City & Guilds Level 2 Diploma in Manufacturing (Knowledge and Skills) (4500-12)

January 2022 Version 1.0

Qualification Handbook

Qualification at a glance

Subject area	Engineering
City & Guilds number	4500-12
Age group approved	16+
Entry requirements	None
Assessment	Short Answer, Centre Devised, Portfolio of Evidence
Grading	Pass/fail
Approvals	Full centre
Support materials	Assessment pack, SmartScreen
Registration and certification	Consult the Walled Garden/Online Catalogue for last dates

Title and level	City & Guilds number	Ofqual number
City & Guilds Level 2 Diploma in Manufacturing (Knowledge and Skills)	4500-12	610/0180/6

Version and date	Change detail	Section
Version 1.0	Created	All

Contents

1 Introduction

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

Area	Description
Who is the qualification for?	This qualification is aimed at learners aged 16 and above who would like to gain the knowledge and skills required to become a Lean Manufacturing Operative as part of an apprenticeship.
What does the qualification cover?	This qualification allows learners to develop the knowledge and skills required for employment and/or career progression in the manufacturing industry sector in general.
What opportunities for progression are there?	Upon completion, learners will have achieved the on-programme competence qualification. This is a mandatory component of the Level 2 Lean Manufacturing Operative apprenticeship framework. Learners could progress on to Level 3 qualifications or into employment in the Manufacturing sector.
Who did we develop the qualification with?	The City & Guilds Level 2 Diploma in Manufacturing (Knowledge and Skills) was developed through close collaboration with the Lean Manufacturing trailblazer group. The trailblazer group included the following employers: Nissan Motor Manufacturing, Toyota Motor Manufacturing, Calsonic Kansei, ADIANT, DHL, JCB, NAC Group, Caterpillar, Perkins, Jaguar Landrover, Bacoll, BMW, Vision Labs, Cargill Meats Limited, Nifty Lift
Is it part of an apprenticeship standard?	This qualification is mandated in the Level 2 Lean Manufacturing Operative ST0420 apprenticeship standard. The qualification can also be used for full time students who would like to gain the skills that will enable them to progress into employment or further training.

Structure

To achieve the City & Guilds Level 2 Diploma in Manufacturing (Knowledge and Skills), learners must achieve the five mandatory units, plus two units from Group A and one unit from Group B:

City & Guilds unit number	Unit title	GLH
Mandatory units (Core):		
Learners must achieve all **five** mandatory units.		
201	Health and safety within a manufacturing environment	30
202	Communicating and working effectively within a manufacturing environment	30
203	Working relationships and individual rights and responsibilities within a manufacturing environment	30
204	Workplace organisational techniques	30
205	Work-related problem-solving techniques	40
Group A optional units (Core):		
Learners must achieve **two** units from this group.		
206	Preparing for manufacturing operations	20
207	Controlling manufacturing operations	20
208	Conclusion and handover of manufacturing operations	40
Group B optional units (role-specific):		
Learners must achieve **one** unit from this group.		
209	Producing products by assembly operations	60
210	Transferring materials for manufacturing operations	60
211	Receiving and checking incoming materials for manufacturing operations	60
212	Producing products by processing	60

213	Finishing products	60
214	Analysing the results of inspection and confirming quality of production	60
215	Carrying out inspection and testing activities	60
216	Recording and reporting inspection and test results	60

Selecting the role-specific unit:

Where this qualification is delivered as part of the Level 2 Lean Manufacturing Operative apprenticeship, the unit selected from the Group B optional units should align to the learner's job role as identified by the apprenticeship standard. This is to ensure that learning takes place for the relevant Knowledge, Skills and Behaviours (KSBs) assessed in the apprenticeship End-point Assessment.

Total Qualification Time

Total Qualification Time (TQT) is the number of notional hours which represents an estimate of the total amount of time that could reasonably be expected for a learner to achieve and demonstrate the achievement of the level of attainment necessary for the award of a qualification.

TQT is comprised of the following two elements:

- The number of hours which an awarding organisation has assigned to a qualification for Guided Learning, and
- An estimate of the number of hours a Learner will reasonably be likely to spend in preparation, study or any other form of participation in education or training, including assessment, which takes place as directed by - but, unlike Guided Learning, not under the Immediate Guidance or Supervision of - a lecturer, supervisor, tutor or other, appropriate provider of education or training

Title and level	GLH	TQT
City & Guilds Level 2 Diploma in Manufacturing (Knowledge and Skills)	260	370

2 Centre requirements

Approval

To offer these qualifications, new centres will need to gain both centre and qualification approval. Please refer to document Quality Assurance Standards: Centre Approval Process for further information.

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

Internal quality assurance

Approved centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications.

Quality assurance includes initial centre approval, qualification approval and the centre's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance and City & Guilds is responsible for external quality assurance.

Standards and rigorous quality assurance are maintained by the use of:

- Internal quality assurance
- City & Guilds external quality assurance.

In order to carry out the quality assurance role, Internal Quality Assurers must have appropriate teaching and vocational knowledge and expertise. Assessor/Verifier (A/V) units are valued as qualifications for the centre, but they are not currently a requirement for this qualification.

Additionally, those involved in internal quality assurance must:

- have experience in quality management/internal verification
- hold or be working towards an appropriate teaching/training/assessing qualification
- be familiar with the occupation and technical content covered within the qualification.

Resource requirements

Centre staffing

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

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

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

Learner entry requirements

City & Guilds does not set entry requirements for these qualifications. However, centres must ensure that candidates have the potential and opportunity to gain the qualification successfully.

This qualification is a mandatory component of the on-programme phase of the Lean Manufacturing Operative Apprenticeship Standard for the following occupational job roles; Production/Assembly, Inspection/Quality assurance, Logistics/Material handling and Production processing/Finishing.

The Standard and Assessment plan was designed by Employers. Individual employers will set the criteria, but employers who recruit learners without English and Maths at level 1 (or equivalent), must ensure that the learner achieves this requirement and take the test for Level 2, prior to completion of the Apprenticeship. Centres should make themselves familiar with the Standard, Assessment Plan and Employer Occupational Brief requirements, details of which can be found at: **https://www.instituteforapprenticeships.org/apprenticeship-standards/lean-manufacturing-operative-v1-0**

Age restrictions

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

3 Delivering the qualification

Initial assessment and induction

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

- if the learner has any specific training needs
- support and guidance they may need when working towards their qualifications
- the appropriate type and level of qualification.

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

Support materials

The following resources are available for these qualifications:

Description	How to access
SmartScreen	www.smartscreen.co.uk
Assessments	www.cityandguilds.com

4 Assessment

Summary of assessment methods

Learners must:

- successfully complete the relevant assessment for each mandatory unit
- successfully complete the relevant assessment for each optional unit chosen
- have a completed Portfolio of Evidence.

City & Guilds has written the following assessments to use with this qualification: Short answer questions for mandatory units 201 – 203. Centres may choose whether to create their own assessments, or use the assessments devised by City & Guilds. If a centre chooses to create their own assessments, these must be submitted to the City and Guilds approval process.

City & Guilds has written guidance for centres on the how to develop a Portfolio of Evidence for units 204 – 216. The evidence that the learner presents for assessment must demonstrate that they have met the required standard specified in the learning outcomes and assessment criteria.

Centres are responsible for deciding on the assessment activities that will enable learners to produce valid, sufficient and authentic evidence to meet the assessment criteria. Learners must be given a clear assessment brief before the assessment takes place, detailing:

- The assessment activity and context
- The learning outcome(s) to be assessed
- The criteria they are expected to meet
- The time and duration of the assessment

Wherever possible, centres should adopt a holistic and integrated approach to assessing units 204 – 216. This gives the assessment process greater rigour, minimises repetition and saves time. The focus should be on assessment activities generated through naturally occurring evidence in the workplace, rather than on specific tasks. Taken as a whole, the evidence must show the learner meets all learning outcomes and assessment criteria over a period of time.

Assessment Types			
Unit	**Title**	**Assessment method**	**Where to obtain assessment materials**
201	Health and safety within a manufacturing environment	**Short-answer test 201** Centres may use the materials provided by City & Guilds, or develop their own (subject to EQA)	www.cityandguilds.com Passwords can be found on the Walled garden.
202	Communicating and working effectively within a manufacturing environment	**Short-answer test 202** Centres may use the materials provided by City & Guilds, or develop their own (subject to EQA)	www.cityandguilds.com Passwords can be found on the Walled garden.
203	Working relationships and individual rights and responsibilities within a manufacturing environment	**Short-answer test 203** Centres may use the materials provided by City & Guilds, or develop their own (subject to EQA)	www.cityandguilds.com Passwords can be found on the Walled garden
204	Workplace organisational techniques	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com
205	Work-related problem-solving techniques	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com
206	Preparing for manufacturing operations	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com
207	Controlling manufacturing operations	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com

208	Conclusion and handover of manufacturing operations	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com
209	Producing products by assembly operations	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com
210	Transferring materials for manufacturing operations	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com
211	Receiving and checking incoming materials for manufacturing operations	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com
212	Producing Products by Processing	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com
213	Finishing products	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com
214	Analysing the results of inspection and confirming quality of production	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com
215	Carrying out inspection and testing activities	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com
216	Recording and reporting inspection and test results	**Portfolio of Evidence** Centre devised, internally set and marked assessment	www.cityandguilds.com

Assessment strategy

The units in this qualification are initially assessed by the Centre (internal assessment), and subject to internal and external quality assurance.

Mandatory units 201, 202 and 203 are assessed by short answer tests, which are graded Pass/Fail. This may be a test created by City & Guilds or Centre devised. Centres may choose whether to create their own assessments, or use the assessments devised by City & Guilds. The tests are marked by the centre and externally quality assured.

Mandatory units 204 – 205, and optional units 206 – 216 are assessed through Portfolio of Evidence. All evidence in the portfolio for the skills learning outcomes must be generated in the workplace or realistic working environment.

Test specifications

The way the knowledge is covered by each test is laid out in the tables below:

Assessment title: 4500-201 Health and Safety Within a Manufacturing Environment

Assessment type: Short answer test

Assessment conditions: Supervised exam conditions

Grading: Pass/Fail

Test: 201	**Duration: 45 minutes**		
Unit	**Outcome**	**Number of marks**	**%**
201	1 Understand the requirements for health and safety and the environment in manufacturing.	12	40
	2 Understand risk assessment in a manufacturing environment.	8	27
	3 Understand safe working practices in manufacturing.	10	33
	Total	**30**	**100**

The pass boundary for this test will be approximately 46%.

The boundary may be subject to slight variation to ensure fairness should any variations in the difficulty of the test be identified.

Assessment title: 4500-202 Communicating and Working Effectively Within a Manufacturing Environment

Assessment type: Short answer test

Assessment conditions: Supervised exam conditions

Grading: Pass/Fail

Test: 202	**Duration: 45 minutes**		
Unit	**Outcome**	**Number of marks**	**%**
202	1 Understand how to communicate general and technical information within a manufacturing environment.	12	40
	2 Understand how manufacturing processes are planned and organised.	8	27
	3 Understand the importance of effective team working.	10	33
	Total	**30**	**100**

The pass boundary for this test will be approximately 43%.

The boundary may be subject to slight variation to ensure fairness should any variations in the difficulty of the test be identified.

Assessment title: 4500-203 Working Relationships and Individual Rights and Responsibilities Within a Manufacturing Environment

Assessment type: Short answer test

Assessment conditions: Supervised exam conditions

Grading: Pass/Fail

Test: 203	Duration: 45 minutes		
Unit	**Outcome**	**Number of marks**	**%**
203	1 Understand how attitude has an influence on behaviour.	8	27
	2 Know the importance of maintaining effective working relationships.	6	20
	3 Understand the purpose and importance of continuous professional development.	6	20
	4 Know the main current legislation and rules that affect employment in the manufacturing environment.	6	20
	5 Understand the role of representative bodies in the manufacturing environment.	4	13
	Total	**30**	**100**

The pass boundary for this test will be approximately 43%.

