7. state the need for tolerances
8. state the need for sectional views.

Range

Instruments and equipment: pencils (grades), board (parallel motion), rule, set squares (45°, 30/60°, adjustable), compasses (spring bow), protractor, eraser.

Drawing scales: smaller than full size, larger than full size

Orthographic views: first angle, third angle

Geometrical construction: bisect a line, construct lines parallel to each other and perpendicular, divide an line into equal parts, construct triangles (equilateral, isosceles), construct an ellipse, construct regular polygons (square, hexagon, octagon)

Common features: threads (external, internal), knurls (diamond, straight), square

Sectional views: elevations and plan, cutting plain line, hatching, parts not hatched (bolts, nuts and washers, pins, keys and keyways, shafts, webs, gussets, spokes).

Appendix 1 Relationships to other qualifications

Literacy, language, numeracy and ICT skills development

This qualification include opportunities to develop and practise many of the skills and techniques required for success in the following qualifications:

- Functional Skills (England) – see www.cityandguilds.com/functionalskills
- Essential Skills (Northern Ireland) – see www.cityandguilds.com/essentialskillsni
- Essential Skills (Wales).

There might also be opportunities to develop skills and/or portfolio evidence if candidates are completing any Key Skills alongside this qualification.

Appendix 2 Sources of general information

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

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

- **Walled Garden**
Find out how to register and certificate candidates on line
- **Events**
Contains dates and information on the latest Centre events
- **Online assessment**
Contains information on how to register for online assessments.

Useful contacts

Type	Contact	Query
Centres	T: +44 (0)20 7294 2787 F: +44 (0)20 7294 2413 E: centresupport@cityandguilds.com	<ul style="list-style-type: none">• Exam entries• Registrations/enrolment• Certificates• Invoices• Missing or late exam materials• Nominal roll reports• Results
Single subject qualifications	T: +44 (0)20 7294 8080 F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) E: singlesubjects@cityandguilds.com	<ul style="list-style-type: none">• Exam entries• Results• Certification• Missing or late exam materials• Incorrect exam papers• Forms request (BB, results entry)• Exam date and time change
Walled Garden	T: +44 (0)20 7294 2840 F: +44 (0)20 7294 2405 E: walledgarden@cityandguilds.com	<ul style="list-style-type: none">• Re-issue of password or username• Technical problems• Entries• Results• Online assessments• Navigation• User/menu option problems

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Published by City & Guilds

5-6 Giltspur Street

London

EC1A 9DE

T +44 (0)20 7294 2800

www.cityandguilds.com

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