The boundary may be subject to slight variation to ensure fairness should any variations in the difficulty of the test be identified.

Portfolio of evidence

The Portfolio of Evidence is intended to be holistic, for example one piece of evidence may be provided against multiple assessment criteria and across more than one unit. It is not necessary for learners to have a separate piece of evidence for each assessment criterion.

Evidence of skills applied in real-work situations is required; scenarios to demonstrate skills and behaviours are not accepted because they do not support a learner demonstrating their competence.

Learners must ensure that they provide multiple examples/references when required by the assessment criterion.

Where demonstrating knowledge, learners may refer to their own organisation, or another they are familiar with.

The Portfolio of Evidence must be provided electronically, unless agreed otherwise under the Special Consideration policy.

Apprenticeship End-point Assessment (EPA): Where this qualification is taken as part of the Level 2 Lean Manufacturing Operative Apprenticeship, learners must review the specific requirements of the EPA assessment methods to ensure compliance.

Evidence sources

A Portfolio of Evidence will typically include several pieces of evidence - it must contain sufficient evidence to demonstrate the knowledge and skills required for each appropriate unit.

Evidence sources may include:

- training logbooks
- centre produced worksheets and activities
- annotated photographs
- video clips (maximum duration in total 10-minutes)
- workplace documentation/records, for example job cards/job sheets, equipment check/maintenance/service records, parts order records.

This is not a definitive list; other evidence sources are permitted.

The evidence provided must be valid and attributable to the learner; the Portfolio of Evidence must contain a statement from the centre confirming this.

Evidence **must not** include:

- any methods of self-assessment
- opinion: employer contributions should focus on direct observation of evidence (for example witness statements) of competence.

Selecting evidence

Before selecting the evidence for the Portfolio of Evidence, the learner should review the assessment requirements in the relevant units to ensure:

- that only evidence relevant to the units is used
- the evidence meets the assessment criteria
- the evidence is suitable and can be presented (see the list above)
- the amount of evidence is appropriate
- the evidence originated during the correct period of time.

To assemble their Portfolio of Evidence, the learner should consider all the evidence they have available that shows they have met the requirements being assessed. Evidence collected towards the end of their programme of study, as they become independent in their work, is likely to provide the most holistic evidence, i.e. covering a number of criteria at once.

From this, the learner should select evidence that **most efficiently** meets all the relevant criteria, and which demonstrated their **best performance**. While there may be some overlap between the evidence collected, multiple pieces of evidence showing coverage of the same criteria should not normally be submitted.

There are two questions that a learner should consider when selecting work to form their Portfolio of Evidence:

1. *Which pieces holistically (most efficiently) give evidence that together cover all of the relevant criteria?*
2. *Is this the **best** evidence I have, showing that I have met all of the requirements for the higher grade?*

Confirming the evidence selection

When the learner has selected the evidence to form their Portfolio of Evidence, this must be reviewed by the centre to ensure:

- all assessment requirements have been met
- there is no unnecessary duplication of evidence against the same criteria
- the work selected represents the best evidence available in relation to grading requirements
- the clarity of any images or scanned evidence is sufficient to determine the quality of the original evidence
- authenticity of evidence has been established.

The centre is responsible for providing guidance to the learner on compiling the Portfolio of Evidence during their programme of study.

Preparing evidence for submission

If the Portfolio of Evidence is being submitted for the Apprenticeship End-point Assessment (EPA), centres must have a header on each page containing the name and e-signature of the apprentice together with the date the evidence was produced. Each piece of evidence must be referenced to the criteria it is being submitted against.

Along with the City & Guilds Portfolio of Evidence Header and Declaration Form which must be completed to:

- Cross-reference each piece of evidence to the relevant KSBs
- Formally declare the authenticity of all evidence.

Authenticity

The learner must complete and sign a Declaration of Authenticity when submitting their Portfolio of Evidence to the Centre. A blank declaration form can be found in the ***City & Guilds Centre Document Library***.

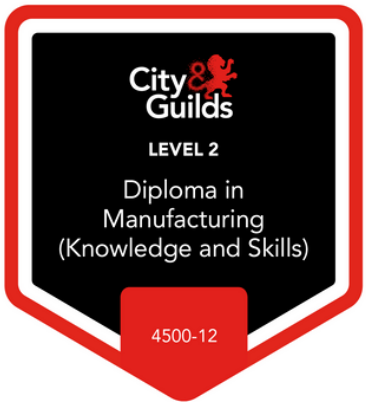
Certificates

A printed certificate will be issued to each successful learner for units and the full qualification.

E-Certificates are a complimentary service for all City & Guilds qualifications enabling customers to view and download PDF versions of certificates.

Digital Credentials

A digital credential is a visual representation of knowledge and skills, and is issued online for the full qualification only, making it easy for individuals to demonstrate their competencies to employers, clients, and peers. Each digital credential has a unique URL that can be shared electronically via social media, in an email signature, and on a CV.



Should the learner wish to receive a digital credential on successful completion of this qualification, as part of the registration process Centres must ensure that the learner's unique email address is added. This will allow City &Guilds to issue the credential directly to them. This is a complimentary service in addition to the paper certificate.

5 Units

Availability of units

All of the units can be found in this handbook.

Structure of the units

These units each have the following:

- City & Guilds reference number
- Title
- Level
- Guided learning hours (GLH)
- Unit aim
- Assessment type
- Learning outcomes, which are comprised of a number of assessment criteria
- Range statements
- Supporting information
- Mapping to the knowledge, skills and behaviours of the Level 2 Lean Manufacturing Operative Standard.

Units

This qualification is comprised of a number of **units**. A unit describes what is expected of a competent person in particular aspects of their job.

Each **unit** is divided into **learning outcomes** which describe in further detail the skills and knowledge that a learner should possess.

Each **learning outcome** has a set of **assessment criteria** (performance, and knowledge and understanding) which specify the desired criteria that have to be satisfied before a learner can be said to have performed to the agreed standard.

Range statements define the breadth or scope of a learning outcome and its assessment criteria by setting out the various circumstances in which they are to be applied. There are two types of range: practical and knowledge. Practical range is specific to learning outcomes which assess competence/practical skills. Knowledge range is specific to learning outcomes which assess knowledge and understanding.

Centres must deliver the full breadth of the range, unless specified, please see individual units. Specialist equipment or commodities may not be available to all centres, so centres should ensure that their delivery covers the majority of the range, the rest may be covered by a practical demonstration (e.g. video).

The range statement sets out the required teaching content of the unit and specifies the knowledge, understanding and skills required to achieve the unit. It enables centres to design and deliver a programme of learning that will enable learners to achieve each learning outcome and to meet the standard determined by the assessment criteria.

Supporting information provides guidance of the evidence requirement for the unit and specific guidance on delivery and range statements. Centres are advised to review this information carefully before delivering the unit.

Where it is designed to support the Level 2 Lean Manufacturing Operative apprenticeship, the knowledge, skills and behaviour requirements from the Apprenticeship Standard are mapped to each assessment criteria and can be found at the end of each unit.

Unit 201 Health and safety within a manufacturing environment

Level:	Level 2
GLH:	30
Aim:	Health and safety is a fundamental requirement in manufacturing. There are legal and moral responsibilities to ensure that workers and everyone else affected by manufacturing are kept safe and healthy. In this unit, learners will develop knowledge of the health and safety requirements in a manufacturing environment and an understanding of the reasons for these requirements.
Assessment type	Short-answer questions

Learning outcome:

The learner will:

LO1 understand the requirements for health and safety and the environment in manufacturing.

Assessment criteria

The learner can:

AC1.1 describe the key requirements of current **health and safety legislation** in manufacturing.

AC1.2 explain the health and safety **responsibilities of employers** and **employees**.

AC1.3 describe **fire evacuation procedures** used in a manufacturing environment.

AC1.4 describe procedures for **accidents and emergencies** in a manufacturing environment.

AC1.5 explain employer's responsibilities to comply with current **environmental regulations**.

Range

AC1.1 Health and safety legislation

- Health and Safety at Work, etc Act
- Provision and Use of Work Equipment Regulations (PUWER)
- Personal Protective Equipment Regulations
- Control of Substances Hazardous to Health Regulations (COSHH)
- Manual Handling Operations Regulations
- Reporting of Diseases and Dangerous Occurrence Regulations

AC1.2 Responsibilities of employers

- Carry out risk assessments

- Reduce risks as far as reasonably practicable
- Providing safe systems of work
- Provide personal protective equipment (PPE)
- Provide a safe working environment for both workers and others
- Provide adequate welfare facilities
- Provide suitable supervision and training

AC1.2 Responsibilities of employees

- Ensure their own activities do not put others at risk
- Follow safe systems of work and control measures provided by the employer
- To use any PPE provided by the employer
- Not to interfere with safety equipment

AC1.3 Fire evacuation procedures

- Actions in the event of a fire
- Functions of the fire marshal and fire wardens
- Contents of the fire action plan
- Training requirements
- Fire exits and escape routes
- Report presence at assembly locations/muster points

AC1.4 Accidents and emergencies

- Types of accident and associated procedures: injury, trips, slips or falls.
- Types of emergency and associated procedures: serious injuries and incidents, electrocution, poisoning, explosion, flood, chemical spills.
- Purpose and use of accident books.
- Role of the first aider: providing first aid, maintaining first-aid equipment, contacting emergency services, keeping records of first-aid incidents

AC1.5 Environmental regulations

- ISO 14001

AC 1.5 Employer's responsibilities

- Reduction of waste
- Safe disposal of waste
- Energy efficiency
- Benefits of conforming to regulations (financial, reputational, avoidance of prosecution)

Learning outcome

The learner will:

LO2 understand risk assessment in a manufacturing environment.

Assessment criteria

The learner can:

AC2.1 describe the **risk assessment process**.

AC2.2 describe **common hazards** that occur in manufacturing and appropriate control measures.

AC2.3 explain the **hierarchy of control** used for control measures.

Range

AC2.1 Risk assessment process

- Identification of hazards
- Evaluation of risk: severity, likelihood, number of people affected, risk rating
- Recommendation and implementation of control measures

AC2.2 Common hazards

- The difference between hazards and risks
- Entanglement in moving parts of machinery
- Ejected parts or materials, including swarf
- Sharp edges
- Heat and hot materials
- Slippery and uneven surfaces
- Dust and fumes
- Compressed gases
- Noise
- Working in confined spaces
- Electric shock
- Lifting and moving heavy loads
- Hazardous substances: explosive, flammable, oxidising, corrosive, toxic

AC2.3 Hierarchy of control

- Elimination
- Substitution
- Engineering controls
- Administrative controls
- Personal protective equipment (PPE)

Learning outcome

The learner will:

LO3 understand safe working practices in manufacturing.

Assessment criteria

The learner can:

AC3.1 identify the meaning of hazard **warning signs** used in manufacturing environments.

AC3.2 describe the purpose and use of different types of **personal protective equipment (PPE)**.

AC3.3 identify different **types of fire extinguishers** and the types of fire for which they are appropriate.

AC3.4 explain **safe working practices** and procedures.

Range

AC3.1 Warning signs

- How shape and colour are used to classify different types of safety signs: warning, mandatory, safe condition, prohibition.
- Safety signs applicable to manufacturing, including hazard pictograms.

AC3.2 PPE

- Safety glasses
- Safety shoes/boots
- Dust masks
- Hard hats
- Earmuffs and ear plugs
- Gloves and gauntlets
- Boiler suits and aprons
- Welders headshield and filter lens

AC3.3 Types of fire extinguishers

- Common causes of fire: flammable and combustible materials, spillages, discarded products, faulty electrical items
- red – water
- cream – foam
- blue – powder
- black – CO2
- yellow – chemical.

AC3.4 Safe working practices

- Maintaining a tidy workplace
- Keeping exits and gangways free from obstruction
- Using equipment safely and only for the purpose intended
- Maintenance of PPE in line with manufacturers' instructions
- Observing organisational safety rules, standard operating procedures (SOPs), signs and hazard warnings
- Correct disposal of waste materials
- Training in safe practices and procedures

Unit 201 Health and safety within a manufacturing environment

Supporting Information

Guidance

This is a theory unit intended to underpin the development of practical skills and safe behaviours whilst working in a manufacturing environment. It is suggested that learning is based on practical activities in the workplace.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K1
	1.2	K1
	1.3	K1
	1.4	K1
	1.5	K2
2	2.1	K1
	2.2	K1
	2.3	K1
3	3.1	K1
	3.2	K1
	3.3	K1
	3.4	K1, K9

Unit 202 Communicating and working effectively within a manufacturing environment

Level:	Level 2
GLH:	30
Aim:	Good communication and teamworking skills are essential in order to work effectively within a manufacturing environment. In this unit, learners will develop knowledge of how to communicate effectively within a manufacturing environment and how the manufacturing processes are planned and organised. Learners will also develop knowledge of the characteristics and importance of effective team working.
Assessment type	Short answer questions

Learning outcome:

The learner will:

LO1 understand how to communicate general and technical information within a manufacturing environment.

Assessment criteria

The learner can:

AC1.1 explain the **principles** and **methods of communication**.

AC1.2 explain **factors** that should be considered when communicating in a manufacturing environment.

AC1.3 describe **documents** used to communicate information in a manufacturing environment.

AC1.4 state the benefits of using standard terminology and conventions when communicating in a manufacturing environment.

Range

AC1.1 Principles of communication

- Purpose and importance
- Two way process
- Exchange of information

Methods

- Verbal
- Non-verbal
- Text-based

- Formal
- Informal

AC1.2 Factors

- Content (language, structure, organisation, legal requirements, relevance)
- Context (intended audience, location and environment, purpose, timescale)
- Presentation style (house style, tone, style)
- Barriers to communication

AC1.3 Documents

- Engineering drawings (orthographic, assembly, exploded view)
- Circuit diagrams
- Specifications
- Technical manuals and reports
- Datasheets
- Bill of materials
- Production plans
- Schedules/Job cards
- Maintenance schedules
- Standard operating procedures (SOPs)

Learning outcome

The learner will:

LO2 understand how manufacturing processes are planned and organised.

Assessment criteria

The learner can:

AC2.1 explain the **characteristics** and purpose of different **scales of manufacture**.

AC2.2 describe how manufacturing processes are **planned**.

Range

AC2.1 Characteristics

- Quantities produced
- Level of automation
- Level of operator skill
- Use of jigs, fixtures, moulds and templates

Scales of manufacture

- One-off/prototyping
- Batch
- Mass
- Continuous

AC2.2 Planning

- Production planning
- Sequence of activities
- Timings
- Tools and equipment
- Materials and consumables
- Health and safety

Learning outcome

The learner will:

LO3 understand the importance of effective team working.

Assessment criteria

The learner can:

AC3.1 explain the importance of effective team working in manufacturing environments.

AC3.2 describe the **characteristics** of an effective team in a manufacturing environment.

AC3.3 describe the **responsibilities** of a team leader.

Range

AC3.2 Characteristics

- Shared purpose
- Positive team morale
- Clearly defined roles and responsibilities
- Effective working relationships
- Good communication
- Effective leadership

AC3.3 Responsibilities

- Setting objectives
- Resource allocation
- Managing workloads
- Motivating staff
- Conflict resolution
- Monitoring performance
- Communication
- Problem solving
- Meeting health and safety requirements

Unit 202 Communicating and working effectively within a manufacturing environment

Supporting Information

Guidance

This is a theory unit intended to underpin the development of practical skills and effective behaviours whilst working in a manufacturing environment. It is suggested that learning is based on practical activities in the workplace.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K8, B7
	1.2	K8, B7
	1.3	K8, B7
	1.4	K8, B7
2	2.1	K9
	2.2	K9
3	3.1	K3, B4, B2
	3.2	K3, B4, B2
	3.3	K3, B4, B2

Unit 203 Working relationships and individual rights and responsibilities within a manufacturing environment

Level:	Level 2
GLH:	30
Aim:	This unit will enable learners to understand the factors that promote a positive working attitude, develop an understanding of the importance of effective working relationships and learn how they can contribute to effective team working. This unit will also give learners the opportunity to examine the importance of representative bodies in manufacturing environments.
Assessment type	Short-answer questions

Learning outcome:

The learner will:

LO1 understand how attitude has an influence on behaviour.

Assessment criteria

The learner can:

AC1.1 describe the **characteristics** of a positive working attitude.

AC1.2 explain the **consequences** of a negative attitude to work in a manufacturing environment.

AC1.3 describe the **factors** which help to create a positive working attitude within a manufacturing environment.

Range

AC1.1 Characteristics

- Taking responsibility
- Being a role model
- Sharing ideas
- Punctuality
- Good morale (effect on colleagues, collaboration, effects of keeping a positive outlook).
- Effective working relationships (customers, clients and other stakeholders).
- Job satisfaction, organisational commitment (effect on productivity)

AC1.2 Consequences

- Low morale
- Underperformance
- Poor customer satisfaction
- Professional development opportunities may be missed
- Increased staff turnover

AC1.3 Factors

- Responsibility (timekeeping, personal appearance, obtaining information, accountability)
- Role models (experienced colleagues, team leaders, mentors)
- Rewards (performance-related bonuses, employee of the month, praise/recognition)
- Workload
- Environment (working safely, workspace organisation, climate control, lighting)

Learning outcome

The learner will:

LO2 know the importance of maintaining effective working relationships.

Assessment criteria

The learner can:

AC2.1 describe the **characteristics** of effective working relationships.

AC2.2 state the **reasons** for maintaining effective working relationships.

Range

AC2.1 Characteristics

- Effective communication
- Appropriate behaviour
- Mutual respect
- Trust among work colleagues
- Time management
- Offering and asking for help

AC2.2 Reasons

- Increased morale and job motivation
- Effective communication
- Meeting deadlines
- Improved productivity

Learning outcome

The learner will:

LO3 understand the purpose and importance of continuous professional development.

Assessment criteria

The learner can:

AC3.1 explain the **benefits** of continuous professional development to employers and employees.

AC3.2 describe **methods** of personal and professional development.

Range

AC3.1 Benefits

- Benefits to employers
  - Changing skills requirements can be met
  - Meeting organisational objectives
  - Increased production efficiency and quality
  - Increased morale of workforce
- Benefits to employees
  - Allows development needs to be identified and met
  - Improved competence in job role
  - Improved promotion and career opportunities
  - Job retention

AC3.2 Methods

- Observing colleagues/work shadowing
- Training courses and educational qualifications
- On-site instruction
- Coaching and mentoring
- Buddying
- Performance reviews

Learning outcome

The learner will:

LO4 know the main current legislation and rules that affect employment in the manufacturing environment.

Assessment criteria

The learner can:

AC4.1 describe the main requirements of **current legislation and regulations** relating to manufacturing.

AC4.2 describe **employees' rights** in the workplace.

Range

AC4.1 Current legislation and regulations

- Equality Act 2010
- Employment Rights Act 1996
- Employment Relations Act 2004

AC4.2 Employees' rights

- Salary or wages
- Induction and appropriate training
- Working hours and restrictions
- Leave entitlement
- Contract of employment
- Health and safety
- Trade union membership

Learning outcome

The learner will:

LO5 understand the role of representative bodies in the manufacturing environment.

Assessment criteria

The learner can:

AC5.1 describe the main **roles and responsibilities** of representative bodies within manufacturing environments.

AC5.2 describe the **benefits** to employers and employees of representative body membership in manufacturing environments.

Range

AC5.1 Roles and responsibilities of:

- Trade unions
- Professional bodies

AC5.2 Benefits

- Review and set professional practice standards
- Provide professional advice on training and development, career pathways, minimum qualifications
- Influence policy relating to the sector
- Support research into issues affecting the sector
- Negotiate agreements on pay and conditions, dispute resolution

Unit 203 Working relationships and individual rights and responsibilities within a manufacturing environment

Supporting Information

Guidance

This is a theory unit intended to underpin the development of practical skills and safe behaviours whilst working in a manufacturing environment. It is suggested that learning is based on practical activities in the workplace.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	B1, B2, B9
	1.2	B1, B2, B9
	1.3	B1, B2, B9
2	2.1	-
	2.2	-
3	3.1	B11
	3.2	B11
4	4.1	-
	4.2	-
5	5.1	-
	5.2	-

Unit 204 Workplace organisational techniques

Level:	Level 2
GLH:	30
Aim:	The way in which a workplace is organised affects both the effectiveness and efficiency in which an activity is carried out. In this unit learners will develop an understanding of the reasons for having a well organised workplace. They will develop understanding of how the 5s approach is applied and implemented. Learners will also develop knowledge of visual management methods used within the workplace.
Assessment type	Portfolio of Evidence

Learning outcome:

The learner will:

LO1 know how workplace organisation affects performance.

Assessment criteria

The learner can:

AC1.1 describe what is meant by workplace organisation.

AC1.2 state the **effects** of a disorganised working environment.

AC1.3 state the **benefits** of having an organised working environment.

Range

AC1.2 Effects of a disorganised working environment

- Confusion about which tasks to complete
- Tools and equipment may not be available
- Tasks may take longer to complete
- Delays to timescales to complete products
- Clutter
- Lack of cleanliness (dirt and dust)
- Safety hazards
- Poor morale/teamwork
- Increased costs
- Poor product quality

AC1.3 Benefits of an organised working environment

- Knowledge of which tasks to complete
- Tools and equipment available

- Tasks completed in minimum time
- Products completed on schedule
- Clean, tidy workplace
- Safe working environment
- Wellbeing of staff
- Achievement of product cost and quality
- Minimisation of waste
- Compliance with legal and regulatory requirements

Learning outcome

The learner will:

LO2 understand how the 5s approach is applied to workplace organisation.

Assessment criteria

The learner can:

AC2.1 describe the **5s approach** to workplace organisation.

AC2.2 explain the **typical actions** involved in each phase of the 5s approach and how these **affect** the working environment and performance.

Range

AC2.1 5s approach

- Sort (decide what is needed) e.g. remove outdated or broken items or equipment
- Set in order (organise) e.g. assign fixed places for materials needed for work
- Shine (clean) e.g. keep tools and equipment clean and ready for use
- Standardise e.g. implement colour coding, labelling system
- Sustain e.g. establish responsibilities, regular audits, reviews

AC2.2 Typical actions and effects

- Sort – remove outdated or broken items or equipment, reduce time taken to find tools/components, maximise the use of space, increased safety
- Set in order – assign fixed places for tools and materials needed for work, use of shadow boards, improve flow of activities, increase efficiency, eliminate unnecessary movement
- Shine – keep tools and equipment clean and ready for use, contribute to a pleasant working environment, early identification and resolution of problems
- Standardise – implement colour coding and labelling systems, establish procedures to help support and maintain ongoing Sort, Set in Order and Shine activities, keep all areas consistent
- Sustain – establish responsibilities, regular audits, reviews, develop behaviours to ensure the 5s approach to workplace organisation is continued over the long term

Learning outcome

The learner will:

LO3 be able to implement 5s in a manufacturing work area.

Assessment criteria

The learner can:

AC3.1 prepare and use appropriate **documentation**.

AC3.2 implement the **steps** of the 5s approach in a manufacturing work area.

Range

AC3.1 Documentation

- Schedules
- Standard operating procedures for operations
- Cleaning and inspection

AC3.2 Steps

- Sort
- Set in order
- Shine
- Standardise
- Sustain

Learning outcome

The learner will:

LO4 understand visual management in manufacturing

Assessment criteria

The learner can:

AC4.1 explain the meaning of visual management

AC4.2 state the benefits of applying effective visual management

AC4.3 describe different types of visual management and their uses

Range

AC4.2 Benefits

- Clear understanding of requirements
- Shared understanding between team members and across the organisation
- Availability of tools and resources

AC4.3 Types of visual management

- Shadow boards
- Schedule boards

- Management boards (notice boards)
- Kanban (pull systems)
- Lights
- Colour coding
- Labelling
- Graphs
- Floor footprints

Unit 204 Workplace organisational techniques

Supporting information

Guidance

This unit is intended to underpin the development of practical skills applying lean manufacturing approaches in an engineering environment. It is suggested that learning is based on practical activities and case studies in the workplace.

For learning outcome 3, candidates can be provided with a checklist for the stages of the 5s process to refer to during assessment. Evidence for this outcome should be generated in the workplace or a realistic working environment.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K9
	1.2	K9
	1.3	K9
2	2.1	K7, K9
	2.2	K7, K9, S9
3	3.1	S9
	3.2	S9
4	4.1	K8
	4.2	K8
	4.3	K8

Unit 205 Work-related problem-solving techniques

Level:	Level 2
GLH:	40
Aim:	In manufacturing, a problem is often defined as a process or product not meeting the required outcome. It can also refer to the challenge of optimising the process of manufacturing a product, for example to reduce waste or cost, or to improve the characteristics or quality of a product. In this unit learners will develop understanding of how work-related problems can be identified, analysed and addressed, using a range of different techniques. Learners will also develop knowledge of the 7 wastes of lean manufacturing and how these can be reduced to optimise manufacturing activities.
Assessment type	Portfolio of Evidence

Learning outcome

The learner will:

LO1 understand methods of identifying and solving problems.

Assessment criteria

The learner can:

AC1.1 explain the difference between the root cause and symptoms of a problem.

AC1.2 describe the **steps** involved in identifying and solving problems.

AC1.3 describe different **techniques** used to identify problems and their applications.

Range

AC1.2 Steps

- Identify the problem
- Identify how the problem can be measured
- Identify the outcome that is required
- Root cause analysis
- Identification of countermeasures
- Implementation

AC1.3 Techniques for identifying problems

- Product inspection
- Statistical process control (control charts)
- Maintenance records
- Data analysis (tally charts, histograms)
- Value stream mapping
- Benchmarking

Learning outcome:

The learner will:

LO2 be able to apply problem solving techniques in a manufacturing situation.

Assessment criteria

The learner can:

AC2.1 apply different **techniques** for analysing and solving problems.

AC2.2 apply different **approaches** to analysing and solving problems.

Range

AC2.1 Techniques

- Pareto analysis
- Ishikawa (fishbone/cause and effect) diagrams
- Brainstorming
- Mind mapping
- 5 why analysis
- 5Ws and H (who, what, why, when, where, how)
- Hypothesis testing
- Trial-and-error
- A3 problem solving

AC2.2 Approaches

- Independent
- Collaborative
- Quality circles

Learning outcome:

The learner will:

LO3 know the 7 wastes of lean manufacturing.

Assessment criteria

The learner can:

AC3.1 describe the **7 wastes** of lean manufacturing.

AC3.2 state the **benefits** to an organisation of reducing the 7 wastes.

AC3.3 describe methods of **identifying** and quantifying the 7 wastes.

AC3.4 describe **actions** that can reduce the 7 wastes.

Range

AC3.1 7 wastes

- Transport
- Inventory
- Motion
- Waiting

- Over-processing
- Overproduction
- Defects

AC3.2 Benefits

- Improved productivity
- Reduced inventory
- Reduced scrap/defective products
- Reduced costs
- Increased profits
- Greater customer satisfaction
- Employee satisfaction

AC3.3 Identification methods

- Value stream mapping to identify value-added and non-value-added activities
- Time and motion studies
- Analysis of inspection records
- Evaluation of scrap rates

AC3.4 Actions to reduce waste

- Workplace reorganisation (factory layout, 5S)
- Elimination of non-value-added activities
- Process changes
- Pull systems of scheduling (Kanban)
- Kaizen (incremental small improvements)
- Quick change over / single minute exchange of die (SMED)

Unit 205 Work-related problem-solving techniques

Supporting Information

Guidance

This is unit is intended to underpin the development of practical skills to identify, analyse and solve problems in a manufacturing environment. It is suggested that learning is based on practical activities and case studies.

LO1 and LO3 contain theory-based objectives and can be delivered in the classroom, whereas LO2 details the practical skills that candidates must be able to demonstrate in the workplace.

For LO2 the entire range for both ACs should be delivered. Candidates should be assessed on at least **two** of the techniques stated in the range for AC2.1, using at least **one** of the approaches stated in the range for AC2.2.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K6
	1.2	K6
	1.3	K6
2	2.1	S6, S7
	2.2	S6, S7
3	3.1	K6, K7
	3.2	K6, K7
	3.3	K6, K7
	3.4	K6, K7, K9

Unit 206 Preparing for manufacturing operations

Level:	Level 2
GLH:	20
Aim:	Effective preparation is the key to achieving a safe, efficient and successful outcome from a manufacturing operation. In this unit learners will develop knowledge of the manufacturing information to help plan manufacturing activities, and how a work area should be organised. Learners will then apply this knowledge to set up a work area for a manufacturing activity.
Assessment type	Portfolio of evidence

Learning outcome:

The learner will:

LO1 know how to prepare for a manufacturing activity.

Assessment criteria

The learner can:

AC1.1 state the **documents** required to support a manufacturing activity.

AC1.2 describe how to **obtain** the relevant documents required to support a manufacturing activity.

AC1.3 describe how a **working area** should be organised for safe use.

Range

AC1.1 Documents

- Production plan
- Job cards
- Working drawings
- Standard operating procedures

AC1.2 Obtain the relevant documents

- Document source (person, hard copy, electronic)
- Version control

AC1.3 Working area

- Layout
- Accessibility
- Signage
- Lighting

- Component delivery and storage
- Removal of unnecessary materials (clutter)

Learning outcome

The learner will:

LO2 be able to prepare for a manufacturing activity.

Assessment criteria

The learner can:

AC2.1 interpret **documentation** to establish the **requirements** for the manufacturing operation.

AC2.2 evaluate the **risks** associated with a planned process.

AC2.3 obtain the **resources** required to carry out a manufacturing operation.

AC2.4 check the condition and safety of **tools**, **equipment** and **materials**.

AC2.5 **organise the work area** appropriately for the manufacturing operation.

Range

AC2.1 Documentation

- Production plan
- Job cards
- Working drawings
- Standard operating procedures

Requirements

- Process
- Time frame
- Dimensions
- Tools and equipment
- Materials
- Consumable items

AC2.2 Risk assessment

- Hazards
- Risks
- Control measures

AC2.3 Resources

- Materials (production, consumable)
- Tools and equipment
- Jigs and fixtures
- Handling facilities (lifting equipment, rollers, trolleys, conveyors)
- Measurement and inspection equipment

- Safety equipment (local exhaust ventilation, PPE, machine guarding, process specific requirements)

AC2.4 Tools and equipment

- Test certificates (PAT, LEV)
- Maintenance records
- Checks for wear and tear

Materials

- Correct identification
- Availability
- Quantity
- Condition

AC2.5 Organise the work area

- Areas for receipt and storage of materials and finished products (easy access, labelling)
- Remove unnecessary items (clutter)
- Tool storage

Unit 206 Preparing for manufacturing operations

Supporting Information

This unit should be delivered **after** unit 201 Health and Safety Within a Manufacturing Environment.

Evidence requirements

Evidence for this unit and unit 207/208 can be generated from different stages of the same manufacturing activity. For AC2.2 any available risk assessment template can be used, provided that the elements in the range are included.

The practical activities in this unit should be carried out in a realistic working environment, which would be located in a workplace, or appropriate academic workspace. Learners will require access to the following additional resources:

- A range of documentation relating to the manufacture of a product (as detailed in the unit content).
- Tools, equipment and materials required to carry out preparation for manufacture of a product.

While learners may not necessarily have access to the full range of resources/facilities in their workplace, they should be able to demonstrate knowledge/awareness of their use in other applications.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K3, K4, K8
	1.2	K3, K4, K8
	1.3	K3, K4
2	2.1	S3, S4, B2, B5, B6, B7, B10
	2.2	K1, S1, S3, S4, B2, B5, B6, B7, B10
	2.3	S3, S4, B2, B5, B6, B7, B10
	2.4	S3, S4, B2, B5, B6, B7, B10
	2.5	S3, S4, B2, B5, B6, B7, B10

Unit 207 Controlling manufacturing operations

Level:	Level 2
GLH:	20
Aim:	Effective control of a manufacturing operation is essential to assure that the final product meets the required dimensions, cost and functionality. In this unit learners will develop the ability to set up, control and monitor a manufacturing process. They will also develop knowledge of set up reduction.
Assessment type	Portfolio of evidence

Learning outcome:

The learner will:

LO1 be able to set up a process for a manufacturing operation.

Assessment criteria

The learner can:

AC1.1 **interpret documentation** required to control a manufacturing operation.

AC1.2 **set up** a manufacturing process.

AC1.3 carry out **checks** to confirm that the process is meeting the required outcome.

Range

AC1.1 Documentation

- Production plans
- Job cards/instructions
- Working drawings
- Standard operating procedures

Data to be interpreted:

- Dimensional accuracy
- Surface finish
- Cycle time
- Material usage
- Safety

AC1.2 Set up a manufacturing process

- Use of work holding devices

- Jigs and fixtures
- Entering process parameters

AC1.3 Checks

- Dimensional and characteristic checks appropriate to the requirements of the product

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Learning outcome:

The learner will:

LO2 understand how to reduce the set-up time for a manufacturing process.

Assessment criteria

The learner can:

AC2.1 describe what is meant by quick change over / single minute exchange of die (SMED).
AC2.2 describe how to carry out a **set up** reduction activity.
AC2.3 explain the **benefits** of a set up reduction activity.

Range

AC2.2 Set up reduction activities including:

- Work holding including the use of jigs and fixtures
- Ensuring tools are available
- Offline sub-assemblies

AC2.3 Benefits

- Reduced downtime
- Increased total production output

Learning outcome:

The learner will:

LO3 be able to control manufacturing operations.

Assessment criteria

The learner can:

AC3.1 carry out a manufacturing operation in line with **requirements**.
AC3.2 make **adjustments** to a manufacturing process as instructed.
AC3.3 stop the manufacturing operation and shut down all machines and equipment safely.

Range

AC3.1 Requirements

- Health and safety requirements
- Job instructions
- Production and quality specifications

- Environmental regulations
- Equipment/tool operating instructions
- Company standards and procedures

AC3.2 Adjustments

- Process parameters
- Product dimensions
- Tooling

Learning outcome:

The learner will:

LO4 be able to monitor the process during manufacturing operations.

Assessment criteria

The learner can:

AC4.1 monitor **performance data** during a manufacturing operation.

AC4.2 record and evaluate relevant **quality data**.

AC4.3 make **adjustments** to a manufacturing operation to address a problem with quality or performance requirements.

AC4.4 report problems that cannot be addressed or are outside permitted authority to an appropriate person.

Range

AC4.1 Performance data:

- Process parameters
- Equipment characteristics (vibration, temperature, lubricant consumption)
- Output

AC4.2 Quality data:

- Dimensional requirements

AC4.3 Adjustments:

- Process parameters
- Tooling

Unit 207 Controlling manufacturing operations

Supporting Information

Evidence requirements

Evidence for this unit and unit 206/208 can be generated from different stages of the same manufacturing activity.

The practical activities in this unit should be carried out in a realistic working environment, which would be located in a workplace, or appropriate academic workspace. Learners will require access to the following additional resources:

- A range of documentation relating to the manufacture of a product (as detailed in the unit content).
- Tools, equipment and materials required to carry out the manufacture of a product.

While learners may not necessarily have access to the full range of resources/facilities in their workplace, they should be able to demonstrate knowledge/awareness of their use in other applications.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	S3, B5, B6, B10
	1.2	S3
	1.3	S3
2	2.1	K3, K4
	2.2	K3, K4
	2.3	K3, K4
3	3.1	S1, S3, B5, B6, B10
	3.2	S3, B5, B6, B10
	3.3	S1, S3, B5, B6, B10
4	4.1	S3, S5, B5, B6, B10
	4.2	S3, S5, B5, B6, B10
	4.3	S3, S5, B5, B6, B10
	4.4	S3, S5, B7

Unit 208 Conclusion and handover of manufacturing operations

Level:	Level 2
GLH:	40
Aim:	Effective handover at the conclusion of a manufacturing operation is essential to ensure the subsequent safe and effective use of manufacturing facilities. In this unit learners will carry out final inspection of a manufactured item and develop understanding of the procedures for concluding and handing over a manufacturing operation. They will also develop their knowledge of total preventative maintenance (TPM).
Assessment type	Portfolio of evidence

Learning outcome:

The learner will:

LO1 carry out final inspection of a manufactured item.

Assessment criteria

The learner can:

AC1.1 measure the **characteristics** of a manufactured item.

AC1.2 compare the outcomes of testing to **requirements**.

AC1.3 complete a test inspection report.

Range

AC1.1 Characteristics

- Dimensions
- Tolerances
- Function

AC1.2 Requirements

- Specifications
- Drawings
- Standards

Learning outcome:

The learner will:

LO2 understand the procedures for concluding and handing over a manufacturing operation.

Assessment criteria

The learner can:

AC2.1 describe the **documentation** used when handing over a manufacturing operation.

AC2.2 state the **procedures** used to hand over following the manufacturing operation.

AC2.3 describe the **procedures** that are used for managing **materials** once the manufacturing activity has been concluded.

AC2.4 explain how problems that cannot be solved or are outside permitted authority, should be reported.

Range

AC2.1 Documentation

- Job instructions
- Test inspection reports
- Equipment handover instructions
- Checklists

AC2.2 Procedures

- Completion of documentation
- Health and safety checks
- Cleaning of work area

AC2.3 Procedures

- Storage of completed items
- Handling and disposal of waste materials

Materials

- Finished goods/components
- Surplus production materials
- Surplus consumable materials
- Waste or scrap

Learning outcome:

The learner will:

LO3 know the purpose of total preventative maintenance.

Assessment criteria

The learner can:

AC3.1 state the reasons for total preventative maintenance (TPM).

AC3.2 describe the **activities** involved in TPM.

Range

AC3.2 Activities

- Monitoring (vibration, temperature, lubricant consumption, operator feedback, tool wear)
- Replacement of consumables and tools
- Adjustment of process parameters
- Reporting problems that cannot be solved or are outside permitted authority

Learning outcome:

The learner will:

LO4 conclude and hand over a manufacturing operation.

Assessment criteria

The learner can:

AC4.1 interpret the **documentation** used when handing over a manufacturing operation.

AC4.2 **restore the work area** to an appropriate condition for handover.

Range

AC4.1 Documentation

- Job instructions
- Test inspection reports
- Equipment handover instructions
- Checklists

AC4.2 Restore the work area

- Clean work area
- Safety checks on machines, tools and equipment
- Return materials, tools and equipment to safe storage
- Safely dispose of waste

Unit 208 Conclusion and handover of manufacturing operations

Supporting Information

Evidence requirements

Evidence for this unit and unit 206/207 can be generated from different stages of the same manufacturing activity.

The practical activities in this unit should be carried out in a realistic working environment, which would be located in a workplace, or appropriate academic workspace. Learners will require access to the following additional resources:

- A range of documentation relating to the conclusion and handover of the manufacturing operation (as detailed in the unit content).
- Tools and equipment required to carry out final inspection of a product.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	S1, S5, S6, S8, B5, B6, B7, B10
	1.2	S1, S5, S6, S8, B5, B6, B7, B10
	1.3	S1, S5, S6, S8, B5, B6, B7, B10
2	2.1	K8
	2.2	K3
	2.3	K2, K9
	2.4	K8
3	3.1	K3, K4
	3.2	K3, K4
4	4.1	S3, S4, S8, B5, B6, B7, B10
	4.2	S3, S4, S8, B5, B6, B7, B10

Unit 209 Producing products by assembly operations

Level:	Level 2
GLH:	60
Aim:	Most engineered products are assemblies of more than one component. The effective assembly of a manufactured item is essential to achieve the expected performance of the product. In this unit learners will develop knowledge of how to manufacture products by assembly operations. They will also develop the skills to carry out the assembly of a manufactured item.

Assessment type Portfolio of evidence

Learning outcome:

The learner will:

LO1 know how to manufacture products by assembly operations.

Assessment criteria

The learner can:

AC1.1 describe the relevant health and safety **considerations** specific to assembly operations.

AC1.2 describe specific assembly **operations** that need to be performed.

AC1.3 describe how **faults**, **problems** and **variations** which can occur during assembly operations can be rectified.

Range

AC1.1 Considerations

- PPE
- Manual handling
- Tools and equipment
- Working environment (lighting, moving vehicles, workplace organisation, extraction, ventilation)

AC1.2 Operations

- Positioning (aligning, mating, datums)
- Fixing components securely in position
  - Permanent joining methods (brazing, soldering, welding, adhesives)
  - Semi-permanent joining methods (screws, bolts, keyways)

    - Riveting (hammered over, pop rivet)
- Filing
- Drilling
- Punching
- Threading
- Cutting (manual, mechanical, thermal)

AC1.3 Faults

- Out of alignment
- Damaged components
- Defective materials

Problems

- Unrealistic time and cost estimates
- Equipment failure/breakdowns
- Safety issues
- Inadequate communication
- Inadequate training

Variations

- Changing requirements

Learning outcome

The learner will:

LO2 be able to manufacture products by assembly operations.

Assessment criteria

The learner can:

AC2.1 carry out a **risk assessment** for the assembly operation.

AC2.2 work safely at all times, complying with health and safety, environmental and other relevant regulations and guidelines.

AC2.3 interpret the **requirements** of job instructions, standard operating procedures and assembly specifications.

AC2.4 **check** that all materials are available and in a usable condition.

AC2.5 secure the components in position using the specified fastening device/method.

AC2.6 select appropriate tools, equipment and materials required to complete the assembly operation.

AC2.7 check that tools and equipment are in a safe and usable condition.

AC2.8 **carry out the assembly operation** to the required specification.

AC2.9 report any problems that cannot be solved, or that are outside permitted authority, to the appropriate person.

AC2.10 carry out **quality checks** on the completed assembly.

AC2.11 ensure product is ready for subsequent process.

AC2.12 complete relevant documentation.

Range

AC2.1 Risk Assessment

- Hazards
- Risks
- Control measures

AC2.3 Requirements

- Dimensional requirements
- Processing requirements
- Assembly sequence
- Relative location of parts

AC2.4 Checks

- Dimensional checks
- Free from defects and damage
- Conform to specification

2.8 Carry out the assembly operation

- Work completed in a timely manner

2.10 Quality checks

- Completeness of the assembly
- Component quality
- Freedom from damage

Unit 209 Producing products by assembly operations

Supporting Information

Evidence requirements

Evidence for this unit and unit 206/207/208 can be generated from different stages of the same manufacturing activity.

The practical activities in this unit should be carried out in a realistic working environment, which would be located in a workplace, or appropriate academic workspace. Learners will require access to the following additional resources:

- A range of documentation relating to the assembly operation (as detailed in the unit content).
- Tools and equipment required to carry out the assembly operation.

Learning outcome 2, AC2.1, centres may use any available risk assessment format, provided the learner completes all information listed in the range.

Guidance

Useful reference materials:

- Zeus Precision – Data charts and Reference Tables for Drawing Office, Tool Room & Workshop
- Fabrication and Welding Engineering, Roger Timings

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K1, K10
	1.2	K10, K12
	1.3	K14
2	2.1	S1, S13
	2.2	S1, S2, S13
	2.3	K13, S13
	2.4	S10
	2.5	S11
	2.6	S12
	2.7	S12
	2.8	S11, S12, S13, S14
	2.9	S15
	2.10	K11, S15
	2.11	S15
	2.12	S14, S15

Unit 210 Transferring materials for manufacturing operations

Level:	Level 2
GLH:	60
Aim:	Effective and efficient movement of materials is essential to minimise costs in manufacturing. In this unit learners will develop knowledge of how to transfer, move and transport materials for manufacturing operations. They will also develop the practical skills to carry this out safely and efficiently.

Assessment type Portfolio of evidence

Learning outcome:

The learner will:

LO1 understand how to transfer materials.

Assessment criteria

The learner can:

AC1.1 describe the relevant health and safety **regulation** requirements of the work area.

AC1.2 describe how **hazards** associated with carrying out material moving operations are managed.

AC1.3 describe the types of **personal protective equipment (PPE)** that may be used during materials movement activities.

AC1.4 describe the **documentation** required to allow the transfer of materials to take place.

AC1.5 explain the **factors** that must be considered prior to moving operations being performed.

AC1.6 explain the lifting and load bearing capacities of equipment.

AC1.7 describe the applications of different **lifting equipment**.

AC1.8 explain **actions** that can be taken to solve **problems** that are within the limits of own responsibility.

Range

AC1.1 Regulations

- Health and safety at work, etc Act
- PPE regulations
- Manual handling regulations

- Lifting regulations (LOLER)
- Control of Substances Hazardous to Health Regulations (COSHH)

AC1.2 Hazards

- Spillages
- Sharp edges
- Falling objects
- Size, shape and weight of objects
- Temperature
- Hazardous substances
- Insufficient lighting
- Obstructions
- Moving vehicles
- Other activities encroaching on the work area

AC1.3 Personal protective equipment (PPE)

- Fluorescent/high visibility clothing
- Gloves/gauntlets
- Safety glasses
- Ear protection
- Safety boots
- Hard hats
- Face masks (FFP – Fine Filter Protection)

AC1.4 Documentation

- Release notes
- Lifting plans
- Delivery notes (inbound and outbound)
- Bill of materials
- Inventory documentation
- Delivery/shipping labels
- Vehicle daily check sheets

AC1.5 Factors

- Size
- Quantity
- Timescale
- Access
- Strength of material or packaging
- Destination
- Training
- Obstructions
- Environment (indoors/outdoors, weather conditions)

AC1.7 Lifting equipment

- Ropes, slings, straps and chains

- Eyebolts, shackles and hooks
- Cranes, forklifts, lifts
- Pallet trucks, trolleys, carts
- Conveyors

AC1.8 Problems

- Personal injury or injury of a fellow worker (seek first aid, inform supervisor, fill in accident book with first aider)
- Damaged lifting equipment
- Damaged materials
- Damage to environment

Actions

- Report issues that occur through movement of materials to the appropriate person.
- Stop/pause the operation.

Learning outcome:

The learner will:

LO2 be able to transfer materials for manufacturing operations.

Assessment criteria

The learner can:

AC2.1 follow the relevant **procedures and safety requirements** when lifting and moving materials.
AC2.2 interpret the necessary job instructions and lifting and moving equipment operating procedures.
AC2.3 carry out a **risk assessment** for the operation.
AC2.4 **evaluate how the materials can be safely** and efficiently **moved**.
AC2.5 select appropriate **equipment** and techniques to move the materials.
AC2.6 carry out appropriate **checks** to ensure equipment is in a safe and usable condition.
AC2.7 load materials using appropriate equipment.
AC2.8 carry out safe and correct **manual lifting techniques** for different loads.
AC2.9 report any **problems** outside own permitted authority to an appropriate person.
AC2.10 **reinstate the work area** to a safe and reusable condition.

Range

AC2.1 Procedures and safety requirements

- Health and safety regulations (manual handling, LOLER, COSHH, PPE)
- Lifting and moving equipment operating instructions
- Company standards and procedures

AC2.3 Risk Assessment

- Hazards
- Risks

- Control measures

AC2.4 Evaluate how the materials can be safely and efficiently moved

- The materials are as specified on the documentation
- Material condition
- Size
- Quantity
- Stability
- Centre of gravity
- Timescale
- Access
- Strength of material or packaging
- Destination
- Obstructions
- Environment (indoors/outdoors, weather conditions)
- Training

AC2.5 Equipment

- Hand operated
  - By hand
  - Hand trolley/wheelbarrow
  - Lifting straps
  - Free rolling cage/trolley/cart
  - Pallet truck
  - Block and tackle
- Power operated
  - Motorised pallet truck
  - Conveyor belt
  - Cranes
  - Lifts

AC2.6 Checks

- Visual inspection
- Safety checks
- Check equipment functions correctly

AC2.8 Manual lifting

- Lifting alone
- Lifting with assistance from others

Manual lifting techniques for different loads

- Lifting from ground level
- Lifting from an angle
- Lifting from waist high
- Lifting from below ground level
- Lifting from overhead

AC2.9 Problems

- Quality concerns
- Damage

AC2.10 Reinstate the work area

- Return materials, tools and equipment to safe storage
- Complete 5s while working to manage workload and eliminate waste
- Check machinery and equipment when lifting operations are completed
- Dispose of waste according to company procedures

Unit 210 Transferring materials for manufacturing operations

Supporting Information

Evidence requirements

For Learning outcome 2, AC 2.5 – it is **not** required that the full range of equipment is assessed, centre should choose **two** hand-operated and **one** power operated. Learners should select appropriate equipment from this range for the moving operation being carried out.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K1, K2
	1.2	K1, K9
	1.3	K1
	1.4	K20, K21
	1.5	K21, K22
	1.6	K24
	1.7	K23
	1.8	K6, K20, K21
2	2.1	S1, S2, S22, B10
	2.2	S23
	2.3	S1
	2.4	S24
	2.5	S24
	2.6	S24
	2.7	S22
	2.8	S22, S24
	2.9	S25, S26
	2.10	S27

Unit 211 Receiving and checking incoming materials for manufacturing operations

Level:	Level 2
GLH:	60
Aim:	The successful production of a product is dependent upon obtaining, handling and using materials which meet the requirements. In this unit learners will develop knowledge of the requirements for receiving and checking incoming materials into a manufacturing company. They will also develop the practical skills needed to receive and check incoming materials for manufacturing operations.
Assessment type	Portfolio of evidence

Learning outcome:

The learner will:

LO1 know the requirements for receiving and checking incoming materials for manufacturing operations.

Assessment criteria

The learner can:

AC1.1 identify the **regulations** and **procedures** relevant to the receipt of materials.
AC1.2 describe the **documentation** required for the receipt of materials.
AC1.3 describe the **forms of supply** of different **materials**.
AC1.4 describe the **process** for receiving incoming materials.
AC1.5 describe the **equipment** used for lifting and handling operations.
AC1.6 describe how **checks** are carried out when receiving materials.
AC1.7 state the **potential problems** that can occur when receiving materials.

Range

AC1.1 Regulations and procedures

- Health and Safety at Work, etc Act
- Manual handling regulations
- PPE regulations
- Control of noise
- Control of substances hazardous to health (COSHH)
- Lifting Operations and Lifting Equipment Regulations (LOLER)
- Working at height

- Company operating procedures
- Control of documentation

AC1.2 Documentation

- Job instructions
- Material specifications
- Release notes
- Lifting plans
- Delivery notes (inbound and outbound)
- Bill of materials
- Inventory documentation
- Delivery/shipping labels

AC1.3 Forms of supply

- Standard components
- Powders
- Granules
- Fibres
- Liquids
- Section
- Tube/pipe
- Bar stock
- Extrusions
- Sheet
- Plate

Materials

- Polymers
- Metals
- Engineering ceramics

AC1.4 Process

- Liaise with delivery and transportation drivers/workers
- Visually inspect the delivery
- Check and sign documentation
- Isolate any parts that do not meet requirements
- Store delivery
- Report any damage or defects to the appropriate person

AC1.5 Equipment

- Hand and powered lifting equipment
- Safety checks
- Load bearing capacities

AC1.6 Checks

- Check for damages to packaging
- Check sheet material condition

- Visually inspect surface finishes/treatments
- Check quantities
- Check shipping documentation
- Check for signs of tampering

A.C1.7 Potential problems

- Late delivery
- Missed time slot
- Incorrect or inaccurate documentation
- Availability of tools and machinery
- Damaged items
- Faults arising from production
- Contamination
- Incorrect dimensions
- Goods not to specification

Learning outcome

The learner will:

LO2 be able to receive and check incoming materials for manufacturing operations.

Assessment criteria

The learner can:

AC2.1 interpret **documentation** required to receive materials.
AC2.2 carry out the **receipt of different materials**.
AC2.3 **check** that incoming materials meet the required specifications.
AC2.4 interpret **measurements** using metric and imperial systems.
AC2.5 **store materials** appropriately.
AC2.6 dispose of packaging materials appropriately.
AC2.7 resolve any problems with the materials, within the limits of own responsibility.
AC2.8 report to the appropriate person any problems with the materials that they cannot solve or that are outside their permitted authority.

Range

AC2.1 Documentation

- Job instructions
- Material specifications
- Release notes
- Lifting plans
- Delivery notes (inbound and outbound)
- Bill of materials
- Inventory documentation
- Delivery/shipping labels

AC2.2 Receipt of different materials

- Use correct manual handling techniques
- Check that lifting equipment is in a safe condition
- Check the load bearing capacity of lifting equipment is sufficient for the required operation
- Safely use hand and powered lifting equipment
- Return equipment to correct location after use
- Follow all company standard operating procedures

AC2.3 Checks

- Identify anomalies in packaging and overall appearance.
- Identify material using documentation, characteristics, classification, finish.
- Visual inspection.
- Identify faults arising from production (incorrect size, excessive tool marks, contaminated, scratched, scarred, blemished, bent, torn, fractured, punctured)
- Segregate materials that do not meet specification

AC2.4 Measurements

- Linear dimensions (length, breadth, height, diameter, thickness)
- Weights
- Volumes

AC2.5 Store materials

- Sheet, plate, spools, rolls, coils, drums, compressed gas, sealed containers, hoppers
- Organise surfaces, racks and shelves appropriately
- Prevent cross contamination of materials and chemicals

Unit 211 Receiving and checking incoming materials for manufacturing operations

Supporting Information

Guidance

This unit is intended to underpin the development of practical skills and effective behaviours whilst working in a manufacturing environment. It is suggested that learning is based on practical activities in the workplace.

LO1 contains theory-based objectives and can be delivered in the classroom, whereas LO2 details the practical skills that candidates must be able to demonstrate in the workplace.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K20, K21, K22
	1.2	K20
	1.3	K21
	1.4	K22
	1.5	K23, K24
	1.6	K20, K21
	1.7	K20, K21
2	2.1	S23
	2.2	S22, S23, S24, S27
	2.3	S23, S25, S26
	2.4	S25
	2.5	S22, S24
	2.6	S2
	2.7	S23, S26
	2.8	S23, S26

Unit 212 Producing products by processing

Level:	Level 2
GLH:	60
Aim:	Products are manufactured using a range of different processing operations. In this unit learners will develop knowledge of the principles of producing products by processing and the relevant techniques and methods used. They will also be able to safely carry out processing operations to produce products.

Assessment type Portfolio of evidence

Learning outcome:

The learner will:

LO1 know the principles of producing products by processing.

Assessment criteria

The learner can:

AC1.1 describe what is meant by producing products by processing.

AC1.2 describe common **hazards** that occur in processing operations and how they are controlled.

AC1.3 describe the **levels of automation** used when producing products by processing.

AC1.4 describe relevant job **roles and responsibilities** within the working area.

Range

AC1.2 Hazards

- Sharp edges
- Heat
- Flying debris
- Entanglement in moving parts of machinery
- Ejected parts, materials or workpieces
- Dust and fumes
- Compressed gases
- Noise
- Working in confined spaces
- Electric shock
- Lifting and moving heavy loads
- Hazardous substances

AC1.3 Levels of automation

- Hand manufacturing
- Manually operated processes
- Computer controlled/fully automated processes

AC1.4 Roles and responsibilities

- Production engineers
- Supervisor/team leader/line manager
- Quality controllers

Learning outcome

The learner will:

LO2 know the techniques, methods and procedures used to produce products by processing.

Assessment criteria

The learner can:

AC2.1 describe types of processing techniques and the tools and equipment required.

AC2.2 describe the **sequence of events** required for producing products by processing.

AC2.3 describe the **procedures used to check the quality** of processing operations.

AC2.4 describe **problems** that can occur during processing operations and how these can be resolved.

AC2.5 describe how addressing the **7 wastes** improves efficiency of processing operations.

Range

AC2.1 Processing techniques

- Wasting (cutting, drilling, milling, turning)
- Forming and shaping (bending, vacuum forming, injection moulding, casting)
- Additive (3D printing, brazing, welding, soldering)
- Heat treatment (hardening, tempering, annealing, normalising, quenching)
- Assembly
- Finishing

AC2.2 Sequence of events

- Obtain work instructions
- Follow relevant job instructions and production schedules
- Source appropriate materials and tooling
- Loading materials
- Processing operation
- Removal of materials
- Quality inspection
- End of production

AC2.3 Procedures to check quality

- Visual inspection
- Use of measuring equipment (rules, Vernier/digital callipers, micrometers, go/no-go gauges, coordinate measuring machine (CMM))
- Checking for conformity with standards and specification requirements

AC2.4 Problems

- Production shortfall
- Production issues carried forward from previous operations
- Damage to product and/or tooling
- Incorrect materials
- Incorrect process times
- Incorrect or inaccurate documentation

AC2.5 7 Wastes

- Transport
- Inventory
- Motion
- Waiting
- Over-processing
- Overproduction
- Defects

Learning outcome

The learner will:

LO3 be able to safely carry out processing operations.

Assessment criteria

The learner can:

AC3.1 obtain **documentation** relevant to processing operations.

AC3.2 interpret **documentation** relevant to processing operations.

AC3.3 safely perform **processing operations** using different **levels of automation**.

AC3.4 carry out **procedures** to monitor and ensure quality of processing operations.

AC3.5 complete relevant **records and reports**.

AC3.6 carry out appropriate **actions** when the process does not meet specified quality requirements.

Range

AC3.1 and AC3.2 Documentation

- Engineering drawings
- Specifications
- Standards
- Regulations (health and safety, environmental)
- Job instructions/production schedules

- Standard operating procedures (SOPs)
- Production plans
- Manufacturer's datasheets
- Risk assessments

AC3.3 Processing operations

- Wasting
- Forming and shaping
- Additive
- Heat treatment
- Assembly
- Finishing

Levels of automation

- Hand manufacturing
- Manually operated processes
- Computer controlled/fully automated processes

AC3.4 Procedures

- Visual inspection
- Use of measuring equipment
- Checking for conformity with standards and specification requirements

AC3.5 Records and reports

- Records of processing operations completed
- Test and inspection records
- Handover reports

AC3.6 Actions

- Stop/pause production
- Quarantine
- Label
- Restart production
- Report to appropriate person

Unit 212 Producing products by processing

Supporting Information

Guidance

This unit is intended to underpin the development of practical skills and effective behaviours whilst working in a manufacturing environment. It is suggested that learning is based on practical activities in the workplace.

LO1 and LO2 are theory-based objectives and can be delivered in the classroom, whereas LO3 details the practical skills that candidates must be able to demonstrate in the workplace.

For AC3.3, candidates must be able to perform at least **one** of the stated operations given in the range and using at least **one** level of automation.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K3
	1.2	K1, K27
	1.3	K25
	1.4	K3, B4
2	2.1	K4, K5
	2.2	K29
	2.3	K25, K26, K28
	2.4	K28
	2.5	K9
3	3.1	S29
	3.2	S29
	3.3	S28, S30, S33
	3.4	S28, S31, S32
	3.5	S32, S33
	3.6	S28, S31, S32, S33

Unit 213 Finishing products

Level:	Level 2
GLH:	60
Aim:	Finishing ensures that products are resistant to wear, damage and corrosion. Surface finishes can also improve the aesthetics of products, which makes them more visually appealing. In this unit learners will develop knowledge of the principles of finishing products and the relevant processes, methods and procedures used, and be able to apply them.

Assessment type Portfolio of evidence

Learning outcome:

The learner will:

LO1 know the principles of finishing products.

Assessment criteria

The learner can:

AC1.1 state the **reasons** why products are finished.

AC1.2 describe common **hazards** that occur in finishing operations and how they are controlled.

AC1.3 describe the **levels of automation** used when finishing products.

AC1.4 describe relevant job **roles and responsibilities** within the working area.

Range

AC1.1 Reasons

- Function (corrosion resistance, wear resistance, tarnish resistance, hardness)
- Aesthetics (smoothness/roughness, colour)

AC1.2 Hazards

- Sharp edges
- Entanglement in moving parts of machinery
- Ejected parts, materials or workpieces
- Dust and fumes
- Compressed gases
- Noise
- Working in confined spaces
- Electric shock

- Lifting and moving heavy loads
- Hazardous substances

AC1.3 Levels of automation
- Hand manufacturing
- Manually operated processes
- Computer controlled/fully automated processes

AC1.4 Roles and responsibilities
- Finishing engineers
- Supervisor/team leader/line manager
- Quality controllers

Learning outcome

The learner will:

LO2 know the techniques, methods and procedures used to finish products.

Assessment criteria

The learner can:

AC2.1 describe how to **prepare materials** for surface finishing.

AC2.2 describe types of **finishing operations** and the tools and equipment required.

AC2.3 describe the **procedures used to check** the quality of finishing operations.

AC2.4 describe **problems** that can occur during finishing operations and how these can be resolved.

AC2.5 describe how addressing the **7 wastes** improves efficiency of finishing operations.

Range

AC2.1 Preparation methods
- Cleaning the surface
- Removal of surface contaminants
- Application of primer/undercoat

Types of materials
- Metals and alloys
- Polymers
- Timbers
- Composites

AC2.2 Finishing operations
- Painting (brush, spray)
- Coating (dip, powder, gel coat)
- Grinding
- Polishing
- Electroplating
- Galvanising
- Cathodic and anodic protection

- Self-finishing

AC2.3 Procedures to check quality

- Visual inspection
- Use of measuring equipment
- Checking for conformity with standards and specification requirements

AC2.4 Problems

- Production issues carried forward from previous operations
- Damage to product and/or tooling
- Incorrect materials
- Incorrect process times
- Incorrect or inaccurate documentation

AC2.5 7 Wastes

- Transport
- Inventory
- Motion
- Waiting
- Over-processing
- Overproduction
- Defects

Learning outcome

The learner will:

LO3 be able to safely carry out finishing operations.

Assessment criteria

The learner can:

AC3.1 obtain **documentation** relevant to finishing operations.

AC3.2 interpret **documentation** relevant to finishing operations.

AC3.3 **prepare surfaces** for finishing operations.

AC3.4 safely perform **finishing operations**.

AC3.5 carry out **procedures** to monitor and ensure quality of finishing operations.

AC3.6 complete relevant **records and reports**.

AC3.7 carry out appropriate **actions** when the process does not meet specified quality requirements.

Range

AC3.1 and AC3.2 Documentation

- Engineering drawings
- Specifications
- Standards
- Regulations (health and safety, environmental)

- Job instructions/production schedules
- Standard operating procedures (SOPs)
- Production plans
- Manufacturer's datasheets
- Risk assessments

AC3.3 Surface preparation
- Cleaning the surface
- Removing surface contaminants
- Applying primer/undercoat

AC3.4 Finishing operations
- Painting
- Coating
- Grinding
- Polishing
- Electroplating
- Galvanising
- Cathodic and anodic protection
- Self-finishing

AC3.5 Procedures
- Visual inspection
- Use of measuring equipment
- Checking for conformity with standards and specification requirements

AC3.6 Records and reports
- Records of finishing operations completed
- Test and inspection records
- Handover reports

AC3.7 Actions
- Stop/pause production
- Quarantine
- Label
- Restart production
- Report to appropriate person

Unit 213 Finishing products

Supporting Information

Guidance

This unit is intended to underpin the development of practical skills and effective behaviours whilst working in a manufacturing environment. It is suggested that learning is based on practical activities in the workplace.

LO1 and LO2 are theory-based objectives and can be delivered in the classroom, whereas LO3 details the practical skills that candidates must be able to demonstrate in the workplace.

For AC3.3, candidates only need to apply primer/undercoat if applicable to the job instructions or finishing technique being carried out.

For AC3.4, candidates must be able to perform at least **one** of the stated operations given in the range.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K3
	1.2	K1, K27
	1.3	K25
	1.4	K3, B4
2	2.1	K25, K27
	2.2	K25, K26, K27, K29
	2.3	K25, K26, K28
	2.4	K28, K29
	2.5	K9
3	3.1	S29
	3.2	S29
	3.3	S28, S30, S33
	3.4	S28, S30, S33
	3.5	S28, S31, S32
	3.6	S32, S33
	3.7	S28, S31, S32, S33

Unit 214 Analysing the results of inspection and confirming quality of production

Level:	Level 2
GLH:	60
Aim:	Effective quality management in the manufacturing sector is essential to confirming the quality of manufacturing production. In this unit learners will gain knowledge of the process used to inspect products and components. Learners will then apply this knowledge to correctly analyse the results of inspection of purchased or manufactured goods and take appropriate action. Learners will also develop knowledge of approaches to quality control used when manufacturing products in quantity.
Assessment type	Portfolio of evidence

Learning outcome:

The learner will:

LO1 know the process used to inspect products.

Assessment criteria

The learner can:

AC1.1 describe the meaning of **key terms** related to inspection.
AC1.2 state why interpretation of inspection data is important.
AC1.3 state the **stages** of quality inspection data **analysis**.
AC1.4 describe different **sampling methodologies**.
AC1.5 describe how results from inspection **data are recorded**.
AC1.6 describe **issues** encountered during analysis of quality inspection data.
AC1.7 describe the **actions to be taken** when samples do not meet the specification.

Range

AC1.1 Key terms

- Nominal
- Calibration
- Accuracy
- Repeatability
- Precision
- Tolerance
- Error

AC1.3 Stages of analysis

- Data collection
- Recording
- Processing
- Interpretation of inspection results from sampling

AC1.4 Sampling methodologies

- 100% inspection
- Random sampling
- Defined (first, final, batch)

AC1.5 Data recording

- Inspection forms
- Tables
- Charts
- Graphs
- Spreadsheets

AC1.6 Issues

- Accuracy of data
- Precision of data
- Reliability of data
- Ability to process data quickly enough

AC1.7 Actions taken

- Stop/pause production
- Quarantine
- Label
- Report to appropriate person (team leader, production supervisor, quality control supervisor)

Learning outcome

The learner will:

LO2 be able to analyse the results of inspection and confirm the quality of production.

Assessment criteria

The learner can:

AC2.1 obtain the **documents** required to analyse the quality of manufacturing production.

AC2.2 **interpret** the **documents** required to analyse the quality of manufacturing production.

AC2.3 follow all relevant **safe working practices and safety regulations**.

AC2.4 **interpret inspection data** from a range of **product types**.

AC2.5 **interpret inspection data** from a range of **manufacturing methods**.

AC2.6 carry out appropriate **actions** where materials and products do not meet specified quality requirements.

Range

AC2.1 and AC2.2 Documents

- Engineering drawings
- Job instructions
- Specifications
- Datasheets
- Inspection and testing procedures
- Inspection and testing results

AC2.2 Interpret

- Dimensions
- Features
- Limits/tolerances
- Finishes

AC2.3 Safe working practices and safety regulations

- Procedures and safety requirements for sampling
- Health and safety and environmental regulations
- Machinery/equipment safety procedures
- Standard operating procedures.

AC2.4 and AC2.5 Interpret inspection data

- Record findings (tables, charts, graphs, spreadsheets)

AC2.4 Product types

- Raw materials
- Purchased components
- Manufactured components
- Finished products

AC2.5 Manufacturing methods

- Hand manufacturing
- Manually operated machine operations
- Computer-controlled operations / fully-automated processes

AC2.6 Actions

- Stop/pause production, quarantine, label
- Report to appropriate person (team leader, production supervisor, quality control supervisor)

Learning outcome

The learner will:

LO3 know the approaches to quality control used when manufacturing products in quantity.

Assessment criteria

The learner can:

AC3.1 describe **statistical process control**.

AC3.2 describe the **typical trends** exhibited on control charts.

AC3.3 describe **suitable conditions for the use of six sigma** process control.

Range

AC3.1 Statistical process control

- Nominal
- Process capability
- Sampling
- Control charts
- Control limits
- Action limits

AC3.2 Typical trends

- Acceptable parts
- Variation requiring adjustment
- Tool wear
- Vibration
- Temperature increase due to insufficient lubricant

AC3.3 Suitable conditions for the use of Six sigma

- High volume manufacture
- Capable processes
- Repeat products

Unit 214 Analysing the results of inspection and confirming quality of production

Supporting Information

Guidance

The practical activities in this unit should be carried out in a realistic working environment, which would be located in a workplace, or appropriate academic workspace. Learners will require access to the following additional resources:

- A range of documentation relating to the inspection inspection/analysis (as detailed in the unit content).
- Tools and equipment required to carry out the inspection/analysis operation.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K16
	1.2	K16
	1.3	K16, K17
	1.4	K15, K17
	1.5	K16
	1.6	K17
	1.7	K18
2	2.1	S16
	2.2	S16
	2.3	S16, K19
	2.4	S20, S21
	2.5	S20, S21
	2.6	S21
3	3.1	K7, K16
	3.2	K7, K16
	3.3	K7, K16

Unit 215 Carrying out inspection and testing activities

Level:	Level 2
GLH:	60
Aim:	Inspection and testing of products is essential for confirming that they satisfy the requirements. In this unit learners will gain knowledge of the process used to inspect and test products. Learners will develop the skills required to safely conduct a range of sampling, testing and inspection procedures.

Assessment type Portfolio of evidence

Learning outcome:

The learner will:

LO1 know the process used for inspecting and testing products.

Assessment criteria

The learner can:

AC1.1 describe the meaning of **key terms** related to inspection.
AC1.2 state why **inspection and testing** are important.
AC1.3 state the **stages of the quality inspection** process.
AC1.4 describe types and applications of **inspection and test equipment**.
AC1.5 state the **calibration** requirements for test equipment.
AC1.6 describe different **sampling methodologies**.
AC1.7 describe how **results** from testing and inspection are **recorded**.
AC1.8 describe **issues** encountered when testing and inspecting products.
AC1.9 describe **actions** to be taken when parts tested do not meet the specification.

Range

AC1.1 Key terms

- Nominal
- Calibration
- Accuracy
- Repeatability
- Precision
- Tolerance
- Error

AC1.2 Importance of inspection and testing

- Identifying quality problems
- Ensuring that products meet the requirements of specification
- Maintaining product quality
- Satisfaction of end-user

AC1.3 Stages of quality inspection

- Confirming the requirements
- Sampling
- Measurement
- Recording
- Interpretation of inspection results

AC1.4 Inspection and test equipment

- Callipers (internal, external, odd leg, digital vernier)
- Micrometers (internal, external, depth)
- Surface roughness gauge
- Go/no-go gauges
- Mechanical test fixtures
- Electrical test rigs
- Coordinate Measuring Machine (CMM)

AC1.5 Calibration

- Frequency
- Method
- Verification that calibration is currently valid (‘in date’)

AC1.6 Sampling methodologies

- 100% inspection
- Random sampling
- Defined (first, final, batch)

AC1.7 Recording results

- Inspection forms
- Tables
- Charts
- Graphs
- Spreadsheets
- Electronic data logging

AC1.8 Issues

- Accuracy of measuring instruments (fit for purpose, calibration)
- Precision of measurements
- Time required to record data

AC1.9 Actions

- Stop/pause production
- Quarantine
- Label

- Report to appropriate person (team leader, production supervisor, quality control supervisor)

Learning outcome

The learner will:

LO2 be able to carry out inspection and testing activities in a manufacturing environment.

Assessment criteria

The learner can:

AC2.1 obtain the **documents** required to carry out inspection and testing.

AC2.2 **interpret** the documents required to carry out inspection and testing.

AC2.3 follow all relevant **safe working practices and safety regulations**.

AC2.4 **sample**, inspect and test **manufactured items** safely following the **correct procedures**.

AC2.5 record **inspection data**.

AC2.6 present completed **inspection records** to an appropriate person.

AC2.7 carry out appropriate **actions** where materials and products do not meet specified quality requirements.

Range

AC2.1 and AC2.2 Documents

- Engineering drawings
- Job instructions
- Specifications
- Inspection and testing procedures

AC2.2 Interpret

- Sampling requirements
- Dimensions
- Features
- Limits/tolerances
- Finishes

AC2.3 Safe working practices and safety regulations

- Procedures and safety requirements for sampling
- Health and safety and environmental regulations
- Standard operating procedures.

AC2.4 Manufactured items

- Raw materials / purchased components / manufactured components / finished products

Sampling

- Storage and preparation of samples
- Select and handle items for test and inspection

Correct procedures using:

- Callipers / Micrometers / Gauges / Fixtures

Carry out tests according to specification

- Dimensions
- Finishes
- Function

AC2.5 Inspection data

- Inspection forms / tables / charts / spreadsheets

AC2.6 Inspection records and reporting procedures

- Communication methods
- Identifying appropriate people to report to (team leader, production supervisor, quality control supervisor)

AC2.7 Actions

- Stop/pause production, quarantine, label
- Report to appropriate person (team leader, production supervisor, quality control supervisor)

Unit 215 Carrying out inspection and testing activities

Supporting Information

Evidence requirements

While learners may not necessarily have access to the full range of resources/facilities in their workplace, they should be able to demonstrate knowledge/awareness of their use in other applications.

Guidance

The practical activities in this unit should be carried out in a realistic working environment, which would be located in a workplace, or appropriate educational workspace. Learners will require access to the following additional resources:

- A range of documentation relating to inspection and testing (as detailed in the unit content).
- Tools and equipment required to carry out the inspection/testing process.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K16
	1.2	K17
	1.3	K17, K18
	1.4	K16
	1.5	K5
	1.6	K17, K18
	1.7	K17
	1.8	K18, K19
	1.9	K18
2	2.1	S16, K16
	2.2	S16, K16
	2.3	S1, S16, K19
	2.4	S1, S17, S18
	2.5	S21
	2.6	S21
	2.7	S19

Unit 216 Recording and reporting inspection test results

Level:	Level 2
GLH:	60
Aim:	The recording and reporting of inspection test results is essential for the quality production of products. In this unit, learners will develop knowledge of the processes used to record and report test results and develop the skills to apply them. They will also develop the skills to calculate the parameters for control charts used for statistical process control.

Assessment type Portfolio of evidence

Learning outcome:

The learner will:

LO1 know the process used to record and report inspection and test results.

Assessment criteria

The learner can:

AC1.1 describe the meaning of **key terms** related to inspection.
AC1.2 state why recording and reporting of inspection test results are important.
AC1.3 state the importance of following specified procedures to record and report inspection test results.
AC1.4 describe the **key information** contained on a quality control record.
AC1.5 describe different **sampling methodologies**.
AC1.6 describe how quality control documentation is **disseminated** when completed.
AC1.7 describe the **purpose of retaining quality control records**.
AC1.8 describe **issues** encountered when testing and inspecting products.
AC1.9 describe potential **problems** associated with completing quality records.
AC1.10 describe **statistical process control**.
AC1.11 describe suitable **conditions for the use of six sigma process control**.

Range

AC1.1 Key terms

- Nominal
- Calibration
- Accuracy

- Repeatability
- Precision
- Tolerance
- Error

AC1.4 Key information
- Signatures
- Date/time
- Batch number
- Part number
- Frequency of tests
- Test results

AC1.5 Sampling methodologies
- 100% inspection
- Random sampling
- Defined (first, final, batch)

AC1.6 Disseminated
- Lines of communication
- Quality control department
- Lab staff
- Team members
- Team leader
- Production supervisor

AC1.7 Purpose of retaining quality control records
- Audit trail
- Improve processes
- Provides historical data to identify trends

AC1.8 Issues
- Accuracy of measuring instruments (fit for purpose, calibration)
- Precision of measurements
- Time required to record data

AC1.9 Common problems
- Ability to record data quickly enough
- Missing information
- Inaccurate data
- Inaccurate interpretation of data

AC1.10 Statistical process control
- Nominal
- Process capability
- Sampling
- Control charts
- Control limits
- Action limits

AC1.11 Suitable conditions for the use of six sigma

- High volume manufacture
- Capable processes
- Repeat products

Learning outcome

The learner will:

LO2 be able to record and report inspection and test results.

Assessment criteria

The learner can:

AC2.1 follow all relevant **safe working practices** and safety requirements.

AC2.2 obtain correct quality control **documents** for a range of products.

AC2.3 **interpret** the **documents** required to record and report inspection and test results.

AC2.4 record inspection data for a range of **product types, sampling methods and manufacturing methods**.

AC2.5 **report** inspection data in a range of appropriate **formats**.

AC2.6 present completed report to the appropriate person.

Range

AC2.1 Safe working practices

- Procedures and safety requirements for sampling
- Health and safety and environmental regulations
- Safe working practices
- Machinery/equipment safety procedures
- Company standards and procedures.

AC2.2 and AC2.3 Documents

- Engineering drawings
- Job instructions
- Specifications
- Datasheets
- Inspection and testing procedures
- Inspection and testing results

AC2.3 Interpret

- Dimensions
- Features
- Limits/tolerances
- Finishes

AC2.4 Product types, sampling methods and manufacturing methods.

- Product types (raw materials, purchased components, manufactured components, finished products)

- Sampling methods (storage and preparation of samples, random, defined (first/final))
- Manufacturing methods (hand manufacturing, manually operated machine operations, computer-controlled operations, fully automated processes)

AC2.5 Appropriate recording formats

- Tables
- Spreadsheets
- Graphs
- Charts
- Sample data sheets
- Quality inspection reports

Learning outcome

The learner will:

LO3 be able to deal with problems while recording and reporting inspection and test results.

Assessment criteria

The learner can:

AC3.1 identify problems or issues affecting recording or reporting of inspection results.

AC3.2 propose **feasible solutions** to problems affecting recording or reporting of inspection results.

AC3.3 report **problems or issues** beyond the scope of their own authority to the appropriate person.

Range

AC3.2 Feasible solutions

- Practical aspects of dealing with common problems encountered during recording and reporting inspection and test results, e.g. use of email to speed up reporting

AC3.3 Problems or issues

- Identifying and reporting problems or issues beyond the scope of own authority, e.g. changes to existing procedures

Unit 216 Recording and reporting inspection test results results

Supporting Information

Guidance

This unit is intended to underpin the development of practical skills and effective behaviours whilst carrying out testing and inspection activities in a manufacturing environment.

LO1 is a theory-based objectives and can be delivered in the classroom, whereas LO2 and LO3 detail the practical skills that candidates must be able to demonstrate in the workplace.

Mapping to ST0420 Lean Manufacturing Operative apprenticeship standard

The mapping grid is a guide only. Additional KSBs could be covered during the assessment of the unit.

Learning Outcome	Assessment criteria	KSB(s)
1	1.1	K16
	1.2	K16
	1.3	K16
	1.4	K16
	1.5	K16
	1.6	K16
	1.7	K16
	1.8	K16
	1.9	K16
	1.10	K16
	1.11	K16
2	2.1	S16, S18, S21
	2.2	S16, S18, S21
	2.3	S16, S18, S21
	2.4	S16, S18, S21
	2.5	S16, S18, S21
	2.6	S21
3	3.1	S16, S18
	3.2	S16, S17, S18, S20
	3.3	S21

Appendix 1 Relationships to other qualifications

Links to other qualifications

This qualification has connections to the:

- Level 2 Lean Manufacturing Operative apprenticeship standard ST0420

This qualification forms the on-programme element of the above apprenticeship, and is a gateway requirement for the following End-point Assessments:

- **9315-22** Level 2 End-point Assessment in Lean Manufacturing Operative ST0420/AP02 (Production & Assembly)
- **9315-23** Level 2 End-point Assessment in Lean Manufacturing Operative ST0420/AP02 (Inspection & Quality Assurance)
- **9315-24** Level 2 End-point Assessment in Lean Manufacturing Operative ST0420/AP02 (Logistics & Material Handling)
- **9315-25** Level 2 End-point Assessment in Lean Manufacturing Operative ST0420/AP02 (Processing & Finishing)

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 ***Centre Document Library*** on ***www.cityandguilds.com*** or click on the links below:

Quality Assurance Standards: Centre Handbook
This document is for all approved centres and provides guidance to support their delivery of our qualifications. It includes information on

- Centre quality assurance criteria and monitoring activities
- Administration and assessment systems
- Centre-facing support teams at City & Guilds / ILM
- Centre quality assurance roles and responsibilities.

The Centre Handbook should be used to ensure compliance with the terms and conditions of the Centre Contract.

Quality Assurance Standards: Centre Assessment
This document sets out the minimum common quality assurance requirements for our regulated and non-regulated qualifications that feature centre assessed components. Specific guidance will also be included in relevant qualification handbooks and/or assessment documentation.

It incorporates our expectations for centre internal quality assurance and the external quality assurance methods we use to ensure that assessment standards are met and upheld. It also details the range of sanctions that may be put in place when centres do not comply with our requirements, or actions that will be taken to align centre marking/assessment to required standards. Additionally, it provides detailed guidance on the secure and valid administration of centre-assessments.

Access arrangements - When and how applications need to be made to City & Guilds provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The ***Centre Document Library*** also contains useful information on such things as:

- Conducting examinations
- Registering learners
- Appeals and malpractice

Useful contacts
Please visit the Contact Us section of the City & Guilds website, ***Contact us***

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